



Installation and Operation Manual

Digital Reference Unit

**8272-221 Direct Acting, 0–6 V Output
8272-468 Inverse Acting, 6–0 V Output**

Manual 82343 (Revision B)

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WARNING—OUT-OF-DATE PUBLICATION

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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.
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

Description

The Digital Reference Unit (Figure 1-1) consists of two printed circuit boards (PCBs) housed in a steel chassis. Potentiometers for adjusting reference levels and for meter calibration are on the front of the top PCB (A1) and are accessed through the front cover. All other adjustments and test points are on the back of PCB A1 or on the front of the bottom PCB (A2) and are accessed by removal of the cover. See Figure 1-2 for PCB locations.

Terminal blocks are mounted directly on the PCBs, eliminating unnecessary wiring and connections. A ribbon cable connects the two PCBs.

Function

The Digital Reference Unit generates a precise voltage that may be used wherever a reference signal is required. Typical uses include control of speed, load, pressure, and voltage. The level of the output voltage can be raised or lowered at one of four rates. Six reference selections also are available.



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.

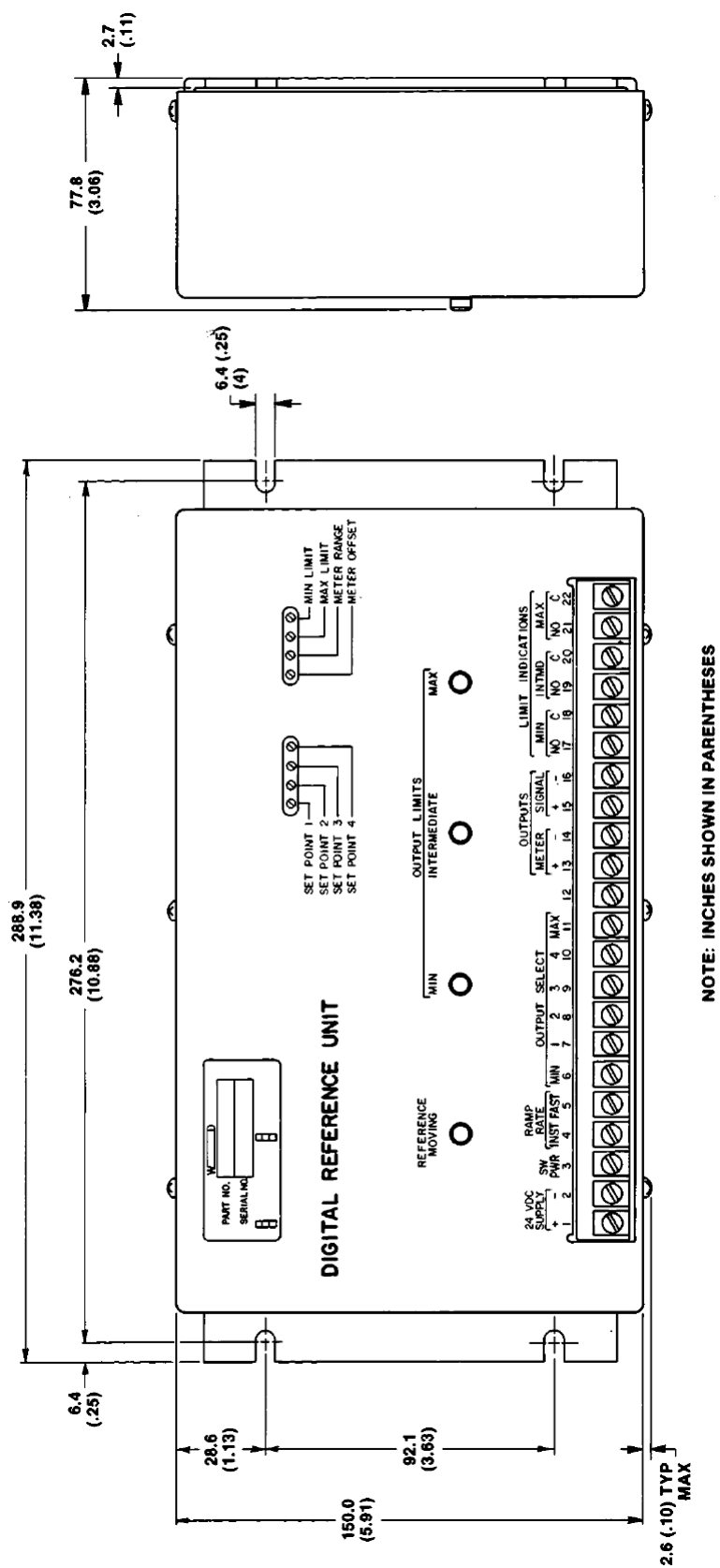


Figure 1-1. Digital Reference Unit Outline Drawing

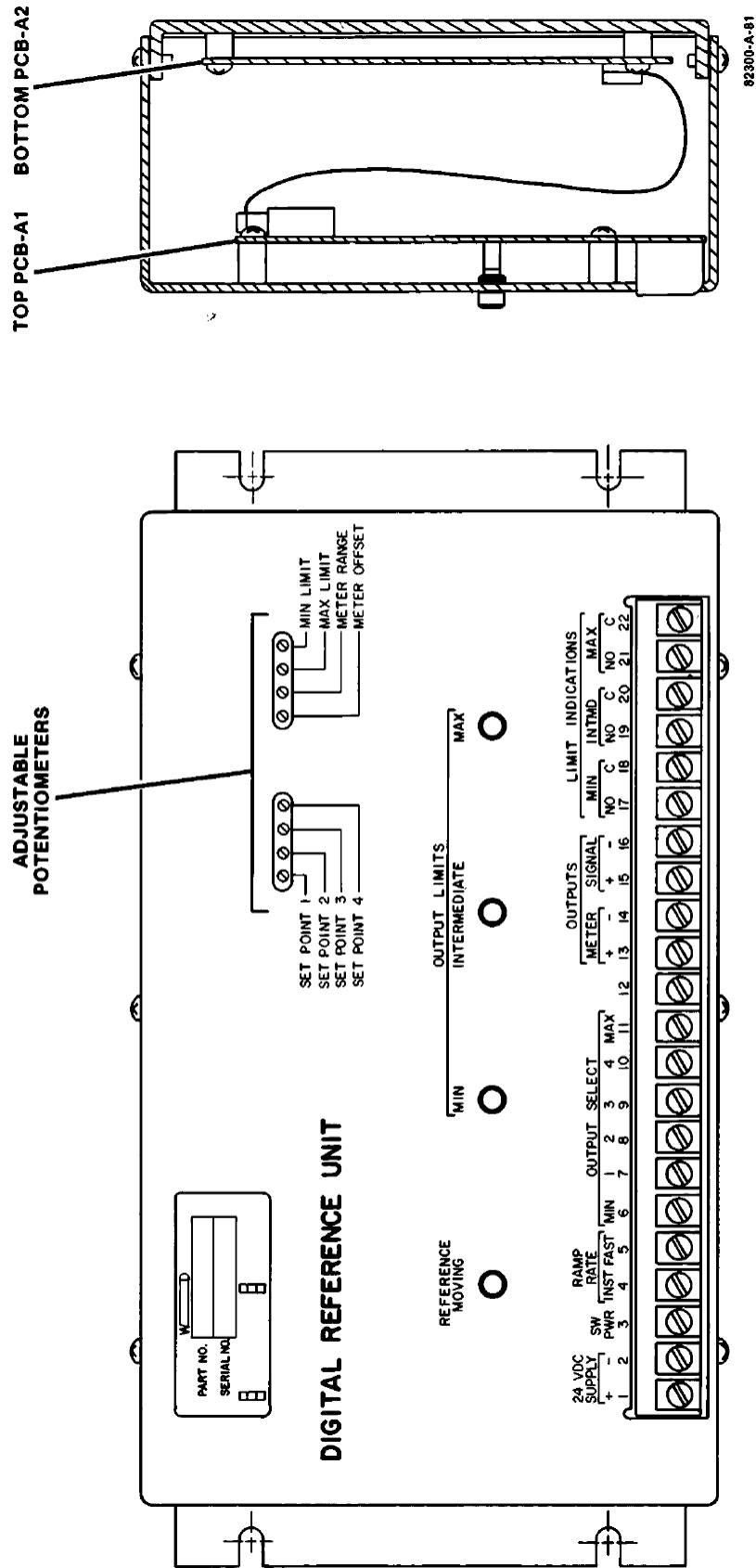


Figure 1-2. Digital Reference Unit Assembly Drawing

Chapter 2. Installation and Adjustment

Unpacking and Inspection

Before handling the control, read page ii, "Electrostatic Discharge Awareness." After carefully unpacking the control, visually inspect it for damage such as bent or dented panels, and loose or broken components. If any damage is found, immediately notify the shipper.

Application Information

Power Requirements

The Digital Reference Unit will operate with input power of 18 to 4 Vdc. The power input is connected to terminal 1 (+) and 2 (–). A battery can be used to supply the operating power. With a battery charger connected, the voltage must stay between 18 and 40 Vdc.



CAUTION—BATTERY

To prevent damage to the control, make sure that the alternator or other battery-charging device is turned off or disconnected before disconnecting the battery from the control.

Environmental Cautions

The Digital Reference Unit operates within a temperature range of –40 to +160 °F (–40 to +71 °C).

Location Considerations

The unit can be mounted in any position that provides adequate ventilation and space for servicing.

Electrical Connections

The plant wiring diagram (Figure 2-1) shows the wiring connections for the Digital Reference Unit. Connect the ramp-rate and reference terminals (terminals 4 through 11) to the +24 Vdc of terminal 3 as shown.

Reference Output Connections

Connect the reference output to terminals 15 and 16. For systems that use positive ramps, connect the system reference input to terminal 15 and the system circuit common to terminal 16. For systems that require negative ramps, connect the system circuit common to terminal 15 and the system reference input to terminal 16.

Recommended Test Equipment

The following test equipment is recommended for the checkout procedure in this chapter. Equipment having equivalent specifications may be substituted.

Digital Multimeter (DMM):	DC voltage accuracy of $\pm 0.3\%$ (Hewlett Packard 3476B or Fluke 8020A)
Volt-Ohmmeter (VOM):	20 k Ω /V $\pm 0.2\%$ (Simpson 260)
Power Supply:	24 Vdc

Checkout Procedure

Input and output connections to the control are shown in the plant wiring diagram, Figure 2-1. Potentiometers for setting minimum, maximum, and intermediate set points, along with meter range and meter offset are on PCB A1 and are accessed through the front cover. All other settings and adjustments require removal of the front cover. (Refer to Figures 3-1 and 3-2 for potentiometer and switch locations.)

1. With no wires connected to the unit, measure the resistance between each terminal and the chassis. Resistance should be a minimum of 10 M Ω .
2. Connect the input power to terminals 1 (+) and 2 (–).



NOTE

All adjustments are turned clockwise to increase the output level.

When the limit indication contacts are closed (zero resistance), the relays are energized.

Signal Output Checks

1. Connect a voltmeter to terminals 15 (+) and 16 (–).
2. Turn on the power and verify that the signal output at terminals 15 (+) and 16 (–) is less than 7 Vdc.

Minimum Output Limit

3. Issue a MIN Output Select command. Verify that the MIN Output LED illuminates, and that the system is controlling at the level specified. If necessary, adjust the MIN Limit (Offset) potentiometer (R8) until the system is controlling at the desired control point. Verify with an ohmmeter that the MIN Limit Indication contacts at terminals 17 and 18 close.

Maximum Output Limit

4. Without disconnecting the MIN Output, issue a MAX Output Select command. Verify that the reference-output level does not change and that the REFERENCE MOVING indicator is not illuminated.

5. Disconnect the MIN Output Select. Verify that the reference now moves toward the Maximum control point. Make sure the REFERENCE MOVING indicator is illuminated until the Max limit is reached. When the Max limit is reached, verify that the REFERENCE MOVING indicator turns off and the MAX Output Limit indicator turns on. Make sure that the MAX Output level is at the desired point. If necessary, adjust the Max Limit (Range) potentiometer (R7). Verify with an ohmmeter that the MAX Limit Indication contacts at terminals 21 and 22 close.
6. Repeat steps 3 through 5 until MIN and MAX set points are at the desired level.

**NOTE**

In the following steps, if an adjustment is made, the selections must be momentarily disconnected.

Intermediate Output Set Points

7. Connect an ohmmeter between terminals 19 and 20.
8. Make sure that switch S1-1 is closed, and that S1-2, S1-3, and S1-4 are open.
9. Issue an Output Select 1 command. Verify that after the REFERENCE MOVING indicator turns off, the INTERMEDIATE OUTPUT LIMIT indicator turns on. Verify zero resistance between terminals 19 and 20. If the reference output of Output Select 1 is not at the desired level, adjust the Set Point 1 potentiometer (R1).
10. Open switch S1-1 and close S2-2. Verify that the INTERMEDIATE OUTPUT LIMIT indicator turns off and that the ohmmeter indicates terminals 19 and 20 are open (infinite resistance).
11. Issue an Output Select 2 command. Verify that, after the REFERENCE MOVING indicator turns off, the INTERMEDIATE OUTPUT LIMIT indicator turns on. Verify zero resistance between terminals 19 and 20. If the reference output of Output Select 2 is not at the desired level, adjust the Set Point 2 potentiometer (R2).
12. Open switch S1-2 and close S1-3. Verify that the INTERMEDIATE OUTPUT LIMIT indicator turns off and that the ohmmeter indicates terminals 19 and 20 are open.
13. Issue an Output Select 3 command. Verify that after the REFERENCE MOVING indicator turns off, the INTERMEDIATE OUTPUT LIMIT indicator turns on. Verify zero resistance between terminals 19 and 20. If the reference output of Output Select 3 is not at the desired level, adjust the Set Point 3 potentiometer (R3).
14. Open switch S1-3 and close S1-4. Verify that the INTERMEDIATE OUTPUT LIMIT indicator turns off and that the ohmmeter indicates terminals 19 and 20 are open.
15. Issue an Output Select It command. Verify that after the REFERENCE MOVING indicator turns off, the INTERMEDIATE OUTPUT LIMIT indicator turns on. Verify zero resistance between terminals 19 and 20. If the reference output of Output Select It is not at the desired level, adjust the Set Point 4 potentiometer (R4).

16. Make sure all set point switches are opened except the one connecting the desired Intermediate Output Select contact.

Meter Output Signal Check

1. Connect either a 0 to 1 mA meter or a 4 to 20 mA meter to terminals 13 (+) and 14 (-).
2. Issue a MIN Output Select command and wait until the REFERENCE MOVING indicator turns off. Verify that the meter indicates 0 mA for the 0 to 1 mA meter. For the 4 to 20 mA meter, adjust the Meter Offset potentiometer (R5) as necessary to obtain a zero indication for the 4 mA input.
3. Issue a MAX Output Select command and wait until the REFERENCE MOVING indicator turns off. Verify that the meter indicates 1 mA for the 0 to 1 mA meter or full scale for the 4 to 20 mA meter. If necessary, adjust the Meter Range potentiometer (R6).
4. Repeat steps 2 and 3 until no further adjustment is required to calibrate the output to read 0 mA at MIN output and 1 mA at MAX output for a 0 to 1 mA meter, or zero at 4 mA and full scale at 20 mA for a 4 to 20 mA meter.

Ramp Rate Adjustments

Of the four ramp rates available, three are adjustable as indicated below. Potentiometers for setting ramp times are located on PCB A2. PCB A2 is accessed by removal of the cover.

Ramp Rate	Potentiometer	Range
SLOW	A2-R1	25–440 seconds
MEDIUM	A2-R2	25–440 seconds
FAST	A2-R3	4.8–98 seconds
INSTANT	None	70ms

A SLOW ramp rate is automatically selected if no other rate command is issued. For a MEDIUM ramp rate both INST and FAST rates must be selected. Select each rate and set the ramp time desired by adjusting the corresponding potentiometer.

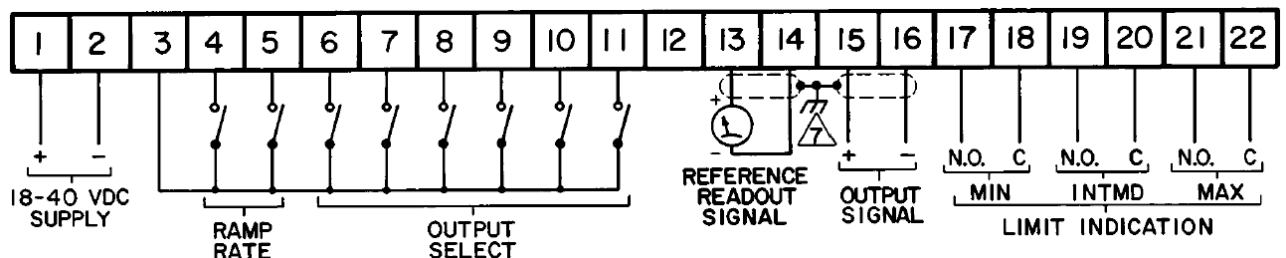


Figure 2-1. Typical Plant Wiring Diagram

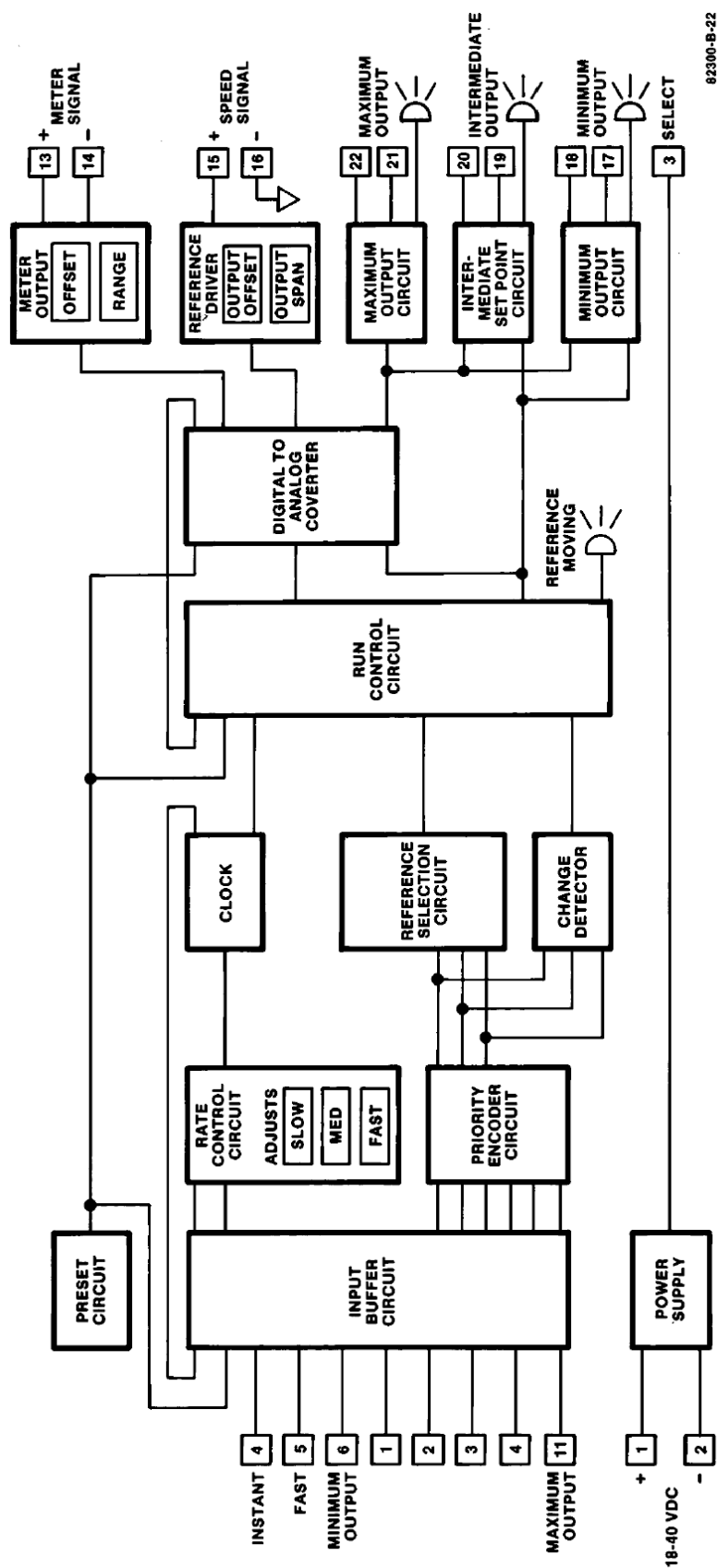


Figure 2-2. Block Diagram

Chapter 3.

Principles of Operation

Power Supply

The power supply of the Digital Reference Unit changes the 18 to 40 Vdc input voltage into the regulated voltages needed by the unit. Input voltages can be supplied by a battery and battery charger system, but must not be greater than 40 Vdc.

Input Buffer

The terminals for MIN, MAX, and INTERMEDIATE Output Selects and FAST and INST Ramp Rates are connected to the reference circuits by the Input Buffer. The Input Buffer gives signals to the Priority Encoder and Rate Control circuits to control the reference output of the Digital Reference Unit and the rate at which the reference changes.

Circuits

Priority Encoder Circuit

The Priority Encoder circuit uses the outputs from the Input Buffer to control the reference selected. If more than one input is selected, the input with the lowest reference level is selected by the Priority Encoder. The Priority Encoder generates a digital code for the reference selected which is used by the Reference Selection circuit and the Change Detector circuit.

Reference Selection Circuit

The Reference Selection circuit uses the digital codes from the Priority Encoder to connect the intermediate Set Point Selections (1 through 4) to the Run Control circuit. The reference levels are between the maximum and minimum counts of the Digital to Analog Converter (DAC) output.

Rate Control and Clock Circuits

The Rate Control circuit uses the rate signals from the Input Buffer circuit modified by the slow-, medium-, and fast-rate potentiometers to control the frequency of the Clock circuit output. The Clock circuit generates the pulses counted by the DAC circuit.

Change Detector Circuit

The Change Detector circuit uses the digital codes from the Priority Encoder to control if the reference selection is changed. When a change is detected, the circuit sends a signal to the Run Control circuit.

Run Control and Digital to Analog Converter Circuits

The Run Control circuit uses the signals from the Clock, Reference Selection, Change Detector, and DAC circuits. When the signal from the Change Detector indicates a change in reference level is needed, the clock pulses are given to the counters. The circuit compares the output level of the DAC with the Reference Selection output to determine whether to count up or down. When the DAC and reference-selection signals are equal, the clock pulses are disconnected. When the clock pulses are being counted, the REFERENCE MOVING indicator on the cover is illuminated. The DAC circuit counts the clock pulses and gives an analog output that is proportional to the count. The DAC analog output is used for setting the size of the reference output. The DAC circuit also sends digital signals to the indication circuits.

Switch Point Circuits

The Switch Point Indication circuits are the Minimum Output, Intermediate Output, or Maximum Output indication circuits. These circuits indicate when the counters in the DAC circuit are at the intermediate, minimum, or maximum output level. The Maximum Output circuit illuminates the MAX Output indicator when the Run Control and DAC circuits indicate that the reference is at the maximum output level. The Set Point circuits illuminate the INTERMEDIATE indicator when the Run Control and the DAC circuits indicate that the reference is at the intermediate level. The Minimum Output circuit illuminates the MIN Output indicator when the counters in the DAC circuit reach the maximum count.

Reference Driver and Preset Circuits

The Reference Driver circuit changes the output of the DAC circuit into a reference signal usable by the system. The Preset circuit sets the Run Control, Input Buffer, and the counters in the DAC circuit, to the Minimum Output level when the power is Digital Reference Unit.

Meter Output Circuit

The Meter Circuit provides an output for use of a remote meter of either 0 to 1 mA or 4 to 20 mA.

Operation

Reference

The reference generated by the Digital Reference Unit can be increased or decreased by connecting the appropriate output selections to terminal 3. Maximum, Minimum, or one of four Output Select (intermediate set point) contacts can be manually or automatically selected. The intermediate set point must be preset by closing one of four switches (there is one switch for each of the four intermediate set points) located on PCB A2. See Figure 2-2 for switch locations. The switches are accessible by removing the cover of the control. The potentiometers for adjusting the levels of the reference set points are accessible through the front cover.

Ramp Rate

The rate of change from one reference level to another can be selected from four rates: Slow, Medium, Fast, and Instant. The Fast and Instant rates are selected by connecting their respective terminal to terminal 3. The Medium rate is selected by connecting BOTH the Fast and Instant terminals to terminal 3. When neither the Fast nor Instant rates are connected to terminal 3, the Slow rate is automatically selected.

Test Points and Adjustments

Removal of the cover allows access to the test points and adjustments that are not accessible through the front cover. Of the two circuit boards in the control, the front (or top) board is attached to the cover and the rear (or bottom) board is attached to the chassis. All internal test points and adjustments are mounted on the side of the circuit board that is visible when the cover removed. The function and location of the test points and adjustments are listed below and shown in Figures 3-1 and 3-2.

Test Point Locations and Functions

Top Board (A1)

TP1	DAC Output
TP2	Circuit Common

Bottom Board (A2)

TP1	Clock Output
TP2	Circuit Common

Adjustment Locations and Functions

Top Board (A1)

S1-1	Switch for intermediate Set Point 1
S1-2	Switch for intermediate Set Point 2
S1-3	Switch fir intermediate Set Point 3
S1-4	Switch for intermediate Set Point 4

Bottom Board (A2)

R1	Slow Ramp Rate
R2	Medium Ramp Rate
R3	Fast Ramp Rate

Output Adjustments

Top Board (A1) (*Adjustment does not require removal of the control cover*)

R1	Set Point 1
R2	Set Point 2
R3	Set Point 3
R4	Set Point 4
R5	Meter Offset
R6	Meter Range
R7	Max Limit
R8	Min Limit

Function Indicators

The function indicators are Light Emitting Diodes (LEDs) on the control cover. They illuminate to indicate the status of the reference.

MAX	Illuminates when the reference reaches the maximum output level.
INTERMEDIATE	Illuminates when the reference reaches the intermediate set point level.
MIN	Illuminates when the reference reaches the minimum output level.
REFERENCE MOVING	Illuminates while the reference level is changing.

Selectable Inputs

Ramp Rate Selection

Slow	Selected by not connecting terminal 3 to the INST or FAST terminals.
Medium	Selected by connecting terminal 3 to both the INST and FAST terminals.
Fast	Selected by connecting terminal 3 to the FAST terminal.
Instant	Selected by connecting terminal 3 to the INST terminal.

Reference Level Selection

MIN Output	The Minimum reference level is selected by connecting terminal 3 to the MIN terminal.
1, 2, 3, 4	The Intermediate reference level is selected by connecting terminal 3 to Output Selection 1, 2, 3, or 4. The corresponding S1 switch also must be closed. (See listing under Adjustments.)
MAX Output	The Maximum reference level is selected by connecting terminal 3 to the MAX terminal.



NOTE

If more than one reference selection is connected, the **LOWEST** reference controls the output of the Digital Reference Unit.

Outputs

SIGNAL	Positive Ramp—Connect the Reference output to terminals 15 (+) and 16 (–). Negative Ramp—Connect the Reference output to terminals 16 (+) and 15 (–).
METER	0–1 mA or 4–20 mA Readout meter can be connected to terminals 13 (+) and 14 (–)

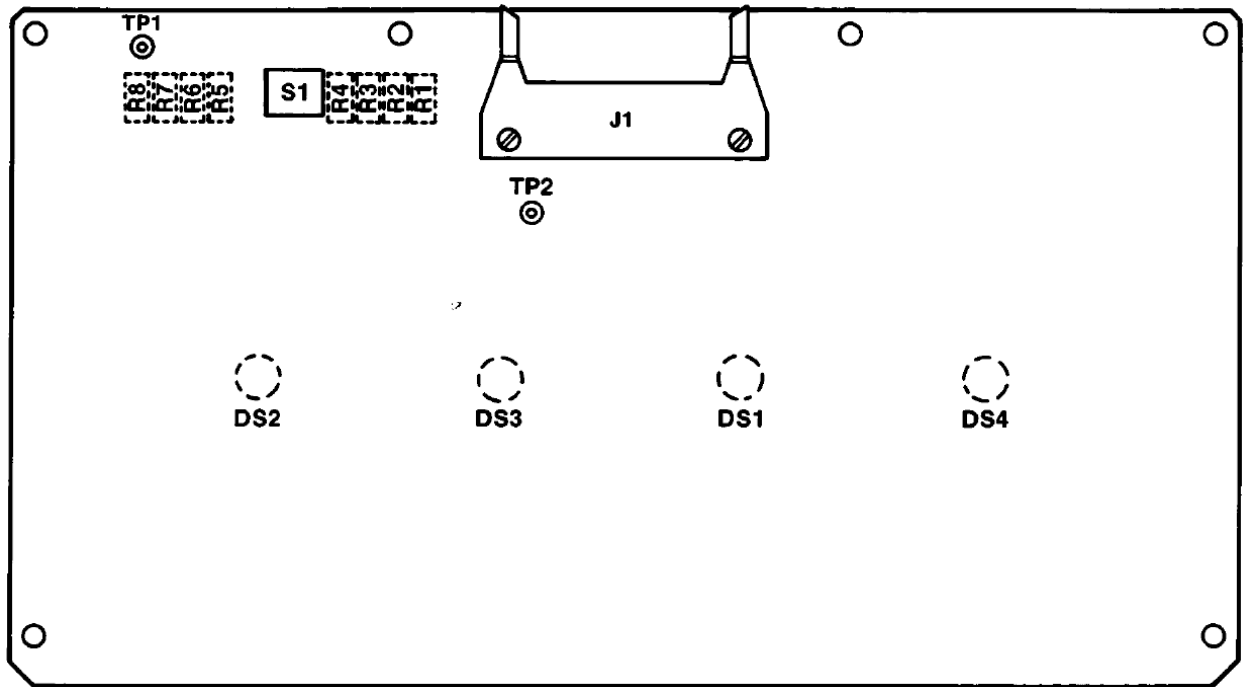


Figure 3-1. Top Board Potentiometers, Switches, and Test Points

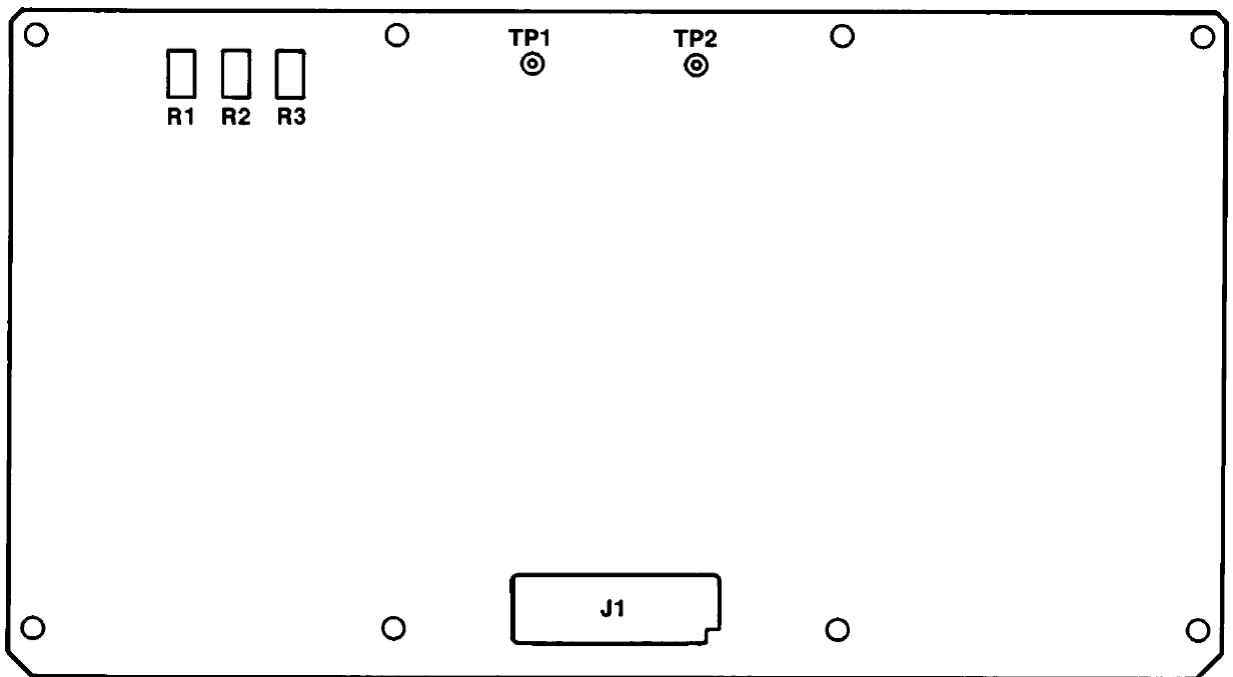


Figure 3-2. Bottom Board Potentiometers and Test Points

Chapter 4.

Troubleshooting

Visual Inspection

Before troubleshooting the Digital Reference Unit, visually inspect it for burned or broken parts, faulty wire or wiring connections, or faulty solder joints. A burned resistor often indicates a shorted transistor or a shorted wire. Be sure all connections are tight and making good contact. If nothing is found, proceed with troubleshooting the unit.



NOTE

A difference in the color of the potting compound on power resistors is common and does not indicate a burned-out condition.

Initial Troubleshooting Setup

1. Connect all wires to the terminals as needed.
2. Connect the power input.
3. Using a digital voltmeter, check the voltage on terminal 3 for 25.0 ± 1.5 Vdc with the MIN indicator illuminated and the Minimum Output relay (K1) energized.
4. Connect a voltmeter between terminals 15 (+) and 16 (–).

Symptom	Procedure	Results
Not able to select a new reference level	Make sure the Reference Moving indicator is on when a new reference level is selected.	If the Reference Moving indicator is not illuminated, go to the next step.
	Make sure that the new level is lower than the old level if two are connected at the same time.	If A and B are OK, return the unit for repair.
	If selecting an intermediate level, make sure the proper S1 switch is closed.	
The Reference level cannot be raised or lowered. (The voltage on terminals 15 (+) and 16 (–) will not change.)	Make sure that the MIN terminal is not selected.	If the MIN terminal is not selected, go to the next step.
	Make sure the Output Span adjustment is not limiting level below desired point.	
Limit LED indicators are not working.	Make sure that the input terminals are correct.	If the inputs are correct, return the unit for repair.
Not able to change the rate.	Make sure that the input voltages on the Fast and instant terminals are correct.	No voltage on either for Slow rate. Voltage on both for Medium rate. Voltage on FAST for Fast rate, on INST for the Instant rate.
	Connect a scope or counter to TP1 on Board A2. With Slow selected; select Fast, then Slow, then Medium. The clock rate must change. Repeat the procedure for the Fast and Medium Adjustments.	If the switching has no effect, or the INST is not instant, return the unit for repair.

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.

<u>Facility</u>	<u>Phone Number</u>
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.



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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.