WOODWARD

User Manual

APECS Controllers for DYNA 2000 and 2500 Linear Actuators

DYN1-10704 / DYN1-10706 / DYN1-10714 / DYN1-10716
DYN1-10724 / DYN1-10726 / DYN1-10734 / DYN1-10736

Manual 36550

WARNING—DANGER OF DEATH OR PERSONAL INJURY

WARNING—FOLLOW INSTRUCTIONS

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.

WARNING—OUT-OF-DATE PUBLICATION

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 Woodward website:

www.woodward.com/pubs/current.pdf

The revision level is shown at the bottom of the front cover after the publication number. The latest version of most publications is available at:

www.woodward.com/publications

If your publication is not there, please contact your customer service representative to get the latest copy.

WARNING—OVERSPEED PROTECTION

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—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.

CAUTION—POSSIBLE DAMAGE TO EQUIPMENT OR PROPERTY

CAUTION—BATTERY CHARGING

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.

CAUTION—ELECTROSTATIC DISCHARGE

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.**

IMPORTANT DEFINITIONS

- **A WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**
- **A CAUTION indicates a potentially hazardous situation which, if not avoided, could result in damage to equipment or property.**
- **A NOTE provides other helpful information that does not fall under the warning or caution categories.**

Revisions—Text changes are indicated by a black line alongside the text.

Contents

Illustrations and Tables

Electrostatic Discharge Awareness

All electronic equipment is static-sensitive, some components more than others. To protect these components from static damage, you must take special precautions to minimize or eliminate electrostatic discharges.

Follow these precautions when working with or near the control.

1. Before doing maintenance on the electronic control, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).

2. 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.

3. Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the control, the modules, and the work area as much as possible.

4. 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.

CAUTION—ELECTROSTATIC DISCHARGE

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*.

Chapter 1.
General Information

Introduction

This manual provides information on the following controllers:

ENGINE	CE MARKED	PART NUMBER	INPUT SIGNAL FREQUENCY
Diesel		DYN1-10704-000-0-12/24	2500-5000 Hz
	◆	DYN1-10704-001-0-12/24	
		DYN1-10706-000-0-12/24	5000-9500 Hz
	◆	DYN1-10706-001-0-12/24	
		DYN1-10714-000-0-12/24†	2500-5000 Hz
		DYN1-10716-000-0-12/24†	5000-9500 Hz
Spark Ignited		DYN1-10724-000-0-12/24	2500-5000 Hz
	◆	DYN1-10724-001-0-12/24	
		DYN1-10726-000-0-12/24	5000-9500 Hz
	◆	DYN1-10726-001-0-12/24	
		DYN1-10734-001-0-12/24†	2500-5000 Hz
		DYN1-10736-000-0-12/24†	5000-9500 Hz

(†) Units have self-monitoring feature.

Woodward controllers for DYNA 2000 and 2500 linear actuators are all solid state design for fast, stable engine response to speed or load changes. The controller circuits measure PROPORTIONAL (amount of offspeed), INTEGRAL (time of offspeed) and DERIVATIVE (rate of change of offspeed) to ensure optimum performance.

The controller electronics are environmentally potted, providing protection against the various liquids and vibrations associated with engines. This makes the unit suitable for panel or engine mounting. It is easy to adjust, having only speed and gain adjustment. The power for the controller is obtained from the engine's DC starting system, eliminating the need for mechanical drives and hydraulic lines.

Models DYN1-10704 and DYN1-10724 are basic controllers without an overspeed. The 10704 controller is normally used on diesel engines and the 10724 is normally used on ignition engines.

Model DYN1-10714 and DYN1-10734 are also basic controllers with overspeed protection 12.5% above set speed. The 10714 controller is normally used on diesel engines and the 10734 controller is normally used on ignition engines.

Features include:

- All electric
- All engine compatibility
- Mounts in any position
- High reliability
- Temperature stability

Speed Sensing

These APECS all-electric controllers require a frequency signal to read engine speed. Typically, a hole is drilled and tapped in the flywheel housing perpendicular to the crankshaft, and a magnetic pickup is inserted into it to sense the teeth on the ring gear.

Failsafe

APECS controllers have an internal FAILSAFE circuit that instantly reacts to:

- Interruption of the DC power to spring return actuator to minimum fuel position.
- Loss of speed reference signal to remove power from actuator causing it to spring return to minimum fuel position.

WARNING—OVERSPEED PROTECTION

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.

Chapter 2.
Specifications

	DYN1-10704 DYN1-10706	DYN1-10724 DYN1-10726	DYN1-10714 DYN1-10716	DYN1-10734 DYN1-10736
Current @ 12 Vdc Max. Amps:	6.0	6.0	6.0	6.0
Current @ 24 Vdc Max. Amps:	5.0	5.0	5.0	5.0
Weight: Pounds **Kilograms**	1.25 0.568	1.25 0.568	1.35 0.613	1.35 0.613
Operating Voltage	12 or 24 Vdc ±20%			
Ambient Operating Temperature	-40°F to +180°F (-40°C to +85°C)			
Mechanical Vibration	5 to 500 Hz, Curve L, per MIL-STD-810C			
Sealing	Oil, water and dust tight			
Connections	# 18 gauge leads with minimum length of 10 inches (25.4 cm) with no connector of any kind			
Input Signal Frequency from Magnetic Pickup	Input signal frequency in Hertz $= \frac{\text{Engine RPM x number of gear teeth on flywheel}}{60}$			
Input Signal Voltage from Magnetic Pickup	2.5 Vac RMS minimum during cranking			
Steady State Speed Band	±0.25%			
Controller Adjustments	Gain and Speed			
Self Monitoring Shutdown	112.5% of set point speed			

Chapter 3.
Calibration

NOTE
Controller must be calibrated in order to perform properly.

Controllers must be calibrated by customer to suit particular application.

1. With no power to the governor, adjust the GAIN to 9:00 o'clock.
2. Start the engine and adjust the speed by turning the SPEED pot clockwise to desired speed.

   NOTE: Controllers are factory adjusted to minimum RPM. However, for safety, one should be capable of disabling the engine if an overspeed should exist.
3. At no load, turn the GAIN potentiometer clockwise (CW) until the engine begins to hunt. If the engine does not hunt, physically upset the governor linkage.
4. Turn the GAIN potentiometer counterclockwise until stable.

Chapter 4.
Wiring & Installation

Dimensions

NOTE: Dimensions apply to both CE and non-CE models.

Dimensions are in inches.

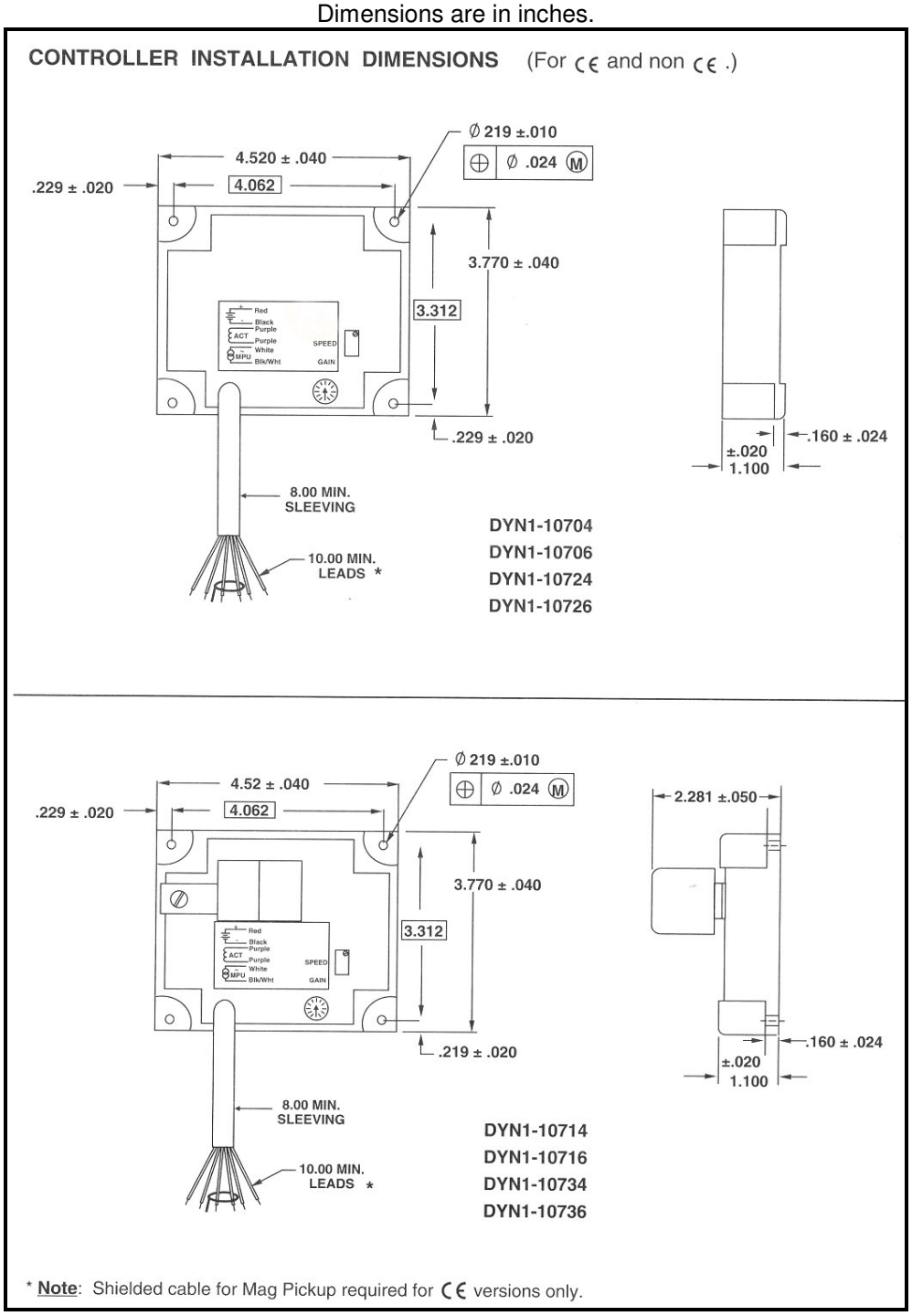

Figure 1. Dimensions for CE and Non-CE Models

Wiring

Figure 2 shows wiring procedure for either non-CE or CE versions.

1. Red to battery positive
2. Black to battery negative
3. Purple to the actuator, no polarity
4. White to one side of the magnetic pickup
5. Black and white to the other side of the magnetic pickup connected with the shielded drain wire.

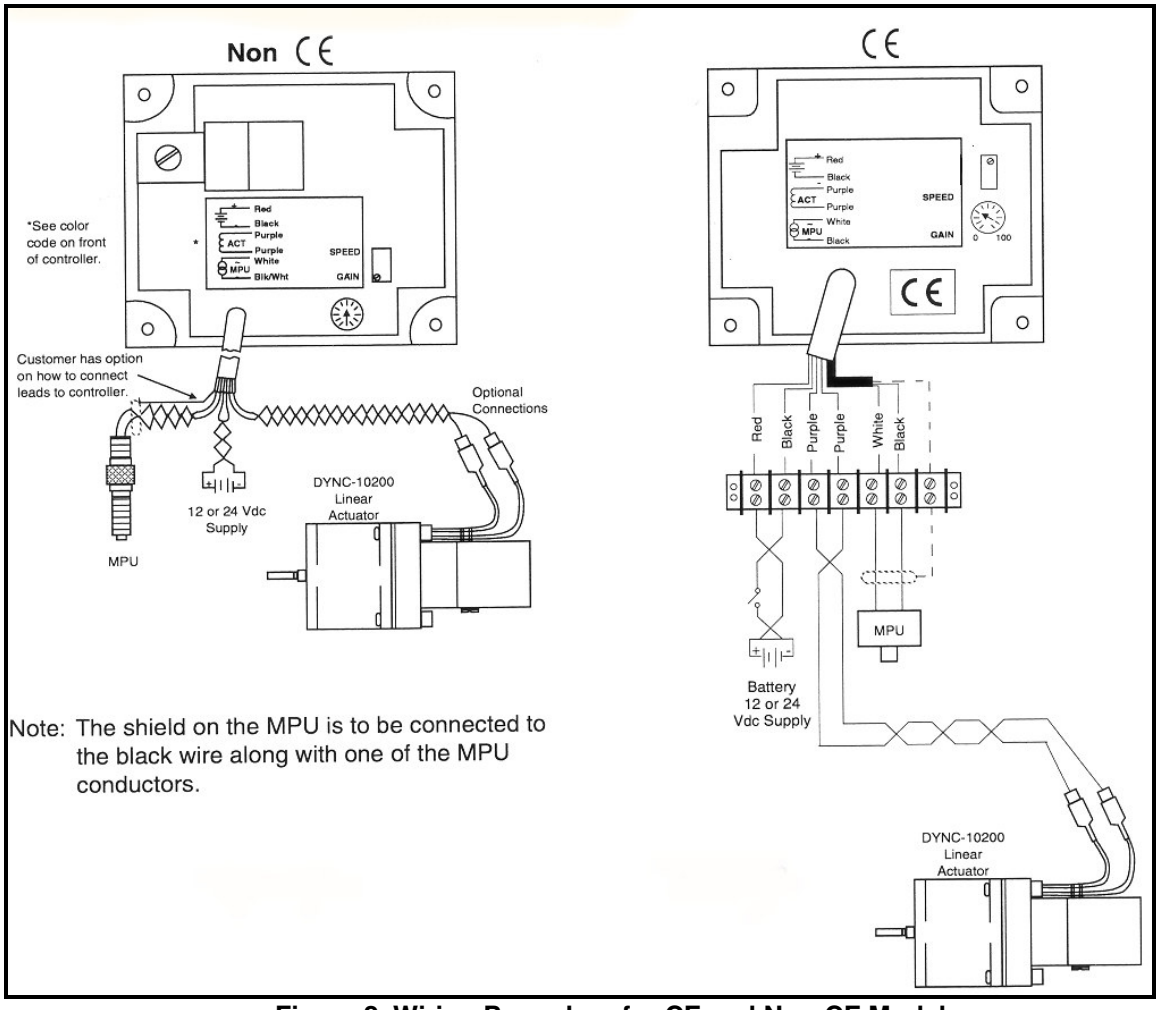

Figure 2. Wiring Procedure for CE and Non-CE Models

CAUTION—POSSIBLE DAMAGE TO EQUIPMENT OR PROPERTY

To prevent damage to the controller, make sure that it is wired in accordance with the wiring instructions and diagrams in this manual.

- **Do not tin the leads before placing them into the terminals.**
- **Ensure the terminals are tightened properly to secure wires.**

CAUTION—POSSIBLE DAMAGE TO EQUIPMENT OR PROPERTY

As a safety measure, the engine should be equipped with an independent overspeed shutdown device in the event of failure, which may render the governor inoperative.

Chapter 5. Troubleshooting

General Checklist

Battery Voltage Check

1. Set multimeter dial to read DC volts.
2. Connect the meter leads across the Red (battery positive) and Black (battery negative) wires of controller. With power to the controller ON, check the voltage during cranking and engine running. Voltage should be within range of engine manufacturer's specifications.
3. If voltage is low, check the battery, charging system and/or wiring.

Linkage Check

Many problems can be traced to linkage binding confining motion due to tight settings and/or linkage backlash (backward motion due to loose connections).

Linkage must have minimal friction, binding and backlash in order to assure accurate, responsive performance of the application.

1. With engine OFF, check for bent or misaligned linkage.
2. With engine OFF, manually operate linkage to see that it is not sticking, binding or has any backlash.
3. With engine OFF, ensure full travel of the linkage by manually moving it from idle/shutdown to maximum fuel. Travel should be smooth and should not exceed specified actuator stroke.
4. With engine OFF, check for worn out rod end bearings. Hardened steel races are recommended.
5. Correct linkage as needed.

Magnetic Pickup Check

1. Set multimeter dial to read AC volts
2. Connect the meter leads to the magnetic pickup White and Black/White wire of the controller. Check the voltage during cranking and running. Voltage should be 2.5 volts RMS or greater during cranking and running. (AC input impedance of meter must be 5000 ohms/volt or greater).
3. Check the magnetic pickup harness for an open circuit or short.
4. Check for damage to or improper adjustment of magnetic pickup. Replace or readjust. Too large of an air gap between the sensed gear and magnetic pickup could cause a weak signal. Adjust as needed, while avoiding damage to the magnetic pickup (magnetic pickup coming in the sensed gear).
5. Check wiring from the magnetic pickup to the controller. Twisted shielded cable is recommended. The cable should only be grounded at one end of the harness.
6. Check the mounting of the magnetic pickup. Mounting should be rigid; excessive vibration could cause spurious signals and unacceptable performance.
7. Make sure the sensed gear is not missing any teeth.
8. Check coil resistance of the magnetic pickup. Call the manufacturer of the magnetic pickup for specifications.

Troubleshooting Chart

NOTE: Controller must be calibrated in order to perform properly. See Chapter 3.

Problem	Detection	Corrective Action
ENGINE WILL NOT START. ACTUATOR IS NOT PULLING IN DURING CRANKING OR RUNNING.	Perform voltage, linkage and magnetic pickup checks outlined in General Checklist. If OK conduct the following checks: **1. Actuator Check** To measure actuator coil resistance: 1. Disconnect the wires from the actuator. 2. Set the multimeter on ohms using a low scale. 3. Connect the meter leads across the actuator wires. 12-volt actuator should read 1.8 ± 0.2 ohms at room temperature. 24-volt actuator should read 7.3 ± 1.0 ohms at room temperature. 4. Connect one meter lead to the actuator wire and the other lead to the actuator case. Reading should indicate an open circuit. 5. Connect one meter lead to the other coil lead and one to the actuator case. Reading should indicate an open circuit. **2. Actuator Output from Controller** 1. Reconnect the actuator leads. 2. Set multimeter to DC volts. 3. With power "ON" to controller: a. Connect the meter leads across the Purple actuator wire and the Black (battery negative) wires on controller. Output should read the same voltage as the battery voltage being supplied to the controller (+ 0.00 / – 0.75 Vdc). b. Connect the meter leads across the second Purple actuator wire and the Black (Battery negative) wire on controller. Output should read the same voltage as the battery voltage being supplied to the controller (+ 0.00 / – 0.75 Vdc). 4. Check wiring harness from the controller to the actuator for shorts and opens.	If the measured coil resistance is not within specifications, replace the actuator. If continuity is detected between the actuator coil and the actuator case, replace the actuator. If all component and actuator checks do not resolve problem, please contact Woodward Technical Support for additional troubleshooting procedures.

Problem	Detection	Corrective Action
ACTUATOR GOES TO FULL FUEL WHENEVER POWER TO THE CONTROLLER IS TURNED "ON" AND THE ENGINE IS NOT RUNNING	Remove Purple actuator lead from the controller and turn power to the controller "ON."	If actuator goes to full fuel, check actuator harness for short to ground. If actuator does not go to full fuel, replace the controller.
ACTUATOR HUNTS DURING OPERATION	Perform voltage, linkage and magnetic pickup checks in General Checklist. If OK conduct the following checks: 1. Improper governor adjustments.	Readjust calibration. See Chapter 3 for calibration procedure. If all component and actuator checks do not resolve problem, please contact Woodward Technical Support for additional troubleshooting procedures.
ENGINE OVERSPEEDS ON STARTUP	Perform voltage, linkage and magnetic pickup checks in General Checklist. If OK conduct the following checks: 1. Improper governor adjustments. 2. Perform steps under "Acutator Goes to Full Fuel Whenever Power to the Controller is Turned "On" and the Engine is Not Running."	Readjust calibration. See Chapter 3 for calibration procedure. If all component and actuator checks do not resolve problem, please contact Woodward Technical Support for additional troubleshooting procedures.

NOTE
Controller must be calibrated in order to perform properly. See Chapter 3 for calibration procedure.

Chapter 6.
Service Options

Product Service Options

The following factory options are available for servicing Woodward equipment, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is purchased from Woodward or the service is performed:

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

If you are experiencing problems with installation or unsatisfactory performance of an installed system, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In most cases, your problem can be resolved over the phone. If not, you can select which course of action you wish to pursue based on the available services listed in this section.

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 also a flat rate structured program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call 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 Woodward facility as explained below (see "Returning Equipment for Repair" later in this chapter).

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 to Woodward within 60 days, Woodward will issue a credit for the core charge. [The core charge is the average difference between the flat rate replacement/exchange charge and the current list price of a new unit.]

Return Shipment Authorization Label. To ensure prompt receipt of the core, and avoid additional charges, the package must be properly marked. A return authorization label is included with every Replacement/Exchange unit that leaves Woodward. The core should be repackaged and the return authorization label affixed to the outside of the package. Without the authorization label, receipt of the returned core could be delayed and cause additional charges to be applied.

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 to Woodward for repair, please contact Woodward in advance to obtain a Return Authorization Number. When shipping the item(s), attach a tag with the following information:

- 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.

CAUTION—ELECTROSTATIC DISCHARGE

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*.

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.

Return Authorization Number

When returning equipment to Woodward, please telephone and ask for the Customer Service Department [1 (800) 523-2831 in North America or +1 (970) 482-5811]. They will help expedite the processing of your order through our distributors or local service facility. To expedite the repair process, contact Woodward in advance to obtain a Return Authorization Number, and arrange for issue of a purchase order for the item(s) to be repaired. No work can be started until a purchase order is received.

NOTE

We highly recommend that you make arrangement in advance for return shipments. Contact a Woodward customer service representative at 1 (800) 523-2831 in North America or +1 (970) 482-5811 for instructions and for a Return Authorization Number.

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.

How to Contact Woodward

In North America use the following address when shipping or corresponding:

Woodward Governor Company
PO Box 1519
1000 East Drake Rd
Fort Collins CO 80522-1519, USA

Telephone—+1 (970) 482-5811 (24 hours a day)
Toll-free Phone (in North America)—1 (800) 523-2831
Fax—+1 (970) 498-3058

For assistance outside North America, call one of the following international 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.

Facility	Phone Number
Brazil	+55 (19) 3708 4800
India	+91 (129) 230 7111
Japan	+81 (476) 93-4661
The Netherlands	+31 (23) 5661111

You can also contact the Woodward Customer Service Department or consult our worldwide directory on Woodward's website (**www.woodward.com**) for the name of your nearest Woodward distributor or service facility.

Engineering Services

Woodward Industrial Controls Engineering Services offers the following after-sales support for Woodward products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Contact information:

Telephone—+1 (970) 482-5811
Toll-free Phone (in North America)—1 (800) 523-2831
Email—icinfo@woodward.com
Website—**www.woodward.com**

Technical Support is available through our many worldwide locations or our authorized distributors, depending upon the product. This service can assist you with technical questions or problem solving during normal business hours. Emergency assistance is also available during non-business hours by phoning our toll-free number and stating the urgency of your problem. For technical support, please contact us via telephone, email us, or use our website and reference ***Customer Services*** and then ***Technical Support***.

Product Training is available at many of our worldwide locations (standard classes). 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. For information concerning training, please contact us via telephone, email us, or use our website and reference ***Customer Services*** and then ***Product Training***.

Field Service engineering on-site support is available, depending on the product and location, from one of our many worldwide locations or from one of our authorized 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 field service engineering assistance, please contact us via telephone, email us, or use our website and reference ***Customer Services*** and then ***Technical Support***.

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:

General

Your Name_____
Site Location_____
Phone Number_____
Fax Number_____

Prime Mover Information

Engine/Turbine Model Number_____
Manufacturer_____
Number of Cylinders (if applicable)_____
Type of Fuel (gas, gaseous, steam, etc)_____
Rating_____
Application_____

Control/Governor Information

Please list all Woodward governors, actuators, and electronic controls in your system:

Woodward Part Number and Revision Letter

_____

Control Description or Governor Type

_____

Serial Number _____

Woodward Part Number and Revision Letter

_____

Control Description or Governor Type

_____

Serial Number _____

Woodward Part Number and Revision 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 include the manual number from the front cover of this publication.

WOODWARD

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

Email and Website—www.woodward.com

**Woodward has company-owned plants, subsidiaries, and branches,
as well as authorized distributors and other authorized service and sales facilities throughout the world.**

Complete address / phone / fax / email information for all locations is available on our website.

06/6/M