WOODWARD

Product Manual 82350
(Revision D)
Original Instructions

Real Power Sensor

8272-387, 8272-394, 8272-480, 8272-778

Installation and Operation Manual

General Precautions

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.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

www.woodward.com/publications

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

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.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

Contents

Illustrations and Tables

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Important Definitions

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

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

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

⚠WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

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.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

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.**

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*.

Follow these precautions when working with or near the control.

1. 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.
2. 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.

Chapter 1.
General Information

Description

The 8272-387, 8272-394, 8272-480, and 8272-778 Real Power Sensors are used with Woodward Speed Control Systems and other controls, whenever a current signal is needed that is proportional to load.

- The 8272-394 Real Power Sensor produces a +4 to +20 mA signal and may be connected to sense either imported or exported power.
- The 8272-480 Real Power Sensor may be connected to sense both imported power and exported power. Its output will be from 0 to –20 mA for imported power, and from 0 to +20 mA for exported power.
- The 8272-387 and 8272-778 Real Power Sensors produce a +4 to +20 mA signal and may be connected to sense either imported power or exported power, and also include a load bridge and load-sharing-line connections so that they may be used as part of an isochronous load sharing system.

These load sensors may be used to sense load in any three-phase circuit. Some examples of their use include sensing the load on a generator, the plant load on a utility, or the power exported to a utility.

Power is measured in kilowatts and is calculated as follows:

For single-phase power:

$$P = \frac{V \cdot I \cdot \text{Cos}\ \theta}{1000}$$

P = power (in kilowatts)
V = rms line voltage (in volts)
I = rms line current (in amps)
θ = angle between line voltage and line current (in degrees)

For three-phase power, assuming balanced phases (applies to either delta or wye connected):

$$P = \frac{3 \cdot V \cdot I \cdot \text{Cos}\ \theta}{1000}$$

P = power (in kilowatts)
V = rms phase voltage (in volts)
I = rms phase current (in amps)
θ = angle between phase voltage and phase current (in degrees)

To calculate the power from the location of the real power sensor, again assuming balanced phases, use the following formula:

$$P = \frac{\sqrt{3} \cdot V' \cdot R_{pt} \cdot I' \cdot R_{ct} \cdot \text{Cos}\ \theta}{1000}$$

P = Power (in kilowatts)
V' = rms voltage at one phase's potential transformer secondary connections (in volts)
R_{pt} = Ratio of potential transformer
I' = rms phase Current at one phase's current transformer secondary connections (in amps)
R_{ct} = Ratio of current transformer
θ = Angle between phase voltage and phase current (in degrees)

The 8272-394 and 8272-480 Real Power Sensors both produce a signal which can be used to drive an external meter. This meter then indicates the amount of electrical power being produced and used. This same signal can also be used as a load input signal to other Woodward controls. The 8272-480 has a load gain potentiometer, and the 8272-394 does not.

The 8272-387 and 8272-778 Real Power Sensors provide the readout meter drive and also provide a voltage signal (proportional to actual power) to the control system for load sharing. They also allow for Isoch/Droop operation and have an input connection available for an SPM (speed and phase matching) Synchronizer output signal.

IMPORTANT

The 8272-387 and 8272-778 Real Power Sensors are identical except that 8272-778 has had an 800 ms delay added to the summing amplifier in order to reduce its sensitivity.

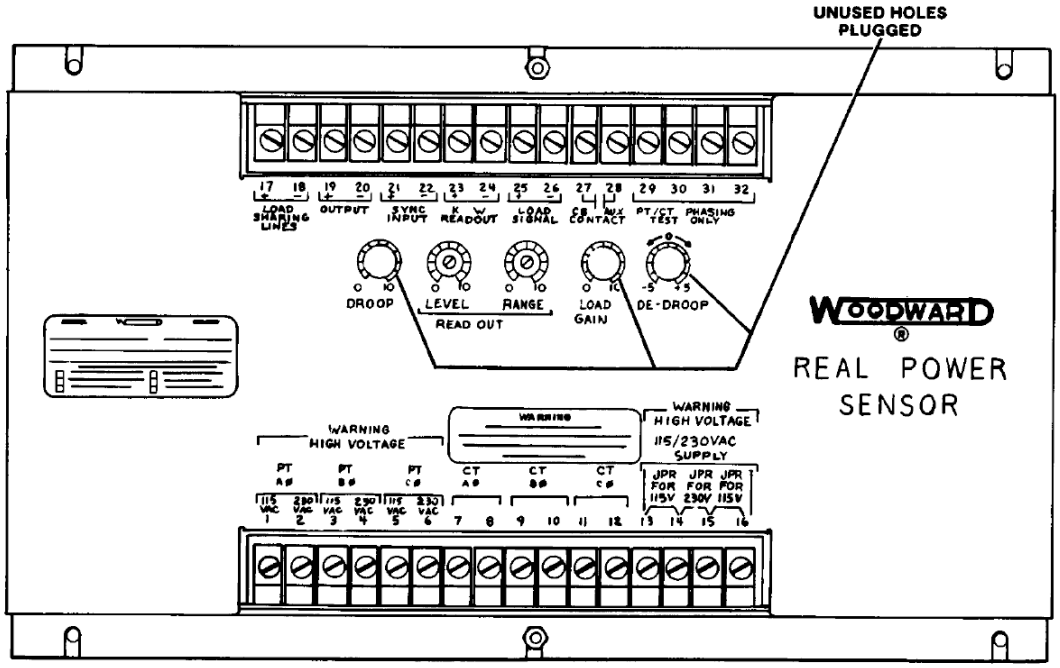


Figure 1-1. Real Power Sensor

Chapter 2.
Theory of Operation

Power Supply

Input power for the Real Power Sensor can be either 115 Vac or 230 Vac. Terminals 13 through 16 are jumpered differently to accommodate the different input voltages. Input power is connected to terminals 13 and 16. For 115 Vac operation. terminals 13 and 14 are jumpered together, also jumper terminals 15 and 16 together. For 230 Vac operation, terminals 14 and 15 are jumpered together.

The power supply steps the input ac voltage down and rectifies it to dc power. It is then regulated and filtered to provide both a +12 and –12 Vdc supply and a +R and –R (reference) supply to be used by the circuitry of the Real Power Sensor.

Phase Voltage Sensors

Each of the phase voltage sensors in the Real Power Sensor is connected to either a 115 Vac or a 230 Vac tap on a three-phase potential transformer (PT), which in turn is connected to the circuit being monitored. For 115 Vac operation, Phase A is connected to Terminal 1, Phase B is connected to Terminal 3, and Phase C is connected to Terminal 5. For 230 Vac operation, Phase A is connected to Terminal 2, Phase B is connected to Terminal 4, and Phase C is connected to Terminal 6.

The phase voltage sensors step down the input potential voltages to a lower voltage. The output to the summing amplifier is determined by the phase current sensor circuit output.

Phase Current Sensors

Each of the phase current sensors in the Real Power Sensor is connected to the output of a current transformer (CT), which in turn, is placed around one conductor of one phase of the circuit being monitored.

For proper operation, it is important that the current transformers be connected correctly. This means that the Phase A current transformer and the Phase A potential transformer must be connected to the Phase A Terminals on the Real Power Sensor, and the correct polarity must also be observed. The same applies to Phases B and C.

The phase current sensors step down the current and provide a burden resistance to prevent lethal voltage build up (as long as the current transformers are connected to the Real Power Sensor). This reduced current is converted to a voltage signal and controls the amount of the potential voltage signal that is allowed to pass to the summing amplifier. The resulting signal is proportional to current amplitude and phase relation of voltage input and current.

Summing Amplifier

The summing amplifier receives a portion of each potential voltage signal (controlled by the current sensor circuit) and sums (combines) these signals, which are 120 degrees out of phase, to produce an output voltage signal proportional to real power. The summing amplifier also has an adjustment to offset or null the circuit (set the output to zero when no power is produced).

The output of the summing amplifier is then sent to the readout meter drive circuit, the droop circuit, and the load sharing circuit. For testing purposes this signal also can be measured at terminals 25 (+) and 26 (–).

The readout meter circuit uses the output of the summing amplifier (the real power signal) to produce a drive signal for an external meter. This meter will indicate the real power of the circuit being monitored, and has an adjustment to zero the meter and an adjustment for output range. The Real Power Sensor may be ordered with a readout-meter output of either 1 to 5 Vdc or 4 to 20 mAdc.

This output also may be used as input to other Woodward controls such as the 505, 501, etc.

Droop Circuit

The droop circuit gives a proportional output of the real power signal into a speed control to provide droop. This droop signal is controlled by the Isoch/Droop contacts of the operator control panel and the auxiliary contacts of the circuit breaker. These contacts control the voltage present at terminals 27 and 28. When voltage is present at terminals 27 and 28 the sensor is operating isochronously, and when the voltage is not present the sensor is in droop operation.

Load Sharing

When the sensor is operating in the Isochronous mode, a portion of the real power signal is sent to terminals 17 and 18 to be used as a load sharing signal for multiple generator systems. This load sharing signal causes other generator sets connected in the system to share the output load. The load error signal is applied to the output driver (through the droop circuit which is set to zero droop).

Synchronizer Circuit

The synchronizer circuit receives input from the SPM (speed and phase matching) synchronizer. This signal indicates whether to increase or decrease speed to match the frequency and phase of this generator with either the utility bus or another generator in use. After the circuit breaker is closed and this generator is “on line” the output signal from the 5PM synchronizer is usually disconnected or disabled.

Output Driver

The output driver combines the real power signal from the droop circuit with the synchronizer signal to produce the output signal at terminals 19 and 20. It also acts as a buffer for the output signal and provides the drive current necessary for the signal to the speed control.

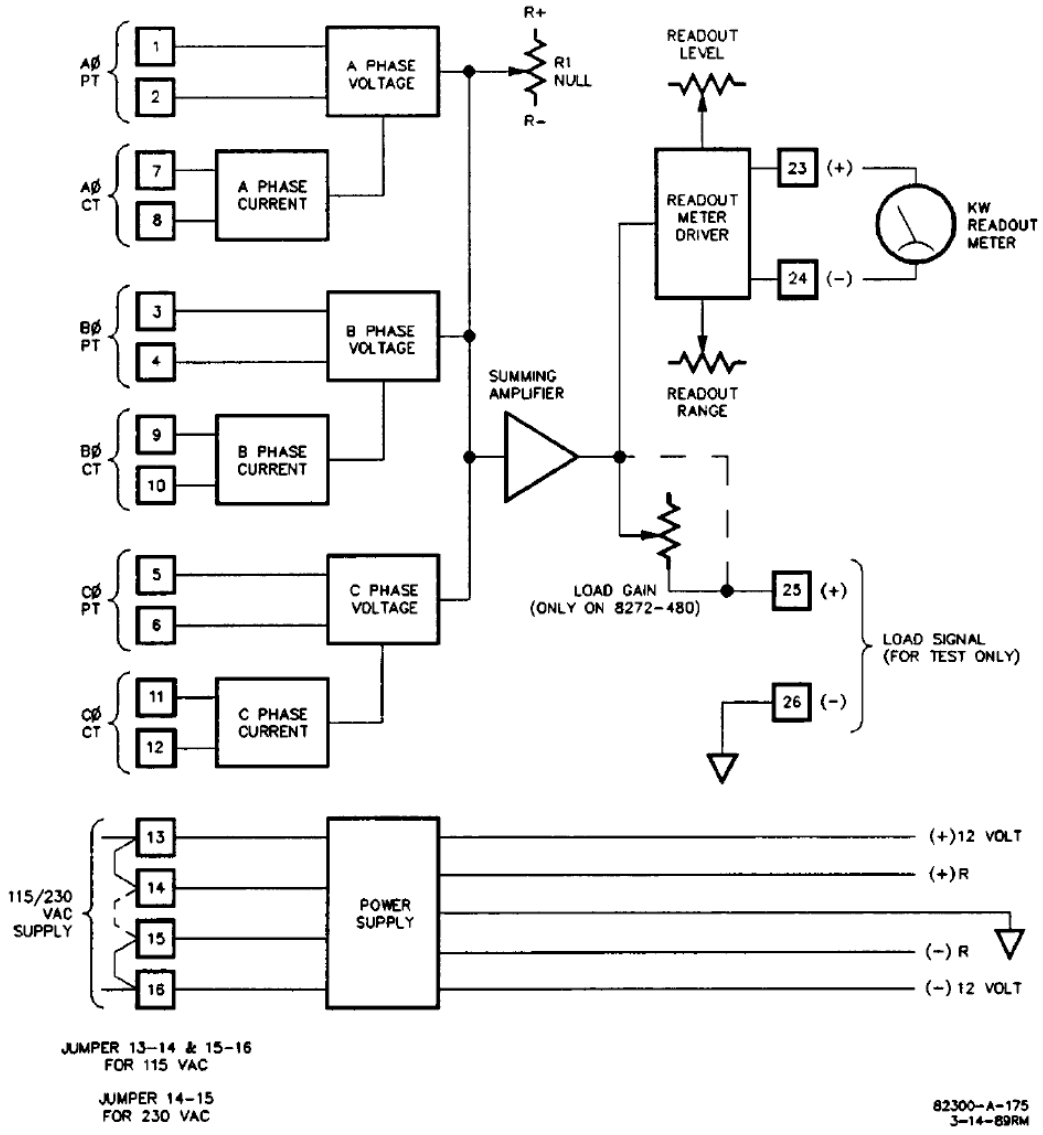


Figure 2-1. Real Power Sensor Block Diagram (8272-394 & 8272-480)

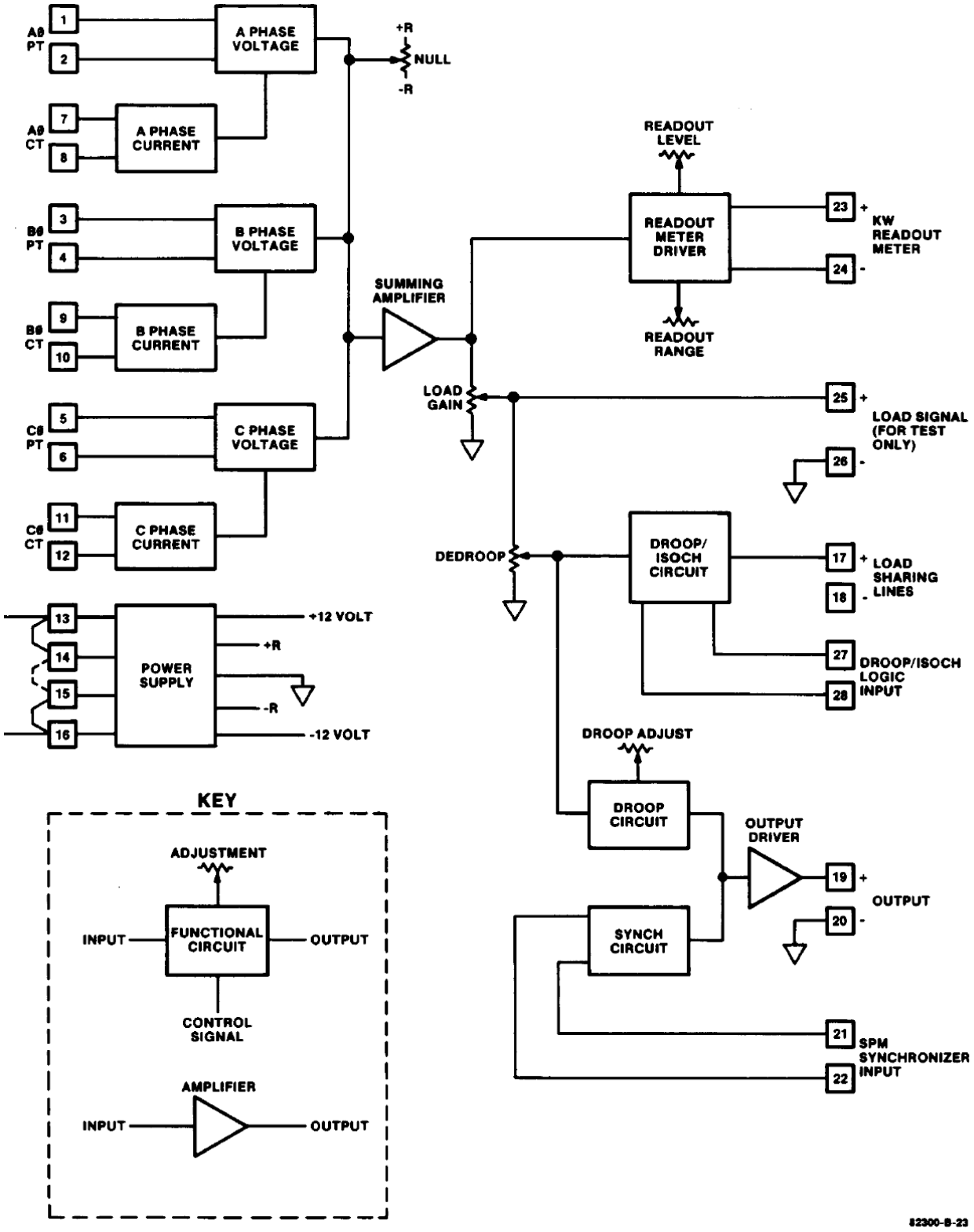


Figure 2-2. Real Power Sensor Block Diagram (8272-387 & 8272-778)

Chapter 3.
Installation

Unpacking

Be careful when unpacking the Real Power Sensor. Check the unit for signs of damage such as bent or dented panels, scratches, and loose or broken parts. If any damage is found, immediately notify the shipper.

NOTICE

Before unwrapping the Real Power Sensor from the protective plastic bag, read the instructions inside the front cover of this manual about the handling precautions, and read page ii, Electrostatic Discharge Awareness.

Location

When selecting a location for mounting the Real Power Sensor, consider the following:

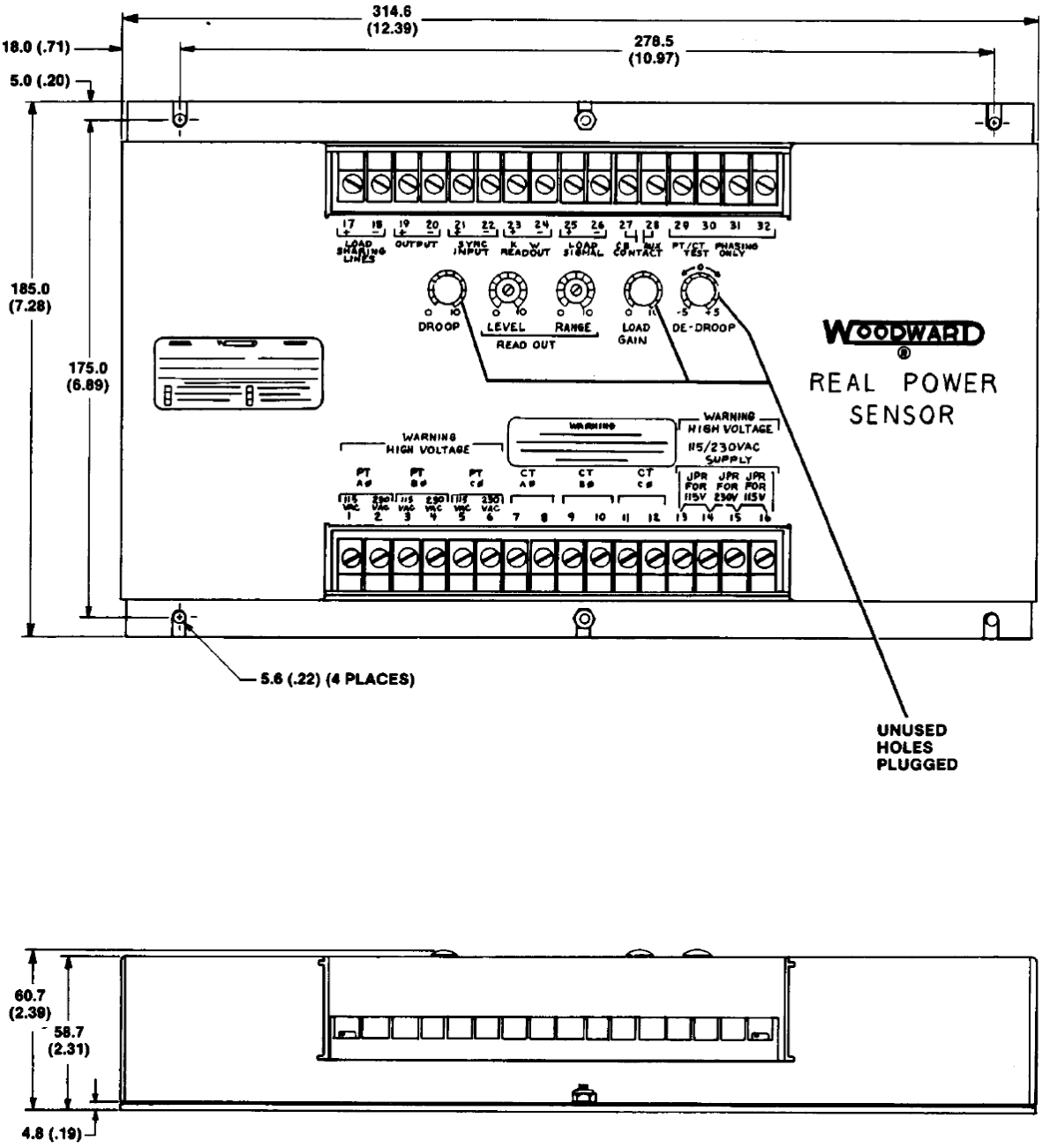
- Protect the unit from direct exposure to water or to a condensation-prone environment.
- The operating range of the unit is –40 to +70 °C (–40 to +158 °F). For best operation, maintain the ambient air temperature between +10 and +30 °C (+50 to +86 °F).
- Provide adequate ventilation for cooling. Shield the unit from radiant heat sources.
- Do not install the unit near high-voltage! high-current devices.
- Allow adequate space around the unit for servicing.
- Ground the unit for proper shielding.

Installation and Wiring

Mount the Real Power Sensor using the four mounting holes provided on the flanges of the enclosure (see Figure 3-1).

Connect the external wiring to the Real Power Sensor as shown in Figure 3-2. When making these wiring connections, observe the following wiring recommendations:

- Use 20 AWG (0.5 mm²) or larger stranded, twisted shielded wire for all signal-carrying wires.
- Use 18 AWG (0.8 mm²) or larger stranded wire for all potential and current transformer connections.
- Make sure that all wires shown on the plant wiring diagram as shielded, are shielded.
- Do not place shielded wires in the same cable conduits with high-voltage or high-current carrying cables.
- Do not connect the cable shields to any external grounds. The cable shield is grounded at the power sensor end only.
- Make sure that cable shields are connected through all intermediate terminal blocks from the signal source to the signal termination. (Do not leave any floating grounds.)



NOTE: INCHES SHOWN IN PARENTHESES

Figure 3-1. Outline Drawing of Real Power Sensor

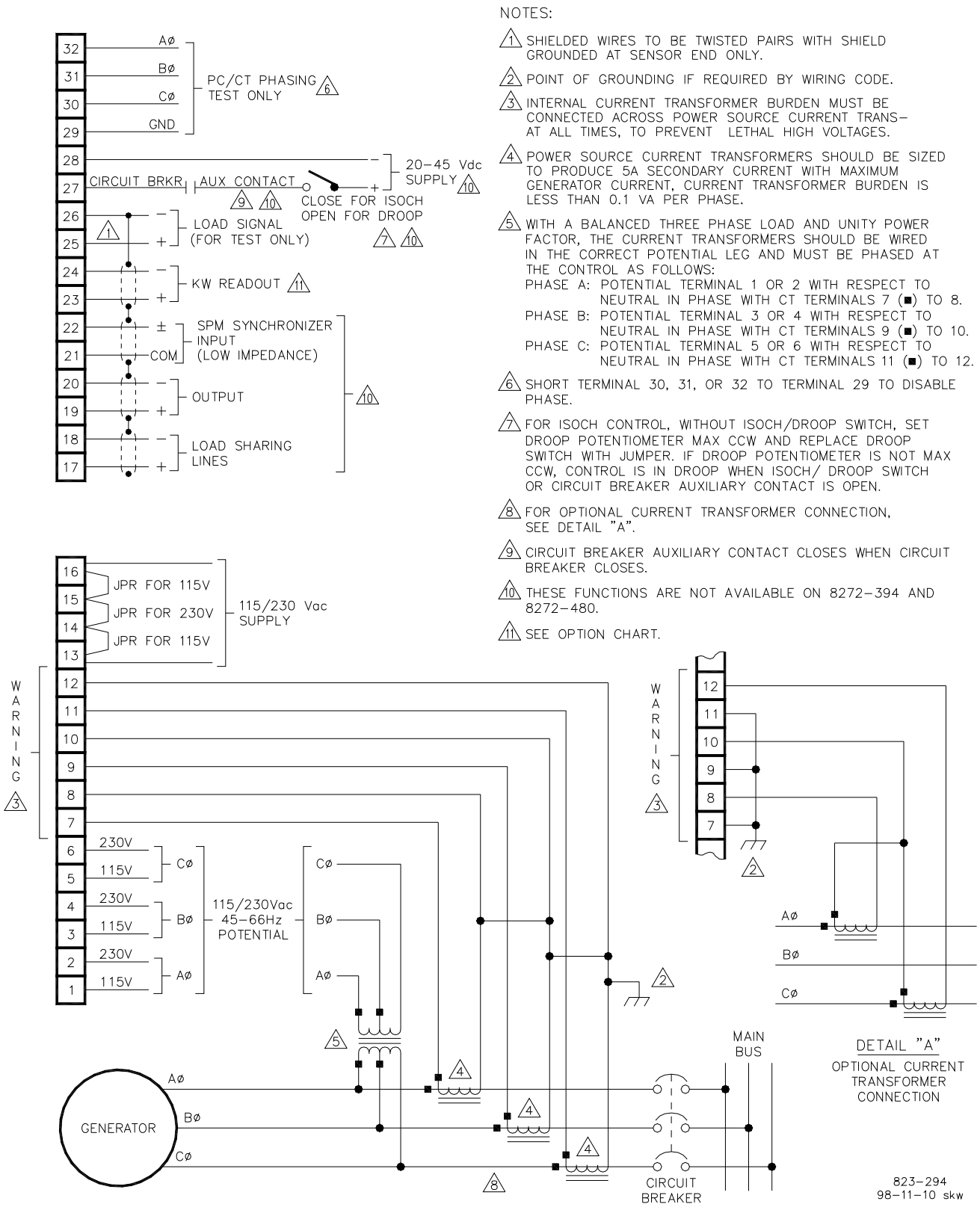


Figure 3-2. Plant Wiring Diagram of Real Power Sensor

Chapter 4.
Calibration Procedure

Introduction

⚠WARNING

HIGH VOLTAGE—High voltage is used in the operation on this equipment. Death on contact may result If personnel fail to observe safety precautions. Learn the areas containing high-voltage in each piece of equipment. Be careful not to contact high voltage connections when operating this equipment. Before working around the equipment, turn off power and ground points of high potential before touching them.

⚠WARNING

Remove rings, watches, and all other jewelry while working on or near this equipment. These Items could cause Injury or death to personnel, or damage to equipment.

Recommended Test Equipment

The following test equipment is recommended for the checkout and calibration of the Real Power Sensor. This is only a recommended list and you should not feel required to purchase this exact equipment. Equipment having equivalent specifications or better may be substituted.

1 Digital Multimeter (Fluke 8021B or equivalent):

DC Voltage accuracy:	±0.25% +1 digit
DC Current accuracy:	±0.75% +1 digit
Resistance accuracy:	±0.2% +1 digit (less than 2000 kΩ)
AC Voltage accuracy:	45–450 Hz ±1% (200 mV to 200 V)
AC Current accuracy:	45–450 Hz ±1.5% +2 digits (2 mA–2 A)

General Information

Read and follow these instructions carefully when checking or calibrating the Real Power Sensor.

⚠WARNING

HIGH VOLTAGE—High voltage is present at the connectors and on the circuit board of the Real Power Sensor. Use care while working around the unit.

NOTICE

Before handling any electronic component, read Manual 82715, *Guide For Handling and Protection of Electronic Controls*.

- **Observe precautions for handling static-sensitive devices.**
- **Use battery-operated test equipment whenever possible.**
- **Isolate the test equipment from all grounds, including the chassis.**
- **The values published in the following calibration procedures are the values used by Woodward for the calibration of the new unit. Before recalibrating the unit check with the equipment manufacturer for any changes in equipment that will change these values. if changes have been made, mark the changes in the manual.**

Operational Tests

This procedure uses the actual generator load or utility power flow to calibrate and test the Real Power Sensor.

Before continuing with the test, double check all wiring and jumpers on the Real Power Sensor with the plant wiring diagram.

8272-387, 8272-394, 8272480, and 8272-778 Real Power Sensors

1. Prepare the generator set for starting (following the set manufacturer's instructions), and prepare the load (utility, plant load, load bank, or other load) for loading.

2. If there is a LOAD GAIN Control, set it fully clockwise.

3. if you are sensing the power on a generator, start the generator (following the manufacturer's instructions), synchronize, and close the breaker.

   If you are sensing the power of a utility, close the utility breaker.

   In either case, make sure that no power (load) is applied.

4. Verify that the supply and potential-transformer (PT) voltages are present at the Real Power Sensor, and are connected to the proper terminals (supply at terminals 13-16 and PT signal at 1-6).

5. With no load, verify that the voltage between terminals 25 (+) and 26 (–) is (0.0 ±0.1) Vdc. if the voltage is not correct, check for circulating currents (KVARS) and for proper phasing of the PTs and CTs.

6. If the phasing appears to be correct, but the voltage reading is wrong, adjust R1 for zero volts at terminals 25 (+) and 26 (–).

IMPORTANT

The R1 adjustment was factory set and should remain correct. Change the R1 potentiometer setting only after you have made sure that the phasing is correct and that your problem is not circulating currents.

If you make this adjustment, you must be very careful. This potentiometer is on top of the circuit board under the chassis, and in order to make this adjustment, you must remove the chassis.

7. increase the load to 50%. If your Real Power Sensor has a LOAD GAIN Control, adjust it so that the voltage between Terminals 26 (–) and 25 (+) is 2.5 Vdc. If your Real Power Sensor does not have a Load Gain Control, the voltage measured between Terminals 26 (–) and 25 (+) should be approximately 3 Vdc, and is not adjustable.

⚠WARNING

HIGH VOLTAGE—High voltage is present on the terminals and circuit board of the Real Power Sensor. Be careful not to touch these terminals; contact with them could cause Injury or death.

IMPORTANT

If the power factor in your system is less than 0.7, the following phasing test will not work.

8. Shut down the generator set and/or open the utility breaker so that there is no power applied to the Real Power Sensor. Connect a jumper wire between terminals 32 and 29 to disable Phase A.

9. if you are sensing the power of a generator, start the generator (following the manufacturer's instructions), synchronize, and close the breaker.

   If you are sensing the power of a utility, close the utility breaker.

10. Increase the load to 50%. Measure the voltage between Terminal 25 (+) and Terminal 26 (–). Record the value.

11. Shut down the generator set and/or open the utility breaker so that there is no power applied to the Real Power Sensor. Disconnect the jumper wire between Terminals 32 and 29. Connect a jumper wire between Terminals 31 and 29 to disable Phase B.

12. If you are sensing the power of a generator, start the generator (following the manufacturer's instructions), synchronize, and close the breaker.

    If you are sensing the power of a utility, close the utility breaker.

    Increase the load to 50%. Measure the voltage between Terminal 25 (+) and Terminal 26 (–). Record the value.

13. Shut down the generator set and/or open the utility breaker so that there is no power applied to the Real Power Sensor. Disconnect the jumper wire between Terminals 31 and 29. Connect a jumper wire between Terminals 30 and 29 to disable Phase C.

14. If you are sensing the power of a generator, start the generator (following the manufacturer's instructions), synchronize, and close the breaker.

    If you are sensing the power of a utility, close the utility breaker.

    Increase the load to 50%. Measure the voltage between Terminal 25 (+) and Terminal 26 (–). Record the value.

15. Shut down the generator set and/or open the utility breaker so that there is no power applied to the Real Power Sensor. Disconnect the jumper wire between Terminals 30 and 29.

16. Compare the values obtained in steps 10, 12, and 14. These values should all be the same (±10%). if they are not the same, recheck for crossed phases (CTs not matched to PTs). Recheck phasing and correct if necessary.

IMPORTANT

In steps 10, 12, and 14, it does not matter whether the load is exactly 50%; however, the load must be as close to the same value in steps 10, 12, and 14 as you can make it. If it is not the same, you will not be able to get the desired result in step 16, even if the phasing is correct.

17. Start the generator set (following the set manufacturer's instructions) or, if sensing utility power, close the utility breaker.

18. Run at zero load.

19. Verify that the kW readout meter reading is *_____ (4.0 ±0.2) mA. If necessary, adjust potentiometer R3 (Readout level).

20. Increase the load to 100%.

21. Verify that the kW Readout Meter reading is *_____ (20.0 ± 0.2) mA. If necessary, adjust potentiometer R4 (Readout range).

22. If a change was made in either step 19 or 21, repeat steps 15 through 18 until you get no further improvement.

23. Reduce the load to zero, open the utility breaker, and/or shut the generator set down.

This completes the operational test for part numbers 8272-394 and 8272-480. If your part number is 8272-387 or 8272-778, continue the procedure below.

8272-387 and 8272-778 ONLY

1. Operating in the isochronous mode with no load, note the generator speed *_____ rpm (Hz).

2. Apply 100% load and note the generator speed *_____ rpm (Hz). This speed should be the same as the speed recorded in Step 1. If it is not, adjust R6 (DE-DROOP) and repeat steps 2 and 3 until no further improvement is noted.

3. Operating in the Droop mode, single generator operation with no load, note the speed of the generator *_____ rpm (Hz).

4. Apply 100% load and note the generator speed *_____ rpm (Hz). The speed decrease from step 3 is the amount of speed droop. To change this droop, adjust R2 (DROOP) and repeat steps 3 and 4 until the desired droop is obtained. Reduce the load to zero.

5. Select isochronous operation.

6. Parallel this generator set with the other generator sets in your load-sharing system (following the generator set manufacturer's instructions) and apply load.

7. Adjust R5 (LOAD GAIN) Control until the generators share load equally.

This completes the operational test of the 8272-387 and 8272-778 Real Power Sensors.

Chapter 5.
Product Support and Service Options

Product Support Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

1. Consult the troubleshooting guide in the manual.
2. Contact the **OE Manufacturer or Packager** of your system.
3. Contact the **Woodward Business Partner** serving your area.
4. Contact Woodward technical assistance via email (**EngineHelpDesk@Woodward.com**) with detailed information on the product, application, and symptoms. Your email will be forwarded to an appropriate expert on the product and application to respond by telephone or return email.
5. If the issue cannot be resolved, you can select a further course of action to pursue based on the available services listed in this chapter.

OEM or Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full-Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.

A current list of Woodward Business Partners is available at **www.woodward.com/directory**.

Product Service Options

Depending on the type of product, the following options for servicing Woodward products may be available through your local Full-Service Distributor or the OEM or Packager of the equipment system.

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

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime.

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Flat Rate Repair: Flat Rate Repair is available for many of the standard mechanical products and some of the electronic products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option, with the exception that the unit will be returned to you in "like-new" condition. This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:
- return number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:
- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Replacement Parts

When ordering replacement parts for controls, include the following information:
- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

Engineering Services

Woodward's Full-Service Distributors offer various Engineering Services for our products. For these services, you can contact the Distributor by telephone or by email.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact.

Product Training is available as standard classes at many Distributor locations. Customized classes are also available, which can be tailored to your needs and held at one of our Distributor locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact one of the Full-Service Distributors listed at **www.woodward.com/directory**.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory published at **www.woodward.com/directory**.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used In Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Products Used In Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used In Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

For the most current product support and contact information, please visit our website directory at **www.woodward.com/directory**.

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number

Prime Mover Information

Manufacturer _____

Engine Model Number _____

Number of Cylinders _____

Type of Fuel (gas, gaseous, diesel, dual-fuel, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.)

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Symptoms

Description _____

_____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 82350D.

WOODWARD

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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.

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