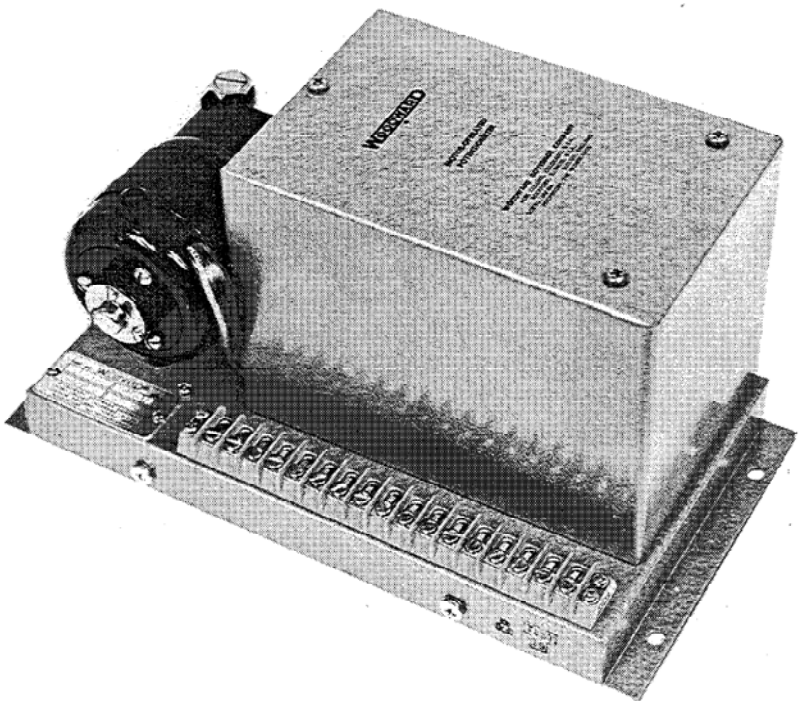
WOODWARD

Product Manual 37716
(Revision D, 1/2013)
Original Instructions



Motor Operated Potentiometer

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 Out-of-date translations are marked with ⚠.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

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

Manual 37716

Contents

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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.

Chapter 1.
Motor Operated Potentiometer

Introduction

The motor operated potentiometer (MOP) is an auxiliary unit for use with electronic speed governors or automated paralleling equipment. Some MOPs are built into the units they control; others are separate and must be wired into their control circuits. The MOP is used primarily for adjusting the speed reference potentiometer to the necessary speed setting on an electronic governor.

Several variations of function and equipment are available, such as: motor type and voltage, potentiometer resistance (determined by type of control and speed range) and rotational travel (determined by required rate of change), number and types of auxiliary cams and switches, trim pots for accurate resetting adjustment, and braking diodes to prevent overrunning by the motor. This manual covers the MOP that has a Bodine ac/dc gear motor driving a potentiometer, and a gear-driven camshaft with two or more cams attached to the shaft.

Operation

Refer to the typical schematic diagram, Figure 1-1. The black lead to the motor is energized to raise governor speed setting; to lower speed setting, the red lead is energized. The common blue lead completes the circuit. An optional shunt resistance allows drive speed to be reduced by lowering current through the motor armature. Potentiometer P3 adjusts this speed.

Limit switches C2 and D are normally closed. Cam C2 opens switch C2 when the low limit is reached; cam D opens switch D when the high limit is reached. Since the limit switches are in series with the motor power circuit, the motor will not be driven beyond the set limits.

Reset cams may be provided to return the governor to a desired speed setting value, such as when paralleling engines after breaker closes to assure equal speed setting. When the reset circuit is energized, if the position of P1 is below rated speed position, current flows through switch A, driving the motor counterclockwise until the set position is reached. Then cam A allows the points of switch A to break contact. If P1 is above rated speed position, cam and switch B operate in the same manner as described for cam A. Trim pots P2 and P4 are used to adjust the output of P 1 for the null point of the reset circuit or to move the speed range of Pl up or down.

Other cam-and-switch arrangements may be used as desired. C1 is available for such use. In some applications, a cam is used to drive the prime mover to a given load value when the governor is in the droop mode.

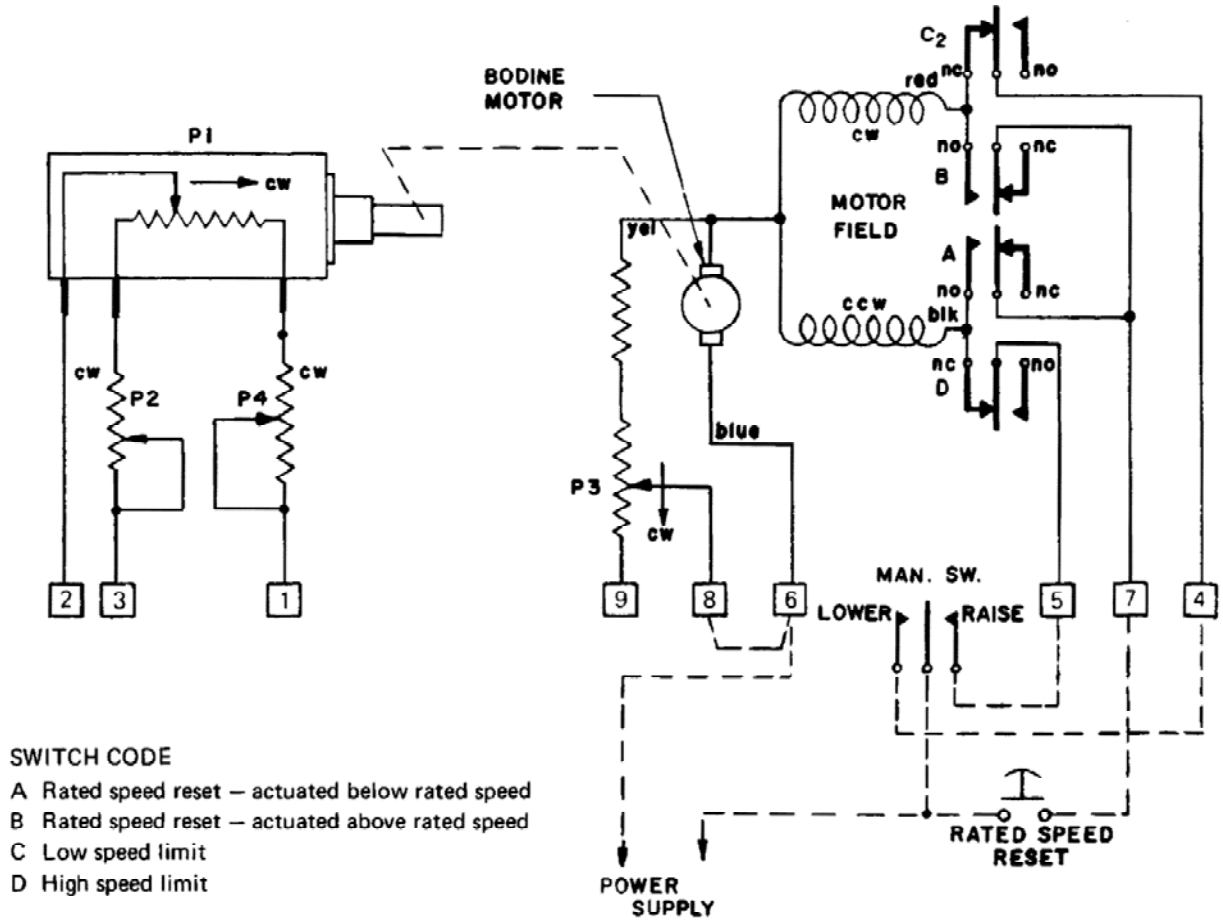

Figure 1-1. Typical Schematic Diagram

IMPORTANT

Refer to plant wiring diagram for your specific control system for terminal connections.

IMPORTANT

Power applied between terminals 4 and 6 rotates the motor clockwise viewed from the end of its shaft. This in turn rotates the potentiometer counterclockwise viewed from the end of its shaft. This increases the resistance between terminals 1 and 2.

Adjustment

Cams are adjusted at the factory and should not need resetting. Trim pot P4 will adjust the null point of the reset circuit. If the limit cams need readjusting, set so that the cam opens its switch about 5° before the potentiometer stop is reached. If the reset cams are set incorrectly, drive the potentiometer to near the middle of its range. Then, with the motor not energized, set cam A so that switch A is not actuated, but will be actuated if the motor is driven clockwise. Now set cam B so that switch B is also not actuated, but will actuate if the motor is driven counterclockwise. Trim pot P4 may then be adjusted for the desired reset speed for the governor.

The clutch between the motor and potentiometer shafts may be adjusted if necessary. Move the motor shaft away from the clutch, then remove retaining ring 52 and cover 53. Tighten nut 54 if clutch has been slipping too readily. Loosen if clutch will not slip at 15·25 inch-ounces of torque.

⚠WARNING

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.

Maintenance

The maintenance procedure for the Bodine motor is covered in Woodward manual 03505, Other components may be checked for operation with an ohmmeter or visually.

Information and Parts Replacement

When requesting additional information concerning MOP operation or when ordering repair parts, please supply the following information.

1. MOP designation number (shown on nameplate) or package designation number if MOP is an integral part of a larger unit. The parts list is general and does not identify exact part numbers or exact quantities needed for your unit.
2. Manual number. This is manual 37716.
3. Part reference number, name of part, or description of part.

Parts List

(See Figure 1-2 for reference callouts.)

REF. NO.	PART NAME ..... QTY
37716-1	Blind rivet 2
37716-4	Nameplate 1
37716-5	Screw, 10-32 x 5/8" 4
37716-6	Split lockwasher, #10.....4
37716-7	Rheostat (motor speed)..... *
37716-8	Retaining ring.....1
37716-9	Gear.....1
37716-10	Gear.....1
37716-11	Washer.....1
37716-12	Cam ..... *
37716-13	Setscrew ..... *
37716-14	Cover 1
37716-15	Screw, 4-40..... *
37716-16	Shakeproof washer. #4..... *
37716-17	Cam ..... *
37716-18	Terminal strip 1
37716-19	Screw, 8-32 x 3/8.....2
37716-20	Shakeproof washer #8.....2
37716-21	Screw, 6-32.....4
37716-23	Nut, 6·32 4
37716-24	Motor.....1
37716-25	Chassis 1
37716-26	Screw, 10-32.....4
37716-27	Motor mtg. plate.....1
37716-28	Potentiometer mtg. plate....1
37716-29	Gear stud 1
37716-30	Gear assy 1
37716-31	Spacer.....1
37716-32	Gear mtg. plate 1
37716-33	Screw, 8·32 x 3/8 3
37716·34	Shakeproof washer.....3
37716-35	Baseplate, MOP.....1
37716·36	Potentiometer ..... *
37716-37	Cam shaft 1

REF. NO.	PART NAME ..... QTY
37716-38	Roller lever .....*
37716-39	Switch .....*
37716-40	Grommet.....1
37716-41	Screw.....*
37716-42	Shakeproof washer.....*
37716-43	Trim pot .....*
37716-44	Screw, 8-32 x 5/8.....6
37716-45	Shakeproof washer, #8 6
37716-46	Trim pot mtg. plate.....1
37716-47	Chassis baseplate 1
37716-48	Resistor .....*
37716-49	Screw, 6-32 .....*
37716-50	Shakeproof washer, #6 .....*
37716-52	Retaining ring 1
37716-53	Friction drive cover 1
37716-54	Elastic stop nut 1
37716-55	Spring 1
37716-56	Friction drive case 1
37716-57	Drive plate 1
37716-58	Bellview spring.....1
37716-59	Roll ping.....1
37716-62	Grommet.....1
37716-63	Grommet.....1
37716-64	Oilite bushing.....2
37716-65	Terminal strip.....1
37716-66	Fiber washer.....*
37716-67	Setscrew, 5-40.....*
37716-68	Setscrew, 6-32.....1
37716-69	Shakeproof washer, #10 ...4
37716-70	Screw.....1
37716-71	Elastic stop nut 1

* Denotes varying quantities, different sizes. or may not appear, according to model of MOP.

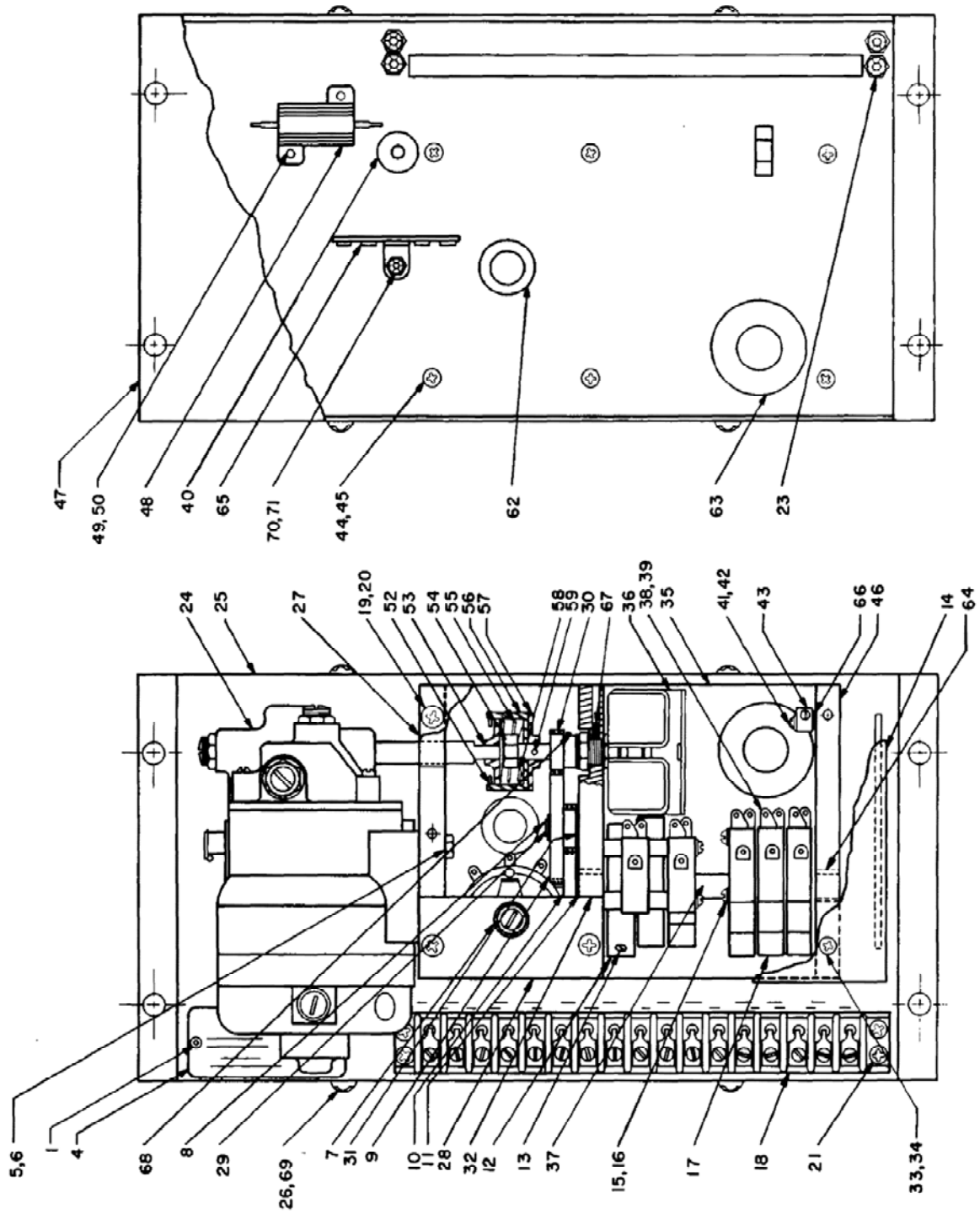

Figure 1-2. Typical Assembly Drawing

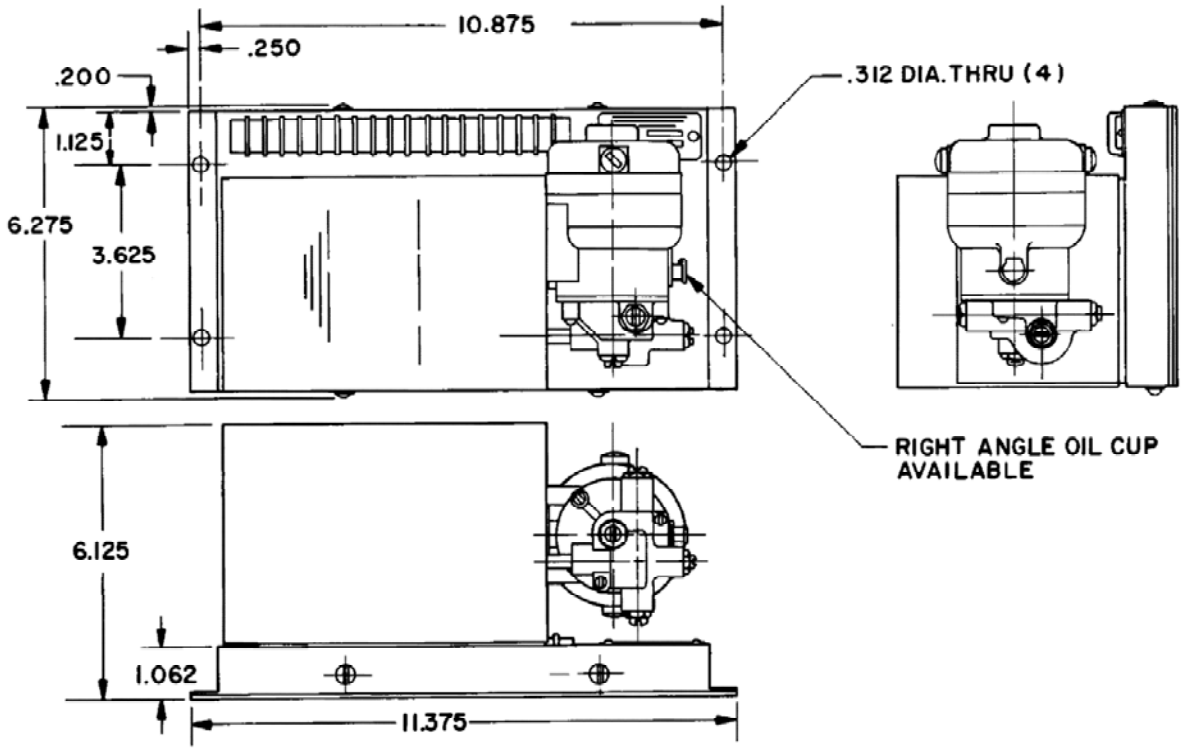

Figure 1-3. Outline Drawing
(Do not use for construction.)

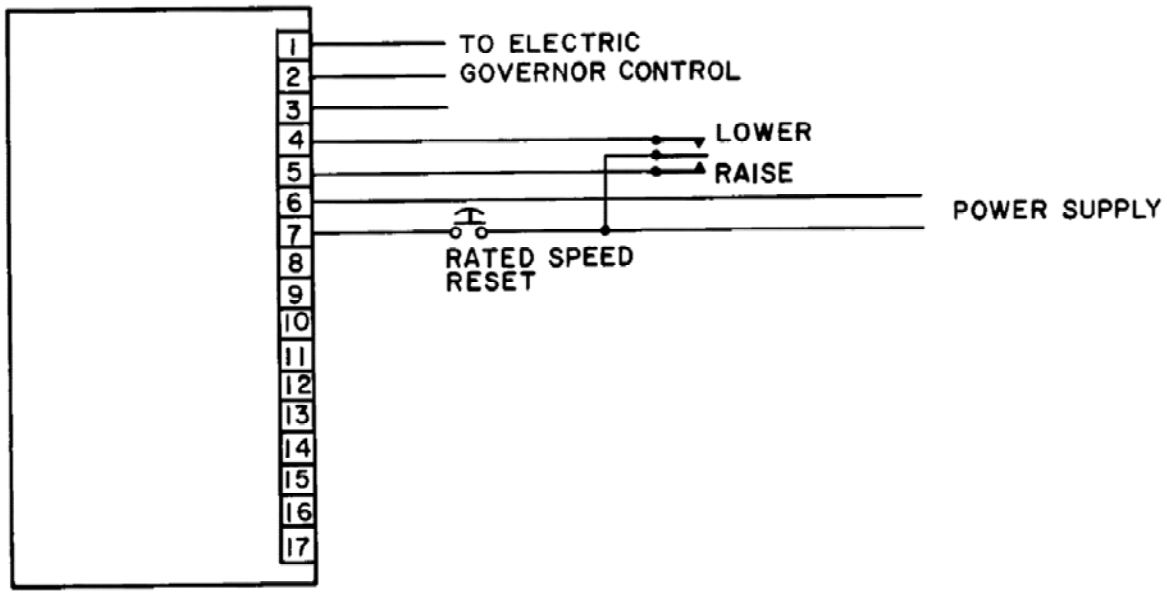

Figure 1-4. Typical Plant Wiring Schematic
(Do not use for construction.)

Chapter 2.
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 37716D.

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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.