WOODWARD

Product Manual 02008
(Revision NEW)
Original Instructions

Fuel Limiter
Reverse Acting Model 8272-789

Installation and Operation Manual

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

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.

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.

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, be sure to check the *publications page* on the Woodward website:
www.woodward.com/publications
The current revision and distribution restriction of all publications are shown in manual *26311*.

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.

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.

NOTICE

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.

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*.

Contents

Illustrations and Tables

Chapter 1. Introduction

A fuel limiter is an electronic device that limits the maximum drive signal to an actuator. The amount of drive current reaching the actuator is determined by the input to the limiter.

The 1–5 Vdc input signal may be from a manifold-pressure sensor, a load sensor, or from a sensor that monitors some other process-related parameter. The fuel limiter also receives an actuator signal from a reverse acting 2301A control. (200 mA signal is minimum fuel, 0 mA is maximum fuel.) This signal is called the "control signal" to the limiter.

Fuel limiters are commonly used to reduce diesel emissions during starting and to provide more efficient engine load or speed increases.

The start-fuel-limiting application reduces smoke by limiting the maximum actuator signal that reaches an actuator during starting.

The fuel limiter consists of a printed-circuit board enclosed in a sheet-metal box. All adjustments and connections for external wiring are accessible from the front of the control.

Chapter 2.
Description of Operation

Figure 2-1 is a block diagram of the 8272-789 fuel limiter. The limiter is designed to provide a maximum actuator signal on a schedule determined by the setting of the slope and level potentiometers for Limiter 1 and Limiter 2.

In operation the limiter modifies a 1–5 volt signal that is proportional to inlet-manifold pressure. This modified signal is then used by the limiter to generate a signal that is reflective of the position on the slope. A modified control-actuator signal is compared with this signal and the highest signal is generated by the current driver to provide a 40–160 mA signal for the actuator on the engine.

The limiter prevents over fueling the engine when the inlet manifold pressure is too low to properly mix a certain amount of fuel. This operation will prevent unnecessary smoke and will also provide more efficient engine load or speed increases.

If the contacts between terminal 12 and 13 are closed the fuel limiter functions are both disabled and the actuator signal will always exactly track the control signal. Should these contacts open the limiter will follow the highest signal from either the speed control or from the limiter schedules.

If the contacts between 14 and 13 or 14 and 15 are closed that respective fuel limiter slope will be disabled and the remaining slope will still be limiting the actuator based on the 1-5 Vdc input. These contacts should only be closed to disable one fuel limiter schedule or the other. Close the contacts between 12 and 13 to disable both limiters at the same time.

IMPORTANT

If the circuit between terminals 12 and 13 is closed the contacts between terminals 14 and 15 and 14 and 13 must be open. If either of the slope contacts (14–15 or 14–13) are closed at the same time as terminals 12–13 the limiter circuits maybe stressed and/or over heated.

NOTICE

The fuel limiter, when active, limits the drive-signal current to the actuator. The actual position of the fuel-rack may vary, depending on temperature, actuator calibration, linkage wear, or other factors.

The fuel limiter must be powered up at all times the engine is running. Should the limiter lose power, the actuator signal will be interrupted. With no control signal the electric side of the reverse acting actuator will call for maximum fuel.

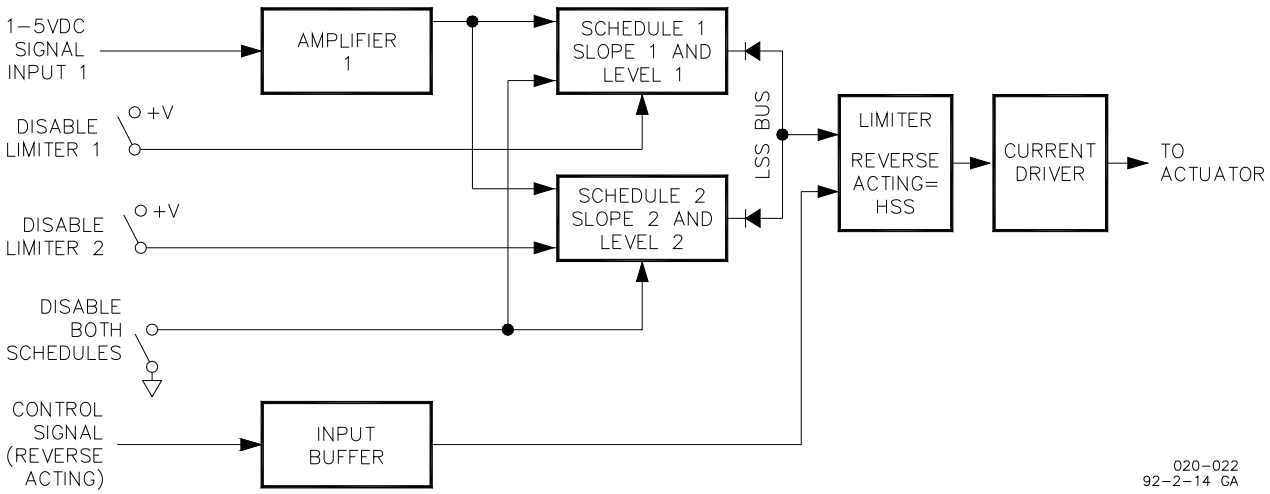

Figure 2-1. Block Diagram of 8272-789 Fuel Limiter

Chapter 3. Installation

Unpacking

The Fuel Limiter is shipped in a foam protected box. Should any damage be discovered while unpacking the limiter, immediately contact the shipper and Woodward.

The limiter is packaged in a special antistatic protective bag. Leave the control in its protective bag until ready to install. An antistatic bag should always be used when the control box is moved or replaced.

Installation

Power Requirements

The fuel limiter requires a voltage source of 20 to 40 Vdc for operating power. If a battery is used for operating power, provide a battery charger to maintain a stable dc supply voltage.

NOTICE

Do not exceed the allowable range for the supply voltage. Over 40 volts will damage the control. Severe voltage spikes also can damage electronic controls.

Location Considerations and Mounting the Control

The fuel limiter is designed to operate within a temperature range of –40 to +160 °F (–40 to +71 °C). The unit may be mounted in any position, provided adequate ventilation is allowed for cooling.

The fuel limiter is shipped with a throwaway cover on the bottom of the box. Detach and discard the cover, being careful not to touch the printed-circuit board.

Install the box in an off-engine location. Consider the needs for adequate ventilation, space for servicing and repair, proximity to auxiliary electrical equipment, and to extreme heat or vibration.

The control box is open on the bottom. Do not attempt to seal the unit to the installation surface as this would disrupt expected air movement and might cause over heating of the unit. Additional air circulation or cooling will not be required.

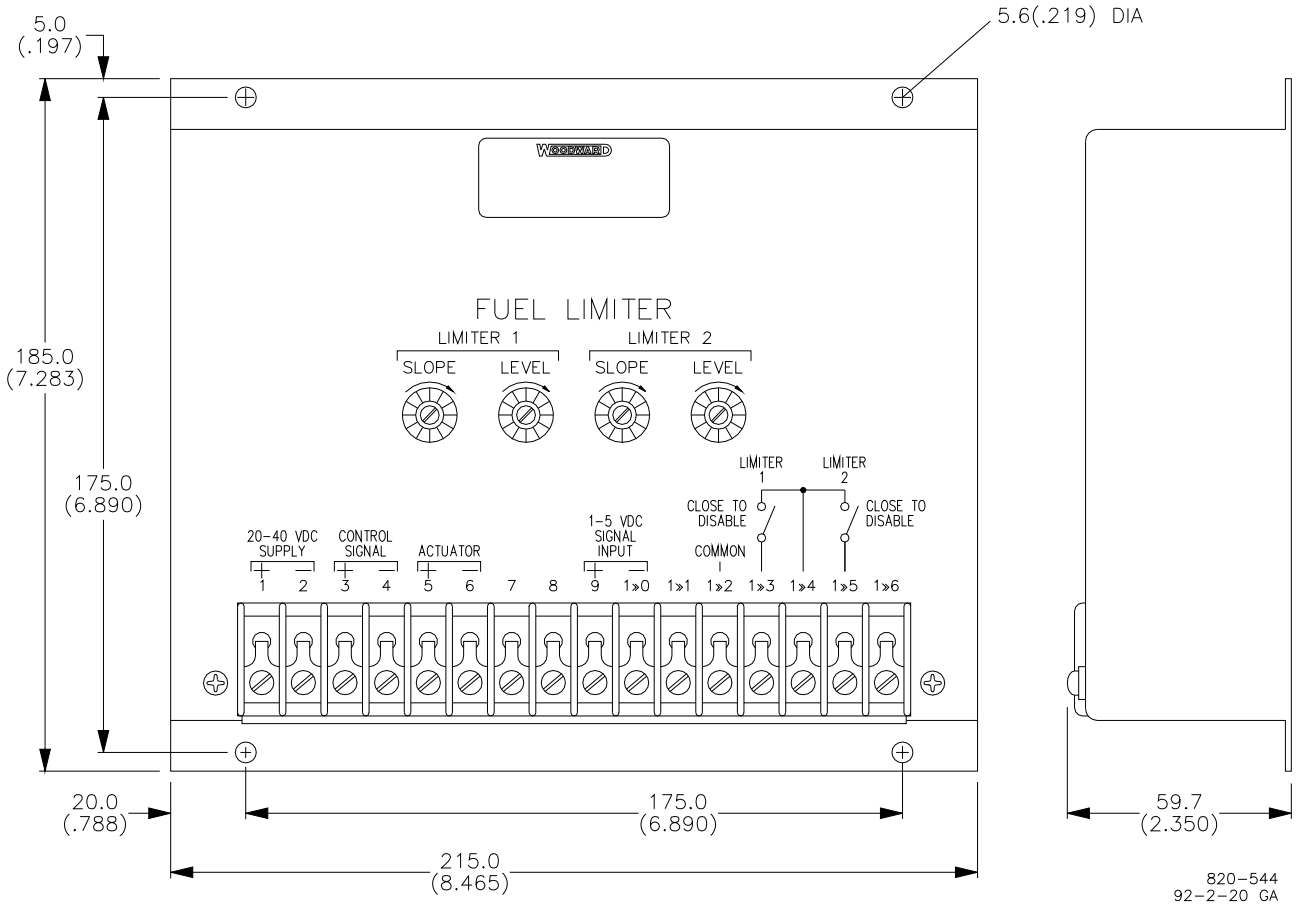

Figure 3-1. Outline Drawing of Fuel Limiter 8272-789

Electrical Connections

The plant wiring diagram (Figure 3-2) shows all external wiring connections needed for installation. Be sure to follow all shielding requirements.

Shielded Wiring

All shielded cable must be twisted-conductor pairs. Do not attempt to tin (solder) the braided shield. See the plant wiring diagram for shield requirement. Connect shield to system ground (chassis) at one point at the limiter end only. The end away from the limiter must be left unconnected. Do not run shielded lines in a conduit with high-current carrying cables.

Shields on the wires to the actuator and on the input from the manifold pressure sensor should be grounded at the limiter. The shield on the wires from the control to the limiter should be grounded at the control and left open at the limiter.

Ground shields at one end only. Do not ground at both ends.

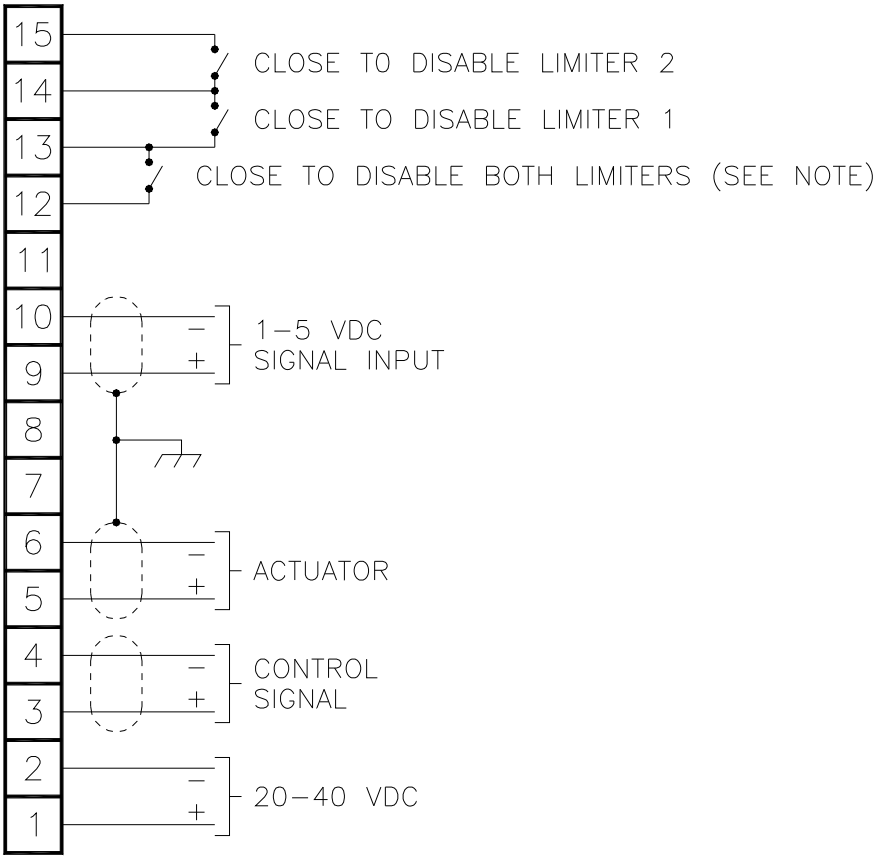

Figure 3-2. Plant Wiring Diagram

Chapter 4.
Limiter Adjustment and Troubleshooting

Introduction

Fuel Limiter schedules are adjustable, but adjustment is not recommended in a field application. The engine manufacturer usually adjusts the individual unit to match an individual engine, then seals the adjustments to prevent movement.

This chapter provides guidelines for adjustment in cases where the limiter has been replaced or where application of the engine has changed and adjustment is necessary.

Troubleshooting Procedure

The solid-state circuitry in the limiter should not shift limiting schedules during the life of the limiter. Should an engine that has been operating acceptably start to smoke or exhibit other indications of limiter problems first check the manifold pressure sensor, the turbo, the waste gate, the linkage from the actuator to the fuel control, the wiring (pay particular attention to the shielding), and the condition of the engine itself.

In most installations the limiter can be bypassed and the actuator signal from the control run directly to the actuator. This may help determine if the limiter is at fault.

Operational Test

1. Remove the limiter from the control system. Connect a 35 ohm, 25 watt resistor between the actuator output terminals 5 (+) and 6 (–). (The resistor is used to simulate the actuator. Connect an ammeter capable of reading 0–200 mA across terminals 5 (+) and 6 (–).

2. Connect a 24 Vdc power supply, minimum capacity of 1.5 amps, to terminals 1 (+) and 2 (–).

3. Connect a variable 1–5 Vdc power supply to terminals 3 (+) and 4 (–).

4. Connect a variable 1–5 Vdc power supply to terminals 9 (+) and 10 (–).

5. Jumper terminal 12 to terminal 13. (There must be no connection between terminals 13, 14, and 15.)

6. As the control signal power supply across terminals 3 and 4 is varied an identical signal should be read across terminals 5 and 6.

7. Remove the jumper between terminals 12 and 13. Set the input at terminals 3 and 4 at maximum (6 Vdc or 160 mA). Set the input of the variable power supply across terminals 9 and 10 at 5 Vdc.

8. Observe the voltage across terminals 5 and 6 increase as the input to terminals 9 and 10 is decreased. (The accompanying graph shows relative output in mA for given limiter voltage inputs. Notice that the output decreases as the manifold signal increases. This is correct for a reverse acting control system.) The graph shows the factory setting for the limiter. The engine manufacturer may have changed this setting and the user cannot expect the limiter output to exactly follow the graph.

9. If the troubleshooting observations are as outlined the operator can assume the limiter is operating correctly . Be careful when replacing the limiter in the control system to attach all wiring according to the plant wiring diagram and to complete all shielding requirements.

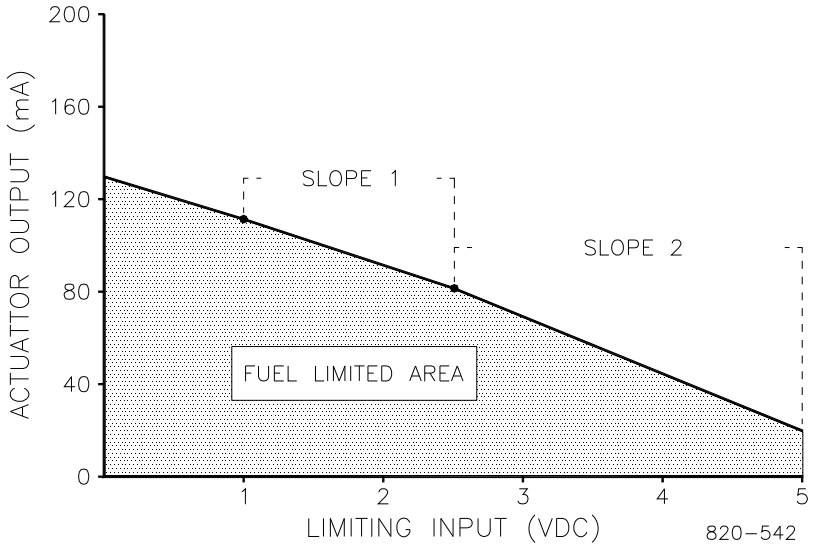

Figure 4-1. Limiter Levels and Slopes

Limiter Adjustment

The desired limiter slopes must be determined before setting up the limiter. Until the starting and ending level of each slope is known a new limiter cannot be adjusted. (Most actuators are almost exactly linear (the actuator output position moves in direct proportion to the magnitude of the control signal). However, linkage between the actuator and the fuel control can modify this linearity. If the adjustment of the fuel level (power output) of the engine is not exactly proportional to the control signal to the actuator the levels and slopes of the limiter may have to be modified.

1. Set up the limiter as described in steps 1, 2, 3, and 4 above.

2. Set the voltage input to terminals 3 and 4 to 0 Vdc.

3. Close contacts between terminals 14 and 15 to deactivate the second slope. Open contacts between 12–13 and 13–14.

4. Set both Level potentiometers fully clockwise (CW).

5. Set both Slope potentiometers fully counterclockwise (CCW).

6. Set the variable supply for the minimum manifold signal at terminals 9 and 10. Set the variable supply at Terminals 3 and 4 for the maximum signal (6 volts).

7. Adjust the Level 1 potentiometer CCW until the actuator signal at terminals 5 and 6 reaches the voltage for maximum limiting.

8. Set the supply at terminals 9 and 10 for the desired level for the end of Slope 1 and start of Slope 2.

9. Adjust the Slope 1 potentiometer CW until the actuator output from the limiter reaches the desired level for this position on your graph.

10. Check the output of limiter for desired range. Repeat steps 6 through 9 until the output of the limiter matches your graph.

11. Open contacts between terminals 14 and 15 and close contacts between 13 and 14 to activate the second slope and deactivate the first slope.

12. Adjust the Level 2 potentiometer CCW until actuator voltage reaches the same level as in step 9.

13. Adjust the supply at terminals 9 and 10 for the desired level at maximum manifold pressure.

14. Adjust the Slope 2 potentiometer CW until the actuator output reaches the level as shown on your graph.

15. Check output of the limiter for desired range. Repeat steps 11 through 14 until the output of the limiter matches your graph.

16. Open the contacts between terminals 13 and 14. Adjust supply at terminals 9 and 10 from minimum to maximum (1–5 Vdc). Measure the output at terminals 5 and 6. The voltage should follow the desired limiting schedule without any "bumps" in the output. If there are noticeable steps in this output repeat steps 6 through 15.

Chapter 5.
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 02008.

WOODWARD

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**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.

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