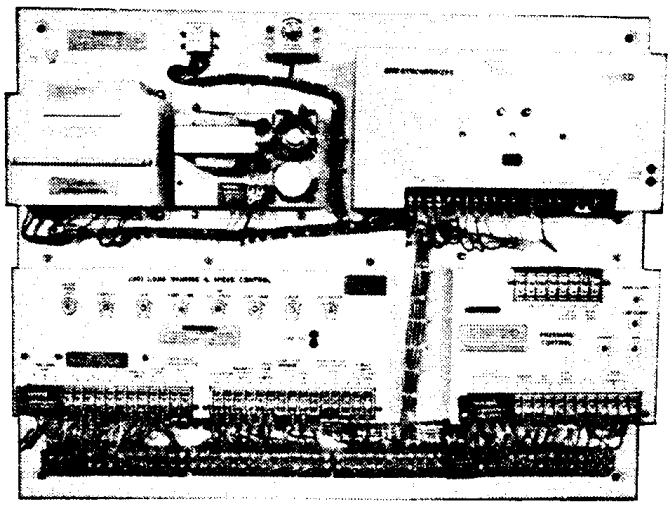
WOODWARD

Product Manual 82445
(Revision NEW)
Original Instructions



Speed, Load Sharing, or Pressure Control for Generators

8272-041

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 Out-of-date translations are marked with ⚠.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 8272-041 is intended to control prime movers which generate electric power. The control provides:

- Speed control at rated speed
- Synchronizing to a bus, voltage regulator control, and breaker close command
- Soft loading and unloading
- Isochronous load sharing with another Woodward controlled generator set
- Process signal control while paralleled to an infinite bus, usually a utility. A 4 to 20 mA input signal is used to keep a process variable constant. In most cases the variable is steam turbine inlet pressure, so this manual will use the word pressure instead of process variable.
- Automatic switch to isochronous operation if the tie breaker opens while controlling pressure. All isochronously operating generators will then share load. This requires each control's load sharing lines be connected to each other and it requires the isolated bus capacity be greeter than the plant load.
- A 24 V supply to power the pressure transducer.

A magnetic pickup (MPU) and an electrical proportional hydraulic actuator, available from Woodward, are required to make a complete governor. In addition, potential and current transformers (PTs and CTs) and a constant source of 115 Vac for operating power are required.

Most 8272-041 Speed, Load, or Process Signal Controls are used for steam recovery. A generator is driven by a steam turbine to provide electric power. This is done by:

- selecting pressure control and paralleling with the utility or
- selecting proportional load sharing for isolated bus (single or multiple unit) operation

Pressure Control

Stated simply, when operating under pressure control, the governor makes the turbine keep turbine inlet pressure at its desired value and produce as much power as the steam flow permits.

If the turbine's available inlet pressure exceeds the desired level, the current of the 4 to 20 mA pressure signal increases. That signal is sent to the pressure control. The 8272-041 uses an inlet pressure control (higher input current causes a higher output voltage). Exhaust pressure controls (higher input current causes a lower output voltage) are available.

When controlling pressure, the pressure control's output is sent to the load sharing line terminals of the 2301 Load Sharing and Speed Control (LSSC). See Figures 1-1 and 1-2. A higher pressure control output makes the actuator voltage increase. That, in turn, makes the actuator output shaft angle increase and the steam valve open.

That opening makes the generator produce more power, and the 2301 LSSC load signal increases. That opening also reduces the inlet pressure. The process continues until the inlet pressure reaches the desired value, that is, until the pressure controller output balances the load signal (the load sensor output).

Proportional Load Sharing

The 8272-041 can proportionally share load. Then pressure control is ignored. The synchronizer, generator loading control, and load sharing lines function normally.

if operating under pressure control and the tie breaker opens, the 8272-041 automatically switches to isochronous control. Since all generators are tied together, they must be set for isochronous load sharing. This is done by connecting 8272-041 terminals 19 and 20 to the system's load sharing lines. Note that the load sharing line input of the 2301 LSSC is separated from the system load sharing lines by:

1. The relay in the generator loading control. This relay is controlled by the generator's aux contacts through 8272-041 terminals 31 and 32.

2. The relay near the 8272-041 nameplate. This relay is controlled by the tie breaker's aux contacts, 8272-041 terminals 33 and 34.

For these reasons the 8272-041 load sharing lines, terminals 19 and 20, should be connected directly to the system load sharing lines.

Operating Power

The 8272-041 terminals 35 and 36 must be powered whenever the turbine is operating. If the actuator (not part of the 8272-041) uses an electric motor for mechanical drive, it should be powered in the same way.

No battery power is required.

Installation

The 8272-041 outline and plant wiring drawings are shown in Figures 1-3 and 1-4.

Refer to manual 25070, *Electronic Control Installation Guide*.

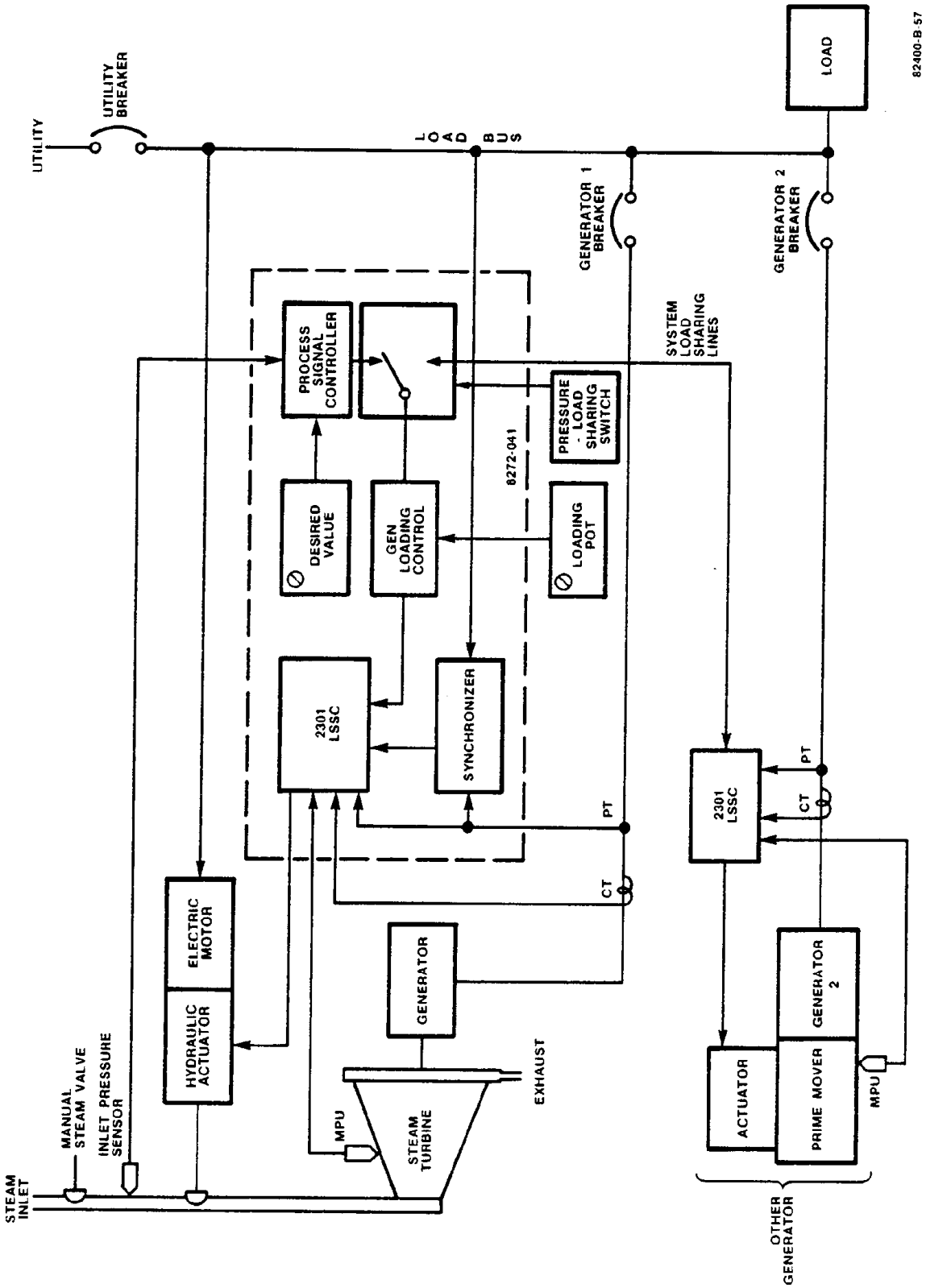


Figure 1-1. Typical Steam Turbine Generator Using the 8272-041, Showing Inlet Pressure Control

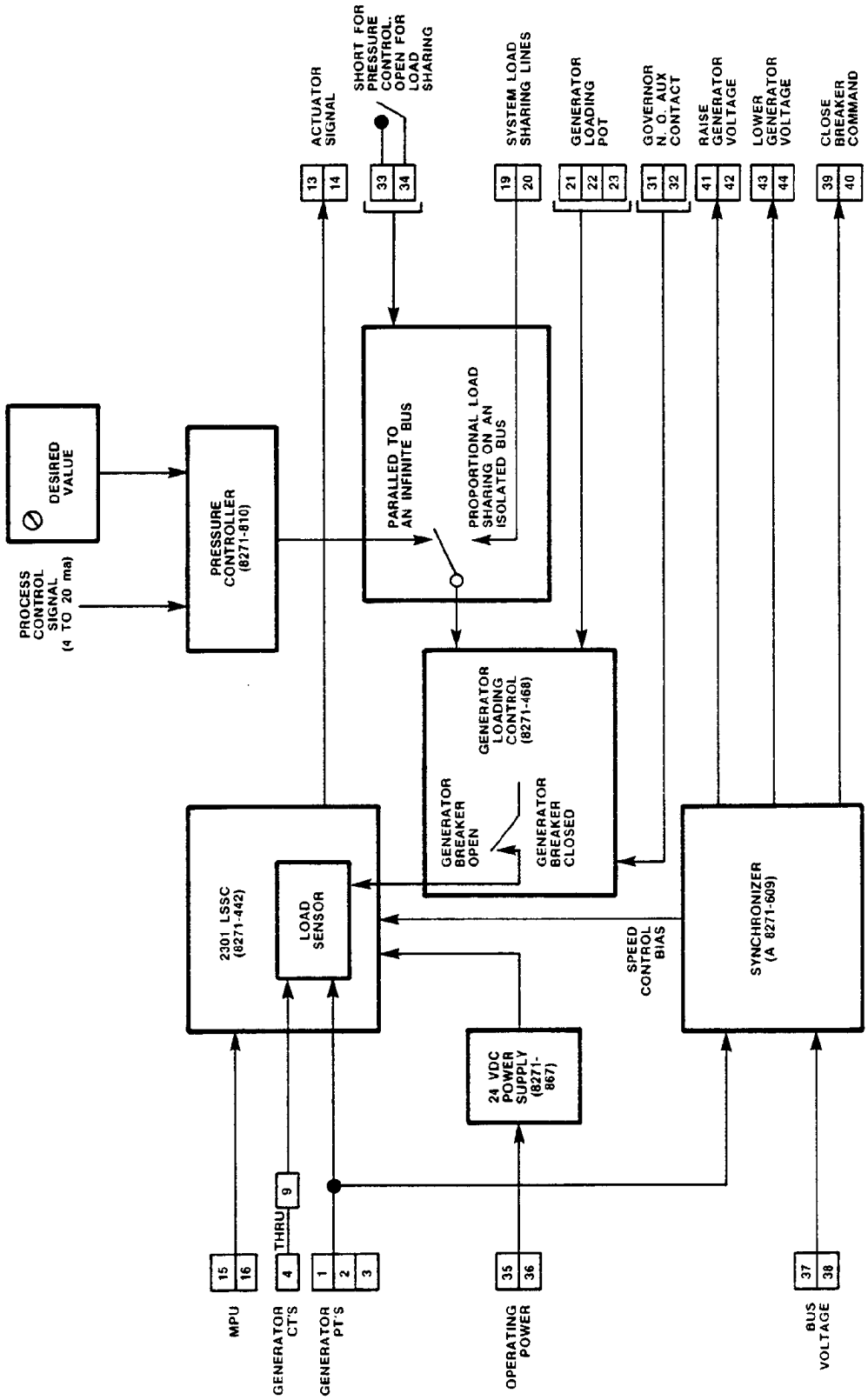


Figure 1-2. Block Diagram of 8272-041, Speed, Load Sharing, or Pressure Control for Generators

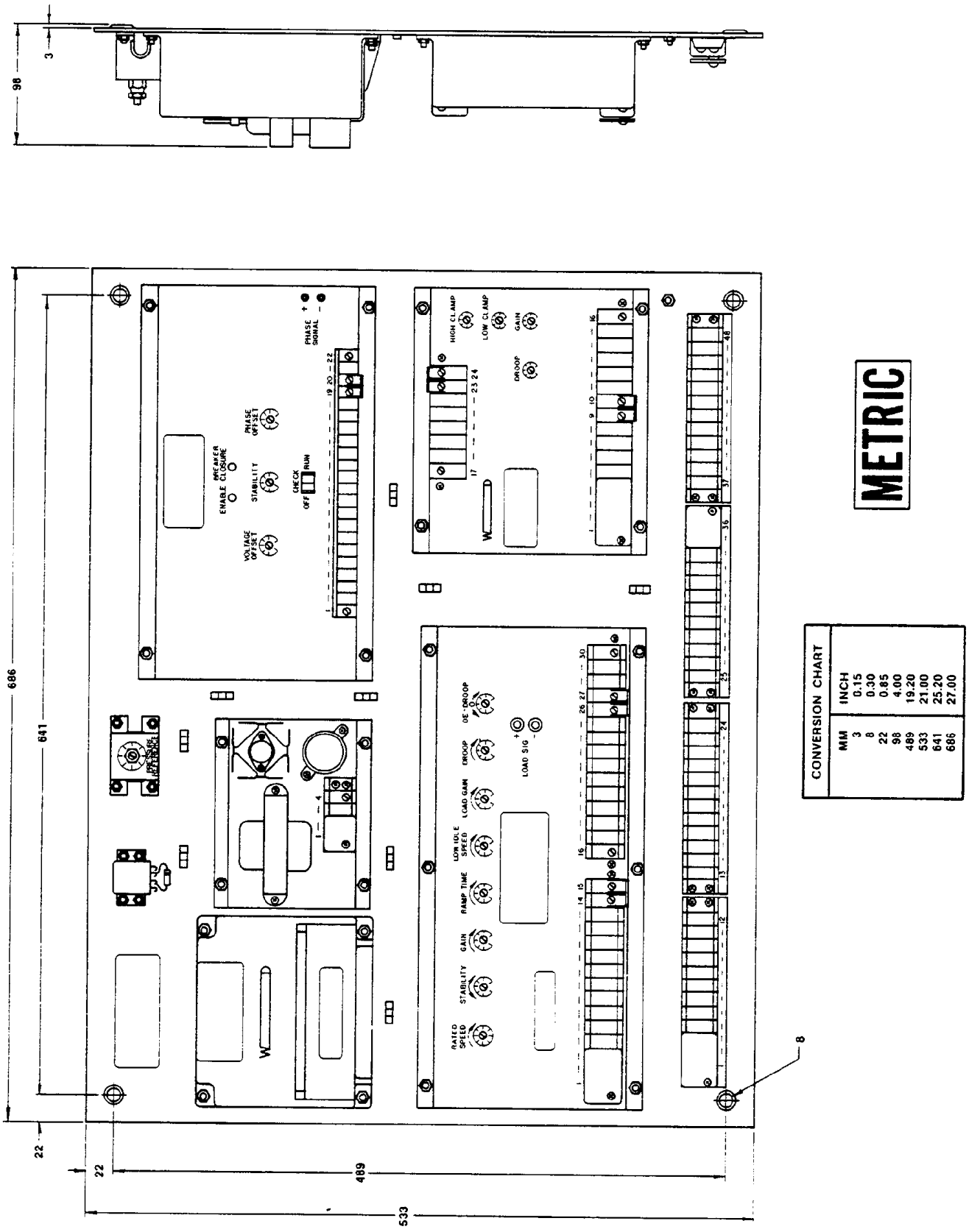


Figure 1-3. 8272-041 Outline Drawing

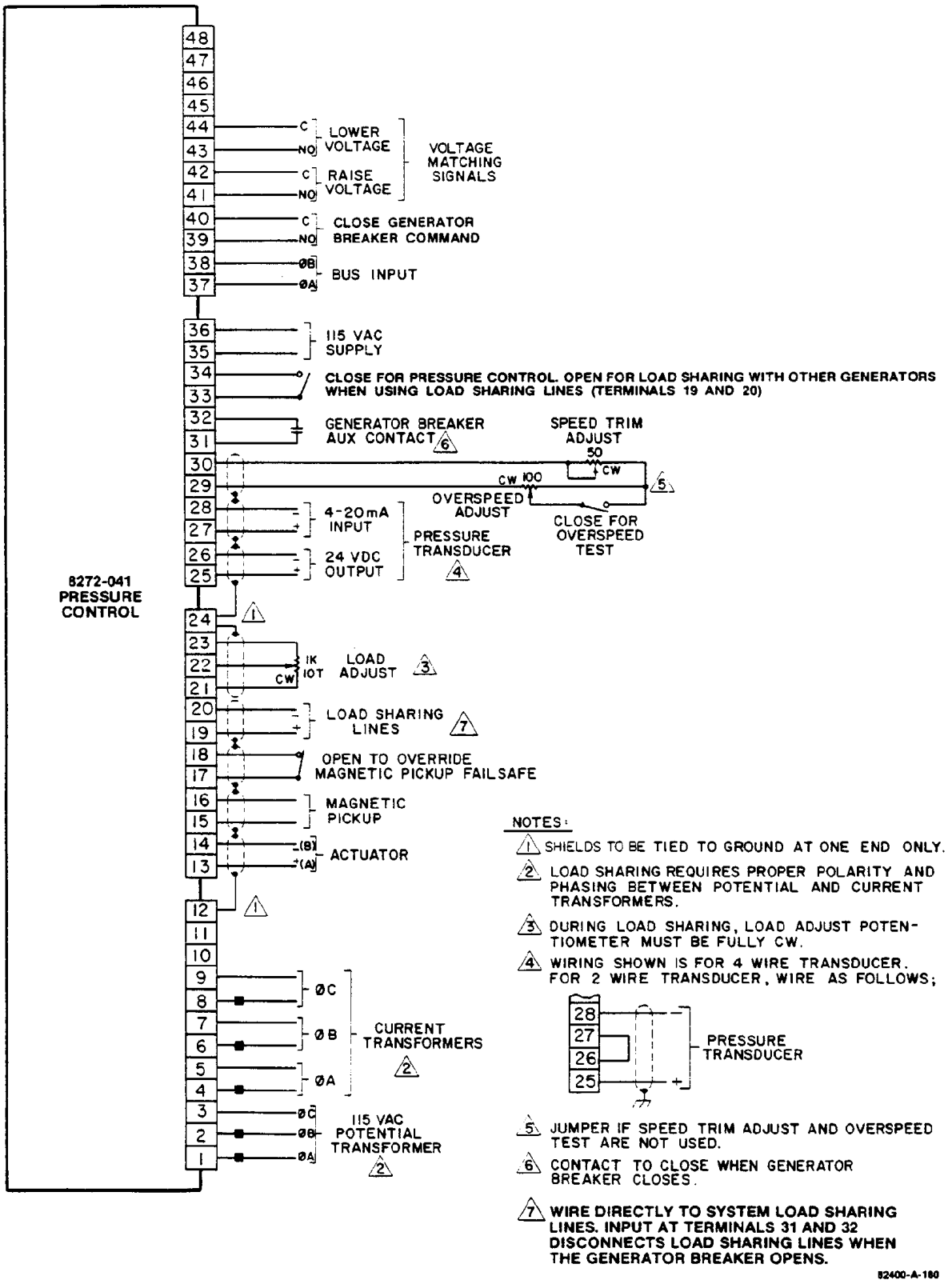


Figure 1-4. 8272-041 Plant Wiring Diagram

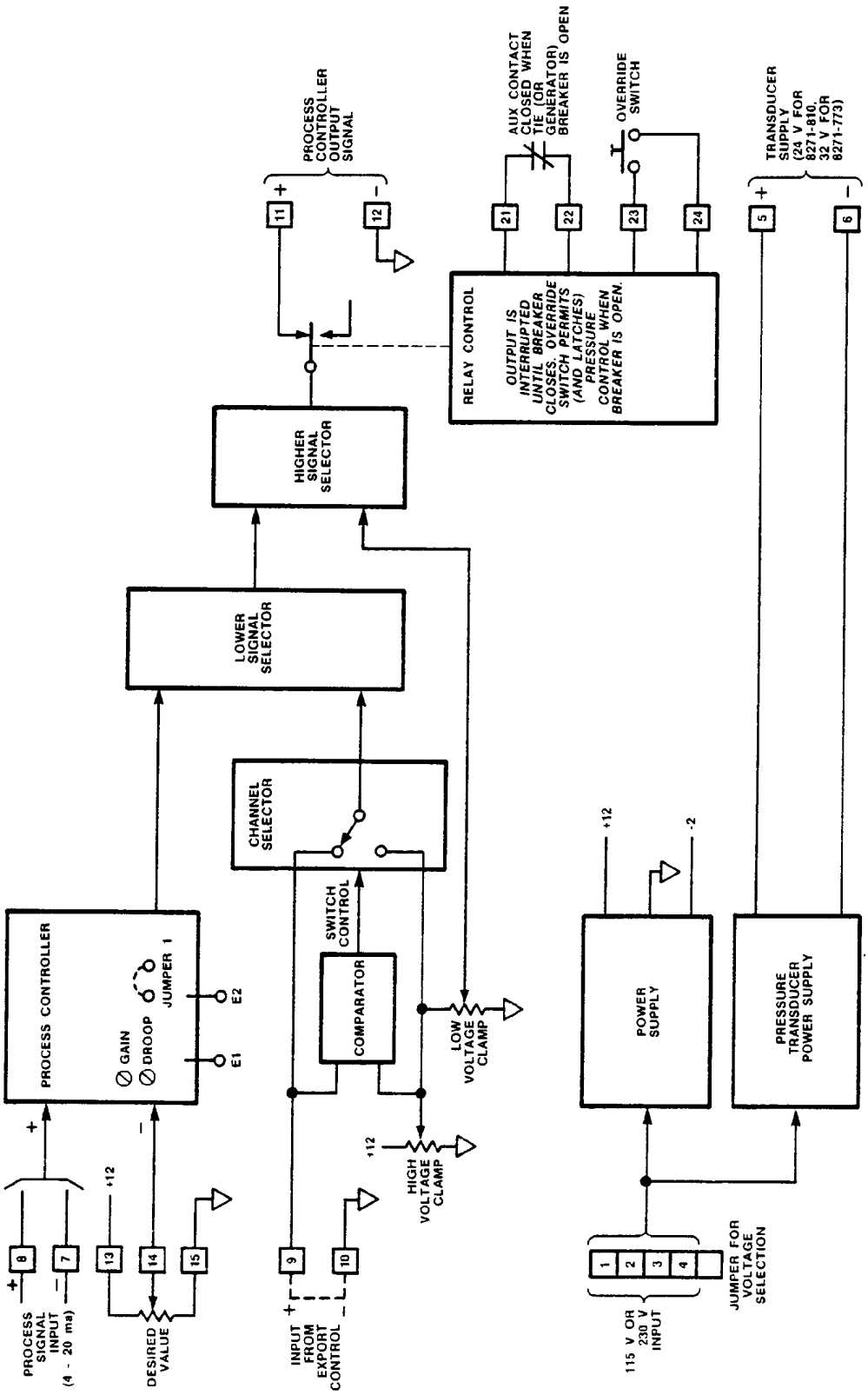


Figure 1-5. Block Diagram of 8271-810 Process Signal Controller

Chapter 2.
Initial Adjustments

The 8272-041 Speed, Load Sharing, or Process Signal Control must be physically installed and correctly wired before making the adjustments.

1. Load Sharing and Speed Control

- Set the pressure – load sharing switch for load sharing.
- Press the synchronizer switch to the off position.
- Manually start the turbine and bring it to rated speed. Follow the turbine manufacturer's instructions.
- Adjust the LSSC as described in the appropriate manual. Record the load signal at full load. It will be used later.

2. SPM Synchronizer

- Disconnect the close breaker signal wires (terminals 39 and 40).
- Adjust the synchronizer as described in the appropriate manual.
- Reconnect the close breaker signal wires.

3. Pressure Control Preset

- With the turbine stopped and power applied to the 8272-041, set the gain and high clamp pots fully clockwise. Set the droop and low clamp pots fully counterclockwise.
- Preset the high clamp by setting the pressure reference pot fully clockwise. The pressure transducer signal must be at or above 4 mA. Measure the voltage at pressure control (8271-810) terminals 11 (+) and 12 (–). Wait a few seconds for the voltage to stabilize. Adjust the high clamp pot for one-half the load signal recorded in step 1, Load Sharing and Speed Control.
- Preset the low clamp by setting the pressure reference pot fully clockwise. Wait a few seconds. If the voltmeter isn't negative, temporarily remove the wire at pressure control (8271-810) terminal 8. Turn the low clamp pot clockwise until the voltmeter shows 0.10 ±0.05 volts. If the wire at terminal 8 was disconnected, reconnect it.

4. Pressure Control

- Set the loading pot (terminals 21, 22. and 23) fully counterclockwise.
- Set the pressure reference pot fully clockwise.
- Start the turbine, parallel with the utility. Sets the pressure – load sharing switch for pressure control.
- Slowly turn the loading pot clockwise. If the turbine isn't stable, alternately turn the Pressure Control's gain pot counterclockwise 1 mark and droop pot clockwise 1 mark until the turbine stabilizes.
- Check the high clamp setting. It should stop any attempt to increase output power beyond the setting. Inlet pressure exceeds its desired value when the high clamp is active.
- Check the low clamp setting. It should prevent the generator from motoring. If the low clamp is active, there isn't enough steam to drive the turbine. The inlet steam pressure will, of course, be far below the desired value.

This completes the initial adjustments.

Chapter 3.
Normal Operation

Start Up

⚠WARNING

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.

The 8272-041 cannot control the turbine while starting and reaching rated speed. This is usually done by manually opening a steam valve.

- Provide 115 Vac and defeat the MPU failsafe circuit to fully open the actuator valve.
- Set the pressure – load sharing switch for load sharing.
- Set the loading pot, at terminals 21, 22. and 23, fully counterclockwise for minimum generator output.
- Manually start the turbine and bring it to speed. Follow the turbine manufacturer's instructions. The 8272-041 will automatically limit steam to maintain rated speed.
- Enable the MPU failsafe circuit.
- The synchronizer will synchronize the turbine generator to the bus and issue a close breaker command.
- Switch from load sharing control to pressure control if desired.
- Increase generator output by slowly turning the loading pot (terminals 21, 22, and 23) until it is fully clockwise.
- Set the desired pressure with the pot labeled pressure reference. It is near the top center of the 8272-041.

Normal Running

During normal running, the 8272-041 controls speed, inlet pressure, or makes the generator provide its proportional share of power (load sharing). Refer to Figure 1-1.

Speed Control

When the turbine starts and the 8272-041 takes control of steam flow, the synchronizer constantly tries to synchronize the generator to the load bus. If there is no load bus voltage, the synchronizer has no effect. Speed is controlled by the rated speed pot.

Pressure Control

During pressure control, the 8272-041 automatically keeps inlet pressure constant and lets the generator output vary. If desired, change the pressure by adjusting the pressure reference pot. The pressure control, 8271-810, has clamps which prevent exceeding the generator's output rating and prevent motoring the generator.

Load Sharing Control

The 8272-041 ensures that the generator provides its proportional share of power. In this case the control lets the process signal (pressure) vary.

Control Mode Summary

Use the following chart to select the desired control mode.

Control Mode	Generator Breaker (Terminals 31 & 32)	Utility Breaker (Terminals 33 & 34)	Load Sharing Lines (Terminals 19 & 20)
Speed	Open	Don't care	Don't care
Pressure	Closed	Closed[1]	Don't care
Load Sharing	Closed	Open	Tied to system load sharing lines[2]

[1]— Bus frequency is controlled by either:
- The utility. Other generator must be in pressure control or droop modes.
- A local generator operating under isochronous speed control.
  In both cases the source must be capable of powering the load.

[2]— If terminals 19 and 20 are unconnected, the governor operates as an isochronous speed control.

For example, to operate as a pressure control, the generator must be paralleled to the utility. Also, the generator and utility breakers must be closed.

Unloading

Unload the generator by:
- Turning the loading pot (terminals 21, 22, and 23) fully counterclockwise.
- Then open the generator breaker.

The 8272-041 will switch from pressure control (or load sharing) to speed control. An external means of preventing breaker closure must be used or the synchronizer will make the breaker close again. This can be done by interrupting the bus input (terminals 37 and 38) or interrupting the close breaker command (terminals 39 and 40).

Shutdown

To shut down the turbine, unload the generator and close the manual steam valve.

Chapter 4.
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 82445.

WOODWARD

PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

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.

2012/11/Colorado