WOODWARD

Product Manual 26206
(Revision NEW)
Original Instructions

Hybrid Position Indicator for Fuel Oil Bypass Control Valve

Installation and Calibration 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 Out-of-date translations are marked with ⚠.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.

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.
Installation and Calibration

Introduction

The Hybrid Position Indicator (HPI) is a field-installable device that provides both visual and electronic feedback for the Fuel Oil Bypass Control Valve product family. An externally mounted piston, cylinder, and spring maintain contact with the flow control piston through a push rod that enters the hydraulic cavity of the valve through a dual seal arrangement. A dual rod LVDT is connected to the piston to provide dual electronic feedback, and a slot in the side of the cylinder is used for visual feedback of the piston position.

The dual LVDT is calibrated to the valve stroke such that it reads 0.7 ±0.1 Vrms at 0% stroke and 3.5 ±0.5 Vrms at 100% stroke with 7.0 Vrms 3000 Hz excitation. All electrical connections for the LVDT are made in a junction box mounted on the side of the HPI cylinder. The HPI is normally factory-calibrated to the fuel valve stroke but can be field-calibrated by using an external position measurement device and the Woodward stroke measurement tool.

Tools Required

- Torque wrenches and assorted sockets to torque nuts between 4 and 250 N·m
- 1-11/16” (43 mm) Crow’s foot for LVDT nuts
- Woodward stroke measurement tool 1008-4446 Rev C or higher
- Linear travel measurement device with a minimum stroke of 1.6 inch (41 mm) and an accuracy of ±0.001 inch (±0.03 mm)
- Voltmeter capable of reading 0–7 Vrms at 3000 Hz with an accuracy of ±0.1 Vrms

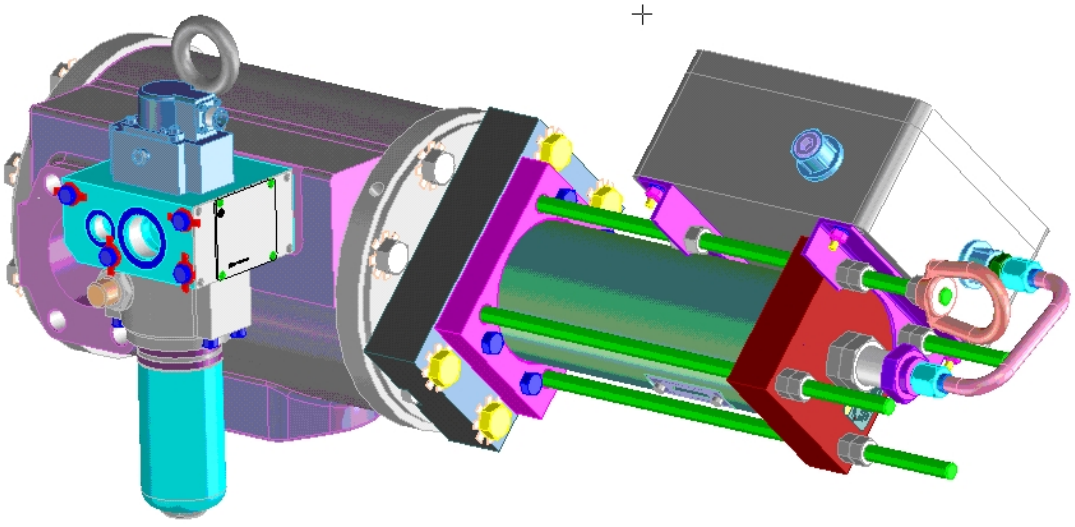


Figure 1-1. HPI Installation Location

⚠WARNING

Be sure that all electric power, hydraulic pressure, and fuel pressure has been removed from the valve before installation, maintenance, or repairs are to begin.

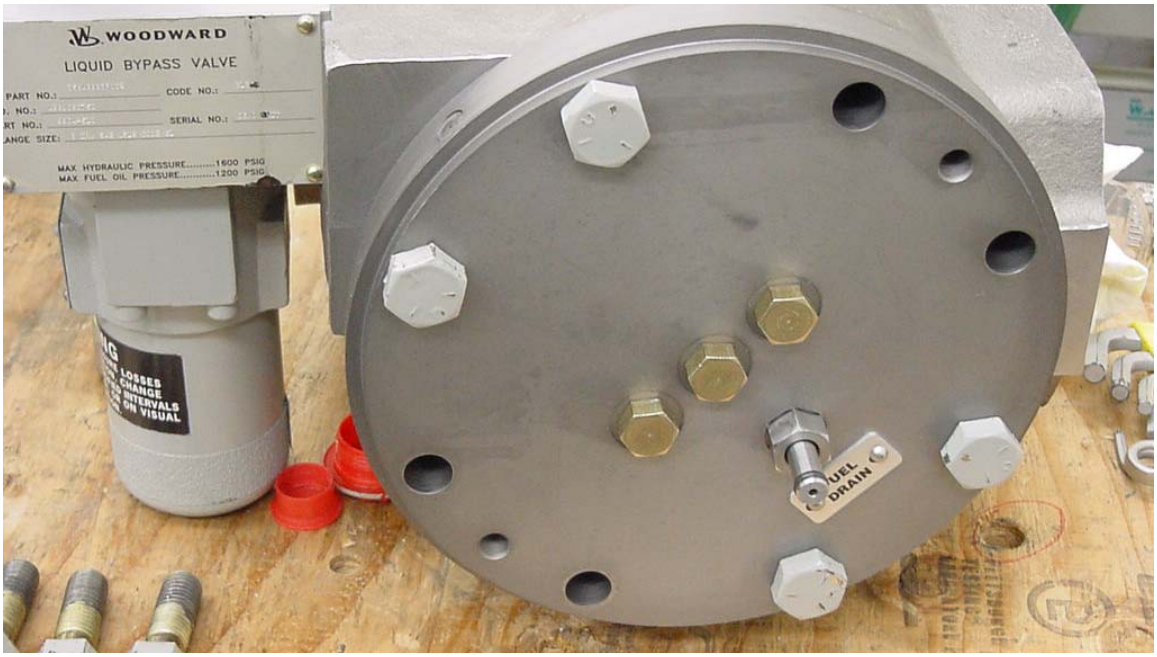
⚠WARNING

Although the HPI will fit on either end of the Bypass Control Valve, it must be attached to the Turbine Port and hydraulic block end in order to retain the correct valve response on loss of hydraulic supply pressure and to have the correct polarity. See Figure 1-1 below for HPI installation location.

Installation of Hybrid Position Indicator (HPI)

1. Remove the “Fuel Drain” tubing and the 0.438-20 (SAE – 04) fitting from the end cap on the Turbine port and hydraulic block end of the valve (see Figure 1-1 above). This tubing will need to be modified to fit the relocated “Fuel Drain” port and must be out of the way to install the HPI.

2. Remove the four 0.625-11 hex head cap screws from the end cap on the same end of the valve (see photo). A screwdriver or chisel can be used to bend the locking tabs down in order to access the screw heads.



3. Clean the surface of the end cap face between and around the bolt holes such that the HPI seal plate will sit flat on the end cap and no debris will enter the valve.

4. Install the special (part number 1295-1013) 0.438-20 (SAE – 04) straight thread O-ring port fitting (including O-rings pre-installed on the fitting) into the “Fuel Drain” port. Torque the fitting to 4.3–4.7 N·m (38–42 lb-in).

5. Remove the 0.562-18 (SAE – 06) straight thread O-ring port plug located in the center of the end cap on the same end of the valve. The valve will contain a large amount of hydraulic fluid that will flow out of the open port. Ensure that no contamination is introduced into the valve while the plug is out of the valve.

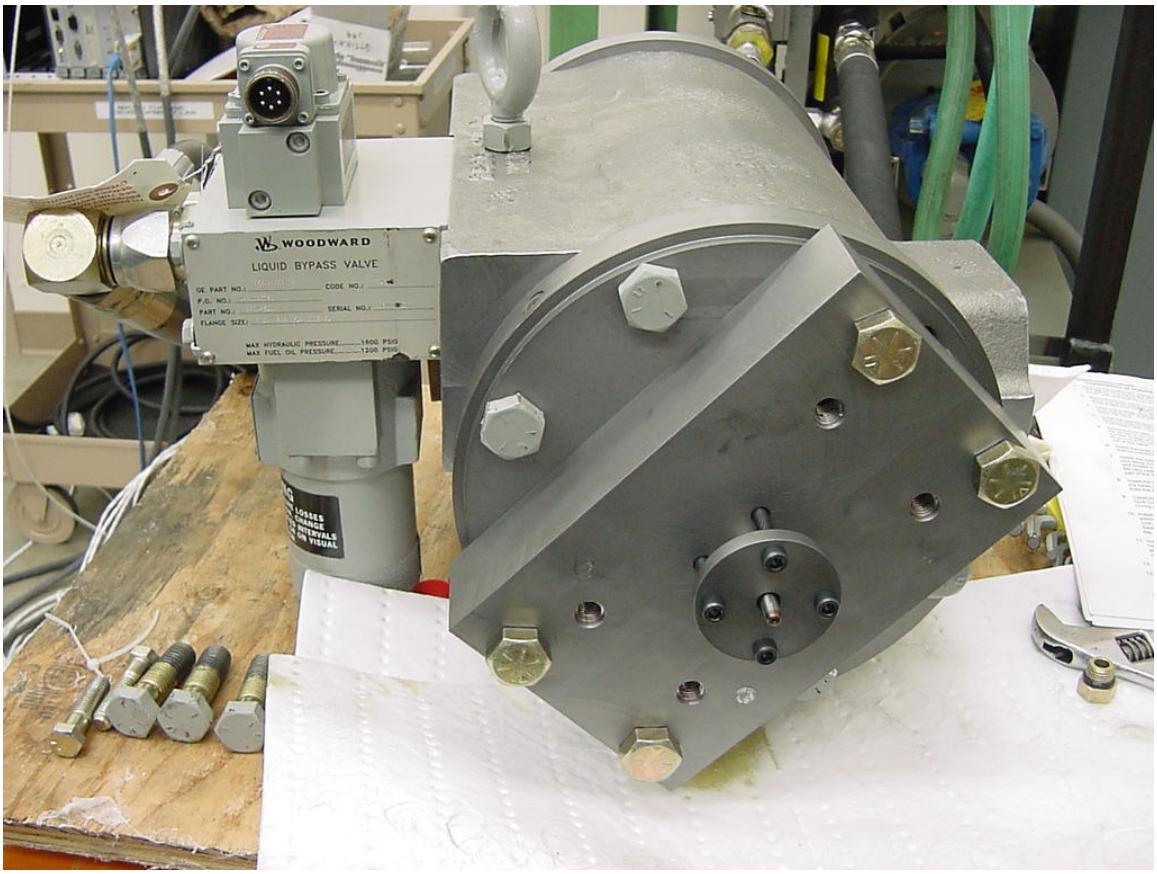
6. Insert the large end of the push rod (1319-1001) into the open port. Ensure that no contamination is introduced into the valve.

7. Install the special (1295-1012) 0.562-18 (SAE – 06) straight thread O-ring port fitting (including two O-rings preinstalled on the fitting) over the push rod and thread it into the end cap. Torque the fitting to 7.9–9.0 N·m (70–80 lb-in). Be very careful not to scratch or bend the push rod because the surface is part of the dynamic seal (see photo).

8. Insert the Quill Tube (3200-1000, including the two O-rings preinstalled on the tube) into the “Fuel Drain” fitting. The O-ring compression is adequate to hold the Quill Tube in position while installing the Seal Plate.

9. Carefully slide the Seal Plate Assembly (4073-3004) over the push rod and Quill Tube until it is piloted on the center 0.562-18 (SAE – 06) straight thread O-ring port fitting and sitting flush against the valve end cap.

10. Install the four 0.625-11 hex head cap screws (1031-1106) with locking tab washers (1012-787) onto the Seal Plate Assembly. Torque the screws to 224–251 N·m (165–185 lb-ft). Bend one locking tab over the edge of the Seal Plate Assembly (4073-3004) and at least one locking tab over a screw flat. A screwdriver or chisel can be used to bend the locking tabs (see photo [tab washers not shown]).



11. Install the Position Indicator Assembly (4073-3003) using four 0.438-14 hex head cap screws (189675) in the orientation desired. This assembly can be attached in two orientations 180 degrees apart. The screws can be started by hand but must then be tightened evenly to compress the return spring without damaging the push rod. Torque screws to 66–83 N·m (49–61 lb-ft).

12. Apply hydraulic pressure to the valve and verify that there are no external leaks or leaks from the “Fuel Drain” port on the HPI.

13. Reinstall the “Fuel Drain” tubing to the new port located on the seal plate assembly. This tubing will need to be modified to fit the relocated “Fuel Drain” port.

14. Wire the LVDT to the controller based on the wiring diagram in Figure 1-2.

15. Verify that the excitation voltage to each LVDT is 7.00 ±0.10 Vrms (measured across terminals 7 & 8 and 11 & 12).

16. Replace the cover to the electrical box.

17. Verify that all hardware has been replaced onto the actuator and that all external fittings are torqued except for the lock nuts on the LVDT and the conduit nut on the LVDT.

18. Remove the old nameplate from the valve, copy the serial number to the new nameplate, and attach the new nameplate to the valve using the four drive screws provided.

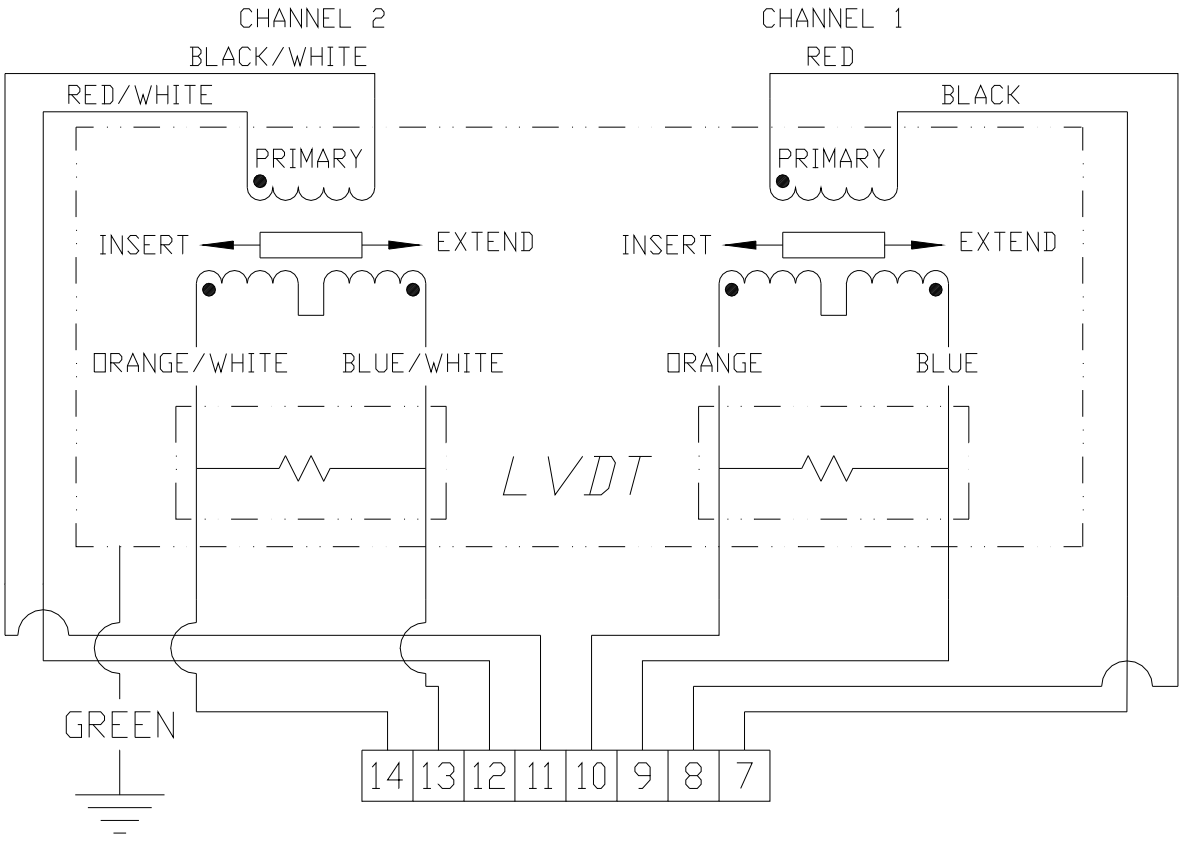


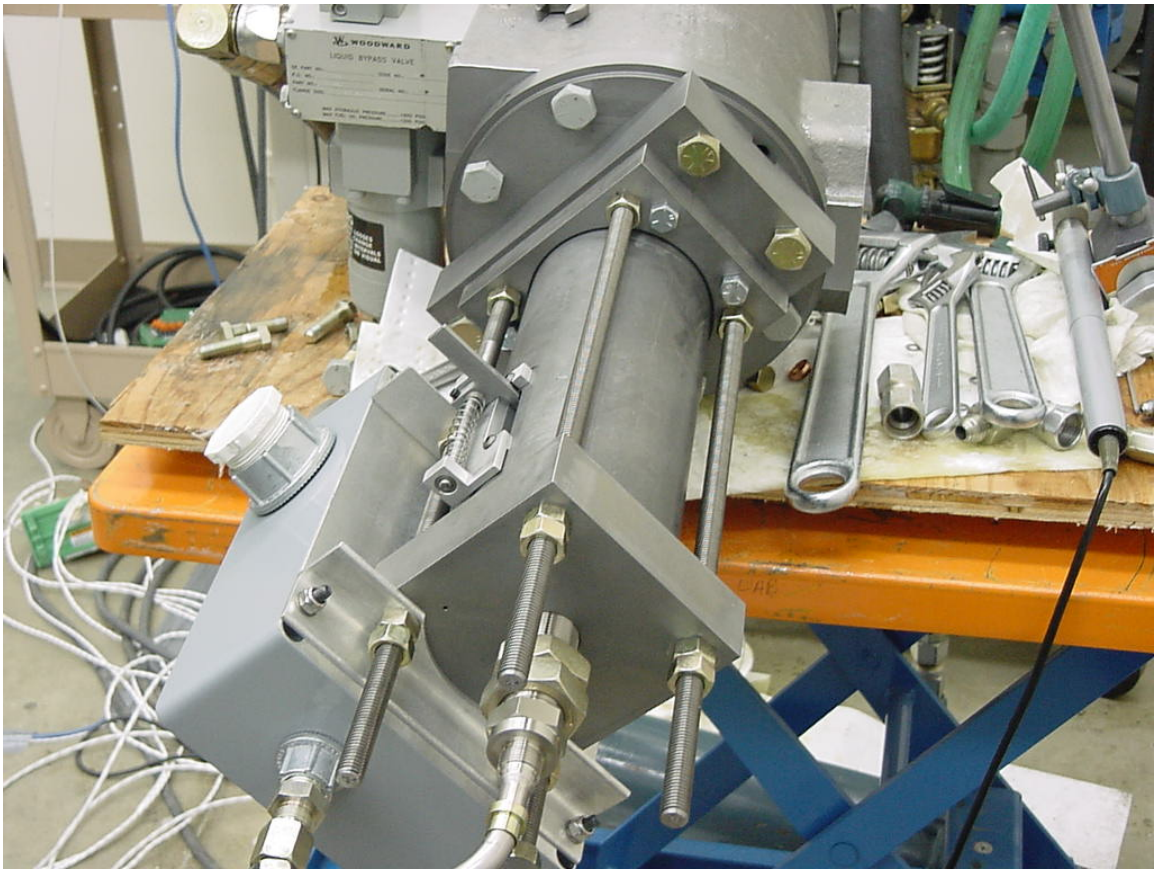
Figure 1-2. LVDT Wiring Diagram

Calibration of Hybrid Position Indicator (HPI)

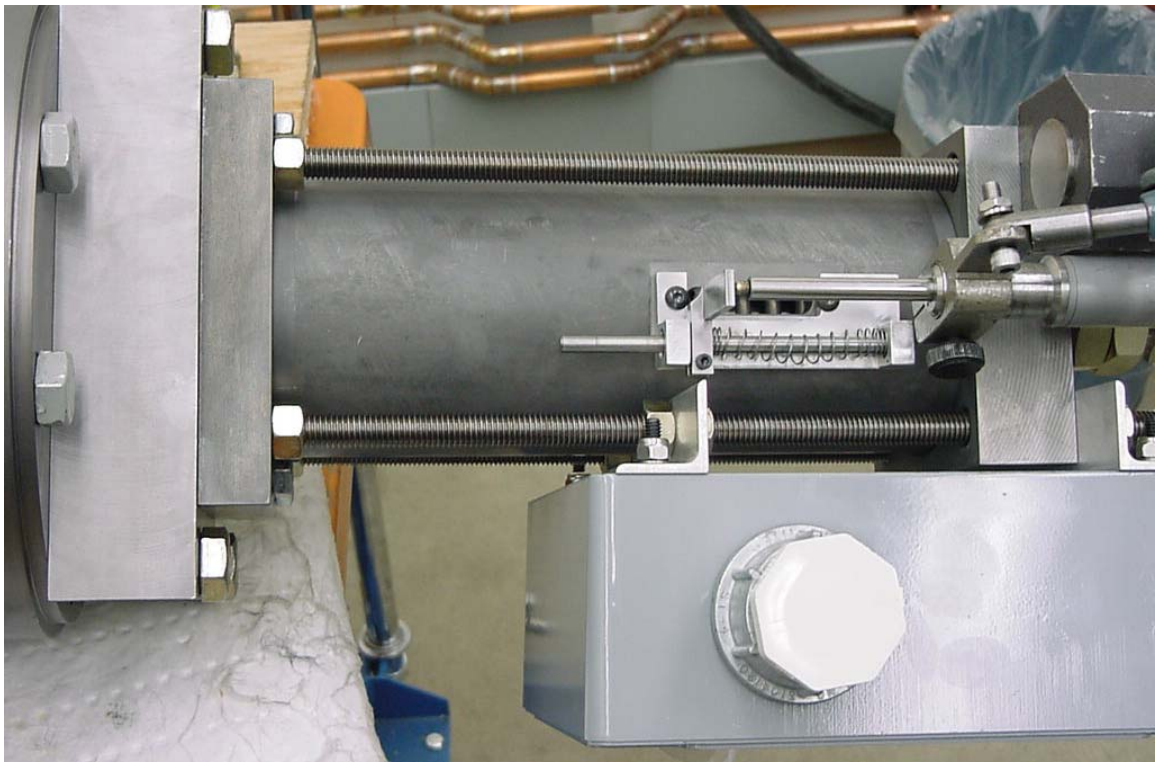
1. Remove the two socket head cap screws holding the visual indicator onto the control valve actuator.

2. Remove the visual indicator plate.

3. Install the stroke measurement tool (part number 1008-4446) into the visual indicator window, making sure that the tip of the tool rests on the top of the indicator piston. Fasten the tool to the cylinder with the screws provided with the tool (see photo).



4. Using a customer-supplied, spring-loaded travel indicator with a total stroke greater than 1.60 inches (40.6 mm), attach the indicator to the actuator housing by whatever means necessary. The indicator tip should rest on the tool platform so that the stroke of the valve can be measured (see photo).



5. Zero the travel indicator.

6. Verify that the excitation voltage to each LVDT is 7.00 ±0.10 Vrms (measured across terminals 7 & 8 for channel 1 and 11 & 12 for channel 2).

7. Supply the actuator with hydraulics (1600 psig/11 032 kPa).

8. Measure the LVDT output voltage using a high-quality digital voltmeter (select AC measurement mode, Volts rms, and measure across terminals 9 & 10 for channel 1 and 13 & 14 for channel 2).

9. Loosen the LVDT lock-nuts and the LVDT conduit nut so that the LVDT can be rotated.

10. With the valve commanded to 0% stroke, the valve will move so that the LVDT reads 0.70 ±0.10 Vrms. Adjust the LVDT in or out of the actuator by screwing the LVDT housing in or out of the top block until the travel indicator reading matches the 0% stroke value listed on the valve test sheet.

IMPORTANT **A small rotation of the LVDT will cause a substantial change in the readout.**

11. While holding the LVDT in position, tighten the lock-nuts to the LVDT and apply anti-tamper lacquer at the base of the first lock-nut. Torque the first lock-nut to 68–102 N·m (50–75 lb-ft) and the second lock-nut to 34–50 N·m (25–37 lb-ft).

12. Tighten the LVDT conduit nuts to 52–62 N·m (38–46 lb-ft) while holding the fitting.

13. Record the feedback voltage from each LVDT at this (0% stroke) position.

14. While still controlling the valve to 0% stroke (LVDT reads 0.7 ±0.1 Vrms), re-zero the travel indicator.

15. Using the control, position the actuator to 38.10 ±0.03 mm (1.500 ±0.001 inches) as indicated on the travel indicator.

16. Record the Feedback Voltage from each LVDT at the 38.10 mm/1.500 inch position ±0.03 mm/0.001 inch (measure across 9 & 10 for channel 1 and across 13 & 14 for channel 2). These values should be between 3.0 and 4.0 Vrms.

17. The LVDT values noted above and the 0% stroke measurement from the valve test sheet must be printed on the self-adhesive label mounted to the rear bulkhead of the wiring enclosure.

Chapter 2.
Service Options

Product Service Options

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

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

OEM and 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 **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

You can locate your nearest Woodward distributor, AISF, RER, or RTR on our website at:

www.woodward.com/directory

Woodward Factory Servicing Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

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

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

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

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

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

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

When shipping the item(s), attach a tag with the following information:

- return authorization number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:

- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

NOTICE

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

Replacement Parts

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

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

Engineering Services

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

- Technical Support
- Product Training
- Field Service

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

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

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

For information on these services, please contact us via telephone, email us, or use our website: **www.woodward.com**.

How to Contact Woodward

For assistance, call one of the following Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (0) 21 52 14 51
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

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

Turbine 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

You can also locate your nearest Woodward distributor or service facility on our website at:

www.woodward.com/directory

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

Your Name	
Site Location	
Phone Number	
Fax Number	
Engine/Turbine Model Number	
Manufacturer	
Number of Cylinders (if applicable)	
Type of Fuel (gas, gaseous, steam, etc)	
Rating	
Application	
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	

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 26206.

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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.

2013/3/Colorado