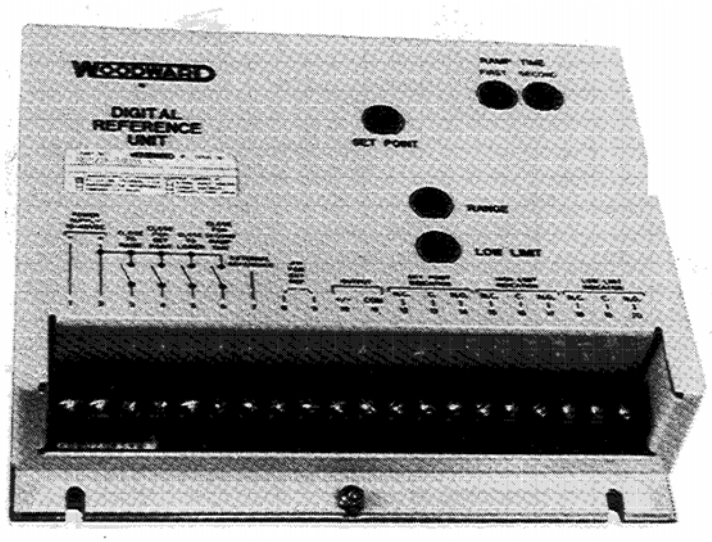
WOODWARD

Installation and Operation Manual



Digital Reference Unit
with high, low, and intermediate setpoints

Manual 82006 (Revision A)

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WARNING—OUT-OF-DATE PUBLICATION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 description, installation, and maintenance information for the Woodward Digital Reference Unit with three set points.

Digital Reference Units

Digital Reference Units use a precise linear ramp to provide a 0 to 8 volt reference signal to the attached control. The reference unit can be used with a speed or load control or a Process and Import/Export control. The reference unit has two separate ramps which are switch selectable to control the 0–8 volt reference signal.

The high, low, and intermediate points on the ramp are selectable on the reference unit. The same set points are used by both ramps. One of the ramps is always engaged so any movement of the output is at the speed of the engaged ramp.

Options

Digital Reference units are available for use with a low voltage power source (10 to 45 Vdc) or a high-voltage power source (90 to 150 Vdc or 88 to 132 Vac at 45 to 440 Hz.)

The three-relay option may be used to provide indication of when the output is at low limit, set point, or high limit, or to cause automatic switching functions within the same system.

Part Number	Power Supply	Relay Indication
8272-682	10–45 Vdc	No
8272-683	10–45 Vdc	Yes
8272-684	90–150 Vdc or 88–132 Vac 45–440 Hz	No
8272-685	90–150 Vdc or 88–132 Vac 45–440 Hz	Yes

Applications

Digital Reference Units are used in place of MOPs (Motor Operated Potentiometers), but provide more precise and more dependable control functions. The Digital Reference Unit set points are easier to adjust than those on a MOP, and the adjustable ramp time is generally not available with a MOP. Installation of the maintenance-free Digital Reference Unit is less restrictive than is installation of a MOP.

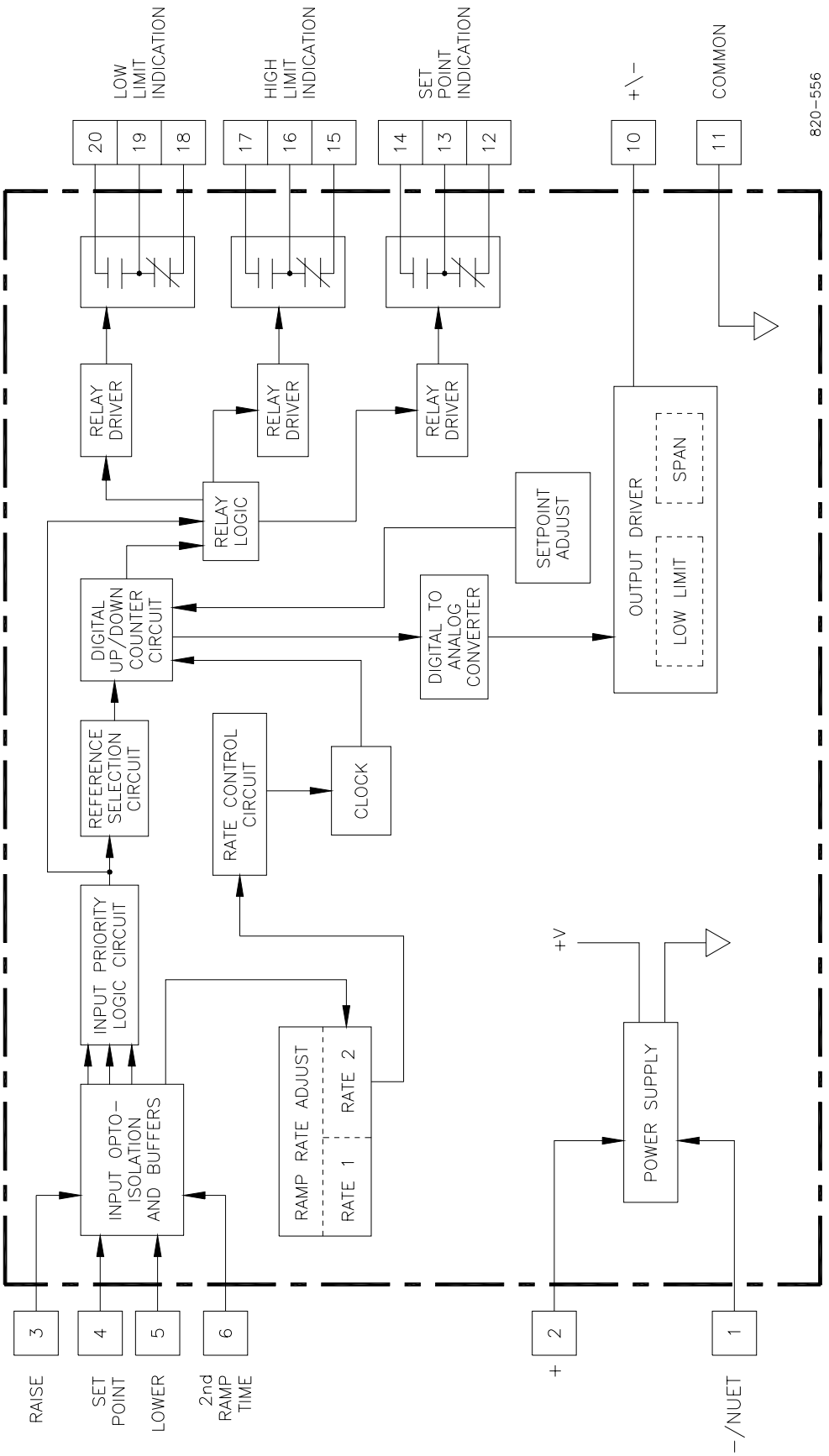


Figure 1-1. Digital Reference Unit Block Diagram

Chapter 2.
Installation and Adjustment

Introduction

This chapter includes information on unpacking, installation, setup, and checkout of the Digital Reference Unit. Information on power requirements, location considerations, and wiring information is also included.

Unpacking and Inspection

Before handling the unit, read page ii, *Electrostatic Discharge Awareness*. Visually inspect the unit for damage such as bent or dented panels, and loose or broken components. Immediately notify the shipper of any damage.

Compare the part number on the front panel with the chart on page 1 of this manual to be sure the reference unit is compatible with the supply voltage to be used.

CAUTION—BATTERY
To prevent damage to a direct-current powered control, make sure that the alternator or other battery-charging device is turned off or disconnected before disconnecting the battery from the control.

Location Considerations

The unit can be installed in any position that provides adequate ventilation and space for servicing. Maximum power use is 3.0 W. The unit will generate a minimal amount of heat during operation. The Digital Reference Unit will operate between –40 and +185 °F (–40 to +85 °C). It is designed to withstand 4 Gs of vibration between 5 and 500 Hz, and 60 Gs of shock.

The unit is not designed for mounting on the engine. Do not expose the box to rain, or pressure wash.

The location should provide ready access to the terminals on the control which is to be influenced by the unit.

See Figure 3-1 for installation dimensions.

Setting the Output Limits

The Low Limit potentiometer sets the minimum output from the Digital Reference Unit. The Range potentiometer sets the maximum output at a position above the Low Limit setting. Since the Low Limit setting changes the setting of the High Limit (Range), it is necessary to always set the Low Limit first and to reset the Range (High Limit) after any change in the Low Limit.

The following step-by-step procedure should be followed any time the limits are set or reset.

To determine and preset the Digital Reference Unit output values, set up the speed, load, or process control as it would be used without the Digital Reference Unit. Replace the reference unit connections to the control with wiring, switches, or potentiometers, as indicated on the plant wiring diagram for the control. Adjust the control for the speeds, loads, or process values which the reference unit will set. For each operating condition (low limit, high limit, and intermediate set point) measure and record the voltage on the terminals to which the output of the reference unit will be connected. (See Chapter 4 for wiring suggestions between the reference unit and various controls.)

It is sometimes difficult to use this method to determine the voltages of the reference unit output on load-sharing lines. Since the load-sharing lines voltage is one-half of the load gain voltage, it is easy to calculate the reference unit output voltage proportional to the load-gain voltage. Zero load is zero volts. One-half load is 1/2 by (1/2 x load gain). With the typical 6 volts load gain, this would be 1.5 volts. Full load for the same system is then 1 x (1/2 x load gain) or 3 volts.

1. Attach a voltmeter capable of reading 0 to 8 Vdc to terminals 10(+) and 11(–).

NOTE
The reference unit can produce a negative voltage. If a negative voltage output is desired, the voltmeter at terminals 10 and 11 should be able to read both + and – outputs.

2. Connect the power supply and appropriate switches to terminals 1 through 5. Close the switch between terminals 2 and 5. (Set the FIRST ramp time counterclockwise to minimize the time required to reach the limits or set point.) When the output stops ramping down, adjust the Low Limit potentiometer through the cover of the reference unit for the desired output as indicated by the voltmeter. (Clockwise on the potentiometer will increase the low-limit position.)

3. Open the switch between terminals 2 and 5, and close the switch between terminals 2 and 3. Adjust the Range pot to provide the maximum desired output from the reference unit. Clockwise will increase the High Limit setting.

4. Open the switch between terminals 2 and 3, and close the switch between terminals 2 and 5. The output should decrease to the desired low limit. If readjustment is necessary, ramp back to High Limit and readjust the Range potentiometer (clockwise is increase.)

5. Open all the switches. Close the switch between terminals 2 and 4. The output will ramp to the set-point position. Adjust the set-point potentiometer up or down as necessary.

NOTE
When selecting two inputs at the same time, Set Point has priority over the Raise, and Lower has priority over the Set Point. If Raise is permanently closed, the unit will automatically go to the High Limit when neither Lower nor Set Point switches are closed.

Setting Ramp Rates

The reference unit is shipped with ramp rates 1 and 2 independently adjustable from a minimum of 20 seconds to a maximum of 120 seconds. If the 20 second to 120 second ramp rate is not applicable to the particular installation, the ramp rates may be changed by setting a miniature rocker switch. The switch is located inside the cover on the printed circuit board, just to the right of the "ramp time second" adjustment potentiometer.

The four switches on the mini-switch are numbered. Switches 1 and 2 control the ramp times for the second ramp. Switches 3 and 4 set the ramp time for the first ramp. The unit defaults to the first ramp, if the second ramp is not selected. Approximate ramp times available are shown in the following table:

Switch Location		Ramp Time with Adjustment Full CCW	Ramp Time with Adjustment Full CW
		1st (default) Ramp	
3 open	4 open	5 seconds to	25 seconds
3 open	4 closed	20 seconds to	120 seconds
3 closed	4 open	100 seconds to	10 minutes
		2nd Ramp Selected	
1 open	2 open	5 seconds to	25 seconds
1 open	2 closed	20 seconds to	120 seconds
1 closed	2 open	100 seconds to	10 minutes

Ramp time is the time it takes the output to ramp from the low limit to the high limit and is independent of the values of the limits. The ramps are linear.

The time to ramp from the Low Limit to the Set Point is dependent on where the Set Point is adjusted. If the Set Point is halfway between the low and high limits, the ramp time will be one-half of the overall ramp time.

Plant Wiring

After the ramp rates have been selected, and the low limit, high limit, and intermediate output positions are set, the reference unit should be permanently wired into the electronic control loop.

Wire according to the plant-wiring diagram (Figure 3-1) and according to the applications chart in Chapter 4. Observe the shielded wiring requirements between the reference unit and the control system. All shields should terminate at the control system only, not the reference unit. Do not terminate any shield at both the reference unit and the control, as this will reduce the effectiveness of the shield.

NOTE

The electronics of the Digital Reference Unit always respond to the lowest signal selected, should two or more of the selection switches be closed at the same time. The ramp will stop should a selection be opened before the limit or set point has been reached.

When Set Point is selected, the output will ramp up or down as necessary to reach the predetermined set point.

Relays

Some Digital Reference Units are equipped with three relays for use by the system operator. The relay contacts are 5 A resistive at 30 Vdc, or 2 A resistive at 115 Vac.

External Reference

The Digital Reference Unit will provide ramp-speed setting for EPG and 2500 controls by connecting the external reference from these controls to terminal 7 on the reference unit, and then connecting the output from the reference unit to the speed-setting connections on the speed control. Terminals 8 and 9 on the reference unit must be jumpered to allow the external reference feature to function.

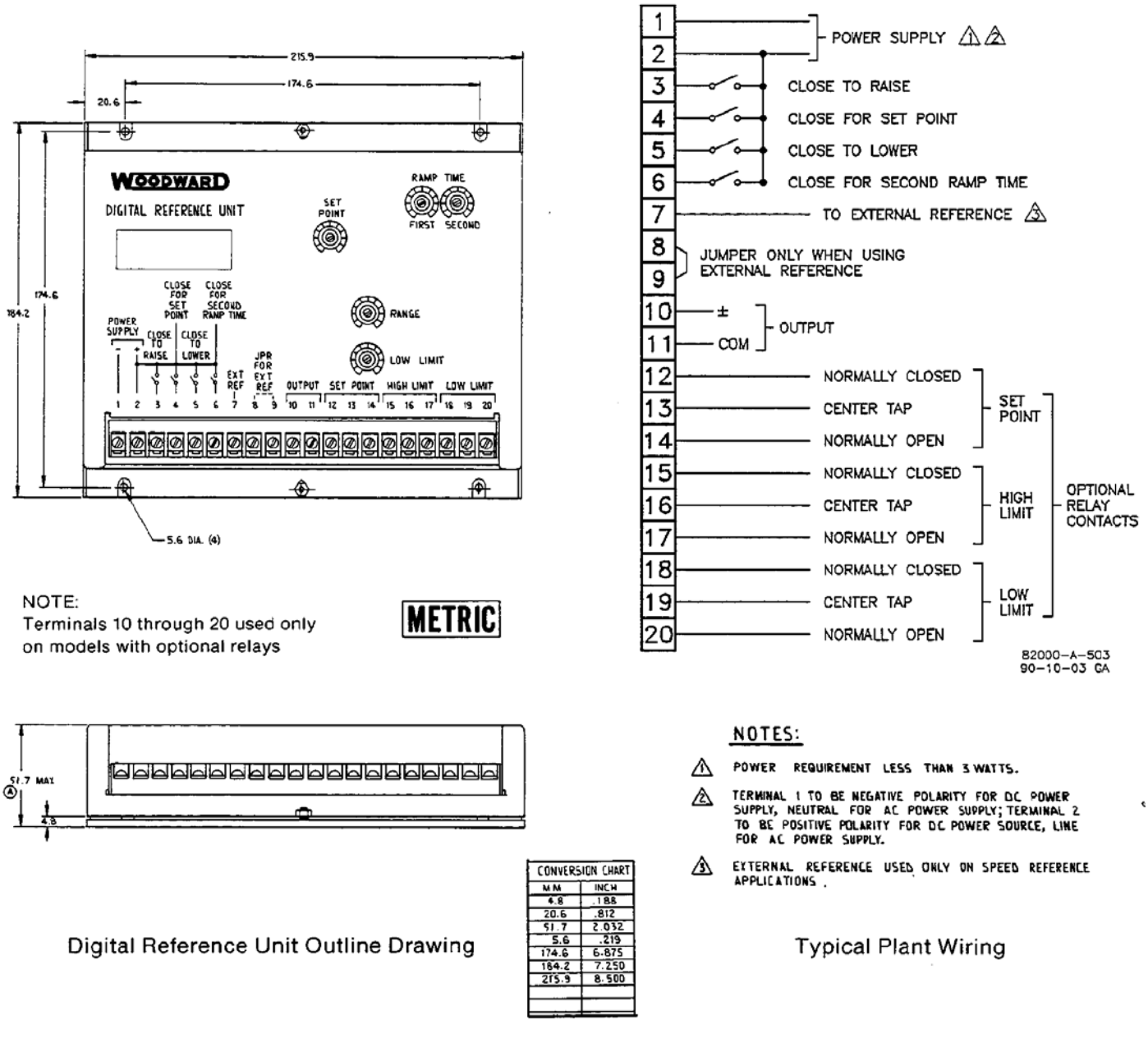


Figure 3-1. Plant Wiring Diagram and Outline Drawing

Chapter 3. Applications

The wiring diagrams in Figure 4-1 show some of the methods used to connect the reference unit to various electronic speed/load controls. Use of the unit is not limited to the installations shown.

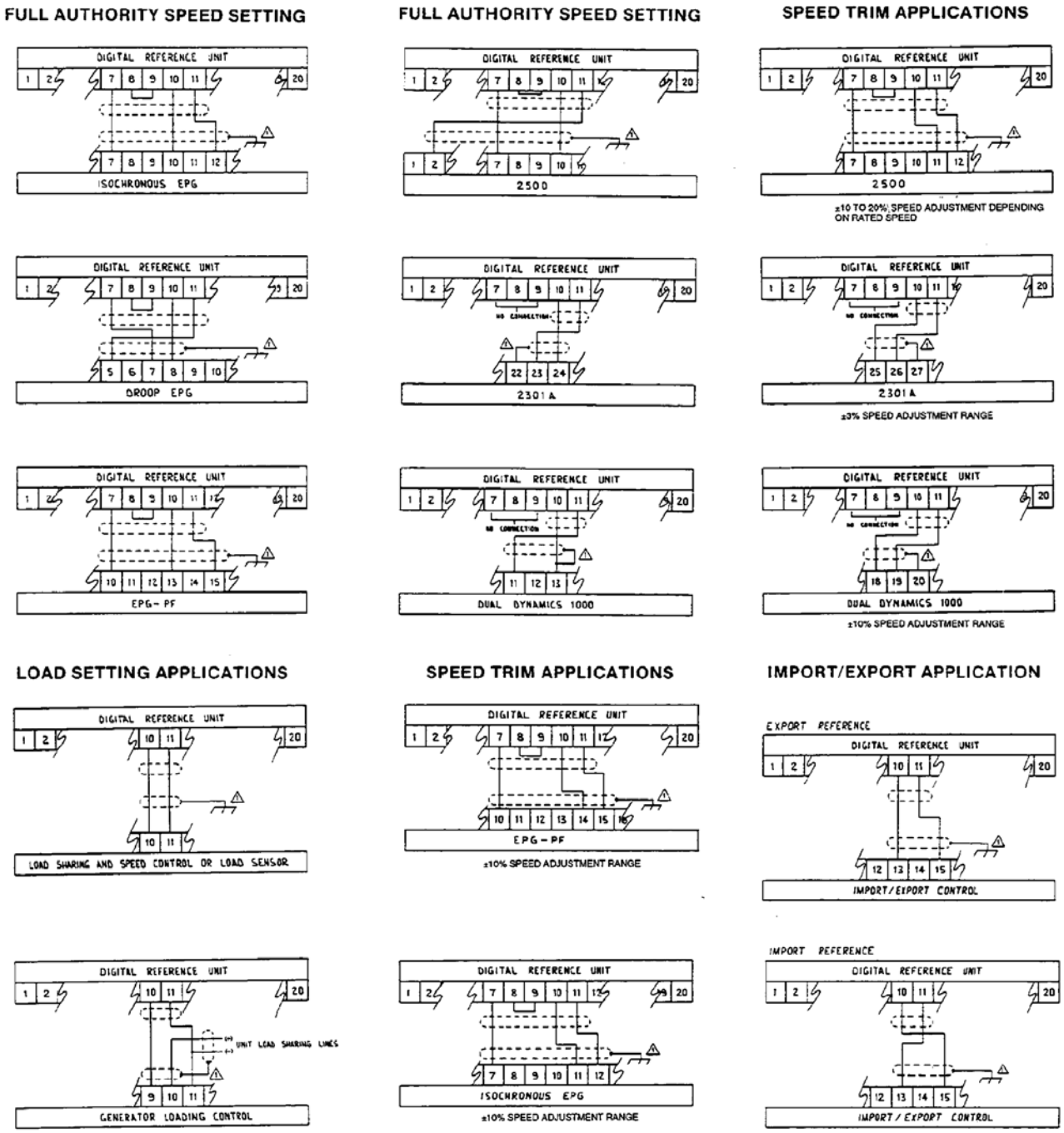


Figure 4-1. Wiring Applications

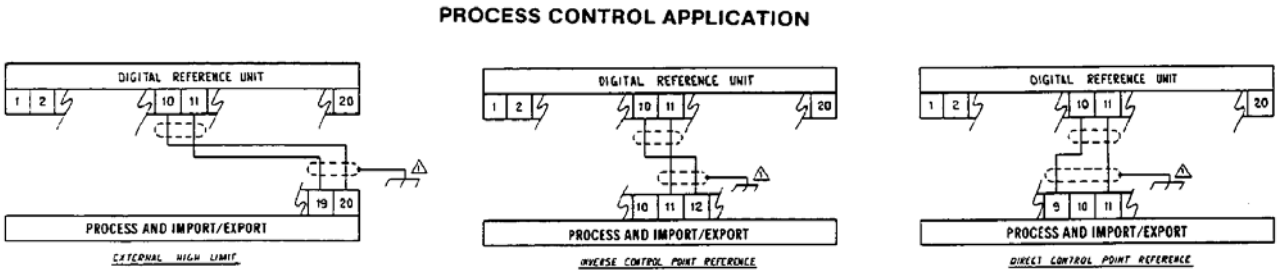


Figure 4-2. Wiring Diagrams

Chapter 4.
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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**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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