WOODWARD

Product Manual 82048
(Revision B)
Original Instructions

Real Power Sensor for Turbomachinery Control Systems

8272-695

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 Out-of-date translations are marked with ⚠.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.

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

The 8272-695 Real Power Sensor is used with Woodward DCS Control Systems whenever a current signal is needed that is proportional to load.

The Real Power Sensor produces 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 it may be used as part of an isochronous load sharing system.

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

Power is measured in kilowatts and is calculated as follows:

For single-phase power:

$$P = \frac{V\ I\ \cos\theta}{1000}$$

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):

$$P = \frac{3\ V\ I\ \cos\theta}{1000}$$

P = power (in kilowatts)
V = rms phase voltage (in volts)
I = 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:

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

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 8272-695 Real Power Sensor produces 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 Real Power Sensor also provides a voltage signal (proportional to actual power) to the control system for load sharing. It also allows for Isoch/Droop operation and has an input connection available for an SPM (speed and phase matching) Synchronizer output signal.

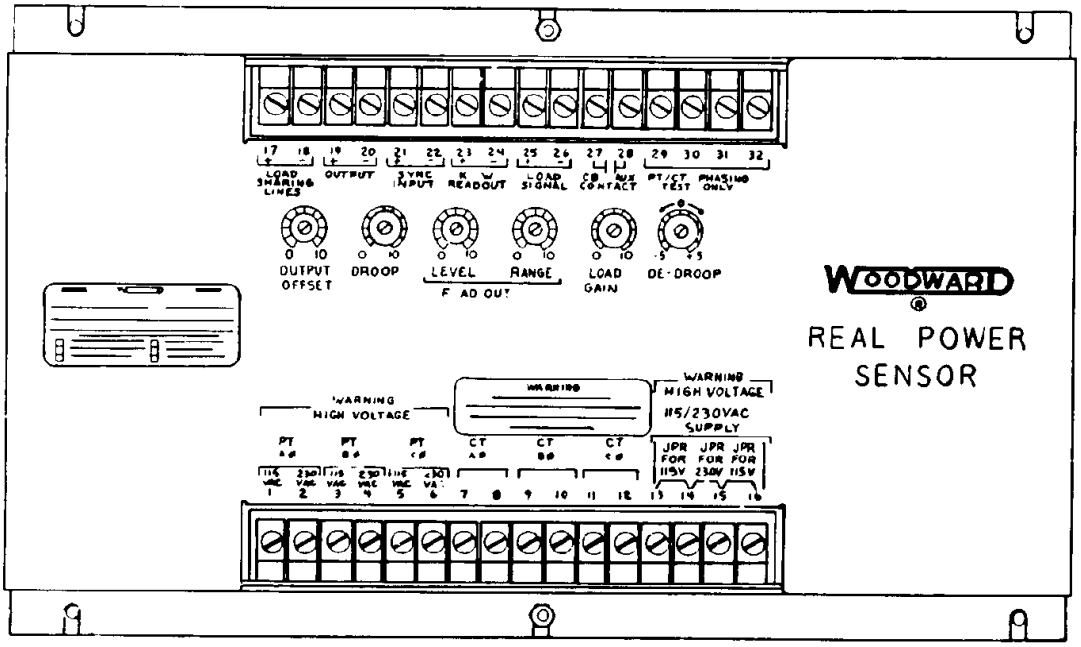


Figure 1-1. 8272-695 Real Power Sensor

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 that the correct polarity must also be observed. The same applies for Phases B and C.

The phase-current sensors step down the current and provide a burden resistance to prevent lethal voltage buildup (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° 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 (–).

Readout Meter Drive Circuit

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 501, NetCon® 5000, etc.

Droop Circuit

The droop circuit feeds a signal into a speed control to provide droop. This droop signal is proportional to the real-power signal and 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 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 for the signal to the speed control.

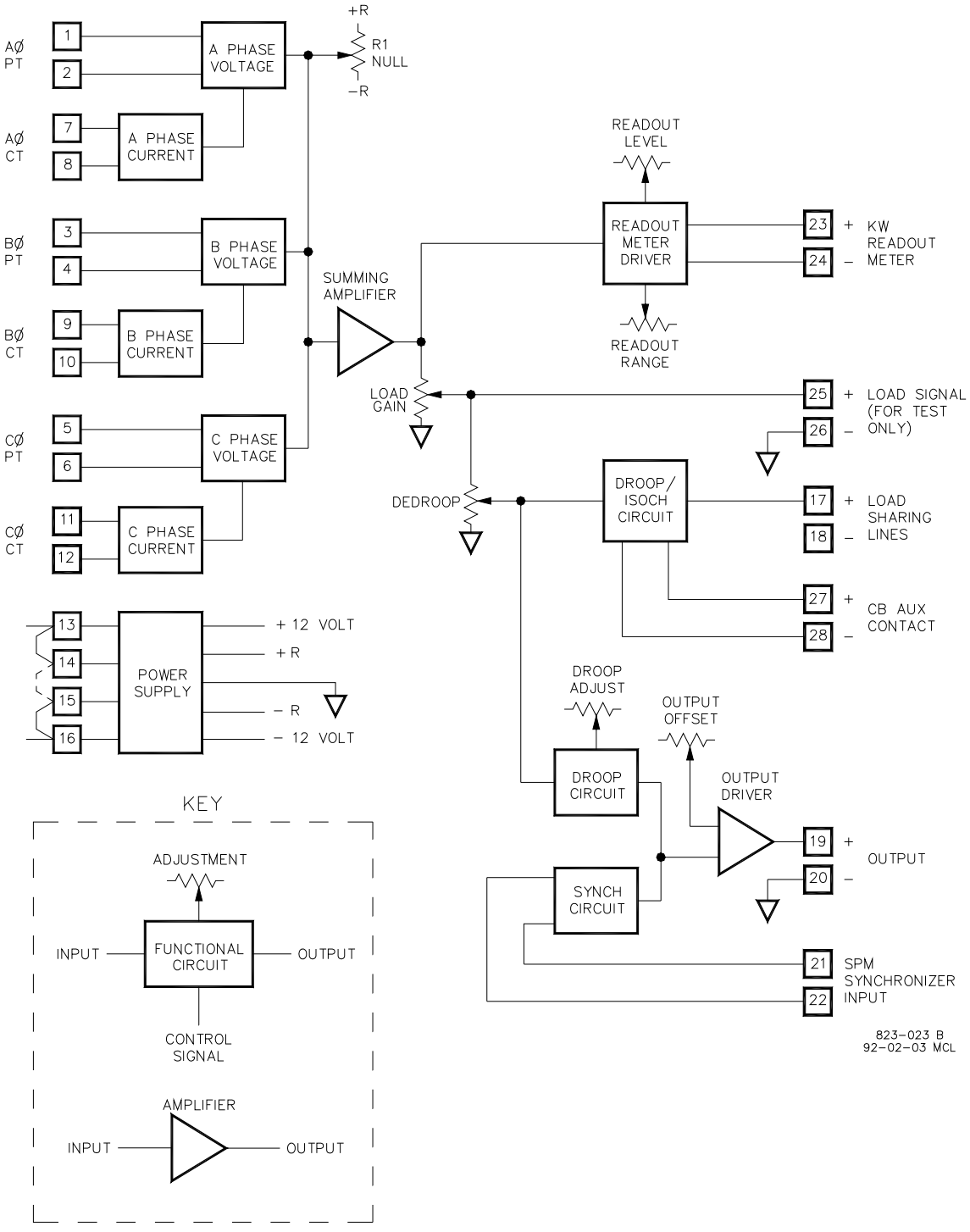


Figure 2-1. 8272-695 Real Power Sensor Block Diagram

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:

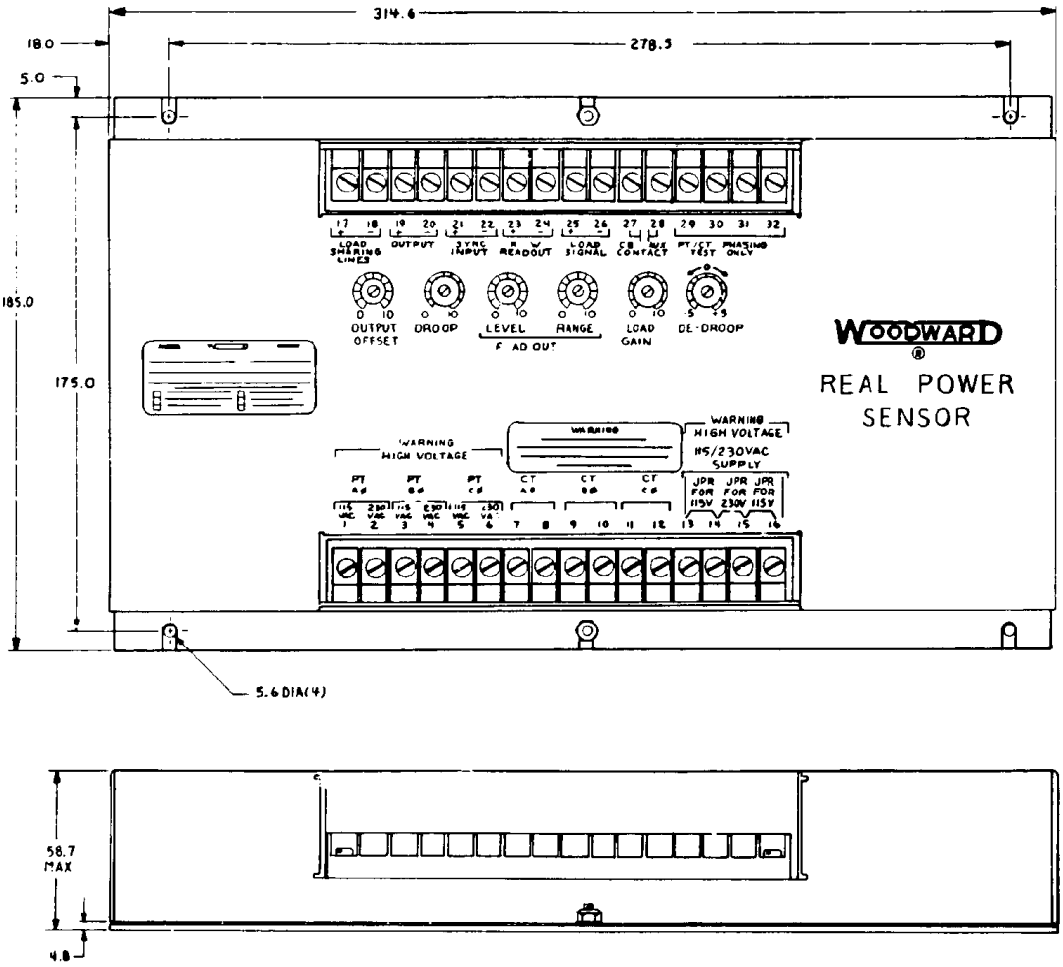
- Protect the unit from direct exposure to water or to a condensation-prone environment.
- The operating range of the unit is –40 to +70 °C (–40 to +158 °F). For best operation, maintain the ambient air temperature between +10 and +30 °C (+50 to +86 °F).
- Provide adequate ventilation for cooling. Shield 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)



CONVERSION CHART	
MM	INCH
4.8	.188
5.0	.197
5.6	.219
18.0	.710
58.7	2.312
60.7	2.391
175.0	6.890
185.0	7.284
278.5	10.966
314.6	12.386

Figure 3-1. Outline of Real Power Sensor

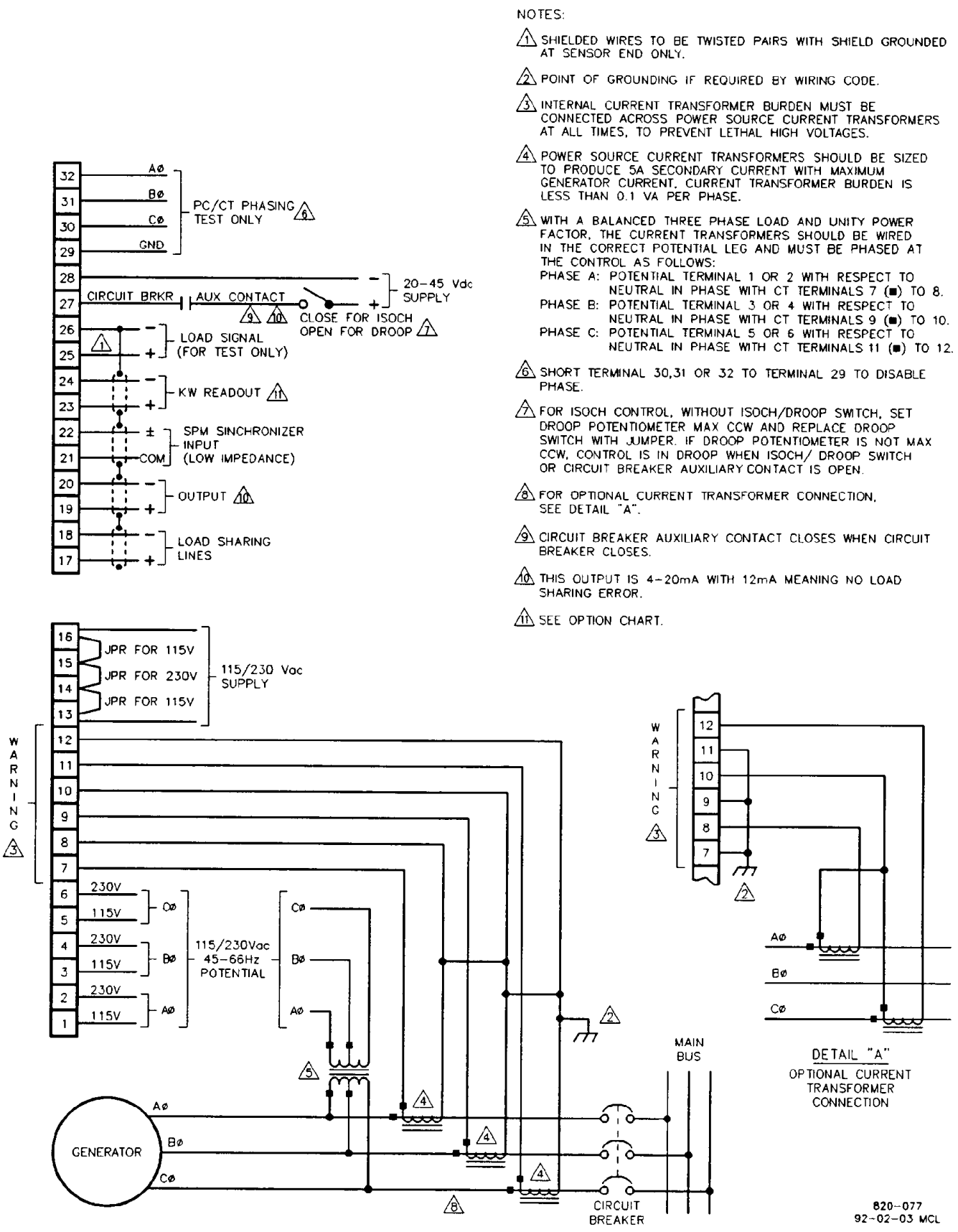


Figure 3-2. Plant Wiring Diagram

Chapter 4.
Calibration Procedure

⚠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, watched, 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.

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)

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.

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 18 through 21 until you get no further improvement.

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

24. Disconnect the wire from Terminal 19 and connect a milliammeter between Terminal 19 (+) and the wire removed from Terminal 19 (–). Wrap the connection with tape to keep it from contacting anything.

25. Set the OUTPUT OFFSET potentiometer fully clockwise.

26. Following the manufacturer's instructions, start the generator. Operating in the isochronous mode, apply 100% load and note the current at Terminal 19. This current should be _____ (12.571) mA. If it is not, adjust the De-Droop potentiometer so that it is.

27. Adjust the OUTPUT OFFSET potentiometer so that the current at Terminal 19 is _____ (12.00 ±.08) mA. Note the generator speed _____ rpm (Hz).

28. Reduce the load to zero and note the generator speed _____ rpm (Hz). This speed should be the same as the speed recorded in step 27.

29. Shut down the generator, disconnect the milliammeter from Terminal 19 and the loose wire, and reconnect the wire to Terminal 19.

30. Following the manufacturer's instructions, restart the generator with no load. Note the generator speed _____ rpm (Hz).

31. Select Droop mode and operate with no load.

32. Apply 100% load. Note the generator speed _____ rpm (Hz). The speed decrease from Step 30 is the amount of speed droop.

    To change this droop, adjust the DROOP potentiometer and repeat steps 30 through 32 until the desired droop is obtained. Reduce the load to zero.

33. Select isochronous operation.

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

35. Adjust the LOAD GAIN potentiometer so that the generators share load equally.

This completes the operational test of the 8272-695 Real Power Sensor.

Chapter 5.
Service Options

Product Service Options

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

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM and 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 **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

You can locate your nearest Woodward distributor, AISF, RER, or RTR on our website at:

www.woodward.com/directory

Woodward Factory Servicing Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- 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 is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

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.

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 within 60 days, a credit for the core charge will be issued.

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 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 authorization 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 offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- 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. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. 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.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or 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 us via telephone, email us, or use our website: **www.woodward.com**.

How to Contact Woodward

For assistance, call one of the following 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.

Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (0) 21 52 14 51
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

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

Turbine 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

You can also locate your nearest Woodward distributor or service facility on our website at:

www.woodward.com/directory

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:

Your Name	
Site Location	
Phone Number	
Fax Number	
Engine/Turbine Model Number	
Manufacturer	
Number of Cylinders (if applicable)	
Type of Fuel (gas, gaseous, steam, etc)	
Rating	
Application	
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	

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 82048B.

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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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