WOODWARD

Application Note

DC10502 Linear Actuator For Cummins “C” Series

Installation Instructions for Kit DYNK-10393

Manual 36530A

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WARNING—OUT-OF-DATE PUBLICATION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.

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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.

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*.

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Chapter 1.
Installation

This manual provides instructions on the installation of the APECS linear actuator DYNC-10502 on the Cummins "C" series range diesel with a Bosch P3000, MW or "A" series pump. The linkage connects to the stop lever of the RSV mechanical governor.

Layout Diagram

See parts list for item numbers noted on **Figures 1** and **2**.

As shown in **Figure 1**, the electric governor linkage connects to a new stop lever (10). The G-Drive engine flywheel has 127 teeth. The mechanical governor throttle lever must be set and locked to operate the engine at 10% above nominal speed to avoid limiting fuel by the mechanical governor under full load.

As **Figure 2** depicts, the fuel pump stop shaft is on the backside pointing toward the engine block.

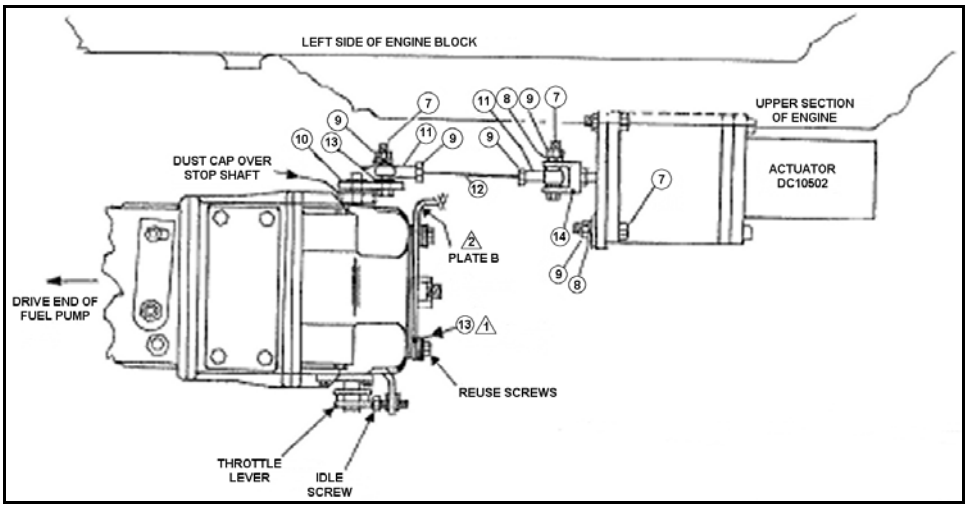

Figure 1. Left side above engine. Fuel pump is at 30° angle in top view.

DIAGRAM NOTES

1 Reuse the two original cover screws and attach three flatwashers (13) on each screw.

2 Plate “B” has a screw that is an adjustable stop for lever “C” operated by a solenoid.

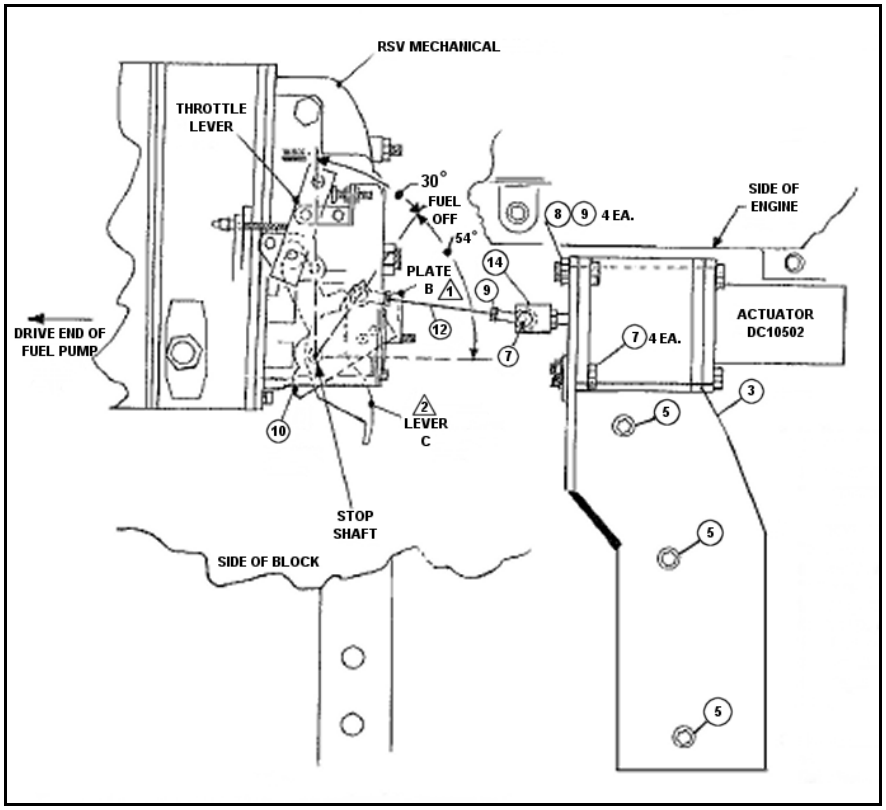

Figure 2. Below left side of engine, 30° below a horizontal reference line. Stop lever is between fuel pump and block.

DIAGRAM NOTES

1 Plate “B” has a screw that is an adjustable stop for lever “C” operated by a solenoid.

2 Remove and discard plate “B”, lever “C”, and the stop solenoid. NOTE: When lever “C” is removed, observe that the stop shaft has a round dust cap. Remove the cap, then remove the helical spring. Discard the spring and replace the round dust cap.

NOTE: Item 4 brace is not used in kit Revision B and later revisions. Instead, a third bracket screw (5) is installed to secure the bracket. This screw locates behind the actuator.

Component Installation

Actuator and Bracket

1) Obtain from the parts kit the new stop lever (10). Install this lever on the stop shaft as shown in **Figure 1**. Use original retainer washer and screw.
2) Install the mounting bracket (3) using screws provided (5).
    a. Reinstall oil filler cap chain to 1/4 x 28 bolt to mounting bracket.
3) Install the actuator (1) on the mounting bracket using four each of mounting bolts (7), lockwashers (8), and nuts (9).
4) Install one rod end bearing (11) on the stop lever using two flat washers, bolts, lockwashers, and one nut. A flat washer is used on each side of the rod end bearing ball.
5) Install the other rod end bearing with a jam nut (9) on one end of the threaded rod.

    NOTE: Engines fueled with a P3000 pump use 1/4 x 28 x 1.5 threaded rod (12). Engines fueled with an MW or "A" series fuel pump use 1/4 x 28 x 3.60 threaded rod (17).
6) Install one nut on the other end of the threaded rod. Set the linkage rod aside for later use.

Fuel Pump Levers

1) Start the engine and control engine speed by moving the mechanical governor throttle lever. Move the throttle lever, increasing engine speed, until the engine speed is 10% above normal desired speed. Lock the throttle lever in this position.
2) Manually operate the inboard stop lever. Slowly move the lever toward the rear of the engine (decreasing engine speed) until the engine stops. Mark the position the lever is in. The lever should be in this position when the linkage is installed.

Actuator Shaft Clevis

Tighten the M6 nut against the back side of the clevis (14).

Linkage Rod

1) Recover the linkage rod that was set aside.
2) Turn the free end of the threaded rod into the rod end bearing that is on the stop lever and tighten the rod jam nut against the bearing.

    Move the stop lever to the “OFF” position that was marked. Adjust the length of the rod as necessary, in or out of the bearings until the rod end bearing ball lines up with the screw hole in the clevis.

    NOTE: At the clevis end of the threaded rod, turn the rod end bearing one additional full turn onto the rod.
3) Install the rod end bearing into the clevis using mounting bolt, lockwasher, and a nut. Secure the jam nuts on the threaded rod against the rod end bearings.

Magnetic Pickup

Observe that in the engine bell housing, a 3/4-16" hole has been drilled and threaded for the magnetic pickup (15). Install the pickup. Back out one-quarter turn; tighten nut.

Controller

The controller (2) should be panel mounted. **The controller is not potted and should not be engine mounted.**

Chapter 2.
Parts List

Governor Assembly

ITEM	DESCRIPTION	PART NUMBER	QTY
1	Actuator 12 Vdc	DC10502-000-012	1
	Actuator 24 Vdc	DC10502-000-024	
2	Controller 12 Vdc	8270-1008	1
	Controller 24 Vdc	8270-1050	

Installation Kit (DYNK-10393)

ITEM	DESCRIPTION	PART NUMBER	QTY.
3	Actuator mounting bracket	DK138-069-0-00	1
4	(intentionally blank)	—	—
5	Bracket & screws M10 x 1.5 x 20 mm	DC3072-100-0-00	3
6	M10 Lockwashers	W1-4	3
7	Actuator mounting bolts 1/4 x 28 x 1" Hex	BYRF-1346	7
8	1/4 Lockwashers	CYRD-558	7
9	1/4 x 28 Nuts	DYRF-110	8
10	Replacement fuel pump stop lever (Shown as lever "D" on Figure 1)	DK138-071-0-00	1
11	1/4 x 28 Rod end bearing	DZ47-001-0-00	2
12	1/4 x 28 x 1.5 Long linkage rod (Used on P3000 pump)	GF42-025-0-00	1
13	1/4 Flatwashers	CYRD-59	7
14	1/4 Clevis to be installed on actuator	DK218-001-0-00	1
15	M6 Nut	N1-1	1
16	3/4-16 Magnetic pickup	DYNT-13200	1
17	1/4-28 x 3.60 Threaded rod (Used on the MW & "A" Series pumps)	GF42-026-0-00	1

Optional Parts

ITEM	DESCRIPTION	PART NUMBER	QTY.
—	Controller 12 Vdc	8270-1015	1
		8270-1018	
	Controller 24 Vdc	8270-1036	
		8270-1038	
—	Remote speed pot - 5K	DYNS-10000	1
—	3-wire foil shielded cable	E26-22N	*
—	DC power switch, toggle type	CP11-001-0-00	1

(*) Specify length

Chapter 3.
Wiring & Calibration

Wiring Instructions

All four controllers are wired as shown in the wiring diagram below.

1) DC power leads and actuator leads should be 14 gauge minimum. If leads exceed 15 ft., use 12 gauge wire. It is recommended that the leads be twisted pairs.
2) DC supply leads to terminals 1 and 2 of the controller can be connected to where the large battery cables connect to the engine.
3) The positive lead can be wired through a normally open relay contact, rated to 10 amperes or more. The coil of the relay is then connected to the engine **fault circuit** for system protection.

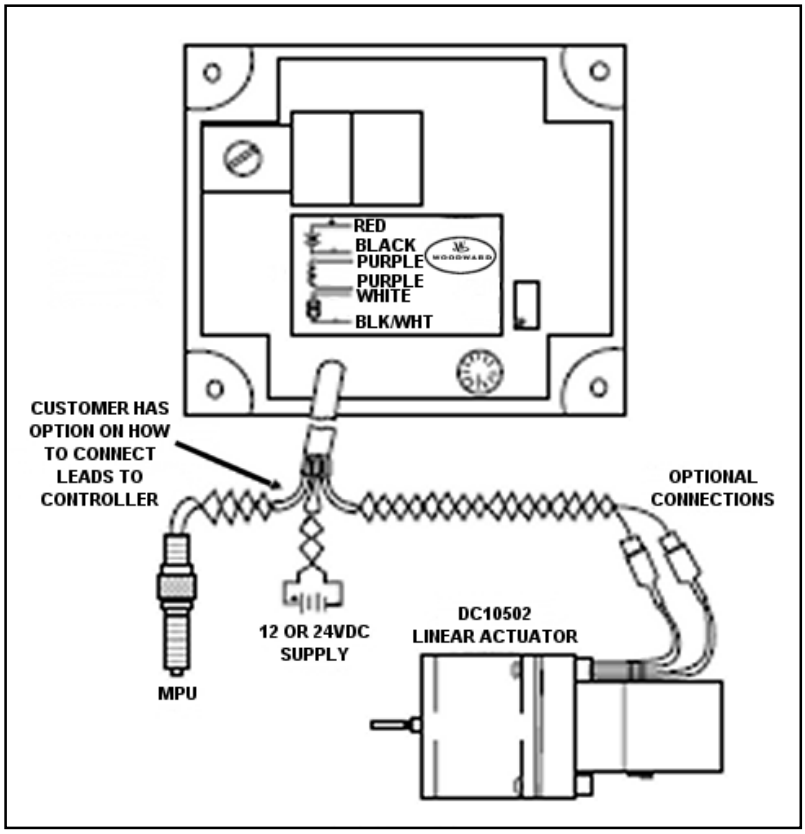

Figure 3. Wiring Diagram

Wire Connections

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 & white to the other side of the magnetic pickup connected with the shield drain wire

Calibration Instructions

Be sure that the S1 and S2 switches on the controller are in the correct position for your governor type and engine.

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.
3. At no load, turn the GAIN potentiometer clockwise 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.

NOTE: Controllers are factory adjusted to minimum RPM. However, for safety, one should be capable of disabling the engine if an overspeed should occur.

Chapter 4. Troubleshooting

PROBLEM	DETECTION	CORRECTIVE ACTION
System appears dead. (Actuator fails to move to full fuel.)	CHECK BATTERY VOLTAGE AT CONTROLLER with power switch “ON”. Measure DC battery voltage between the Red (+) and Black (-) leads. Battery voltage should be present.	Check connections to battery.
	CHECK LINKAGE. Manually operate linkage to see that it is not sticking or binding.	Free linkage.
	NO SIGNAL OR WEAK SIGNAL FROM MAGNETIC PICKUP. Measure AC voltage between the White and Black/White leads on controller while cranking engine. Voltage should be 2.5 volts RMS or greater. (AC input impedance of meter must be 5000 ohms/volt or greater.)	Check for damage to or improper adjustment of magnetic pickup. Replace or re-adjust.
	CHECK ACTUATOR with power “ON” to controller. Measure following terminals on control box with respect to the Black lead. All points should read BATTERY VOLTAGE. (+0.00/-0.75 VDC) a. Purple lead to Black lead on controller. b. Second Purple lead to Black lead on controller. (Continue this test only if battery voltage is not present.) c. Following checks are terminals on the actuator and the Black lead on controller. 1) Low voltage (1.0-2.0 VDC) at either actuator connector. 2) Battery voltage at both actuator connectors. 3) Battery voltage at one actuator lead but not at the other.	Replace controller if battery voltage is not present at both Purple leads. Broken actuator lead. Broken actuator lead. Replace actuator.
Actuator lever goes to full fuel whenever the power is turned "ON" and engine is not running.	CHECK CONTROLLER by removing actuator lead to Purple lead and turning power “ON” to controller. a. Actuator goes to full fuel. b. Actuator does not go to full fuel. Note: Turn off power and reconnect purple lead.	Check for shorted actuator lead. Replace controller because it should not cause actuator lever to go to full fuel with engine not running.
Actuator hunts during operation.	LINKAGE OR ROD END BEARINGS sticking or binding.	Lubricate or replace.
	IMPROPER LINKAGE ARRANGEMENT. (Stroke too short or improper non-linear linkage used)	See installation information.
	IMPROPER GOVERNOR ADJUSTMENT.	Readjust calibration.
	INADEQUATE POWER SUPPLY VOLTAGE. a. Turn power switch "OFF" b. Connect a DC voltmeter to Red and Black leads at control box. c. Disconnect both leads to actuator at Purple leads of control box. d. Connect one actuator lead to the Red lead and one actuator lead to the Black lead of the control box. e. Momentarily turn "ON" the D.C power. The actuator should go to full fuel and the DC voltage must be greater than 80% of supply. 24 Vdc @ 80% = 19.2 Vdc 12 Vdc @ 80% = 9.6 Vdc Note: Reconnect actuator leads properly after completing this test.	If actuator doesn't get to full fuel, then check actuator leads. If voltage is less than specified, check for loose or poor connections to battery, or get larger supply leads or larger power supply.

Chapter 5
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

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