WOODWARD

Product Manual 82018
(Revision A)
Original Instructions

Real and Reactive Power Sensor

8272-701, -702, -705, -719, and -720

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 Out-of-date translations are marked with ⚠.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

Warnings and Notices

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

Introduction

The Woodward Real and Reactive Power Sensor (Figure 1-1) models described in this manual have the following functions:

Model	Function
8272-701	Watt (0–20 mA) and VAR readout signals
8272-702	Watt (4–20 mA) and VAR readout signals
8272-705	Watt and VAR readouts, as well as voltage load-sharing signal
8272-719	Watt readout and voltage load-sharing signal
8272-720	Watt readout signal

Description

These real and reactive power sensors are used with Woodward speed control systems. They sense both real (watt) and reactive (VAR) power produced. A real and reactive power sensor measures the current of each of three phases, the amplitude of the voltage of each phase, and the phase angle between voltage and current. This compensates for unequal loading of the phase of the generator and for changes in the power factor.

Real 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):

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

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)

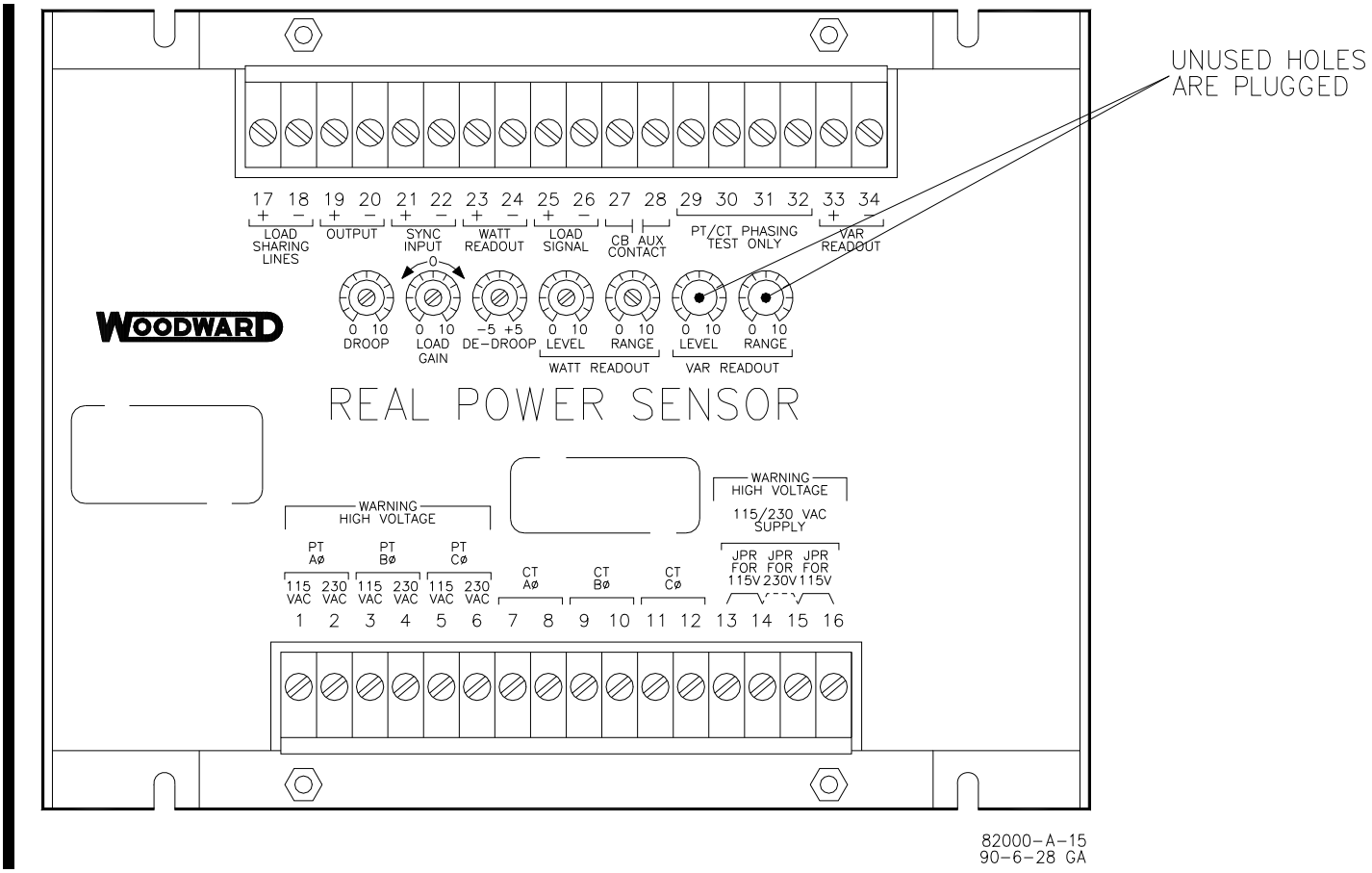

Figure 1-1. Real and Reactive Power Sensor

Reactive power is measured in KVARS and is calculated as follows:

For ***single-phase*** power:

$$Q = \frac{V \cdot I \cdot \sin\theta}{1000}$$

Q = Reactive power (in KVARS)
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):

$$Q = \frac{3\ V \cdot I \cdot \sin\theta}{1000}$$

Q = Reactive power (in KVARS)
V = Rms phase voltage (in volts)
I = Rms phase current (in amps)
θ = Angle between phase voltage and phase current (in degrees)

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

For ***real*** power:

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

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

For ***reactive*** power:

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

Q = Reactive power (in KVARS)
V' = Rms voltage at one phase's potential transformer secondary connections (in volts)
I' = Rms current at one phase's current transformer secondary connections (in amps)
R_{pt} = Potential transformer winding ratio
R_{ct} = Current transformer winding ratio
θ = Angle between phase voltage and phase current (in degrees)

The 8272-701 and -702 Real and Reactive Power Sensors produce watt and VAR readout signals; the 8272-720 model produces only a watt signal. These signals can be used to drive external meters. These meters then indicate the amount of electrical and reactive (8272-701 and -702 only) power being produced and used. These same signals can also be used as load input signals to other Woodward controls.

The 8272-705 Real and Reactive Power Sensor provides the watt and VAR readout signals, as well as a voltage signal (proportional to actual power) to the control system for load sharing. The 8272-719 provides the watt readout and the same voltage signal as the 8272-705. Both these models allow isochronous/droop operation and have an input connection available for a speed and phase matching (SPM) synchronizer output signal.

Chapter 2.
Operation

Introduction

This chapter describes the operation of the circuits of the real and reactive power sensor. Figure 2-1 illustrates the block diagram for the 8272-701 and -702. Figure 2-2 shows the 8272-705. Figure 2-3 depicts the 8272-719 model. And, Figure 2-4 shows 8272-720.

Power Supply

Input power for the real and reactive power sensor can be either 115 Vac or 230 Vac. Terminals 13 through 16 are jumpered differently to accommodate the different input voltages. For either operation, connect input power to Terminals 13 and 16. Then, jumper as follows:

Vac Operation	Jumper Terminals
115	13 and 14, 15 and 16
230	14 and 15

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 real and reactive power sensor circuits.

Phase Voltage Sensors

Each phase voltage sensor is connected to either a 115 or 230 Vac tap on a three-phase potential transformer, which is connected to the output of the generator being monitored.

Vac Operation	Phase	Connect to Terminal
115	A	1
	B	3
	C	5
230	A	2
	B	4
	C	6

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

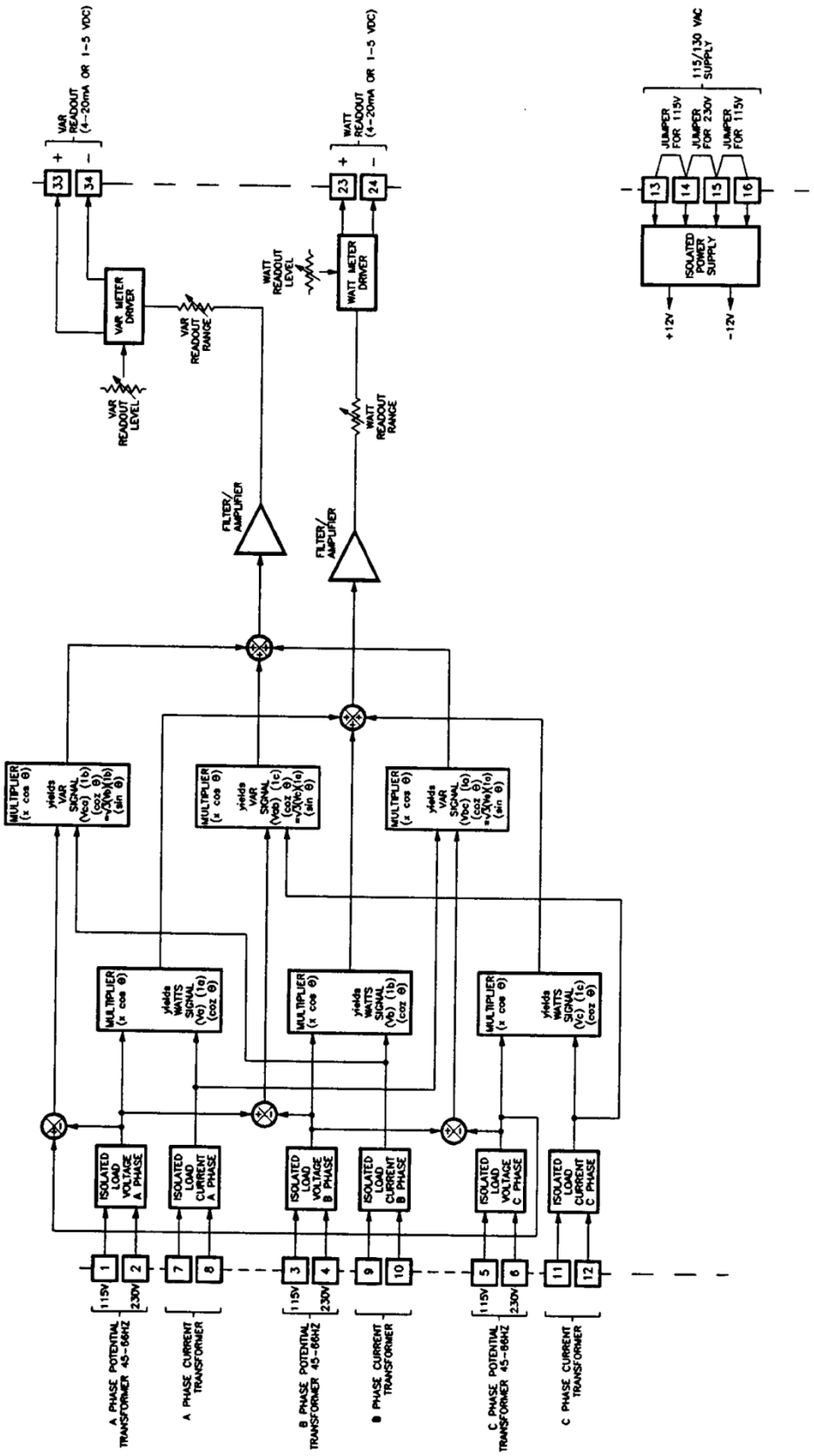

Figure 2-1. 8272-701/-702 Real and Reactive Power Sensor Block Diagram

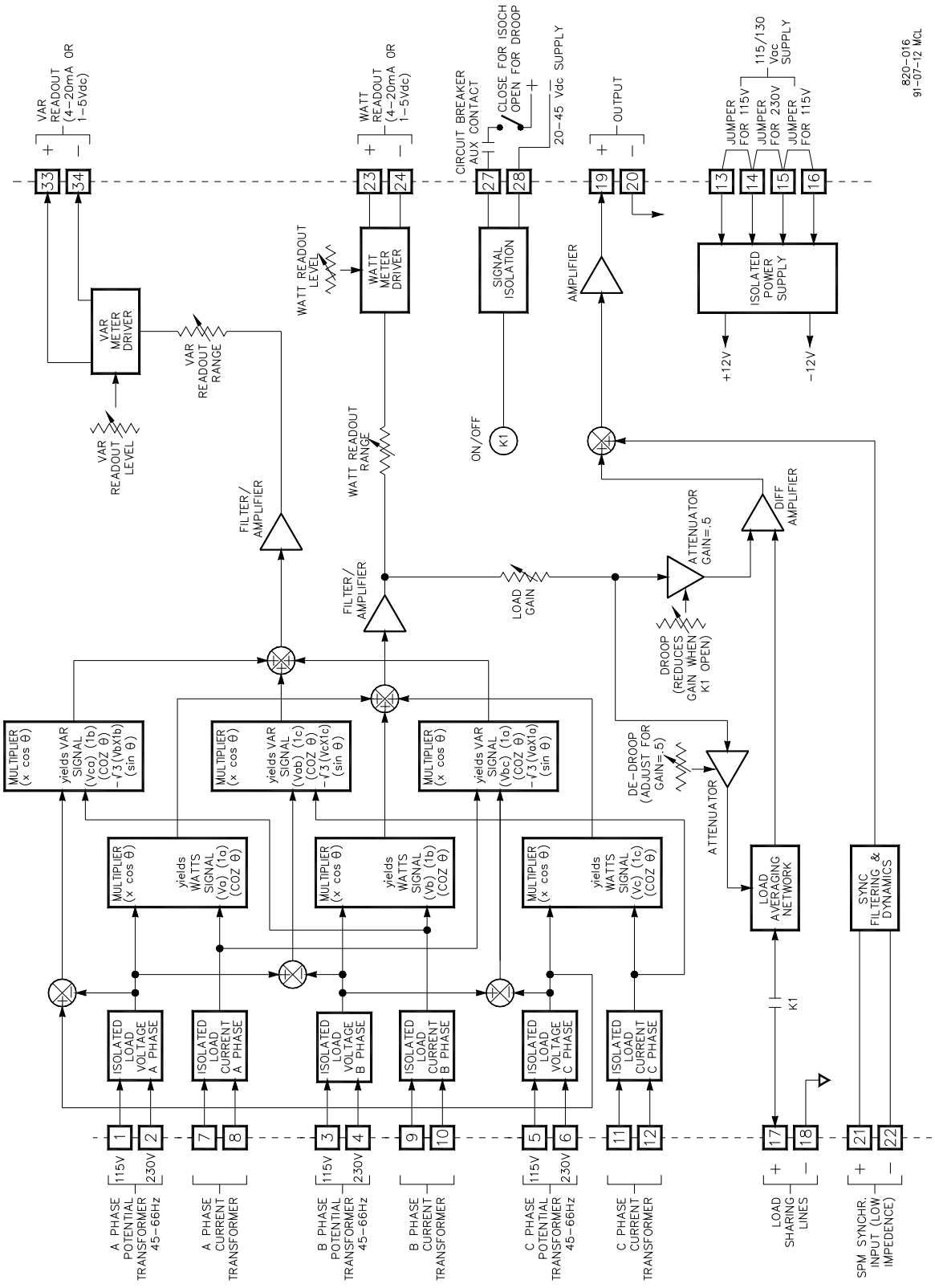

Figure 2-2. 8272-705 Real and Reactive Power Sensor Block Diagram

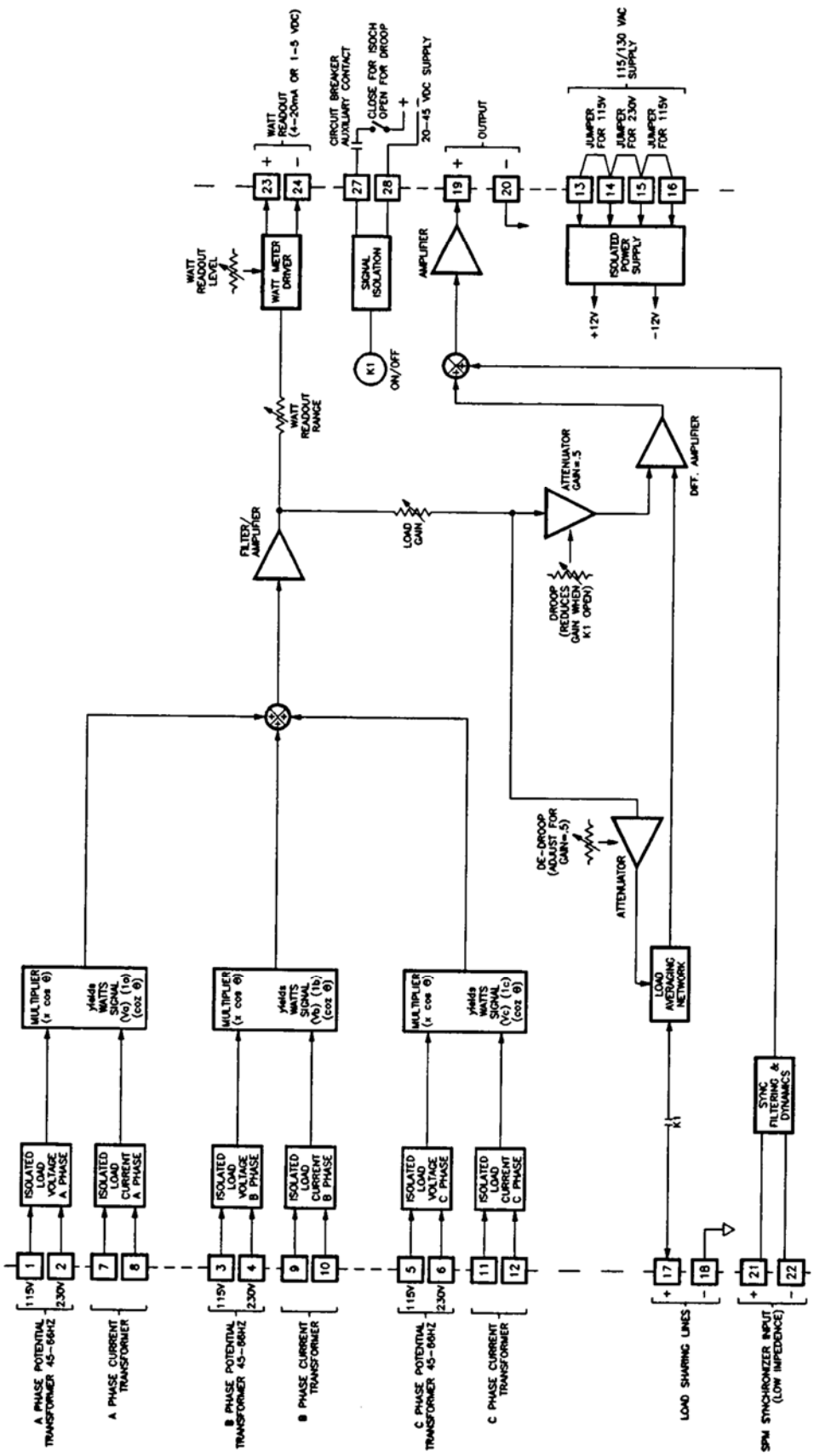

Figure 2-3. 8272-719 Real and Reactive Power Sensor Block Diagram

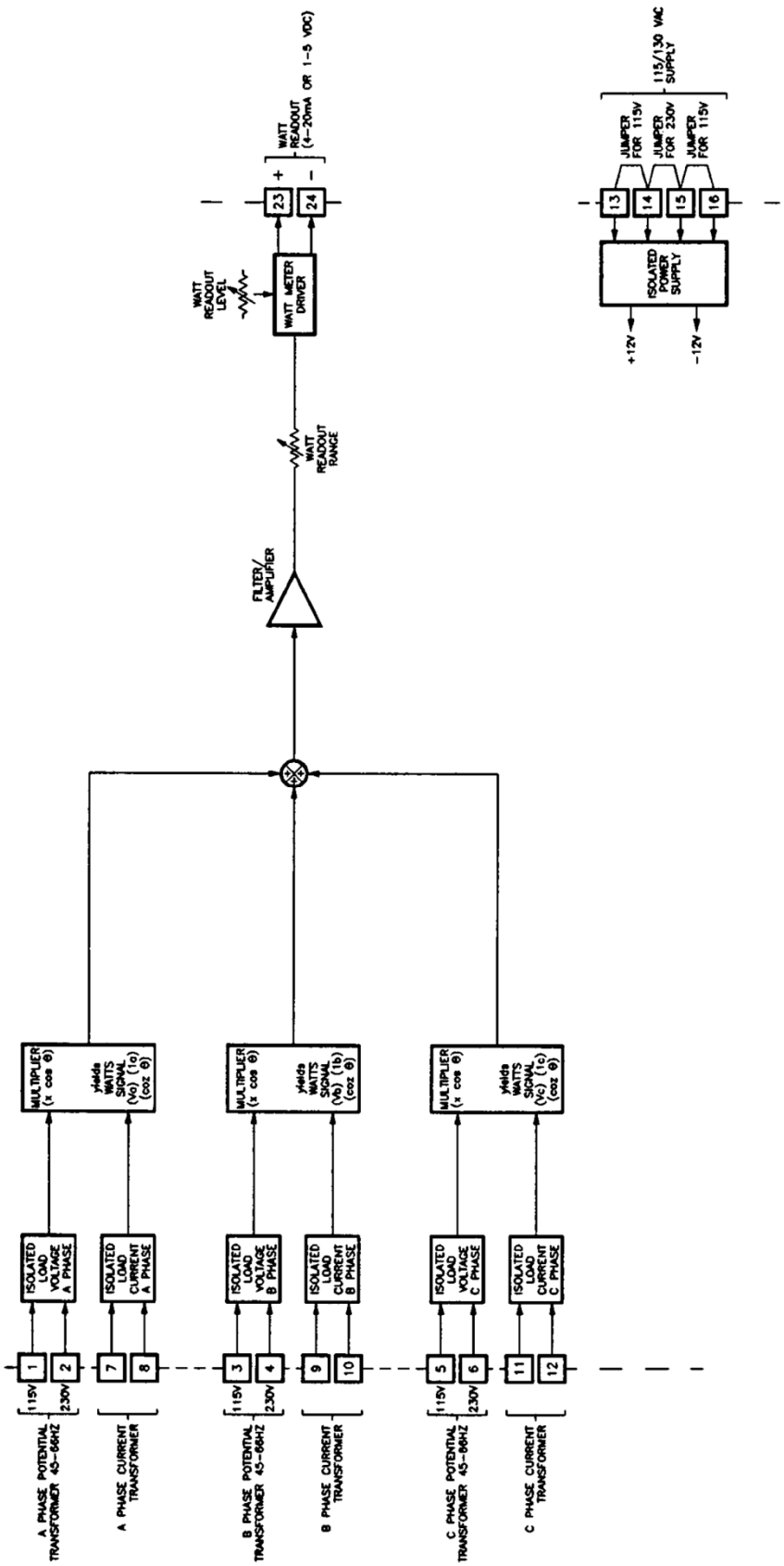

Figure 2-4. 8272-720 Real and Reactive Power Sensor Block Diagram

Phase Current Sensors

Each phase current 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, correctly phase the CTs. For example, connect the A phase CT and the A phase potential transformer (PT) to the A phase connections on the real and reactive power sensor, etc. Also observe correct polarity phase of the CTs.

The phase current sensors step down the current and provide a burden resistance to prevent lethal voltage buildup (as long as the CTs are connected to the real and reactive power sensor). This reduced current is converted to a voltage signal. It controls the amount of the potential voltage signal that is allowed to pass to the filter amplifier, and it controls the phase relation of voltage input and current.

Filter Amplifier

The filter amplifier receives a portion of each potential voltage signal (controlled by the current sensor circuit); it sums these signals, which are 120 degrees out of phase. This produces an output voltage signal that's proportional to real power. You can adjust the filter amplifier to offset or null the circuit (set the output to zero when no power is produced).

The output of the filter amplifier is sent to the readout meter drive circuit, the droop circuit, and the load-sharing circuit. For testing purposes, measure this signal at Terminals 25(+) and 26(–).

Readout Meter Drive Circuits

The readout meter drive circuits use the outputs of the filter amplifiers (real power or reactive power signals) to produce drive signals for external meters. These meters will indicate the real or reactive power of the circuit being monitored and have adjustments to zero the meters and to set output ranges. The real and reactive power sensor may be ordered with readout meter outputs of either 1–5 Vdc or 4–20 mAdc. These outputs may also be input to another Woodward control, such as a 505, a 501, etc.

Droop Circuit

To provide droop, this circuit sends an output to the speed control that's proportional to the real power signal. The 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 whether voltage is present at Terminals 27 and 28. When voltage is present, the real and reactive power sensor is in isochronous mode; when voltage is not present, the sensor is in droop.

Load Sharing

When the real and reactive power sensor is in 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 speed and phase matching (SPM) 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 in "on-line", the output signal from the SPM 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 to send the signal to the speed control.

Chapter 3.
Installation

Unpacking

Be careful when unpacking the real and reactive 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 and reactive power sensor from the plastic bag, read the instructions inside the front cover of this manual about handling precautions, and read page ii, "Electrostatic Discharge Awareness".

Location

When selecting a location for the real and reactive 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 +185 °F). For the best operation, maintain the ambient air temperature between +10 and +30 °C (+5 and +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 and reactive power sensor using the four mounting holes provided on the flanges of the enclosure (see Figure 3-1).

Connect external wiring to the real and reactive power sensor as shown in Figure 3-2. When making these wiring connects, observe the following wiring recommendations:

- Use 0.5 mm² (20 AWG) or larger stranded, twisted shielded wire for all signal-carrying wires.
- Use 0.8 mm² (18 AWG) or larger stranded wire for all potential and current transformer connections.
- Make sure that all wires shown in Figure 3-2 as shielded, are shielded.
- Do not place shielded wires in 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.)

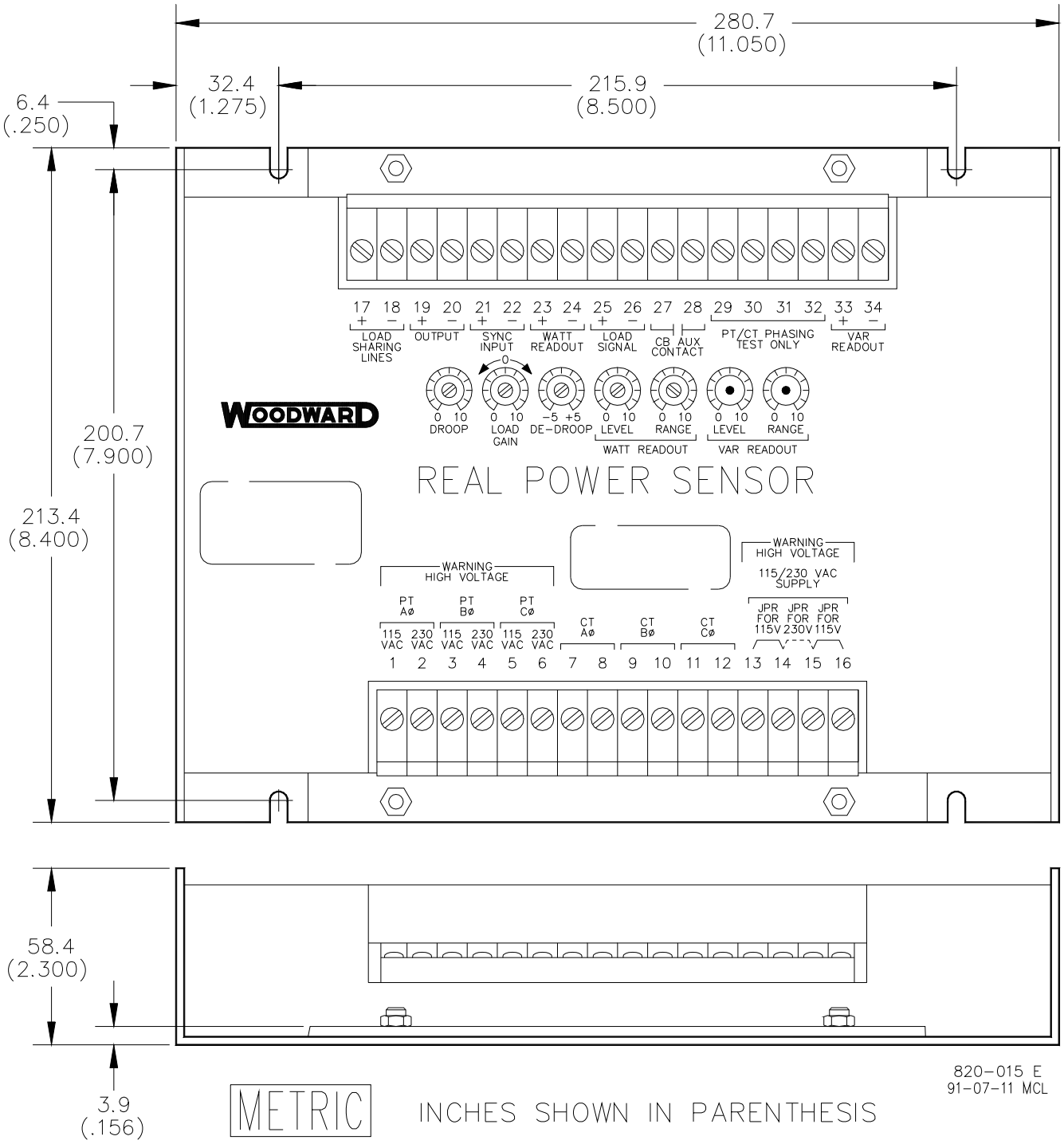

Figure 3-1. Outline of the Real and Reactive Power Sensor

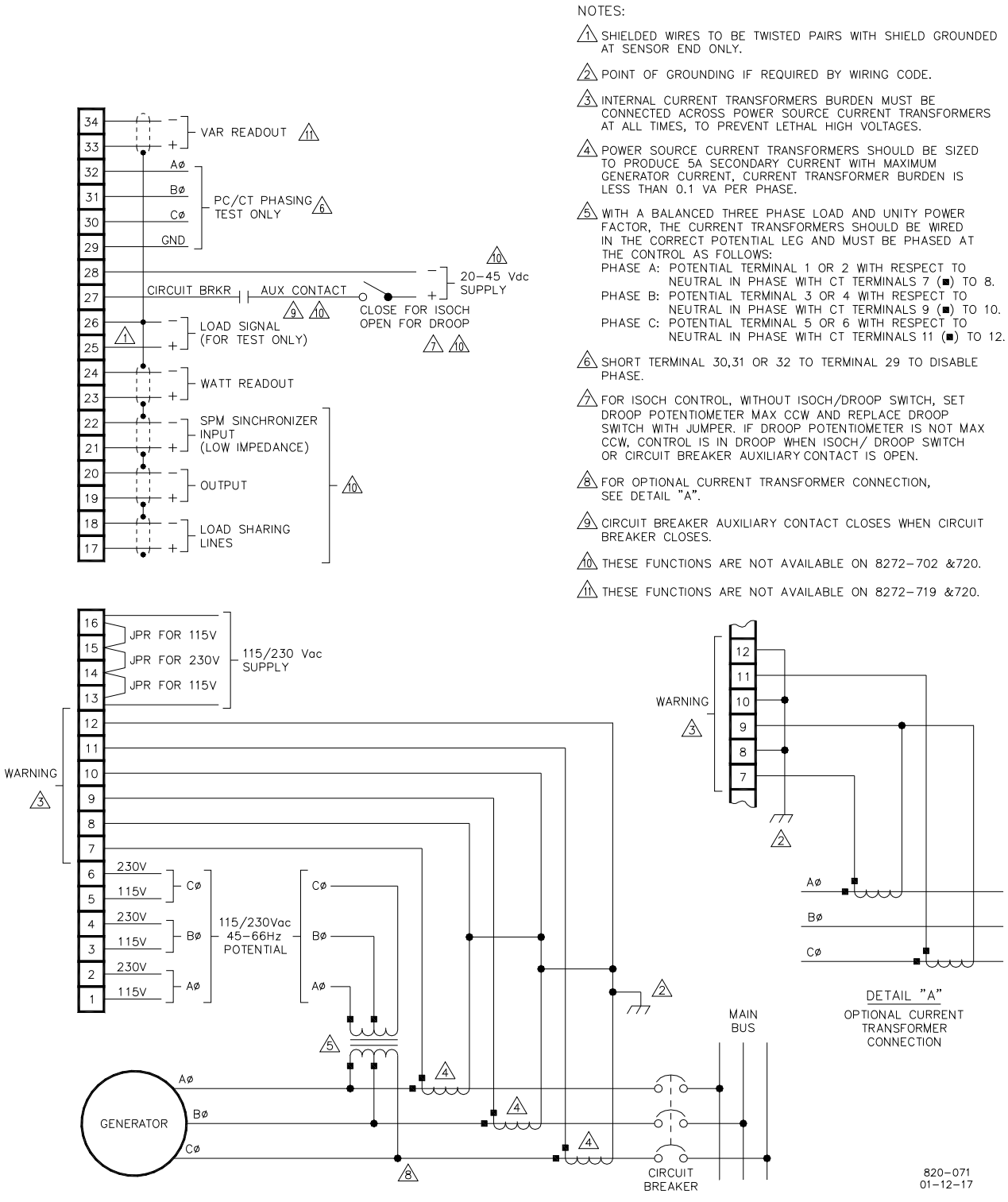

Figure 3-2. Plant Wiring Diagram for the Real and Reactive Power Sensor

Chapter 4.
Calibration

Recommended Test Equipment

⚠WARNING

HIGH VOLTAGE—High voltage is used in the operation of 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 the equipment. These item could cause injury or death to personnel or damage to the equipment.

We recommend the following test equipment when checking out and calibrating a real and reactive power sensor. This is only a recommended list. You should not feel required to purchase this exact equipment; equipment having equivalent or better specifications may be substituted.

Quantity	Description	Specifications	
1	Digital Multimeter	dc voltage accuracy:	±0.25% +1 digit
		dc current accuracy:	±0.75% +1 digit
		resistance accuracy:	±0.2% +1 digit (less than 200 kΩ)
		ac voltage accuracy:	45-450 Hz ±1% (200 mV—200 V)
		ac current accuracy:	45-450 Hz ±1.5% +2 digits (2 mA—2 A)
	(Fluke 8021B or equivalent)		

General Information

Read, then follow these instructions when checking or calibrating the real and reactive power sensor.

⚠WARNING

HIGH VOLTAGE—High voltage is present at the conductors and on the circuit board of the real and reactive power sensor. Death or injury may result from contacting these areas. Use care while working around the unit.

NOTICE

Before handling any electronic components, read Manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

- Follow the guidelines on page ii, "Electrostatic Discharge Awareness".
- Use battery-operated test equipment whenever possible.
- Isolate the test equipment from all grounds, including the chassis.
- The values presented in the following calibrations procedures are values used by Woodward for the calibration of a new unit. Before recalibrating your unit, check with Woodward for any changes in the equipment that will change these values. If changes have been made, mark the changes in this manual.

Operational Test

This test uses the actual generator load or utility power flow to calibrate and test the real and reactive power sensor.

Before continuing with this test, double check all wiring and jumpers on the unit against the plant wiring diagram (Figure 3-2).

1. Prepare either the generator set for starting (follow the set manufacturer's instructions) or the utility load source for loading.

2. For models 8272-705 and -719 only, set the Load Gain control (R3) fully clockwise.

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

   If you're 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 transfer voltages are present at the real and reactive power sensor and are connected to the proper terminals (power supply at 13 and 16 and PT signal at 1-6).

5. With no load, verify that the voltage at Terminals 25(+) and 26(–) is *_____ (0.0 ±0.1) Vdc. If the voltage is not correct, check for circulating currents (KVARS) and proper phasing, then adjust R1 (Null).

IMPORTANT

The R1 adjustment potentiometer is located on the top surface of the circuit board, under the chassis. The chassis must be removed to make this adjustment. Before making this adjustment (which was factory-set), check your equipment for circulating currents and proper phasing.

⚠WARNING

HIGH VOLTAGE—High voltage is present at some terminals in the real and reactive power sensor. It can cause injury and death if proper precautions are not followed. To work safely, heed all warnings in this chapter.

6. If you're sensing the power on a generator, start the generator (following the manufacturer's instructions), synchronize, and close the breaker.

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

7. Increase the load to 50%.

   For models 8272-705 and -719 only, adjust the Load Gain control (R3) so that the voltage between Terminals 26(–) and 25(+) is 2.5 Vdc.

   For models 8272-701, -702, and -720, the voltage measured between Terminals 25 and 26 should be approximately 3 Vdc; it is not adjustable.

8. Shut down the generator or open the utility breaker so that there is no power applied to the real and reactive power sensor. Disable the A phase current transformer (CT) momentarily by shorting Terminal 32 to Terminal 29.

9. If you're sensing the power on a generator, start the generator (following the manufacturer's instructions), synchronize, and close the breaker.

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

   Increase load to 50%. Measure and record the voltage at Terminals 25(+) and 26(–) *_____.

IMPORTANT **In steps 9, 11, and 13, it doesn't matter whether the load is exactly 50%. However, the load must be as identical as possible in each of the three steps. If it's not the same, you won't be able to satisfactorily perform step 15.**

10. Shut down the generator or open the utility breaker so that there is no power applied to the real and reactive power sensor. Remove the short of the A phase CT. Disable the B phase CT momentarily by shorting Terminal 31 to Terminal 29.

11. If you're sensing the power on a generator, start the generator (following the manufacturer's instructions), synchronize, and close the breaker.

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

    Increase load to 50%. Measure and record the voltage at Terminals 25(+) and 26(–) *_____.

12. Shut down the generator or open the utility breaker so that there is no power applied to the real and reactive power sensor. Remove the short of the B phase CT. Disable the C phase CT momentarily by shorting Terminal 30 to 29.

13. If you're sensing the power on a generator, start the generator (following the manufacturer's instructions), synchronize, and close the breaker.

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

    Increase load to 50%. Measure and record the voltage at Terminals 25(+) and 26(–) *_____.

14. Shut down the generator or open the utility breaker so that there is no power applied to the real and reactive power sensor. Remove the short of the C phase CT.

15. Compare your recorded values from steps 9, 11, and 13. These values should be the same (±10%). If they are not, recheck for crossed phases (CTs not matched to PTs). Recheck for phasing, and correct any problems.

16. Start the generator set (according to manufacturer's instructions) or close the utility breaker. Keep the load at zero. Verify that the KW Readout Meter current [Terminals 23(+) and 24(–)] is *_____ (4.0 ±0.2) mA. If necessary, adjust R5 (Watt Readout Level).

17. Load to 100% load.

18. Verify that the KW Readout Meter current [Terminals 23(+) and 24(-)] is *_____ (20.0 ±0.2) mA. If necessary, adjust R6 (Watt Readout Range) and repeat steps 16 and 17 until no further adjustment is required.

IMPORTANT

Note that Woodward can calibrate the KVAR meter readout drive at the factory before shipping if provided with these specifications:

- **The kind of generator**
- **The PT winding ratio**
- **The CT winding ratio**

19. Reduce the load to zero, open the utility breaker, or shut the generator set down.

This completes the operational test for models 8272-701, -702, and 8272-720. If your model is 8272-705 or 8272-719, continue below.

IMPORTANT

Steps 20 through 26 apply to load sharing models (8272-705 and 272-719) only.

20. Operating in isochronous mode and with no load, note the operating speed of the generator *_____ rpm or (Hz).

21. Apply 100% load; note the generator speed *_____ rpm (or Hz). The speed should be the same as in step 20. If it is not, adjust R4 (De-droop) and repeat steps 20 and 21 until no further adjustment is required.

22. Operating in droop mode, in single generator operation with no load, note the speed the generator is operating at *_____ rpm (or Hz).

23. Apply 100% load and note the generator speed *_____ rpm (or Hz). The speed decrease from step 22 is the amount of system droop. To change this droop, adjust R2 (Droop) and repeat steps 22 and 23 until the desired droop is set.

24. Select isochronous operation.

25. Parallel this generator with the other generators in your system (following the set manufacturer's instructions). Apply load.

26. Adjust R3 (Load Gain) until the generator sets share load equally.

This completes the operational test for models 8272-705 and 8272-719.

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 82018A.

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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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