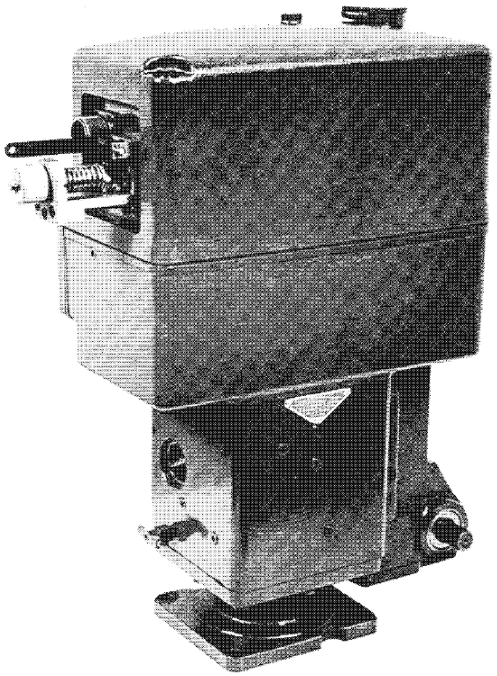
WOODWARD

**Product Manual 36696**
**(Revision A)**
**Original Instructions**



# PG-TR Electronic Speed Setting

**8272-639**

**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:**

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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 Out-of-date translations are marked with ⚠.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.**

# Contents

# Illustrations and Tables

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## 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

## Introduction

This manual, 36696, provides information for the installation, operation, troubleshooting, maintenance, and replacement parts for the 8272-639 electronic speed setting and speed correction system used with PG-TR (Pressure compensated Governor-Transducer Receiver) Governors. The 8272-639 control system replaces an earlier control box used with the same PG-TR governor.

## Description

The electronic speed setting and speed correction system consists of a PG-TR Speed and Speed Correction Control box that houses the electronic circuits and supplies a current level to control 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 current and is arranged to give maximum governor speed for maximum input signal. A magnetic pickup monitors shaft speed and supplies speed information to the speed-correction circuit. A position feedback assembly is present in the PG-TR receiver (see Figure 1-1) but is not used.

## Transducer-Receiver Assembly

The transducer-receiver assembly, located in the PG-TR governor, is a current controlled speed-setting mechanism that is used to adjust the speed of the basic PG governor. It provides continuous precise speed setting proportional to an electrical signal from the PG-TR Speed and Speed Correction Control.

The speed-setting mechanism is an electro-hydraulic transducer assembly. 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 speed-setting 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 setting.

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. A manual remote-control lever assembly is an optional device that may be used with the control knob. The optional device is available for factory installation.

## Speed and Speed Correction Control Box

The PG-TR Speed and Speed Correction 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 a magnetic pickup input from the flywheel for speed feedback. The speed setting circuit can originate externally or from the control box. 115 Vac connects through the box for a solenoid operated idle-shutdown positioner assembly.

## Solenoid Operated Idle-Shutdown Positioner

Some PG-TR units have a hydraulically positioned piston stop in the speed-setting cylinder that establishes a minimum speed setting that is not dependent on the electric speed-setting signal. (The electric speed setting and the linkage is calibrated to cause shutdown at zero current.)

These units are equipped with a solenoid which will cause this stop to retract, permitting the speed-setting servo piston to pick up on the shutdown nuts and shut down the engine. The solenoid assembly can be arranged to remove the idle stop when the solenoid is either energized or de-energized, depending upon the requirements of the installation. A 115 Vac signal to the solenoid will also activate a relay which will remove all electric speed setting signals from the control, allowing shutdown. The signal to the solenoid must be continuous until shutdown is achieved.

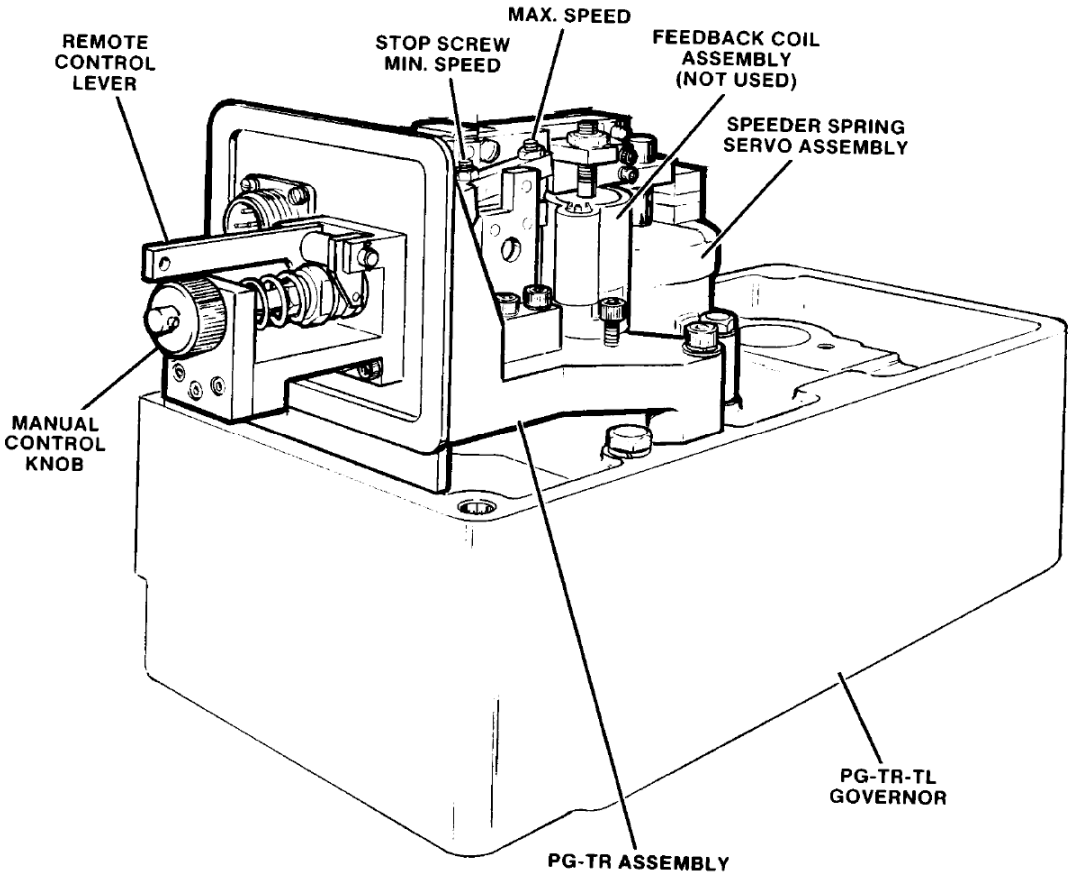


Figure 1-1. PG-TR Receiver

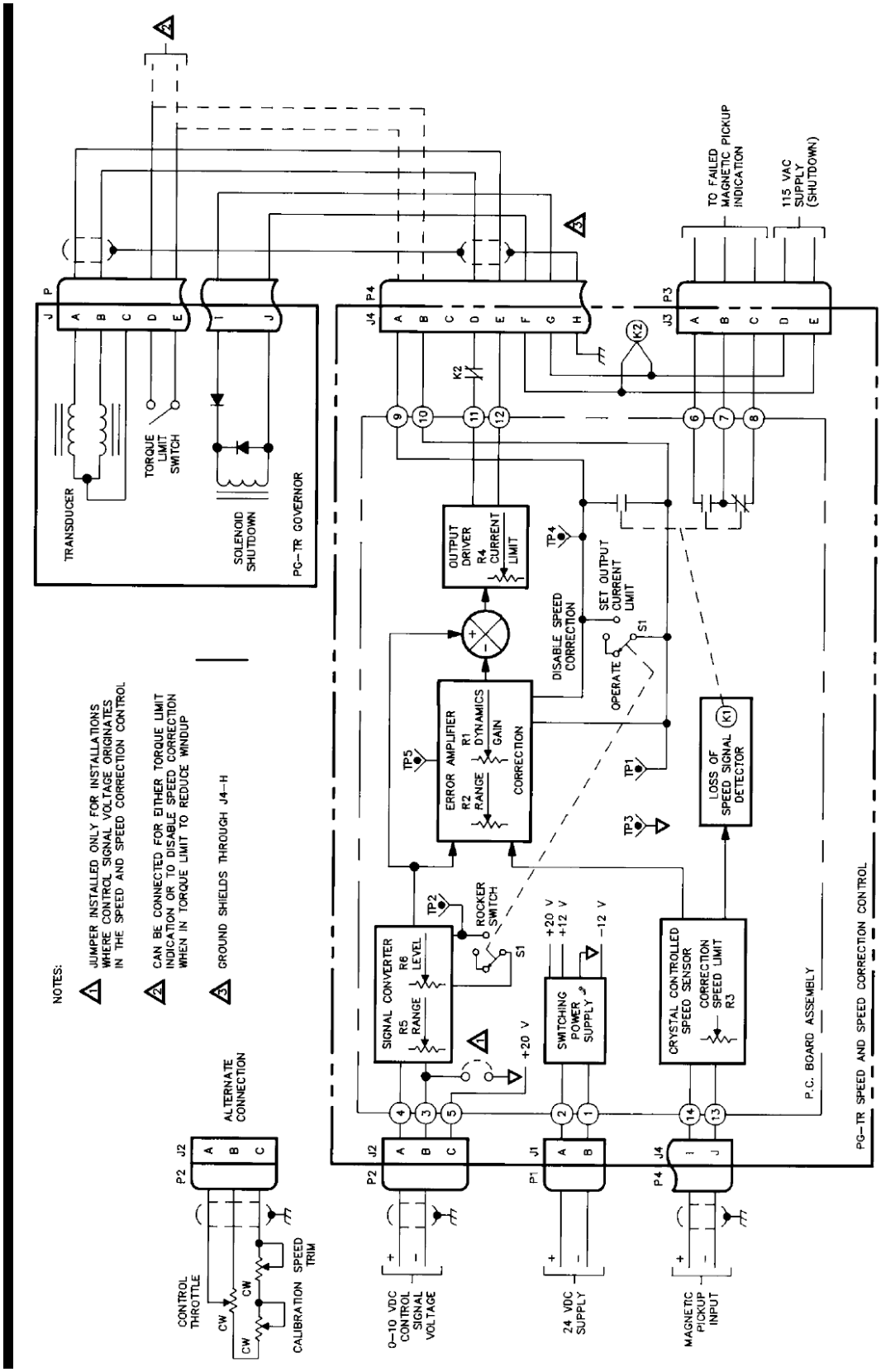


Figure 1-2. Block Diagram of PG-TR Speed and Speed Correction Control Box

# Chapter 2.
# Installation

## Introduction

The transducer-receiver assembly is installed on the governor column and requires no special installation instruction. The PG-TR Speed and Speed Correction Control is a separate electrical box and is placed in the control room, below the control console.

## Installation

Figure 2-1 provides installation dimensions for the PG-TR position control box. The location should provide adequate space for ventilation and servicing.

The ambient temperature of the unit must be within the –65 to +150 °F (–54 to +66 °F) range with adequate ventilation for convection cooling.

## Receiving

The Speed and Speed Correction Control unit is shipped in a separate container. The unit is tested and inspected at the factory and requires only installation, hookup of electrical connectors, and checkout when put into service.

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

Install the Speed and Speed Correction Control box with four 0.250-20 bolts (length as required) through the mounting holes in the chassis.

## Electrical Connection

External electrical connections for the control unit are listed in Table 2-1, which should be used as a checklist in completing and checking connections. The connections should be with the connectors listed in the table.

Use 14 or 16 AWG (1.0 or 2.0 $mm^2$) twisted pairs or 3-conductor for the connections to the control box and between the control box and the PG-TR governor. Braided shields should be used on the connections to the control signal, the magnetic pickup input, and the output to the PG-TR governor receiver. Tie the shields to the Speed and Speed Correction Control through pin J4-H.

**NOTICE**

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

| Connector | Plug & Pin No. | Connection from: | Connection to: |
|---|---|---|---|
| MS3106F-145-95 | | | |
| P1 | J1-A | 24 Vdc supply (+) | Control Box |
| P1 | J1-B | 24 Vdc supply (–) | Control Box |
| MS3106F-145-75 | | | |
| P2 | J2-A | 0–10 Vdc control (+) | Control Box |
| P2 | J2-B | 0–10 Vdc control (–) | Control Box |
| or | | | |
| P2 | J2-A | Control Pot Wiper | Control Box |
| P2 | J2-B | Control Pot CCW | Control Box |
| P2 | J2-C | Control Pot CW | Control Box |
| MS3106F-18-115 | | | |
| P3 | J3-A | MPU failed NO | Control Box |
| P3 | J3-B | MPU failed Common | Control Box |
| P3 | J3-C | MPU failed NC | Control Box |
| P3 | J3-D | 115 Vac source | Control Box |
| P3 | J3-E | 115 Vac source | Control Box |
| MS3106F-18-15 | | | |
| P4 | J4-A | Torque Limit Switch | Control Box |
| P4 | J4-B | Torque Limit Switch | Control Box |
| P4 | J4-C | No wire connection | |
| P4 | J4-D | PG-TR Transducer | Control Box |
| P4 | J4-E | PG-TR Transducer | Control Box |
| P4 | J4-F | 115 V to Solenoid | Control Box |
| P4 | J4-G | 115 V to Solenoid | Control Box |
| P4 | J4-H | Connect Both Shields | |
| P4 | J4-I | Magnetic Pickup | Control Box |
| P4 | J4-J | Magnetic Pickup | Control Box |
| MS3106A-18-15 | | | |
| P5 | J5-A | Transducer Output (+) | PG-TR Governor |
| P5 | J5-B | Transducer Output (–) | PG-TR Governor |
| P5 | J5-C | No wire connection | |
| P5 | J5-D | Control Box | T/Limit Switch |
| P5 | J5-E | Control Box | T/Limit Switch |
| P5 | J5-F | No wire connection | |
| P5 | J5-G | No wire connection | |
| P5 | J5-H | No wire connection | |
| P5 | J5-I | 115 V to Solenoid | PG-TR Governor |
| P5 | J5 J | 115 V to Solenoid | PG-TR Governor |

## Shielded Inputs

Inputs from the magnetic pickup, the control signal (either the 0-10 volt or the throttle control option), and from the Speed and Speed Correction Control output to the PG-TR governor should be shielded. The shields should be connected to the PG-TR Speed and Speed Correction Control chassis through J4-H. Do not ground the shield at the MPU or at the variable control signal source.

## 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 period, and as a preventive maintenance routine.

### Visual Inspection

Inspect the position control unit for loose connections and broken wires, terminals, or 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. 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:

**⚠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.**

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

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

**IMPORTANT**

**If it is necessary to adjust the high-speed-stop screw to obtain maximum engine speed, it will also be necessary to adjust the high-speed stop plunger.**

3. Back off the high-speed stop plunger (if required) (see Figure 3-1); adjust the high-speed stop screw on the pivot lever to about 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 the governor and adjust the needle valve as necessary (see Woodward manual 36600).

**NOTICE**

**The travel of the remote lever at the installation (if used) must be limited within the travel of the 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 the manual speed-control knob to minimum position.

7. Set the output current limit fully ccw, the range to midpoint and the level ccw.

8. Set the toggle switch (S1) to disable both the signal converter and the speed correction by depressing the end of the switch closest to the printed-circuit-board terminals. This also biases the control for full output which is limited by the setting of the output-current limit.

**NOTICE**

**When transferring to electrical control of the governor, be prepared to resume manual control until satisfied the governing system is operative.**

9. Run the manual speed-setting control to maximum. Expect an additional speed increase when the electronic Speed and Speed Correction Control unit is energized.

10. Energize the Speed and Speed Correction control unit from the 24 Vdc power source. Speed should increase about 40 rpm above the mechanical setting.

11. Turn the mechanical speed setting to minimum, verifying operation by the electronic Speed and Speed Correction control unit. (The speed should stay high.)

12. Turn the output-current-limit adjustment cw until maximum desired speed is obtained (about 1980 Hz).

13. Exercise the 0–10 V speed setting control signal voltage and set for zero volts.

14. Set the toggle switch (S1) to mid-position. This enables the signal converter while continuing to hold the speed correction inactive.

15. Turn the level adjust cw until the speed is about 5 rpm above the mechanical speed setting (about 935 Hz).

16. Set the speed-set control signal voltage for 9.5 volts and set the range for maximum operating speed (about 1980 Hz).

17. Repeat steps 13 and 14 until no additional adjustment is required.

18. Set speed-set control signal for zero. Set the speed range adjustment for zero volts between TP5 and TP6.

19. Set speed-set control signal for 9.5 volts. Set the correction speed limit pot for zero volts between TP5 and TP6.

20. Repeat steps 16 and 17 until no additional adjustment is required.

21. Set S1 to the operate position by toggling it toward the center of the PC board

## Failsafe Circuit Test

1. Open circuit pins A and B of connector J2 on the position control unit. The engine should decelerate to the low limit set by the governor (idle speed).

2. Reconnect the circuit and proceed to normal operation.

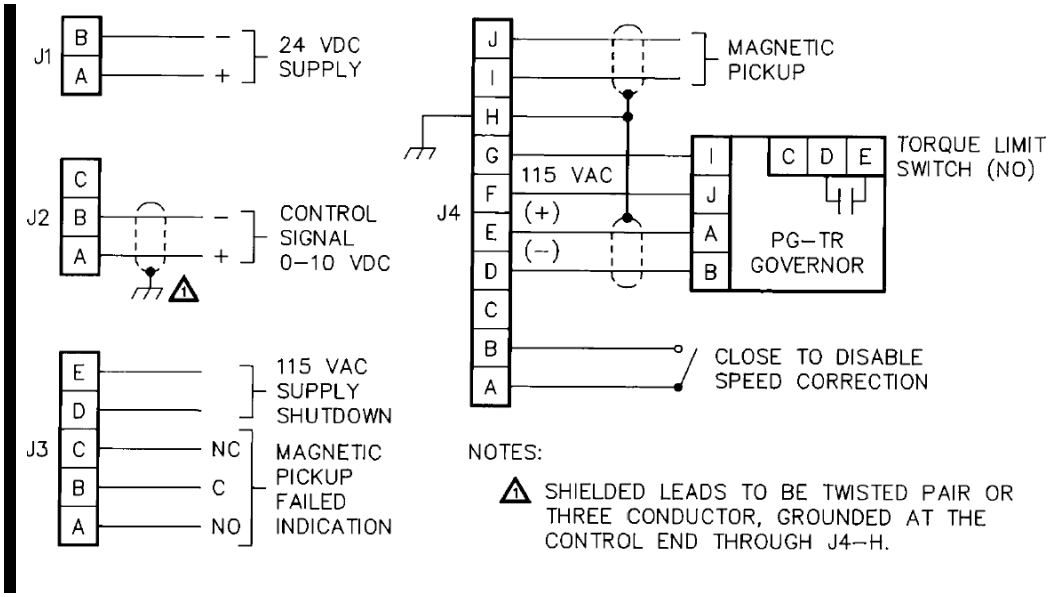


Figure 2-1. PG-TR Plant Wiring Diagram

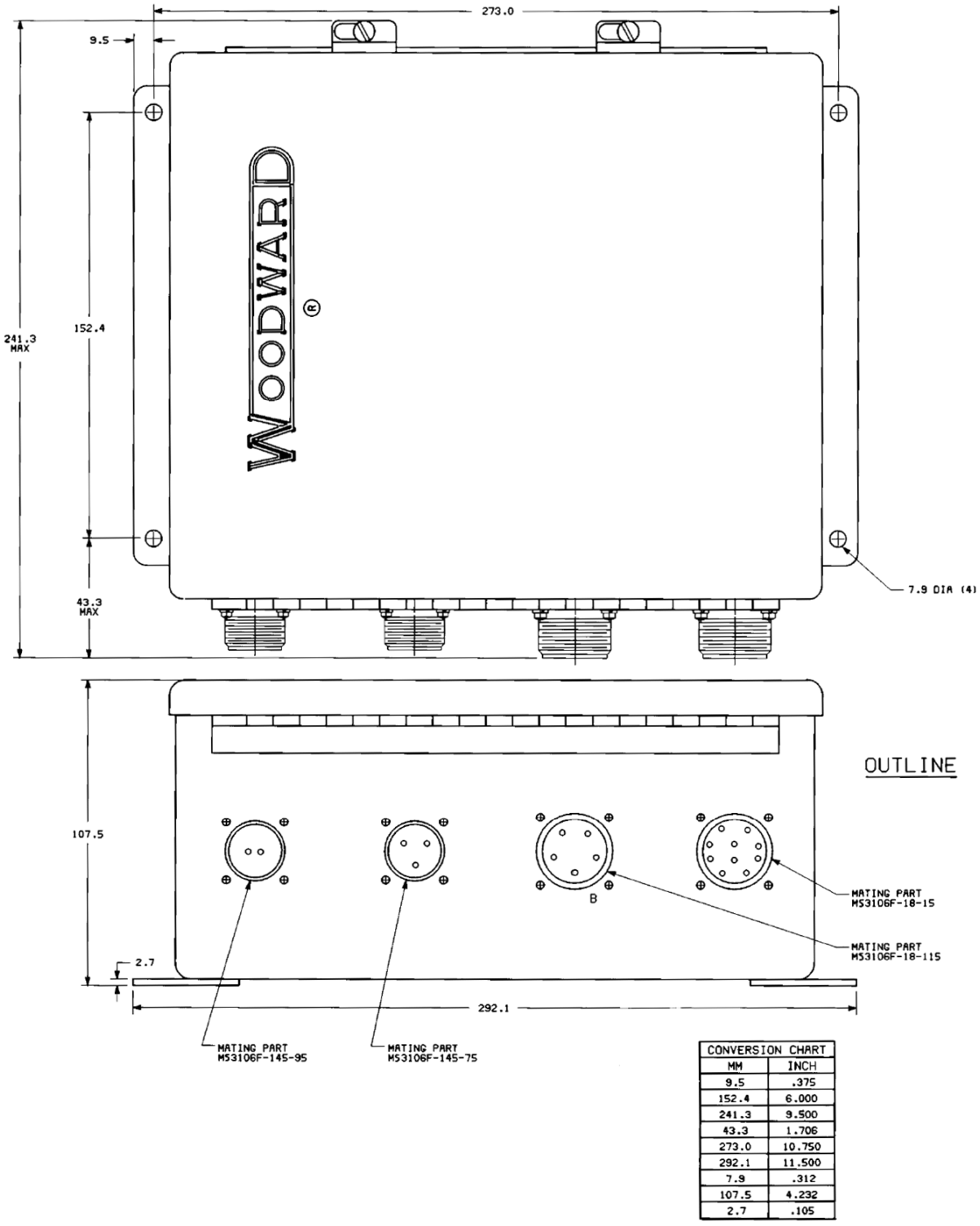


Figure 2-2. Outline Drawing of PG-TR Speed and Speed Correction Control

# Chapter 3.
# Principles of Operation

## PG-TR Speed and Speed Correction Control Box

The PG-TR Speed and Speed Correction Control (speed setting) circuit, shown in Figure 1-2, 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 magnetic pickup monitors engine shaft speed and produces an electrical signal proportional to the speed. The magnetic pickup signal is fed back to the control box. Within the control box the speed 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 speed signals are compared, if a speed-setting level error exists, an error signal is produced. The error signal is amplified and added to or subtracted from the control current to the transducer/receiver to move the pilot-valve plunger and make the speed-setting-servo correction.

The control circuit is divided into six sections: power supply, signal converter, speed sensor, error amplifier, and loss of speed-signal detector.

The following text provides a description of each circuit and its effect on overall operation of the system.

## Power Supply

The power supply is a switching power supply. The control is powered from an external 24 Vdc power source connected to terminals A and B of connector P1-J1. The unregulated 24 Vdc source is fed to the switching circuitry and to a current regulator. The current regulator prevents overcurrent to the supply. The switching circuit isolates the input power from the control circuits.

Three voltages are generated within the switching power supply: –12 Vdc, +12 Vdc, and +20 Vdc. The ±12 Vdc is used to power control circuits. The +20 Vdc is used for output and relay power.

## Speed Setting

The speed-setting control signal is powered from a remote 0 to 10 Vdc speed-setting source connected to pins A and B of connector J2-P2. (This 0–10 Vdc control signal may be supplied from the control by installing jumper 5 and using the alternate wiring indicated in Figure 1-1.)

The slider of the speed-setting control selects a portion of the 0 to 10 Vdc input voltage and feeds it to the signal converter, where it is added to the level-set signal.

**LEVEL (R6)**
The level adjustment sets a minimum output current to the transducer receiver to set the minimum electrically controlled speed.

**RANGE (R5)**
The range adjustment sets the slope for the effect of the control signal input. The summing point receives the output of the sum of the speed setting and of the level setting control signal converter, which is the one output from the speed correction error amplifier. The control signals are added algebraically with respect to common and fed to the output driver.

**SPEED SENSOR**
The ac output signal from the magnetic pickup is applied to the speed sensing circuit. The speed sensor provides a dc output voltage proportional to the shaft speed. This voltage is compared to the signal converter output.

**CORRECTION SPEED LIMIT (R2)**
The correction speed limiter sets the maximum speed correction.

## Error Amplifier

The error amplifier compares the actual speed signal from the speed sensor to the set-point signal from the speed-setting control. The output of the error amplifier is fed to the summing point, adding or subtracting from the signal converter output to maintain the speed setting servo position.

**CORRECTION SPEED RANGE (R3)**
The correction range sets the slope of the speed-sensing circuit so the 0–10 Vdc control signal, through the signal converter, sets the correct speed setting to be compared to the actual speed.

**CORRECTION DYNAMICS GAIN (R1)**
Sets the dynamic response of the error amplifier.

**LOSS OF SPEED SIGNAL DETECTOR**
Detects loss of the speed sensing input. If the system is under electric control, the circuit will remove the correction signal, leaving the speed-set signal in control of the speed without correction.

## 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 3-1). The speed-setting pilot-valve plunger is connected to an armature magnet, which is centered in the field of the two-coil polarized solenoid. An electrical output signal from the 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 the centered position.

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 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. A feedback-coil plunger is also attached to the speed-setting servo piston but is not used.

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 magnetic pickup speed signal is compared with the speed-setting signal and if not correct an error signal is generated. This error signal is amplified in the control box and fed to the transducer solenoid to make the necessary speed-setting servo correction.

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 the 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 speed setting is halted.

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 Idle-Shutdown Positioner

Some PG-TR governors have a hydraulically positioned piston stop in the speed-setting cylinder that establishes a minimum speed setting and prevents shutdown, even if the electric speed-setting signal is at minimum.

The piston stop is retracted by operation of a 115 Vac solenoid, permitting shutdown. The 115 Vac solenoid circuit also activates a relay which removes any electric speed setting signal.

The piston stop is forced down to a position where it stops the speed-setting servo piston from moving below idle or low speed by pressure oil above the piston (see Figure 3-1). The solenoid assembly, as shown in Figure 3-1, is arranged to relieve pressure oil from the piston 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 piston-stop plunger, preventing the servo piston from going lower than the idle or low speed position, is released to sump and the servo piston may move up to pickup on the shutdown nuts and shut the engine down. The solenoid must remain activated until shutdown is accomplished.

## Manual Speed Setting

A manual speed-setting device is included on all PG-TR speed-setting mechanisms. (See Figure 3-1.) 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, 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 position.

An optional device, that may be included with the manual-speed-setting knob, is a remote manual-speed-setting lever. This lever permits remote manual operation of the PG-TR manual speed-setting device. The manual speed-setting knob must be maintained in the minimum speed position during operation of the speed-setting mechanism with either the electrical control box or the remote control lever (when installed.)

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

In the event, 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 the idle or low speed position determined by the solenoid operated idle-shutdown positioner. If the positioner plunger has been withdrawn by operation of the solenoid, 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 Idle-Shutdown positioner has been withdrawn the engine will shut down when the manual-control knob is returned to the minimum position.

# Torque Limit Switch

The torque limiter, located in the PG-TR, causes the governor to cut back on speed when the set torque limit is exceeded. This would cause the electric correction signal to go to maximum, attempting to bring the speed back up again. Thus, when coming out of torque limit, a surge in speed can be expected.

Connecting the torque-limit switch to disable the speed-correction signal while in torque limit will reduce or prevent this surge in speed when coming out of torque limit.

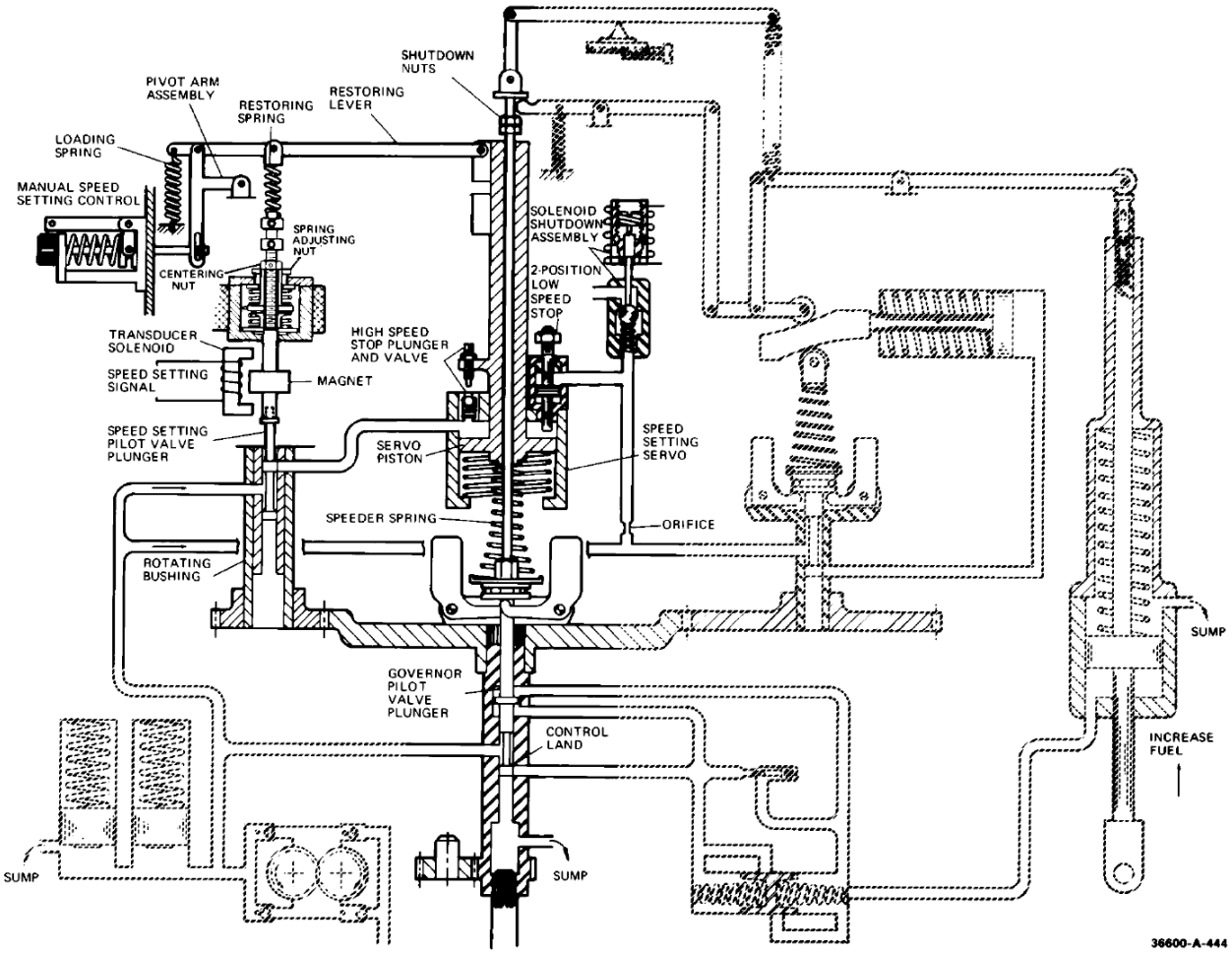


Figure 3-1. Schematic of PG-TR Speed Setting System

# 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 control mechanism, excessive backlash or binding in linkages, improper operation of the engine, 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 a valuable 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:

| | |
|---|---|
| Torque Limit Control with Speed Droop | 36662 |
| PG Servo Assemblies | 36692 |
| PG Base Assemblies | 36693 |
| PG Governor Basic Elements | 36600 |

| Trouble | Probable Cause | Correction |
|---|---|---|
| 1. Engine 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 linkage. | Repair linkage. |
| | Intermittent electrical connections. | Repair connection. |
| | Improper relationship between governor output shaft travel and engine. | 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. |
| 2. Output shaft jiggle. | Rough engine 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. |
| | Governor not mounted squarely on drive pad. | Loosen governor on pad and realign. Tighten attaching bolts or nuts evenly to proper torque value. |

| Trouble | Probable Cause | Correction |
|---|---|---|
| 3. Fuel 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. |
| | Worn governor. | Replace governor. |
| | | 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 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. |
| | 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 stays at maximum speed position regardless of speed setting or load. | 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 that S1 is depressed to center of P.C. Board. |
| | | 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. |
| 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, 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 will not carry full load. | Fuel control does not fully open. | Check and adjust linkage. Check for binding in fuel or steam control. |
| | Torque Limit in the way. | Check governor to engine linkage. |
| | Low governor oil pressure. | See item 3 above. |
| 8. Improper load division between paralleled units, All units in 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. Engine will not start. Governor not moving to start position. | Governor improperly installed. | Check installation. |

# Chapter 5.
# Maintenance

## Introduction

Perform a visual inspection of the control unit to find obvious defects. 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. Dry compressed air at low pressure may be used to blow dust from hard to reach areas.

## Disassembly and Reassembly

If disassembly of the Speed and Speed Correction Control unit is required, take care not to damage other components or wiring. Proceed as follows:

1. Ensure 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.

**NOTICE**

**Interaction of the torque limiter and the electric speed setting make repair of the PG-TR column in the field impractical. Should the adjustments in the PG-TR be moved it will require extensive repair and testing on an approved test stand.**

**If repair of the PG-TR is required, the unit should be removed from the engine and sent to am authorized repair facility.**

Do not remove or disturb the position of setscrews, spring seats, brackets, etc., which function as adjustments; nor disassemble the various linkages.

## Adjustments

It is recommended that no adjustments be made on the transducer-receiver unless adequate facilities are available 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 36696)
- 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 (Figure 6-1)

| Ref. No. | Part Name | Quantity |
|---|---|---|
| 36696-1 | Screw, soc. hd. cap, 1/4-28 x 1-1/4 | 1 |
| 36696-2 | Washer, spring lock, 17/64 ID | 2 |
| 36696-3 | Washer (AN960-416L) | 2 |
| 36696-4 | Screw, soc. hd. cap, 1/4-28 x 2 | 1 |
| 36696-5 | Gasket | 1 |
| 36696-6 | Restoring lever loading spring | 1 |
| 36696-7 | Cotter pin, 1/32 x 3/8 | 1 |
| 36696-8 | Pin, drilled straight, 1/8 x 1 | 1 |
| 36696-9 | Adjusting screw bracket assembly | 1 |
| 36696-10 | Adjusting screw, 10-32 x 1/4 | 1 |
| 36696-11 | Screw, soc. hd. cap, 10-32 x 3/8 | 1 |
| 36696-12 | Washer, split lock (MS35338-43) | 1 |
| 36696-13 | Nut, hex, 10-32 (MS35650-302) | 1 |
| | Parts 14 through 16 are present on all governors. They are not used with the Speed and Speed Correction Control (Woodward part 8272-639). | |
| 36696-14 | Screw, soc. hd cap, 6-32 x 1/2 | 2 |
| 36696-15 | Lockwasher | 2 |
| 36696-16 | Bracket | 1 |
| 36696-17 | Block assembly | 1 |
| 36696-18 | Coil plunger assembly | 1 |
| 36696-19 | Screw, soc. hd, 10-32 x 7/16 | 2 |
| 36696-20 | Feedback coil assembly | 1 |
| 36696-21 | Nut, hex, 8-32 (MS20365-832A) | 1 |
| 36696-22 | Screw, fil. hd., 8-32 x 1 | 1 |
| 36696-23 | Restoring lever | 1 |
| 36696-24 | Setscrew | 2 |
| 36696-25 | Feedback spring assembly | 1 |
| 36696-26 | Centering nut | 1 |
| 36696-27 | Setscrew, no-mar | 1 |
| 36696-28 | Spring adjusting nut | 1 |
| 36696-29 | Screw, soc. hd. cap, 10-32 x 1-5/8 | 2 |
| 36696-30 | Washer, split lock, no 10 (MS35338-43) | 2 |
| 36696-31 | Spring adjusting plate | 1 |
| 36696-32 | Pin | 1 |
| 36696-33 | Transducer bracket | 1 |
| 36696-34 | Centering spring assembly | 1 |
| 36696-35 | Magnet assembly | 1 |
| 36696-36 | Transducer assembly | 1 |
| 36696-37 | Washer, 0.218 ID, 0.438 OD | 1 |
| 36696-38 | Spring | 1 |

| Ref. No. | Part Name | Quantity |
|---|---|---|
| 36696-39 | Bushing | 1 |
| 36696-40 | Pilot valve plunger assembly | 1 |
| 36696-41 | Screw, fil. hd., 6-32 x 1 (AN500-6-16) | 1 |
| 36696-42 | Lockwasher (AN935-GL) | 1 |
| 36696-43 | Washer, plain (AN960-6) | 1 |
| 36696-44 | Rectifier cover | 1 |
| 36696-45 | Rectifier | 2 |
| 36696-46 | Soldering lug | 2 |
| 36696-47 | Rectifier mounting block | 1 |
| 36696-48 | Paper insulator | 1 |
| 36696-49 | Screw, fil. hd., 4-40 x 5/16 (AN500-4-5) | 4 |
| 36696-50 | Washer, lock (AN935-4) | 4 |
| 36696-51 | Receptacle | 1 |
| 36696-52 | Gasket | 1 |
| 36696-53 | Dowel pin | 2 |
| 36696-54 | Headed pin (AN393-25) | 1 |
| 36696-55 | Speed control bracket | 1 |
| 36696-56 | Retaining ring | 2 |
| 36696-57 | Nut, elastic stop, 10-32 | 1 |
| 36696-58 | Low speed stop plunger | 1 |
| 36696-59 | Low speed stop cap | 1 |
| 36696-60 | O-ring, 0.629 OD (NAS1593-04) | 1 |
| 36696-61 | Nut, hex, 10-32 (MS35650-302) | 1 |
| 36696-62 | Socket set screw 10-32 x 1-1/4 | 1 |
| 36696-63 | Speeder spring power piston assembly | 1 |
| 36696-64 | Speeder spring power cylinder assembly | 1 |
| 36696-65 | Cotter pin | 1 |
| 36696-66 | Pin | 1 |
| 36696-67 | Screw, soc. hd. cap, 10-32 x 3/8 | 1 |
| 36696-68 | Screw, soc. hd. cap, 10-32 x 5/8 | 2 |
| 36696-69 | Washer, splitlock (MS35338-43) | 3 |
| 36696-70 | O-ring, 0.441 OD (NAS1593-011) | 1 |
| 36696-71 | Roll pin | 2 |
| 36696-72 | Setscrew, nylok, 10-32 x 1/4 | 1 |
| 36696-73 | Plug | 1 |
| 36696-74 | Knob | 1 |
| 36696-75 | Screw, soc. hd. cap, 10-32 x 3/8 | 3 |
| 36696-76 | Washer, splitlock, No. 10 (MS35338-43) | 3 |
| 36696-77 | Adjuster retainer | 1 |
| 36696-78 | Slider | 1 |

| Ref. No. | Part Name | Quantity |
|---|---|---|
| 36696-79 | Seat, hex | 1 |
| 36696-80 | Nut, jam, 5/16-18 | 1 |
| 36696-81 | Return spring | 1 |
| 36696-82 | Adjuster shaft | 1 |
| 36696-83 | Adjuster bracket | 1 |
| 36696-84 | Cotter pin | 2 |
| 36696-85 | Pin | 1 |
| 36696-86 | Lever assembly | 1 |
| 36696-87 | Screw, soc. hd. cap, 10-32 x 7/8 (MS24678-13) | 2 |
| 36696-88 | Washer, splitlock, No. 10 (MS35338-43) | 2 |
| 36696-89 | Screw, soc. hd. cap, 6-32 x 3/8 (MS35457-7) | 2 |
| 36696-90 | Lockwasher, 0.141 ID (AN935-6L) | 2 |
| 36696-91 | Stop block | 1 |
| 36696-92 | Cotter pin | 3 |
| 36696-93 | Spring washer, 0.188 ID | 2 |
| 36696-94 | Washer, plain, 0.200 ID (AN960-102) | 2 |
| 36696-95 | Pin | 1 |
| 36696-96 | Pivot link | 1 |
| 36696-97 | Pin | 1 |
| 36696-98 | Washer, plain, 0.140 ID | 1 |
| 36696-99 | Pin | 1 |
| 36696-100 | Nut 8-32 | 2 |
| 36696-101 | Setscrew, 8-32 x 3/4 | 2 |
| 36696-102 | Pivot arm | 1 |
| 36696-103 | Speed setting post | 1 |
| 36696-104 | Screw, hex hd. cap | 1 |
| 36696-105 | Washer, splitlock | 1 |
| 36696-106 | O-ring | 1 |
| 36696-107 | Screw, hex hd. cap, 1/4-28 x 1-3/8 | 2 |
| 36696-108 | Washer, plain | 2 |
| 36696-109 | Solenoid shutdown assembly | 1 |

## Parts List—Speed and Speed Correction Control Parts Assembly (Figure 6-2)

| Ref. No. | Part Name | Quantity |
|---|---|---|
| 36696-201 | Enclosure Assembly | 1 |
| 36696-202 | Printed Circuit Board Assembly | 1 |
| 36696-203 | Screw, 6-32 x .375 pan head s.s | 7 |
| 36696-204 | Panel Assembly, mounting bracket | 1 |
| 36696-205 | Screw, 10.32 x .312 pan head s.s | 4 |
| 36696-206 | Receptacle, 2 pin | 1 |
| 36696-207 | Screw, 4-40 x 0.375 pan head s.s | 16 |
| 36696-208 | Gasket, 14 MS connector | 2 |
| 36696-209 | Ring, 14 connector nut | 2 |
| 36696-210 | Receptacle, 3 pin | 1 |
| 36696-211 | Receptacle, 5 pin | 1 |
| 36696-212 | Receptacle, 10 pin | 1 |
| 36696-213 | Gasket, 18 MS connector | 2 |
| 36696-214 | Ring, 18 connector nut | 2 |
| 36696-215 | Label, J1 to J4 identification | 1 |
| 36696-216 | Stick-on Nameplate for front cover (not shown) | 1 |

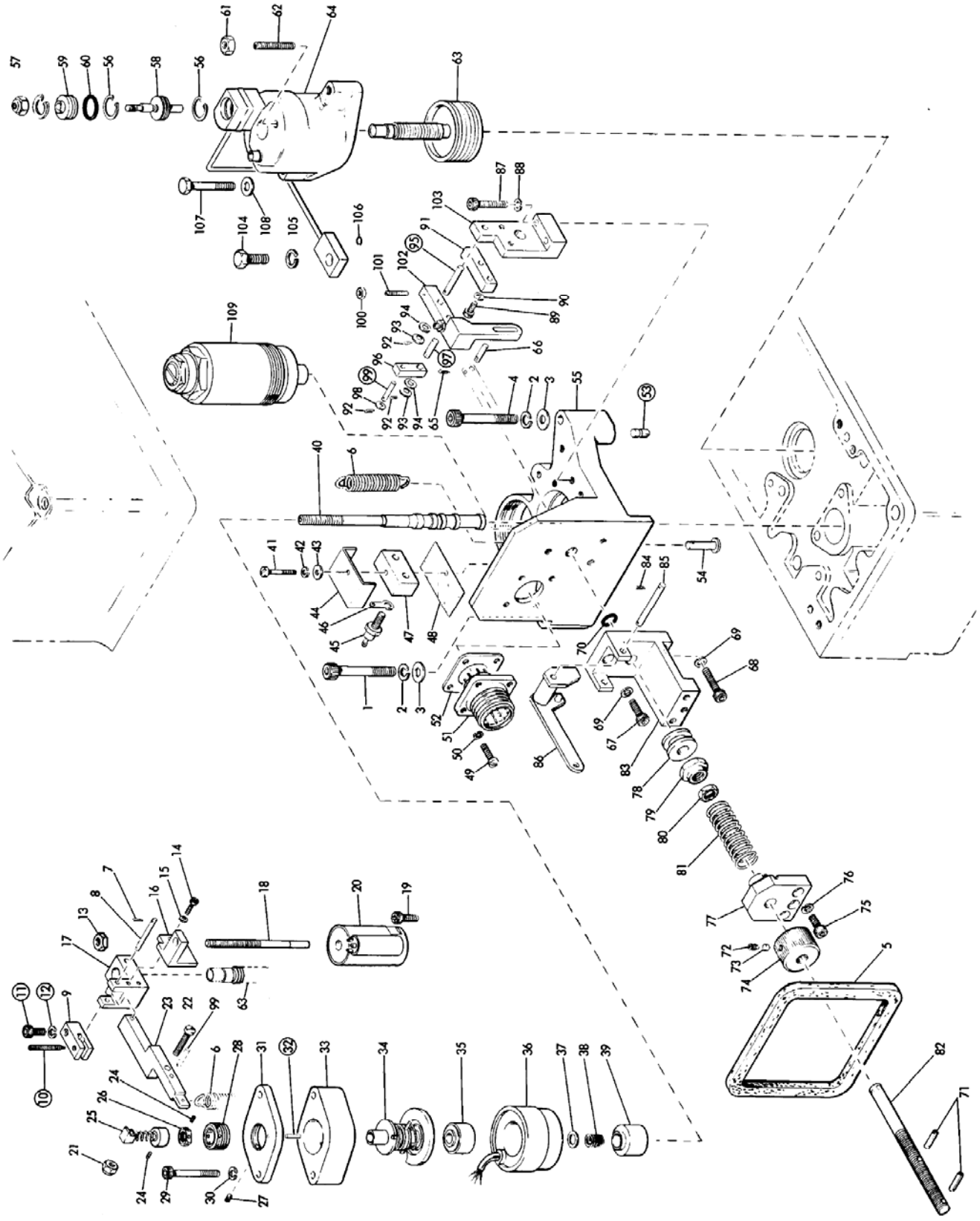

Figure 6-1. Transducer-Receiver Assembly

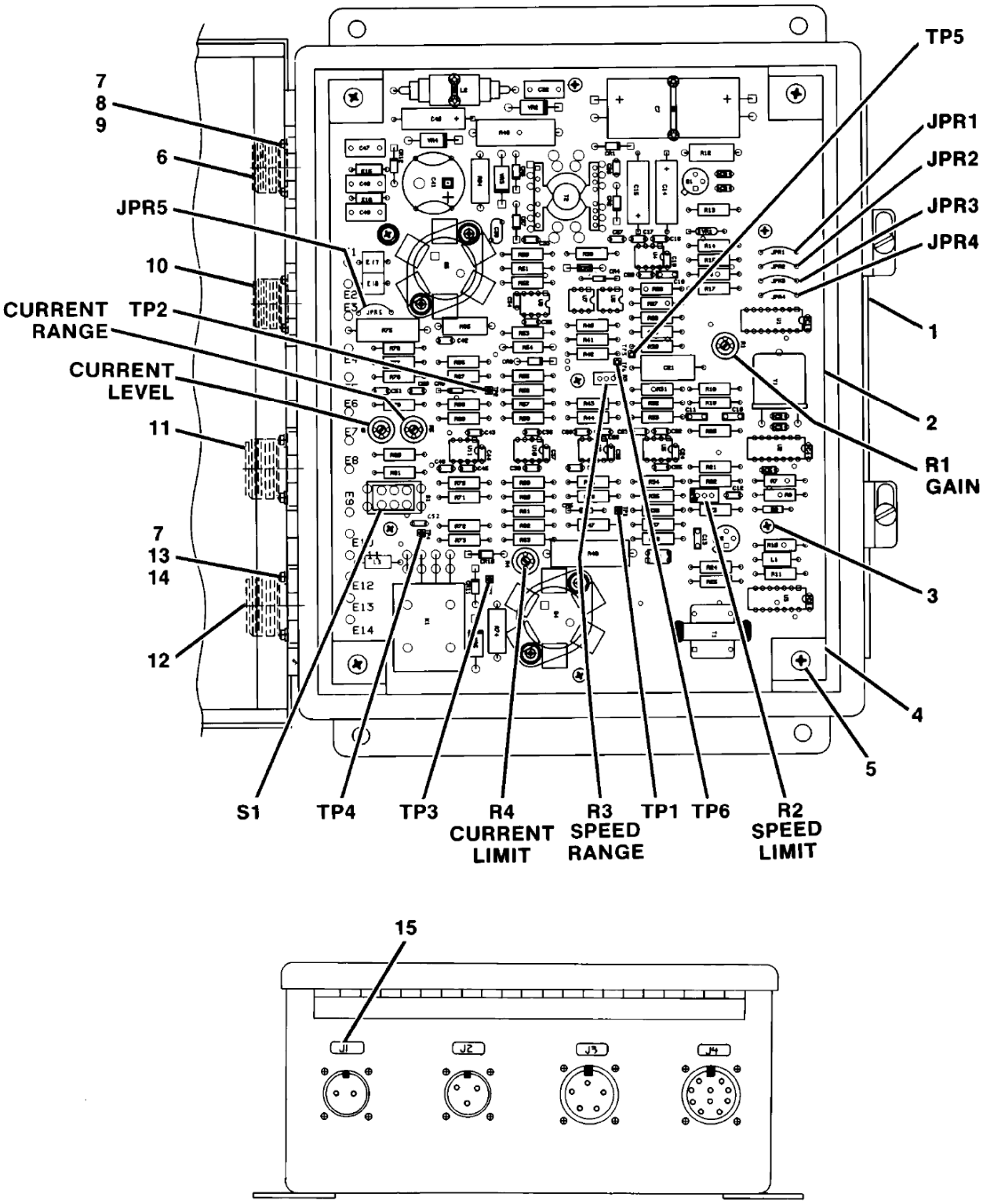


Figure 6-2. Speed and Speed Correction Control Parts

# 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 36696A.**

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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**

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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.**

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