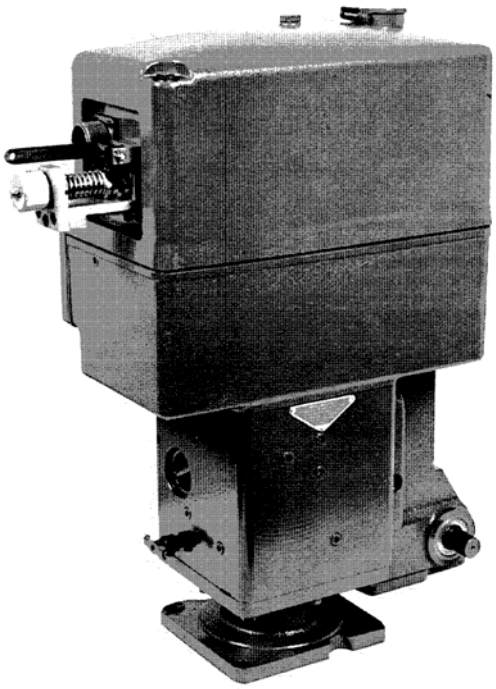
WOODWARD

Product Manual 36691
(Revision A)
Original Instructions



PG Governors (PG-TR)
Electronic Speed Setting

Installation and 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:

www.woodward.com/publications

The latest version of most publications is available on the *publications page*. 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. 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 Out-of-date translations are marked with ⚠.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.

Contents

Illustrations and Tables

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.

Chapter 1.
General Information

Description

The electronic speed setting system consists of a PG-TR position control box that houses the electronic circuits that control a transducer-receiver assembly; a solenoid operated shutdown assembly; and a transducer-receiver assembly that positions the speed setting pilot valve plunger of the PG governor. The PG governor speed setting is proportional to the electrical input signal and is arranged to give maximum governor speed for maximum input signals.

A speed setting mechanism in which an increase in current signal results in an increase in governor speed setting is called a “direct” speed setting mechanism. If an increase in current signal results in a decrease in governor speed setting, the assembly is termed a “reverse” speed setting mechanism. This manual describes the use of a direct speed setting mechanism on the PG-TR governor. Contact Woodward or your authorized dealer/distributor for information on the use of a “reverse” speed setting mechanism.

Transducer-Receiver Assembly

The transducer-receiver assembly is a current controlled speed setting mechanism that is used for adjusting the speed of the basic PG governor. It is installed on the governor, providing continuous precise speed setting in response to an electrical signal from a PG-TR position control box.

The essential components of the speed setting mechanism is a feedback coil assembly and an electro-hydraulic transducer assembly. The feedback coil monitors the position of the speed setting servo piston in relation to the speed setting input signal. The transducer assembly moves the speed setting pilot valve plunger to control oil flow to or from the speed setting servo thus controlling the position of the servo piston.

The transducer assembly is essentially a force-balance system comprised of an electric force motor, a hydraulic speed setting pilot valve, a speed setting servo, and a restoring system for the pilot valve. The transducer converts an electrical input signal into governor speed settings.

The electric force-motor consists of an armature magnet within the field of flux of a two-coil polarized solenoid winding. An electric signal applied to the polarized winding produces a force, proportional to the current in the coil, tending to move the armature magnet.

The speed setting pilot valve plunger is attached directly to the armature magnet, thus the pilot valve plunger moves up and down in unison with the magnet. The pilot valve controls the flow of pressure oil to the speed setting servo.

A manual speed setting control knob is incorporated in the transducer-receiver assembly to permit manual operation at the engine. An optional device that may be used with the control knob is a manual remote control lever assembly; the device is furnished upon request.

PG-TR Position Control Box

The PG-TR position control box houses the electrical control circuit for the transducer-receiver assembly and governor.

The control box requires 0 to 10 Vdc input for the speed set circuit, 24 Vdc input for the control circuit, and 110 Vac connects through the box for a solenoid operated shutdown assembly.

Solenoid Operated Shutdown Assembly

The purpose of the solenoid shutdown assembly is to release pressure oil from the area above the low speed stop piston and permit the speed setting servo piston to pick up on the shutdown nuts and shut down the engine. The solenoid shutdown assembly can be arranged in the governor system to shut down the engine when the solenoid is either energized or de-energized, depending upon the requirements of the installation. In either arrangement, shutdown of the engine can be accomplished only when speed setting controls are set to minimum and engine is operating at idle or low speed.

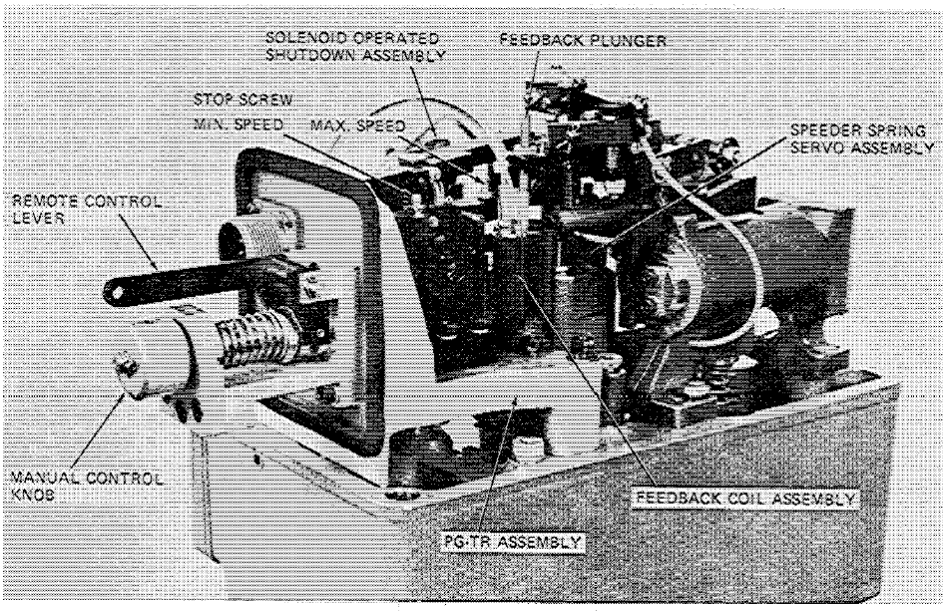


Figure 1-1. Internal View of PG-TR Column

Chapter 2.
Principles of Operation

PG-TR Position Control Box

The PG-TR position control (speed setting) circuit, shown in Figure 1-1, is designed to maintain a speed setting servo position that corresponds to an input speed setting voltage to the circuit. The control box is operated in conjunction with the transducer-receiver assembly, forming a closed loop differential control system. The transducer-receiver assembly converts the electrical output of the control box to a mechanical action, moving the speed setting servo to a position proportional to the output signal. A second transducer, the speed setting servo position sensor (feedback coil assembly), monitors the position of the speed setting servo piston and produces an electrical signal proportional to the speed setting servo position. The servo piston position is then fed back to the control box, completing the closed loop. Within the control box the servo piston position (feedback) signal is compared to a constant speed setting signal which is the sum of the speed setting and level set signals. The speed setting and positional signals are differentiated and if a speed setting servo positional error exists, an error signal is produced. The error signal is amplified and fed to the transducer-receiver to move the pilot valve plunger and make the speed setting servo corrections.

The control circuit is divided into six sections: power supply, speed setting, oscillator, frequency converter, differential amplifier, and failsafe. The following text provides a description of each circuit section and its effect on overall operation of the system.

Power Supply

The power supply circuit provides dc power to all sections of the control. The control is powered from an external 24 Vdc power source connected to terminals A and B of connector P2-J2. The unregulated 24 V source is fed to the power stage of the differential amplifier section and to the current regulator. The current regulator maintains the current at a constant level, thereby regulating the voltage. The output of the current regulator is a regulated 11.5 Vdc signal which is fed to the failsafe circuit and the zener voltage regulator. The output of the zener voltage regulator is a regulated 9.4 Vdc signal which is fed to the remaining circuits.

Speed Setting

The speed setting control is powered from a remote 0 to 10 Vdc speed setting source connected to pins A and B of connector J1-P1. The slider of the speed setting control selects a portion of the 0 to +10 Vdc input voltage and feeds it to the summing point where it is added to the level set signal.

Level Set—The level set control selects a portion of the +9.4 V supply voltage and feeds it to the summing point.

Summing Point—The summing point receives the output signals of the speed setting and level setting controls. The control signals are added algebraically with respect to common and fed to the inverting input of differential amplifier A1.

Oscillator

As the speed setting servo piston moves up or down (see Figure 2-1), the feedback plunger moves correspondingly to change the inductance of the feedback coil. The value of inductance at any given feedback plunger position determines the frequency of the oscillator.

The ac output signal from the oscillator is applied to the frequency converter. The frequency converter then provides a dc output voltage, proportional to feedback plunger position, to the differential amplifier.

Frequency Converter

The output signal of the oscillator is fed to gate G1. Gate G1 passes only the positive half of the alternating oscillator signal, resulting in a positive square wave output. The square wave signal is then differentiated to an alternating spiked signal and fed to gate G2. Gate G2 is triggered by the positive spikes, resulting in a negative pulsating d-c output. The pulsating output is then filtered to a negative level proportional to the speed setting servo position signal. The position signal is then fed to the non-inverting input of differential amplifier A1.

Differential Amplifier

The amplifier section is a single-ended amplifier with proportional derivative and integral terms. Amplifier A_1 compares the actual position signal from the frequency converter to the set point signal from the speed setting control. The amplifier's output increases as necessary to maintain the speed setting servo position. The output voltage at the low speed setting is low while the output voltage at the high speed setting is high.

Failsafe

The transducer coil circuit is completed through the failsafe relay normally closed contacts. The relay is controlled by a failsafe circuit which monitors the frequency converter output. If the output is interrupted, the failsafe circuit energizes the failsafe relay. When the relay is energized the contacts open to interrupt the transducer coil operation. Another set of relay contacts provide an indication of failsafe action.

The relay contacts for indicator light or other uses are located on pins A, B, and C of plug J3. The circuit through B and C is normally closed and the A through B circuit is normally open.

Transducer-Receiver Assembly

The speed setting pilot valve plunger controls the flow of oil to and from the governor speed setting servo piston (see Figure 2-1). The speed setting pilot valve plunger is connected to an armature magnet which is centered in the field of a two-coil polarized solenoid. An electrical output signal from a control box is applied to the polarized coil, and produces a force, proportional to the current in the coil, which moves the armature magnet—and pilot valve plunger—up or down. The pilot valve plunger is lowered by a decrease in the speed setting of the control box; it is raised by an increase in the speed setting. The restoring spring, will return the speed setting pilot valve plunger to its centered position.

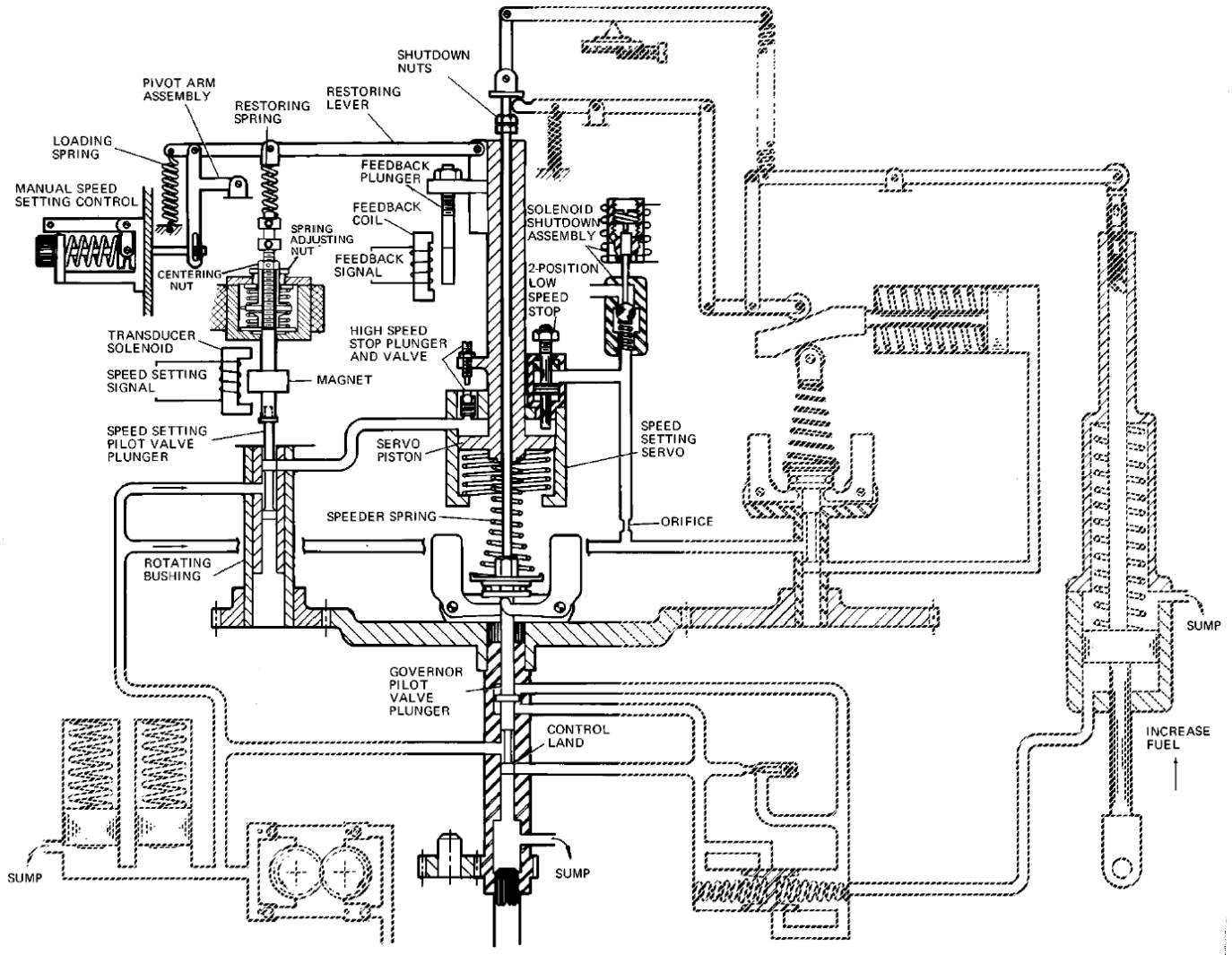


Figure 2. Functional Schematic Diagram of Electronic Speed Setting System for PG Governors

With the speed setting pilot valve plunger centered—the control land covering the control port in the pilot valve bushing—no oil will flow to or from the speed setting servo.

An increase in the speed setting signal to the transducer solenoid will raise the speed setting pilot valve plunger. The raised pilot valve plunger will direct pressure oil to the speed setting servo. The servo piston will be forced downward to increase the governor speeder spring force and thus increase the governor speed setting.

The left end of the restoring lever is attached effectively to ground through the manual speed setting linkage. The restoring lever spring is connected between the restoring lever and pilot valve plunger; the right end of the lever is attached to an extension of the speed setting servo piston. The feedback coil plunger is also attached to the speed setting servo piston. As pressure oil lowers the servo piston, the right end of the restoring lever is also lowered. The lowering of the lever causes two simultaneous functions to occur: (1) The restoring lever increases, through the restoring spring, the net force pushing downward on the pilot valve plunger. When the net downward force is equal to the change in upward force, the speed setting pilot valve plunger will have returned to its centered position. Oil flow to the speed setting servo will then be stopped and further increase in the governor speed setting halted. (2) The feedback plunger, connected to the speed setting servo, is lowered into the feedback coil. The feedback plunger is calibrated in the coil to monitor the position of the speed setting servo piston. When the position of the speed setting servo is not correct, that is it does not correspond to the speed setting input voltage, the feedback coil will generate an error signal. This error from the feedback coil is amplified in the control box and fed to the transducer solenoid to make the necessary speed setting servo corrections.

A decrease in the speed setting signal upsets the force balance, centering the armature magnet and pilot valve plunger. The downward force of the restoring spring lowers the pilot valve plunger. Oil escapes past the pilot valve to sump from the area above the speed setting servo allowing the servo piston to move upward and decrease governor speed setting. The restoring lever, following the movement of the speed setting servo piston, moves up to decrease the downward force of the restoring spring. When the speed setting servo piston has moved up far enough to reduce the downward force of the restoring spring by an amount equal to the change in magnetic force, the speed setting pilot valve is again centered. Oil flow from the speed setting servo is stopped and the decrease in governor speed setting is halted.

Note that, except when speed setting changes are being made, the speed setting pilot valve plunger and the armature magnet assume the same position regardless of the speed setting. In the event the speed setting signal is interrupted, the speed setting pilot valve plunger will be forced downward, oil from the area above the servo piston will go to sump, and the servo piston will move to the low or idle speed position.

Solenoid Operated Shutdown Assembly

Operation of the PG-TR speed setting mechanism may be accomplished by electrical control (through a position control box), manual control with the use of the manual control knob at the unit, or by means of manual remote control (optional lever arrangement at the unit). Engine shutdown, through the solenoid assembly, can be accomplished only when the speed setting controls are set to minimum position and engine is operating at idle or low speed.

With pressure oil above the two position low speed stop piston (see Figure 2-1), the piston plunger is forced down to a position where it stops the speed setting servo piston from moving below idle or low speed. The solenoid assembly as shown in figure 2 is arranged to relieve pressure oil from the two position low speed stop (speeder spring power cylinder assembly) when the solenoid is energized. (The solenoid may be arranged to relieve pressure oil when de-energized.) As the solenoid is energized, the plunger moves down to unseat the valve ball. The pressure oil holding the low speed stop plunger, thus holding the servo piston at low or idle speed, is released to sump and the servo piston moves up to pickup on the shutdown nuts and shut the engine down. (Refer to Woodward manual 36650 for detail description, operation, and adjustment of the solenoid shutdown assembly.)

Manual Speed Setting

A manual speed setting device is included on all PG-TR speed setting mechanisms (see Figure 2-1). The device can be used to adjust the speed setting to any point within the normal speed range when the electrical signal from the control box is not available. The speed setting pilot valve plunger is mechanically connected to the restoring lever through the restoring spring. The loading spring keeps a downward pressure on the restoring lever. Turning the manual speed setting knob clockwise will move the adjustment shaft out and the pivot arm assembly upward to raise the restoring lever and in effect lift the speed setting pilot valve plunger through the restoring spring. As the servo piston moves downward to increase the governor speed setting, the restoring lever movement re-centers the pilot valve plunger. Turning the speed setting knob counterclockwise will cause movements to occur in the opposite direction and decrease the governor speed setting. Speed setting stops located on the pivot arm assembly are adjusted to the maximum and minimum speed positions. An optional device that may be included with the manual speed setting knob is a remote manual speed setting lever (86, Figure 6-1). This lever permits remote operation of the PG-TR speed setting device. The manual speed setting knob must be maintained in the idle or minimum speed position during operation of the speed setting mechanism with either the electrical control box or the remote control lever (when installed).

Loss of Electrical Signal

IMPORTANT **When operating the PG-TR speed setting mechanism under electrical control, the manual and remote manual controls (if applicable) must be set to the minimum speed position.**

While operating under electrical control, the speed setting signal to the PG-TR speed setting mechanism is lost or interrupted, the centering spring force will displace the pilot valve plunger from its centered position. Pressure oil above the servo piston will be relieved to sump and the servo piston will move to idle or low speed position. In the event the installation has the solenoid operated shutdown assembly arranged to de-energize upon loss of signal current, the engine will shut down.

When operating the speed setting mechanism with the manual control knob, loss of the electrical signal will have no effect on the system. If the solenoid shutdown assembly is arranged to de-energize upon the loss of the electrical power, the engine will shut down when the manual control knob is returned to idle or low speed position.

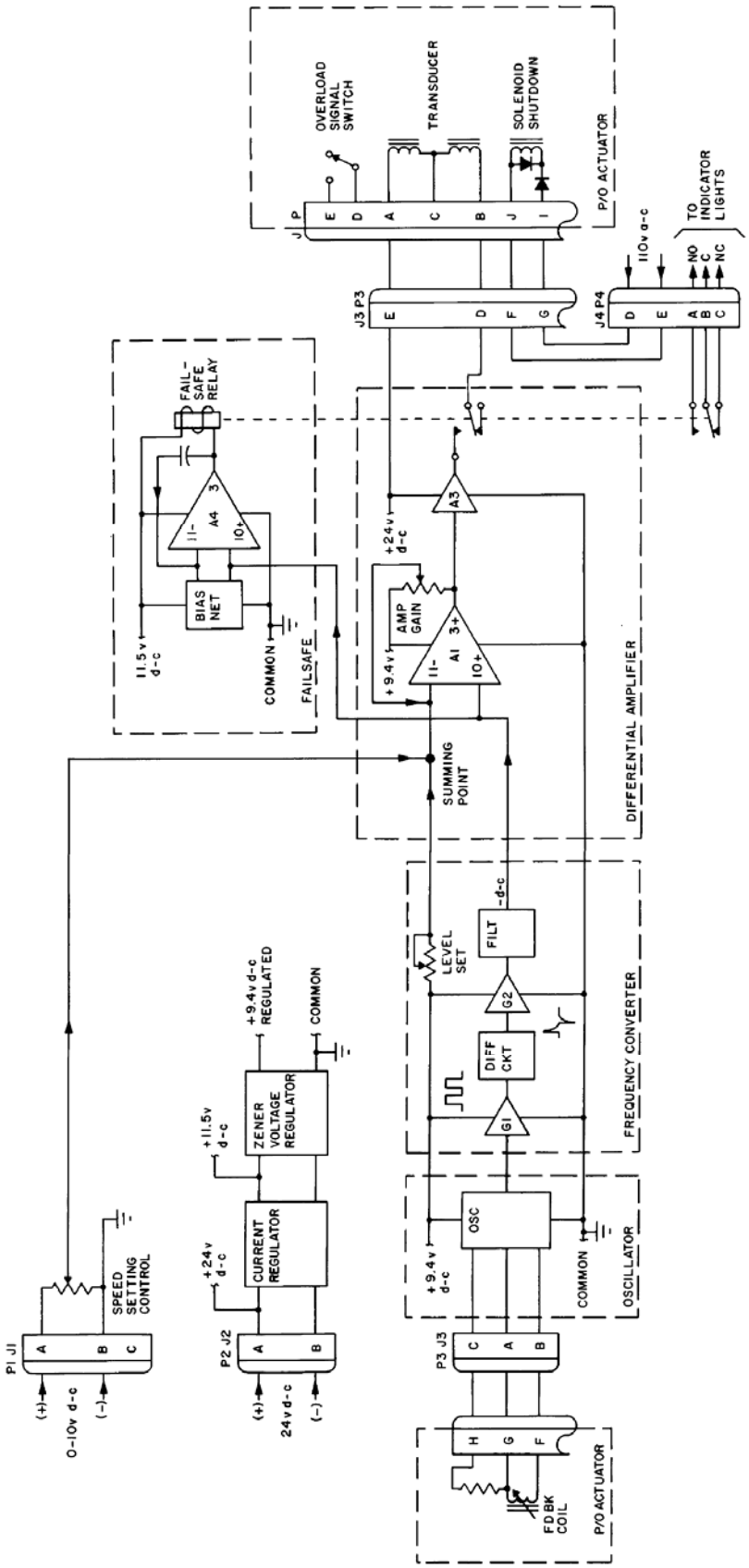


Figure 2-2. Electrical Schematic Diagram of PG-TR Position Control Box

Chapter 3.
Installation and Adjustment

Introduction

The transducer-receiver assembly is installed on the governor column and requires no special installation instructions. The PG-TR position control is a separate electrical box and is placed near the prime mover.

Installation Planning

Figure 6-3 provides mounting dimensions for the PG-TR position control box. In locating the unit, provide adequate space for ventilation and servicing.

Install the unit as close as possible to the prime mover without mounting above or near heat producing equipment.

The ambient temperature of the unit must be within the –65 to +150 °F (–54 to +101 °C) range with adequate ventilation for convection cooling.

Receiving

The control unit is shipped in a separate container. Prior to shipment the unit is tested and inspected. Upon receiving, the unit requires only mounting, hookup of electrical connectors, and checkout.

Unpack unit with the care given precision electronic equipment. Inspect for mechanical damage that may occur during transit. Immediately notify the carrier and Woodward or your authorized dealer/distributor of any damages.

Mounting

Mount the unit with four 1/4-20 bolts (length as required) through the mounting holes in the chassis.

Electrical Connection

External electrical connections for the control unit are listed in Table 3-1, which should be used as a checklist in completing and checking connections.

NOTICE **Do not connect electrical power until all other connections have been made and inspected for proper installation.**

Table 3-1. External Electrical Connections for PG-TR Position Control

Connector	Pin No.	Connection from Control to:
P1	A	External Speed Control (+)
P1	B	External Speed Control (–)
P2	A	24 V source (+)
P2	B	24 V source (–)
P3*	A	Actuator feedback coil
P3*	B	Actuator feedback coil
P3*	C	Actuator feedback coil
P3*	0	Actuator Transducer
P3*	E	Actuator Transducer
P3	F	Actuator Shutdown Solenoid
P3	G	Actuator Shutdown Solenoid
P4	A	Indicator light (NO)
P4	B	Indicator light (common)
P4	C	Indicator light (NC)
P4	D	110 Vac source
P4	E	110 Vac source

*—Where a shielded cable is required, prepare the cable as instructed below and as shown in Figure 3-1. Cut the required length of coaxial cable. (A) Strip off outer insulation from both ends exposing the braided shield. Do not cut the braid. (B) Using a sharp pointed tool (awl) carefully make an opening in the braid and (C) pull inner conductor Out of the braid. Twist braid to prevent it from fraying, then (D) remove 1/4" of insulation from the inner conductor. Connect the longer inner lead to the connector pin and the braid to the chassis ground. Ground the braid at the control unit only. Do not attempt to tin (solder) the braided shield. A heat sink of some type (alligator clip, etc.) must be used to prevent heat from traveling to the insulation of the inner conductor and melting it.

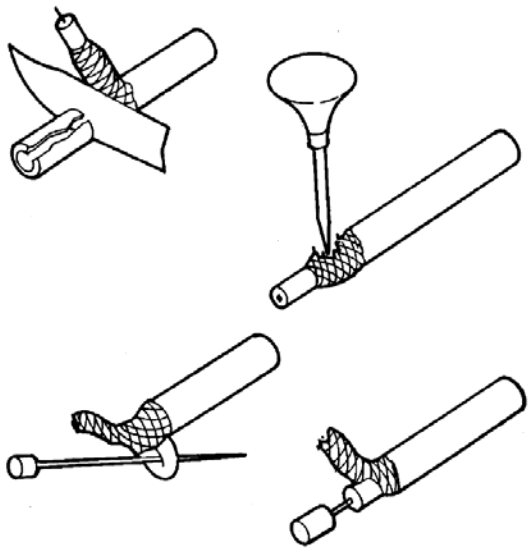


Figure 3-1. Preparation of Shielded Cable

Installation Checkout

To insure proper operation of the governing system, the procedure listed below should be followed after initial installation, extensive maintenance or long idle periods, and as preventive maintenance routines.

Visual Inspection

Inspect the position control unit for loose connections and broken wires, terminals, and components. Repair as necessary.

Initial Operation and Adjustment

Normally, all adjustments on the governing system will have been preset at the factory to the ratings specified for a particular application. However, some minor adjustments may be required after installation due to engine variances.

To start the engine for the first time after installation of a new or overhauled governor, perform the following procedures.

1. Ensure the position shutdown switch is in the off position.

2. Start the engine under manual control in accordance with manufacturers instructions, and allow to warm up. Operate engine through the speed range with the manual control and ensure proper operation.

⚠WARNING

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.

IMPORTANT

If it is necessary to readjust the high speed stop screw to obtain maximum engine speed, it will be necessary to readjust the high speed stop plunger.

3. Back off the high speed stop plunger (if required) (see figure 2); adjust the high speed stop screw on the pivot lever to approximately 5 rpm above the desired maximum speed. Adjust the high speed stop plunger to relieve the pressure oil from the area above the servo piston at the new speed setting.

4. Purge air from governor and adjust needle valve, as necessary, in accordance with Woodward manual 36600.

NOTICE

The travel of the remote lever at the installation (if used) must be limited within the travel of remote lever assembly (86, Figure 6-1) on the transducer-receiver assembly. Damage to the transducer-receiver assembly could occur if overtravel of the lever exists.

5. If the governor is equipped with a remote-manual control, ensure positive control through the speed range.

6. Set manual speed control knob to minimum position.

7. Energize the PG-TR position control unit from 24 Vdc power source.

NOTICE

When transferring to electrical control of the governor, be prepared to resume manual control until satisfied the governing system is fully operative. Ensure remote manual speed setting control is set to minimum.

8. Energize the remote speed setting control (0 to 10 Vdc).

9. Engine should go to the desired low speed setting, approximately 5 rpm above mechanical speed setting. If not, adjust level control in control unit to obtain the desired minimum speed (see figure 6).

10. Rotate the remote electrical speed setting control from minimum to maximum speed position. Engine should go to the desired maximum speed. If not, adjust the speed set (or range) control in the control unit to obtain desired maximum speed.

IMPORTANT

It is recommended that no adjustment be made on the gain control in the control unit. Contact Woodward or your authorized dealer/distributor for detailed information on this adjustment.

11. Refer to Woodward manual 36662, as applicable, for adjustment of speed droop.

Failsafe Test

Perform the following steps to check the failsafe circuit for operation:

1. Short circuit pins A and B of connector J3 on the position control unit. The prime mover should decelerate to the low limit set by the governor (idle speed).

2. Remove the short circuit.

3. Proceed to normal operation.

⚠WARNING

As is the case with any governor of any type, it is essential that the engine or turbine be equipped with a separate overspeed shutdown device to prevent runaway in the event of failure of the governor, the mechanism which drives it, or the control it operates.

Chapter 4. Troubleshooting

General

A troubleshooting chart is provided in this chapter for use in determining the probable causes and corrective actions for troubles which may be encountered in the field. Every possible trouble which may be experienced cannot be anticipated and may, in some instances, be due to faulty operation of other equipment used in conjunction with the governor. The effect of the fuel or steam control mechanism, excessive backlash or binding in linkages, improper operation of engine or turbine, excessive load, etc., must be considered when troubleshooting apparent malfunctions of the governor.

Governor troubles such as erratic operation and poor repeatability are almost always caused by dirty oil. In many instances, this type of trouble can be corrected by flushing the governor with fuel oil or kerosene. The use of non-petroleum base solvents is not recommended as they may damage oil seals or gaskets.

Trouble Isolation

The isolation of a defective component in an electrical circuit is accomplished by a systematic procedure, whereby a malfunction indication is used as a starting point and each circuit loop involved in the function is checked and proven either reliable or defective. Once the malfunction has been isolated to a particular circuit loop, the faulty component or components may be isolated by standard voltage and resistance checks in addition to testing of transistors and other semiconductor devices. In relatively simple circuits the fault may be quite simple to isolate and eliminate with little interruption in operation of the unit. In more complex units, a great deal of interaction between circuits takes place and isolation becomes difficult. In this type of equipment, the most rapid procedure to follow in isolating malfunctions is to replace a printed circuit board suspected of being faulty with a board known to be good. A thorough knowledge of the operating principles of the system and operating characteristics of major components is an invaluable asset in locating and eliminating malfunctions. In a majority of cases malfunctions will be a result of failure on the part of transistors or diodes and these components should be suspected first as a cause. Fuses blowing or similar actions by protective devices are a result of malfunction within the circuit they are protecting. Many potential malfunctions may be detected by careful visual inspection since malfunctions such as incorrect control settings, physical damage, wrong or poorly made electrical connections, and similar failures are not covered in corrective maintenance procedures.

NOTICE

Exercise care when using an ohmmeter to check the operation of diodes or transistors. Some of these devices have a maximum current rating of only 20 mA. Do not remove or plug in printed circuit cards with power on.

Test Equipment

A model 260 Simpson multimeter or equivalent is the only test equipment required for checkout and maintenance of the position control unit.

Troubleshooting Chart

The troubleshooting chart should be used as a guide to isolate a malfunction in the governing system. The malfunctions listed are generally the type that occur during checkout and operation. A thorough knowledge of the operating principles of the governing system is an invaluable asset in locating and eliminating malfunctions.

Manuals for associated components of the governing system are:

36662	Torque Limit Control with Speed Droop
36650	Solenoid Operated Shutdown Assembly
36692	PG Servo Assemblies
36693	PG Base Assemblies
36600	PG Governor Basic Elements

Troubleshooting Chart

Trouble	Probable Cause	Correction
1. Engine or turbine hunts or surges.	Compensation needle valve opened too far.	Adjust needle valve as described in Chapter 3.
	Dirty or foaming oil.	Check oil for air entrainment or proper viscosity. Drain governor and flush with fuel oil or kerosene. Change oil. Disassemble governor, if necessary, and clean.
	Governor overfilled with oil.	Drain oil to proper level.
	Excessive backlash or binding in fuel or steam control.	Repair fuel or steam control.
	Excessive backlash or binding in linkage.	Repair linkage.
	Intermittent electrical connections.	Repair connection.
	Improper relationship between governor output shaft travel and engine or turbine power output.	Governor shaft travel to power output should be approximately linear. Readjust or rework linkage to obtain a linear relationship.
	Insufficient utilization of governor output shaft travel.	Readjust or rework linkage to use more governor output shaft travel from cutoff to no-load rated speed.
	Negative droop set into governor.	Reset zero droop stop.
	Engine misfiring (applies principally to gas engines).	Eliminate misfiring, if possible.
	Buffer spring(s) fatigued or broken. Springs too light.	Replace spring(s). Install heavier springs (consult Woodward or your authorized dealer/distributor).
	Governor parts worn—excessive internal leakage.	Repair governor.

Trouble	Probable Cause	Correction
2. Jiggle at governor output shaft.	Rough engine or turbine drive.	Check drive gear alignment. Inspect gear teeth for roughness. Check gear train for eccentricity or excessive backlash. Check gear mounting on shafts for looseness. Tighten camshaft drive chain, if used. Check vibration dampener, if used. Check for cyclic load variation.
	Failure of spring-driven flyweight head, if used.	Remove flyweight head assembly and check operation of torsion spring. Disassemble and clean parts. Replace tension springs if fatigued or broken. Check for accumulated dirt.
	Governor not mounted squarely on drive pad.	Loosen governor on pad and realign. Tighten attaching bolts or nuts evenly to proper torque value.
3. Fuel or steam control does not open sufficiently or quickly during starting.	Low governor oil pressure.	Check governor oil for foaming. Check for proper oil viscosity. Change oil. Inspect pump check valves for operation. Clean or replace leaking check valves. Check pump gears and gear pockets for excessive wear. Replace worn parts.
		Engine or turbine cranking speed too low.
4. Slow return to speed following a change in load or a slow response to a change in speed setting.	Compensation needle valve closed too far.	Adjust needle valve as described in Chapter 3.
	Engine or turbine overloaded.	Reduce load.
	Compensation buffer piston sticking.	Remove buffer piston and clean piston and cylinder bore. Reassemble governor and flush with fuel oil or kerosene. Clean or replace filter in oil supply system.
	Governor case overfilled with oil.	Drain oil to proper level.
	Low governor oil pressure.	See item 3 above.
5. Governor output shaft goes to and remains at maximum speed position regardless of speed setting or load.	Speed setting servo spring fatigued or broken.	Replace spring.
	Manual speed control set to high speed.	Set manual speed control to minimum.
	PG-TR position control unit emitting a continuous signal calling for maximum speed setting.	Check input voltage to control unit from remote speed setting control. Check output voltage from control unit to transducer. If voltage does not vary with rotations of remote speed setting control, check plunger in feedback coil for looseness and that bond between iron slug and plunger has not broken.

Trouble	Probable Cause	Correction
6. No output from governor.	Dirty oil.	Drain governor oil and flush with fuel oil or kerosene. Change oil. Disassemble governor, if necessary, and clean.
	No governor oil pressure, excessive internal leakage.	Check oil level in governor.
		See item 3 above.
	Failure of drive to governor.	Repair accessory drive.
	Damage to internal governor parts.	Disassemble governor, replace damaged parts.
	Linkage binding or maladjusted.	Repair or readjust linkage.
7. Engine or turbine will not carry full rated load.	Fuel or steam control does not fully open.	Check and adjust linkage. Check for binding in fuel or steam control.
	Low governor oil pressure.	See item 3 above.
8. Improper load division between paralleled units. All units on droop.	Incorrect speed droop setting on one or more units.	Adjust droop on each unit until desired division of load is obtained. Increasing droop will result in the unit taking a smaller share of load changes; decreasing droop, a larger share.
	Different speed settings between units.	Readjust so that all speed settings are the same.
9. Prime mover will not start. Governor not moving to start position.	Governor improperly installed.	Check installation.

Chapter 5.
Maintenance

PG-TR Position Control Maintenance

Inspection

A visual inspection of the control unit should be performed to ascertain if any obvious defects are present. Perform a general check of transistors, relays, printed circuit boards, connectors, and wiring for secure mounting and evidence of overheating.

NOTICE

Do not disturb the setting of screw driver adjusted controls. Do not remove printed circuit board for inspection.

Cleaning

Remove dust and foreign matter from the control unit by brushing with a clean dry brush. Compressed air at low pressure may be used to blow dust from hard to reach areas. When compressed air is used, always direct the first blast at the floor to blow any accumulation of moisture from the air line.

Disassembly and Reassembly

When disassembly of the position control unit (Figure 6-2) is required, take care not to damage other components or wiring. Proceed as follows:

1. Insure all power to the control unit is off.
2. Disconnect all electrical connectors.
3. Determine what wiring must be disconnected and label with a piece of masking tape or similar device.
4. Remove and save all mounting hardware. Assembly is the reverse of disassembly. Mount the component on the unit and make all necessary connections.

Transducer-Receiver Assembly Maintenance

Disassembly

Disassemble the transducer-receiver assembly following the sequence of index numbers assigned to Figure 6-1, giving special attention to the following. Circled index numbers do not require further disassembly unless repair or replacement is required.

It is difficult to re-center the armature magnet and hence the speed setting pilot valve plunger without the use of special equipment. Unless such equipment is available it is recommended that no attempt be made to service the transducer-receiver assembly. Under emergency conditions where it is necessary to disassemble the unit and the special equipment is not available, note and record the position of the feedback spring assembly, centering nut, spring adjusting nut, and feedback coil plunger and nut. When reassembling the unit, reinstall the components in the exact position.

The mechanical manual-remote control shown in Figure 6-1 is an optional device and is not applicable to all installations.

Discard all gaskets, O-rings, seals, retaining rings, etc., removed in the process of disassembly.

Do not remove or disturb the position of setscrews, spring seats, brackets, etc., which function as adjustments; nor disassemble the various linkages further than required to effect removal unless replacement of component parts is necessary.

Cleaning

Wash all parts ultrasonically or by agitation while immersed in cleaning solvent. Use a non-metallic brush or a jet of compressed air to clean slots and holes. Dry all parts after cleaning with a jet of clean, dry compressed air.

Apply a light film of lubricating oil to all finely machined surfaces. Store parts in dust-free, moisture proof container until reassembled.

Inspection

1. Visually inspect all parts for evidence of wear, corrosion, pitting, deep scoring, cracks, or other damage.

2. Mating surfaces must be free of nicks, burrs, cracks or other damage.

3. All moving parts must be free of corrosion and move freely without excessive play.

4. All surfaces and fluid passages must be free of foreign matter.

Repair or Replacement

Repair of small parts of this unit is impractical and shall generally be limited to removal of nicks and burrs from mating flanges and light burnishing of mating parts.

Handle critical parts with extreme care so that mating edges and surfaces are not damaged. Sharp edges must be maintained.

Polish slightly corroded areas with a fine grit (600 grit) abrasive cloth or paper and oil.

Reassembly

Reassemble transducer-receiver parts, as applicable, in reverse order of index numbers in Figure 6-1, following the special instructions given below.

1. When installing O-rings over threaded surfaces, use appropriate size thimble or tape threaded area to prevent damage to 0-rings.

2. Obtain new gaskets, O-rings, retaining rings, etc., to replace those discarded during disassembly.

NOTICE

Count out only required number of small parts such as screws, washers, retaining rings or clips, etc., before proceeding with the operation at hand. When a sufficient number of parts is not available, missing part(s) must be located before performing the next operation. If part(s) cannot be located, it is essential to disassemble unit as necessary to ensure that the missing part has not fallen into an internal cavity. Any parts in the assembly which are not properly secured or in place can readily cause jamming and render the unit inoperative.

Adjustments

It is recommended that no adjustments be made on the transducer-receiver unless adequate facilities are avail able for testing and calibrating. For detail testing and adjusting information contact Woodward or your authorized dealer/distributor.

Chapter 6.
Replacement Parts

When ordering replacement parts, it is essential that the following information be given:

- Governor and/or control unit serial numbers as given on nameplate
- Manual number (this is manual 36691)
- Part reference number as given in parts list and part name or description

The parts breakdown (Figure 6-1) illustrates and lists the parts for the transducer-receiver assembly. Figure 6-2 illustrates and lists parts for the PG-TR position control unit. Index numbers are assigned in disassembly sequence.

Parts List—Transducer-Receiver Assembly

Ref. No.	Part Name	Quantity
36691-1	Screw, soc. hd. cap, 1/4-28 x 1-1/4	1
36691-2	Washer, spring lock, 17/64 ID	2
36691-3	Washer (AN960-416L)	2
36691-4	Screw, soc. hd. cap, 1/4-28 x 2	1
36691-5	Gasket	1
36691-6	Restoring lever loading spring	1
36691-7	Cotter pin, 1/32 x 3/8	1
36691-8	Pin, drilled straight, 1/8 x 1	1
36691-9	Adjusting screw bracket assembly	1
36691-10	Adjusting screw, 10-32 x 1/4	1
36691-11	Screw, soc. hd. cap, 10-32 x 3/8	1
36691-12	Washer, split lock (M535338-43)	1
36691-13	Nut, hex, 10-32 (MS35650-302)	1
36691-14	Screw, soc. hd. cap, 6-32 x 1/2 (M524677-8)	2
36691-15	Lock washer (AN935-6L)	2
36691-16	Bracket	1
36691-17	Fulcrum block assembly	1
36691-18	Coil plunger assembly	1
36691-19	Screw, soc. hd., 10-32 x 7/16	2
36691-20	Feedback coil assembly	1
36691-21	Nut, hex, 8-32 (MS20365-832A)	1
36691-22	Screw, fil. hd., 8-32 x 1	1
36691-23	Restoring lever	1
36691-24	Setscrew	2
36691-25	Feedback spring assembly	1
36691-26	Centering nut	1
36691-27	Setscrew, no-mar	1
36691-28	Spring adjusting nut	1
36691-29	Screw, soc. hd. cap, 10-32 x 1-5/8	2
36691-30	Washer, split lock, no. 10 (MS35338-43)	2
36691-31	Spring adjusting plate	1
36691-32	Pin	1
36691-33	Transducer bracket	1
36691-34	Centering spring assembly	1
36691-35	Magnet assembly	1
36691-36	Transducer assembly	1
36691-37	Washer, 0.218 ID, 0.438 OD	1
36691-38	Spring	1
36691-39	Bushing	1
36691-40	Pilot valve plunger assembly	1
36691-41	Screw, fil. hd., 6-32 x 1 (AN500-6-16)	1
36691-42	Lock washer (AN935-GL)	1
36691-43	Washer, plain (AN960-6)	1
36691-44	Rectifier cover	1
36691-45	Rectifier	2
36691-46	Soldering lug	2
36691-47	Rectifier mounting block	1
36691-48	Paper insulator	1
36691-49	Screw, fil. hd., 4-40 x 5/16 (AN500-4-5)	4
36691-50	Washer, lock (AN935-4)	4
36691-51	Receptacle	1
36691-52	Gasket	1
36691-53	Dowel pin	2
36691-54	Headed pin (AN393-25)	1
36691-55	Speed control bracket	1
36691-56	Retaining ring	2
36691-57	Nut, elastic stop, 10-32	1
36691-58	Low speed stop plunger	1
36691-59	Low speed stop cap	1
36691-60	0-ring, 0.629 OD (NAS1593-014)	1
36691-61	Nut, hex, 10-32 (MS35650-302)	1
36691-62	Socket set screw, 10-32 x 1-1/4	1
36691-63	Speeder spring power piston assembly	1
36691-64	Speeder spring power cylinder assembly	1
36691-65	Cotter pin	1
36691-66	Pin	1
36691-67	Screw. soc. hd. cap, 10-32 x 3/8	1
36691-68	Screw, soc. hd. cap, 10-32 x 5/8	2
36691-69	Washer, splitlock (M535338-43)	3
36691-70	O-ring, 0.441 OD (NAS1593-011)	1
36691-71	Roll pin	2
36691-72	Setscrew, nylok, 10-32 x 1/4	1
36691-73	Plug	1
36691-74	Knob	1
36691-75	Screw, soc. hd. cap, 10-32 x 3/8	3
36691-76	Washer, splitlock, No. 10 (MS35338-43)	3
36691-77	Adjuster retainer	1
36691-78	Slider	1

Ref. No.	Part Name	Quantity
36691-79	Seat, hex	1
36691-80	Nut, jam, 5/16-18	1
36691-81	Return spring	1
36691-82	Adjuster shaft	1
36691-83	Adjuster bracket	1
36691-84	Cotter pin	2
36691-85	Pin	1
36691-86	Lever assembly	1
36691-87	Screw, soc. hd. cap, 10-32 x 7/8 (MS24678-1 3)	2
36691-88	Washer, splitlock, No. 10 (M535338-.43)	2
36691-89	Screw, soc. hd. cap, 6-32 x 3/8 (M535457-7)	2
36691-90	Lock washer, 0.141 ID (AN935-6L)	2
36691-91	Stop block	1
36691-92	Cotter pin	3
36691-93	Spring washer, 0.188 ID	2
36691-94	Washer, plain, 0.200 ID (AN960-102)	2
36691-95	Pin	1
36691-96	Pivot link	1
36691-97	Pin	1
36691-98	Washer, plain, 0.140 ID	1
36691-99	Pin	1
36691-100	Nut 8-32	2
36691-101	Setscrew, 8-32 x 3/4	2
36691-102	Pivot arm	1
36691-103	Speed setting post	1
36691-104	Screw, hex. hd. cap	1
36691-105	Washer, splitlock	1
36691-106	O-ring	1
36691-107	Screw, hex. hd. cap, 1/4-28 x 1-3/8	2
36691-108	Washer, plain	2
36691-109	Solenoid shutdown assembly (refer to Woodward manual 36650)	1

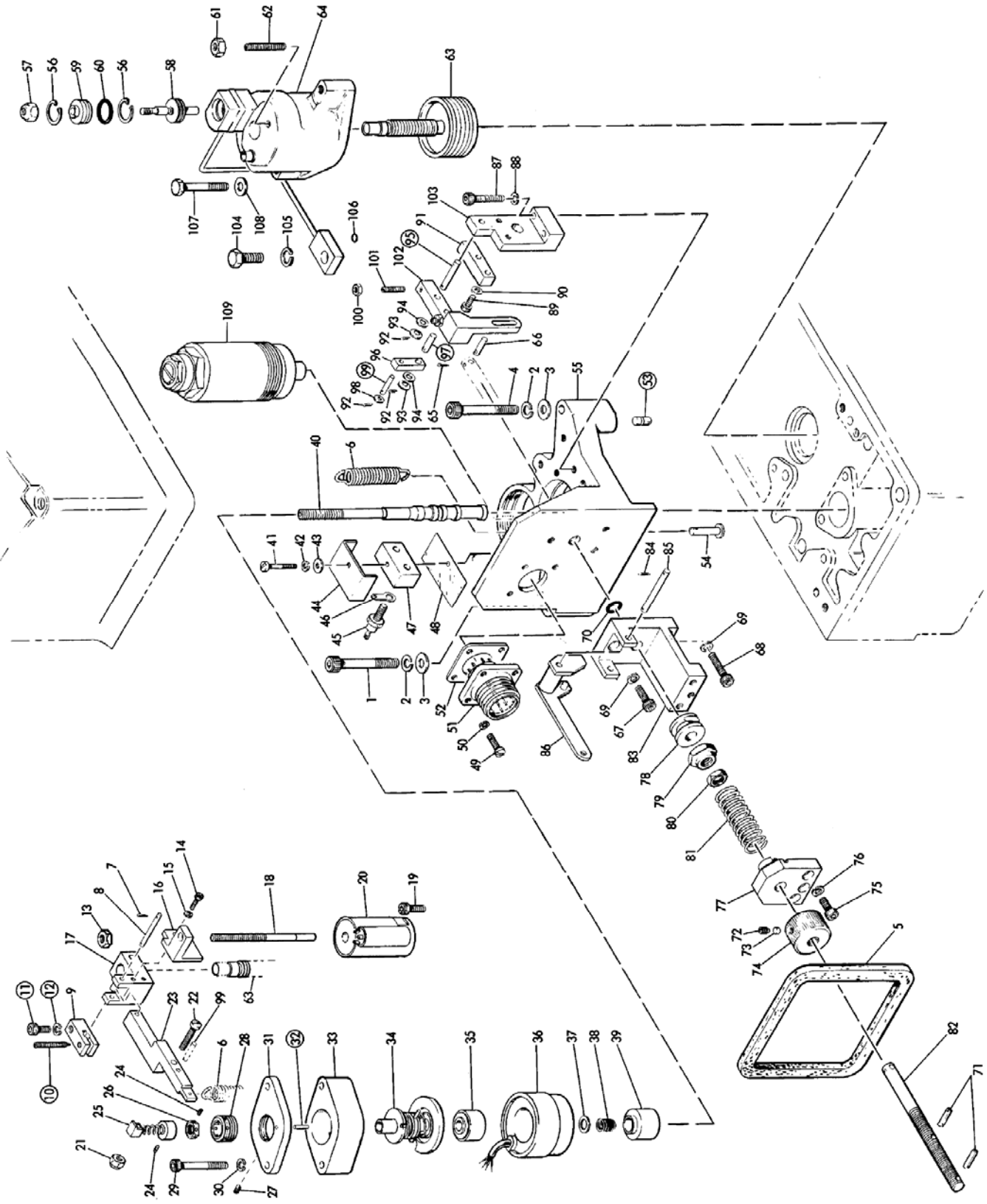


Figure 6-1. Transducer-Receiver Assembly

Parts List—PG-TR Position Control

Ref. No.	Part Name	Quantity
36691-200	Amplifier board assembly	1
36691-201	Failsafe board assembly	1
36691-202	Oscillator board assembly	1
36691-203	Mounting panel assembly	1
36691-204	Enclosure 10 x 8 st 4	1
36691-205	Screw, rd. hd., 2-56 x 5/16	4
36691-206	Washer port, No. 219137	4
36691-207	Nut, elastic hex, 6-32	9
36691-208	Solder lug	4
36691-209	Washer, 0.156 ID x 0500 0D	6
36691-210	Washer, mica, No. 6, 0.750 0D x 0.145 ID	6
36691-211	Teflon spacer, No 10, 0.280 0D x 0.190 ID	6
36691-212	Washer, mica	3
36691-213	Screw, ph. rd. hd., 6-32 x 9/16	6
36691-214	Screw, rd. hd.. 4-40 x 3/8	16
36691-215	Nut, elastic hex, 4-40	16
36691-216	Receptacle, 10 pin	1
36691-217	Oiode (1N3775)	1
36691-218	Relay, 6 volt	1
36691-219	Receptacle, 5 pin	1
36691-220	Resistor, 100 ohm, 10 W	1
36691-221	Transistor 12N30551	2
36691-222	Suppressor, S238	1
36691-223	Receptacle, 3 pin	1
36691-224	Resistor, 25 ohm, 10 W	1
36691-225	Diode, zener, 12 volt, 50 W (1N2810B)	1
36691-226	Receptacle, 2 pin	1

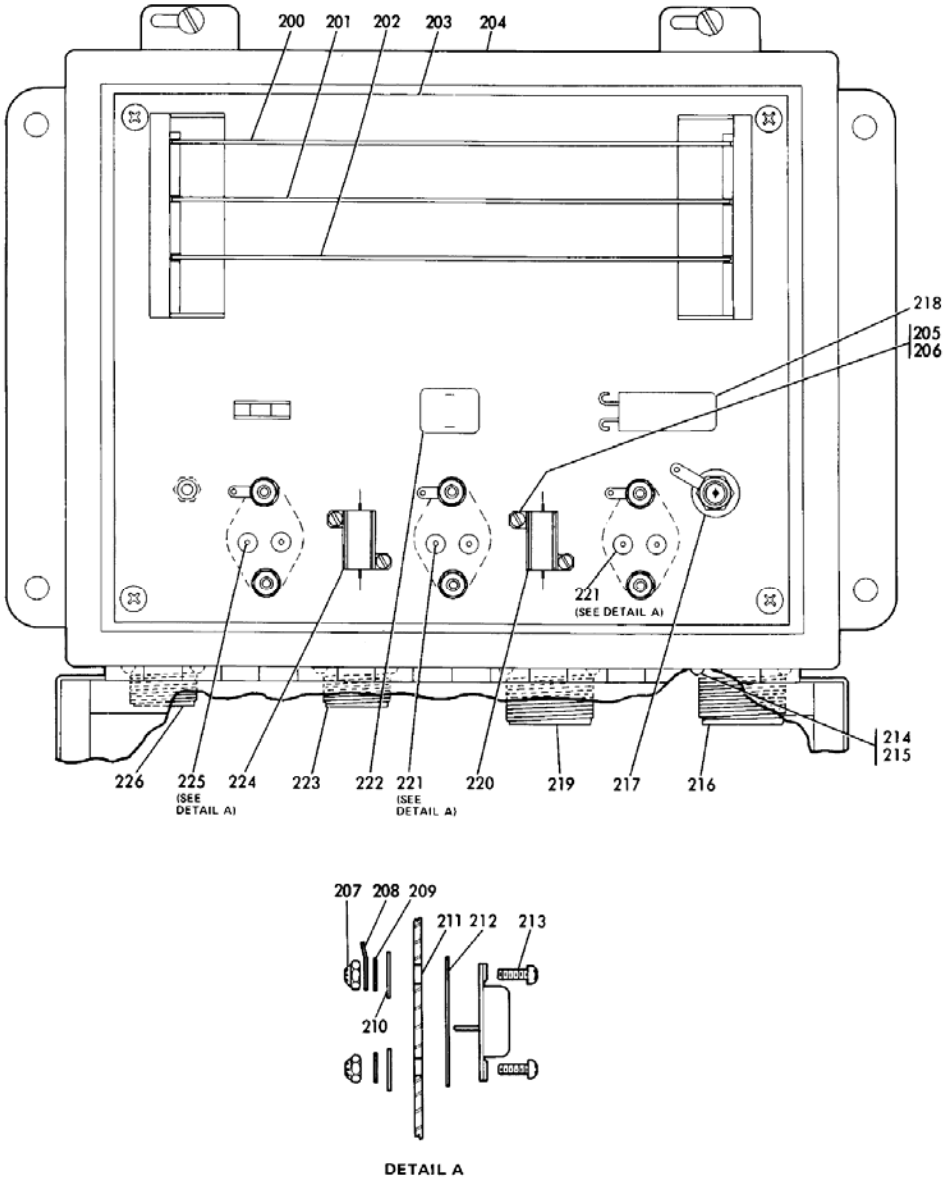


Figure 6-2. PG-TR Position Control Parts

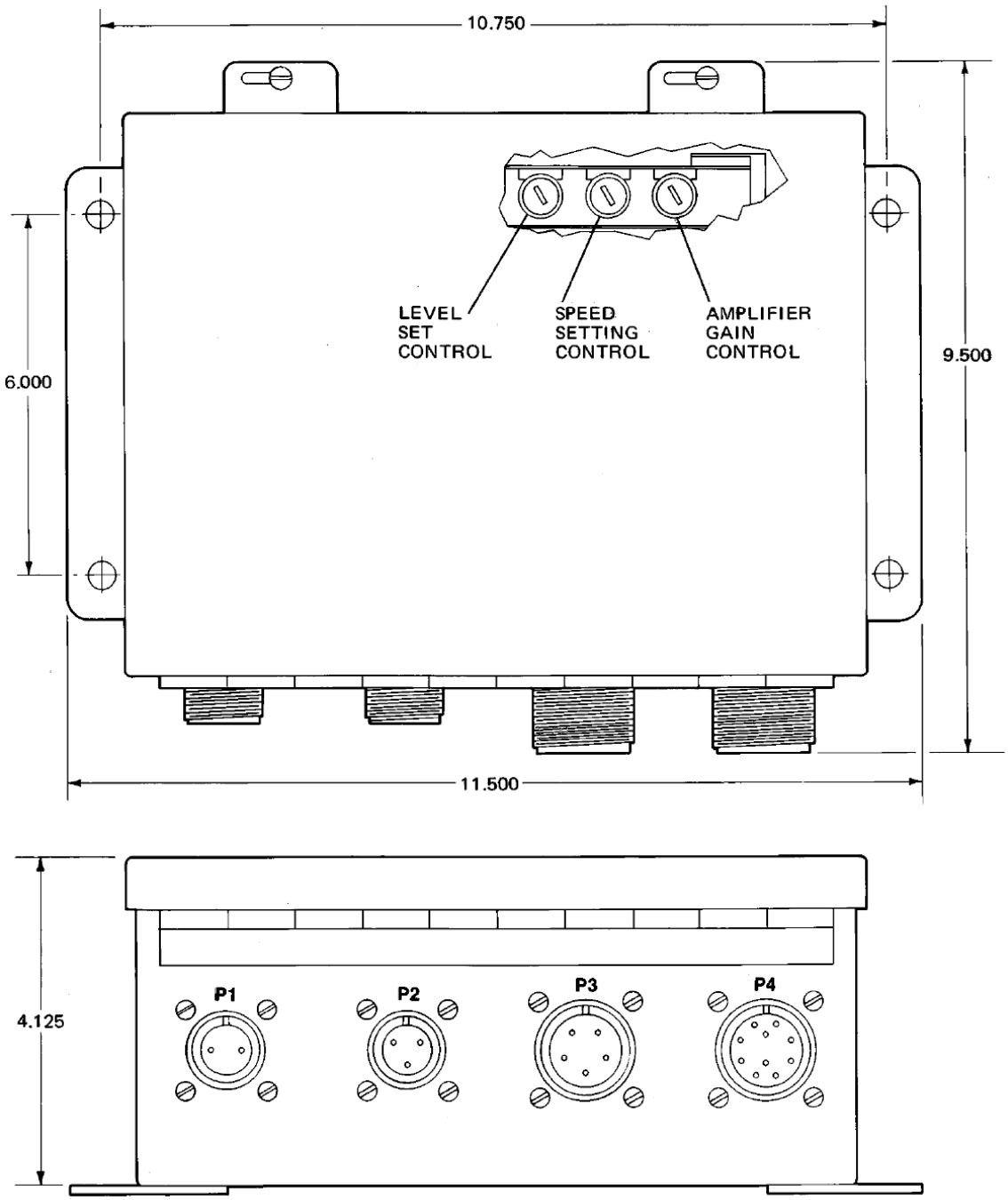


Figure 6-3. Outline Drawing of PG-TR Position Control
(Do not use for construction.)

Chapter 7.
Product Support and Service Options

Product Support Options

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

1. Consult the troubleshooting guide in the manual.
2. Contact the **OE Manufacturer or Packager** of your system.
3. Contact the **Woodward Business Partner** serving your area.
4. Contact Woodward technical assistance via email (**EngineHelpDesk@Woodward.com**) with detailed information on the product, application, and symptoms. Your email will be forwarded to an appropriate expert on the product and application to respond by telephone or return email.
5. If the issue cannot be resolved, you can select a further 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 **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.

A current list of Woodward Business Partners is available at **www.woodward.com/directory**.

Product Service Options

Depending on the type of product, the following options for servicing Woodward products may be available through your local Full-Service Distributor or the OEM or Packager of the equipment system.

- 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 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.

Flat Rate Repair: Flat Rate Repair is available for many of the standard mechanical products and some of the electronic 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.

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. 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 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's Full-Service Distributors offer various Engineering Services for our products. For these services, you can contact the Distributor by telephone or by email.

- 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.

Product Training is available as standard classes at many Distributor locations. Customized classes are also available, which can be tailored to your needs and held at one of our Distributor 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 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 **www.woodward.com/directory**.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory published at **www.woodward.com/directory**.

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) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-510
India	+91 (129) 4097100
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) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
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) 6762 6727
India	+91 (129) 4097100
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

For the most current product support and contact information, please visit our website directory at **www.woodward.com/directory**.

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 _____

Engine Model Number _____

Number of Cylinders _____

Type of Fuel (gas, gaseous, diesel, dual-fuel, 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.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 36691A.

PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

Email and Website—www.woodward.com

**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.

2012/11/Colorado