



ProTech[®] 203 Overspeed Protection System

**9905-750, -751, -752, -753, -754, -755, -756, -989, -990,
-991, -992, -993, -994, -995, -996, -997, -998, -999**

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.



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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.



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Contents

WARNINGS AND NOTICES	III
ELECTROSTATIC DISCHARGE AWARENESS	IV
CHAPTER 1. GENERAL INFORMATION.....	1
Description.....	1
Applications	1
References	2
CHAPTER 2. INSTALLATION.....	3
Unpacking.....	3
Power Requirements	3
Location Considerations	3
Shielded Wiring	3
Plant Wiring	4
Installation Check-out Procedure	5
CHAPTER 3. DESCRIPTION.....	7
Specifications	7
Modes of Operation	10
Operator Interface	11
Power Supply Description	11
CHAPTER 4. CONFIGURATION AND OPERATION	13
Programming	15
ProTech 203 Programming Worksheet.....	16
Operation	17
CHAPTER 5. TROUBLESHOOTING AND USER REPAIRS	19
Troubleshooting	19
User Repairs.....	21
CHAPTER 6. SERVICE OPTIONS	27
Product Service Options.....	27
Woodward Factory Servicing Options	28
Returning Equipment for Repair.....	28
Replacement Parts	29
Engineering Services.....	29
How to Contact Woodward.....	30
Technical Assistance.....	30

Illustrations and Tables

Figure 2-1. Plant Wiring Diagram	4
Figure 2-2. Routing and Stress Relief for Field Wiring Entering the ProTech 203 System	6
Figure 3-1. Outline Drawing of ProTech 203 System	7
Figure 3-2. Interposing Relay Field Wiring	10
Figure 3-3. Voter Relay Configuration	11
Figure 3-4. Block Diagram of One Unit of the ProTech 203 System	12
Figure 4-1. ProTech 203 Front Panel	13
Figure 5-1. ProTech System Front Door	22
Figure 5-2. Unit Covers Inside the ProTech Device	22
Figure 5-3. Board Locations	24
Figure 5-4. Display Boards	25
Figure 5-5. Heat Sink Spacer Location	26
Table 1-1. De-energize-to-Trip ProTech Models	2
Table 1-2. Energize-to-Trip ProTech Models	2
Table 1-3. Voltage Ranges	2
Table 4-1. Allowable Ranges	14
Table 5-1. Power Supply Fuse Data	21

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

This manual describes the ProTech® electronic two-out-of-three Overspeed Protection System. The manual explains the operation and gives the configuration procedures for the system. This manual does not contain instructions for the operation of the complete turbine system. For turbine- or plant-operating instructions, contact the plant-equipment manufacturer.

Before doing any installation, maintenance, adjustments, or configuration on the ProTech 203 system, read manual 82715, *Guide for Handling and Protection: Electronic Controls, Printed Circuit Boards, Modules*.

Description

The ProTech 203 Overspeed Protection System is a digital overspeed trip device that senses prime mover speed through three magnetic pickups (MPUs). It consists of three identical, independent, speed-sensing units which continuously monitor prime mover speed and activate a trip relay when an overspeed condition is detected. The trip relays of the three units are connected in a two-out-of-three voting configuration so that if any single unit fails, the ProTech system will still provide the correct output. The units' functions include the ability to display the actual speed from each speed probe, display the highest speed signal, on-line testing, and modular design that allows a single failed unit to be replaced while the device is running. Light emitting diodes (LEDs) and digital displays on the unit's front panel indicate the functional status.

Applications

The ProTech system can be ordered in either a de-energize-to-trip model or an energize-to-trip model.



Woodward strongly recommends use of the de-energize-to-trip model for reasons of general safety. With an energized-to-trip model, the prime mover may not trip on loss of power. That failure to trip may result in property damage or personal injury and loss of life. However, Woodward recognizes that some applications will require the energize-to-trip option.

Because Woodward recognizes that some installations will use energized-to-trip models, all ProTech systems have been designed with components of the highest quality and relays with operating characteristics that far exceed the anticipated requirements of the device.

The ProTech system can also be configured to be compatible with various combinations of power sources. Tables 1-1, 1-2, and 1-3 show the available ProTech models, the corresponding part numbers, and the voltage ranges.

Table 1-1. De-energize-to-Trip ProTech Models

NEMA 4X P/N	NEMA 4 P/N	UNIT A	UNIT B	UNIT C
9905-998	9905-989	24 Vdc	24 Vdc	24 Vdc
9905-999	9905-990	120 Vac/dc	120 Vac/dc	120 Vac/dc
9905-750	9905-991	220 Vac	220 Vac	220 Vac
9905-751	9905-992	24 Vdc	24 Vdc	120 Vac/dc
9905-752	9905-993	24 Vdc	24 Vdc	220 Vac
9905-753	9905-994	120 Vac/dc	120 Vac/dc	220 Vac

Table 1-2. Energize-to-Trip ProTech Models

NEMA 4X P/N	NEMA 4 P/N	UNIT A	UNIT B	UNIT C
9905-754	9905-995	24 Vdc	24 Vdc	24 Vdc
9905-755	9905-996	120 Vac/dc	120 Vac/dc	120 Vac/dc
9905-756	9905-997	220 Vac	220 Vac	220 Vac

Table 1-3. Voltage Ranges

220 Vac = 180–264 Vac, 7.25 W
 24 Vdc = 18–32 Vdc, 7.25 W
 120 Vac/dc = 88–132 Vac/90–150 Vdc, 7.25 W

References

The following Woodward publications contain additional product or installation information on overspeed protection systems and related components.

Manual	Title
82715	<i>Guide for Handling and Protection: Electronic Controls, Printed Circuit Boards, Modules</i>
82510	<i>Magnetic Pickups and Proximity Switches for Electronic Governors</i>
50532	<i>EMI Control for Electronic Governing Systems</i>

Chapter 2. Installation

Unpacking

Be careful when unpacking the ProTech® 203 system. Check the device for signs of damage such as a bent or dented case and loose or broken parts. If damage is found, notify the shipper immediately. The device may be stored in its original shipping container until it is ready for installation. Protect the device from weather and from extreme humidity or temperature fluctuations during storage.

Power Requirements

The ProTech 203 system can be configured to operate with numerous power sources. Each unit contains an independent power supply module that can be ordered in the configurations described in Tables 1-1, 1-2, and 1-3 in Chapter 1.

Location Considerations

Carefully study this chapter before choosing a location for the ProTech 203 system. Wiring and grounding considerations may influence the selection of a location for the device.

Consider the following general requirements when selecting the location:

- Adequate ventilation for cooling
- A location that will provide an operating temperature range of -25 to $+60$ °C (-13 to $+140$ °F)
- Space for servicing
- Protection from direct exposure to sunlight, water, or to a condensation-prone environment
- Protection from high-voltage or high-current devices which produce electromagnetic interference
- Avoidance of vibration

Field wiring is provided to reset the device from a remote location.

Shielded Wiring

All shielded cable must be twisted conductor pairs with either a foil or a braided shield. All signal lines should be shielded to prevent picking up stray signals from adjacent equipment. Connect the shields as shown in the plant wiring diagram (Figure 2-1). Wire exposed beyond the shield must not exceed 50 mm (2 inches). The other end of the shield must be left open and insulated from any other conductor. Do not run shielded signal wires with other wires carrying large currents. See manual 50532, *EMI Control in Electronic Governing Systems*, for more information.

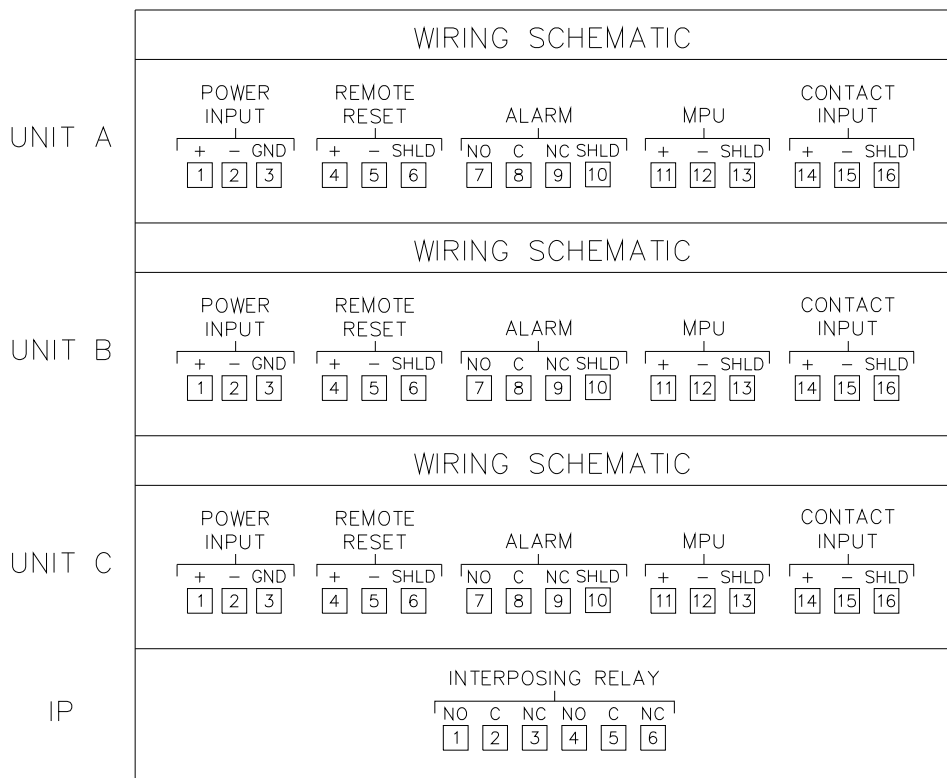
Installations with severe electromagnetic interference (EMI) may require shielded cable run in conduit, double shielded wire, or other precautions. Contact Woodward for more information.

Plant Wiring

Figure 2-1 is the plant wiring diagram for the ProTech 203 system. Figure 2-2 shows the proper routing and stress relief for all field wiring entering the ProTech system. Field wiring to the ProTech system should be between 1.5 and 6 mm² (10 and 16 AWG) wire for the power supplies and between 0.3 and 4 mm² (12 and 22 AWG) for all other I/O runs.

NOTICE

The ground wires for the power supplies of all three units must be tied to earth ground or an inadvertent shutdown could occur.



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Figure 2-1. Plant Wiring Diagram



ELECTRIC SHOCK—When wiring the interposing relays, be sure to wire both contacts with the same polarity. Failure to do so will create a potential shock hazard and therefore possible injury or death.

If the ProTech 203 system is being installed in a hazardous environment, please attend to the following warnings:

**WARNING**

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.

Substitution of components may impair suitability for Class I, Division 2 applications.

**AVERTISSEMENT**

RISQUE D'EXPLOSION—Ne pas raccorder ni débrancher tant que l'installation est sous tension, sauf en cas l'ambiance est décidément non dangereuse.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2.

IMPORTANT

All input and output wiring must be in accordance with Class I, Division 2 wiring methods, and in accordance with the authority having jurisdiction.

All peripheral equipment must be suitable for the location in which they are being used.

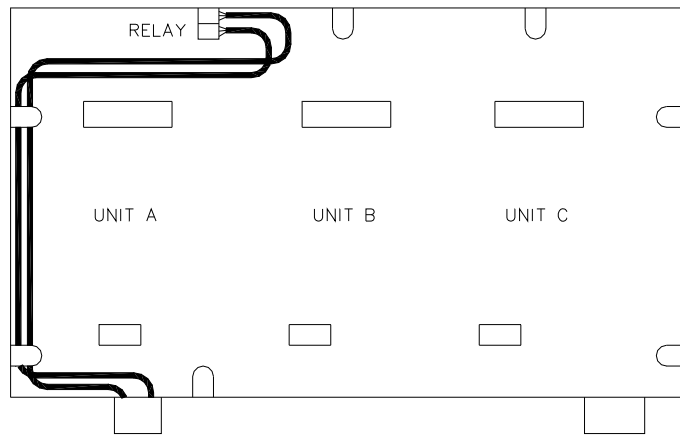
Installation Check-out Procedure

When installation is completed, perform the following check-out procedure before powering up the device.

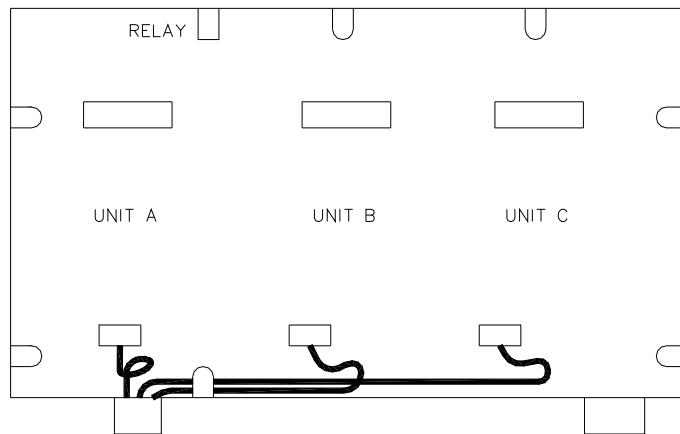
1. Visual inspection
 - a. Ensure that all mounting hardware is tightened and that no wires or cables are pinched.
 - b. Check for correct wiring according to the plant wiring diagram.
 - c. Check for broken terminals or loose terminal screws. Ensure that all ribbon cables are fully seated and clamped in place.
 - d. Check the speed sensor (MPU) for visible damage. Check the clearance between the gear and the sensor and adjust if necessary. See manual 82510, MPUs for Electric Governors.
2. Check for ground
3. Actuating equipment integration assessment: Woodward strongly recommends that the user perform an assessment of the actuating equipment that will receive input from the ProTech 203 system to verify that equipment is properly calibrated, working correctly, properly interfaced, and functioning safely before energizing the ProTech 203 system.

**WARNING**

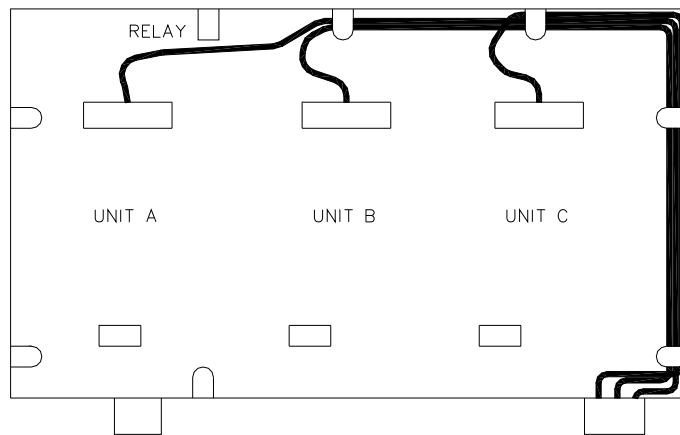
If the actuating equipment assessment is not performed, and, consequently problems are not identified and eliminated, turbine damage can occur with possible personal injury and loss of life to personnel near the turbine.



RELAY BOARD FIELD WIRING
(2 WIRE BUNDLES OF 3 WIRES EACH WITH STRAIN RELIEF)



POWER SUPPLY FIELD WIRING
(3 WIRE BUNDLES OF 3 WIRES EACH WITH STRAIN RELIEF)



I/O BOARD FIELD WIRING
(3 WIRE BUNDLES OF 10 WIRES EACH WITH STRAIN RELIEF)

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Figure 2-2. Routing and Stress Relief for Field Wiring Entering the ProTech 203 System

Chapter 3. Description

The ProTech® 203 Overspeed Protection System is a digital overspeed trip device that reads three individual magnetic pickups, performs three individual speed calculations, and actuates its relay output according to the results of a hardware two- out-of-three vote. The ProTech 203 system is UL certified with Canadian acceptance, for Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only. See Figure 3-1 for the control layout and dimensions.

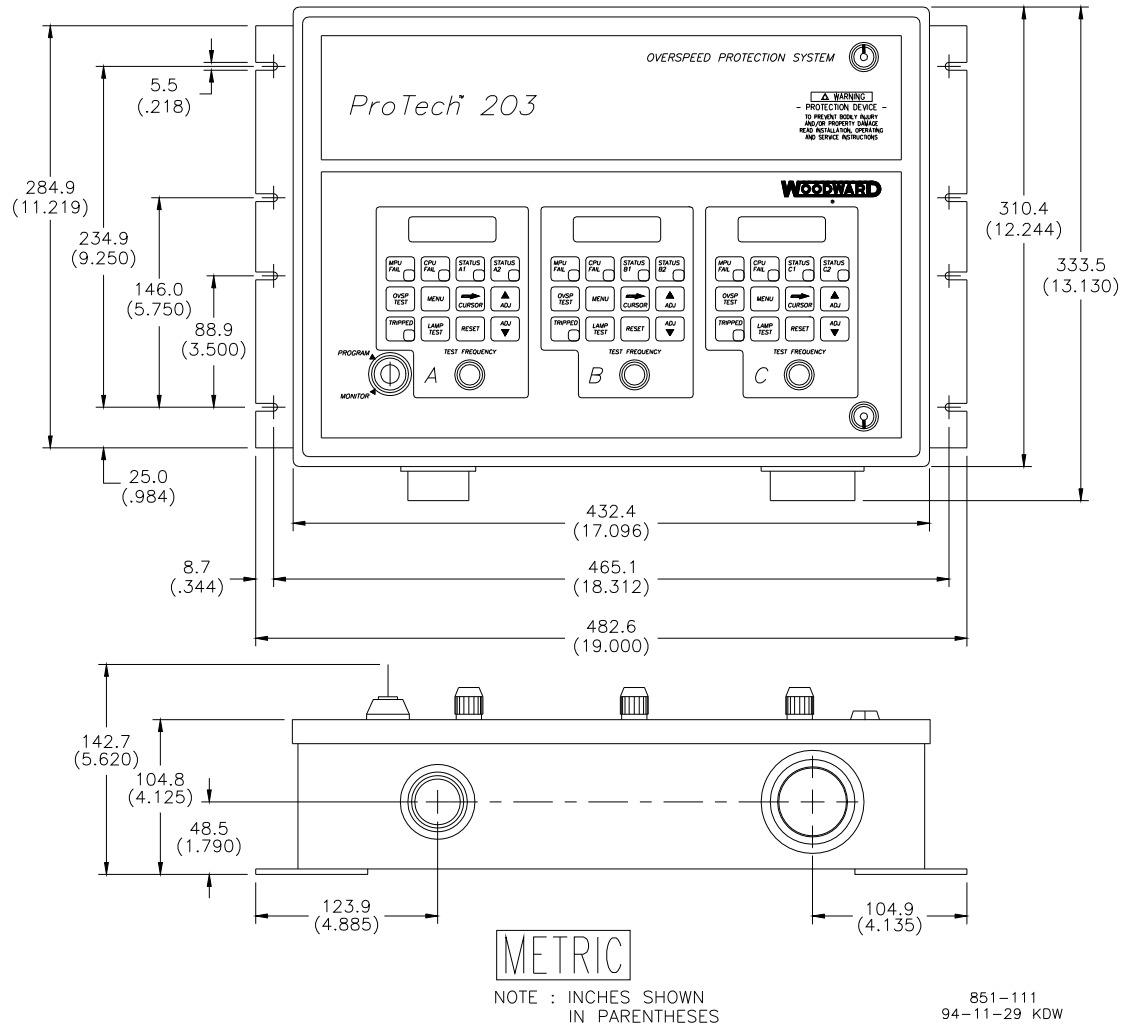


Figure 3-1. Outline Drawing of ProTech 203 System

Specifications

Enclosure

IP 65 (similar to NEMA 4) and NEMA 4X certified.

IMPORTANT

To be certified NEMA 4X, the ProTech 203 system enclosure requires the optional stainless steel hubs.

Remote Reset

Can be reset from a remote location.

Built-In Self-Test

A built-in frequency generator permits testing of each unit individually while prime mover is on-line.

Key Lock

Prevents any programming or testing by unauthorized personnel.

Hot Replacement

Each unit can be replaced with the device running without tripping the prime mover.

Outputs

A separate alarm output and LED indicate if an individual speed-sensing unit has tripped.

MPU Failure Indications

Separate LEDs indicate if an MPU or its wiring has failed.

MPU Fail Timer

Immediately after a reset operation, a timer starts. If prime mover speed is not up to the value programmed when this timer times out, the device will trip the prime mover. Both the time and the speed are programmable.

MPU Fail Option

Each unit can be configured so that on sudden loss of that unit's MPU, the unit can either output both an alarm plus a trip signal, or the unit can output only an alarm.

CPU Failure Indication

A separate LED indicates if any unit's CPU is not operating normally.

Speed-Sensing Frequency Range

100 Hz to 32 kHz

MPU-Check Contact Input

A contact input signals the unit that speed should be above the MPU fail setpoint; when this contact is open, the unit trips if speed is below the MPU fail setpoint, regardless of the state of the MPU fail timer.

Trip-Point Frequency Range

250 Hz to 25 kHz

MPU Input Amplitude

1 Vrms minimum @ 100 Hz to 25 kHz

2 Vrms minimum @ 25 KHz to 32 kHz

Shutdown Contact Ratings

Rated Voltage	Resistive, A	Inductive, A	Tungsten, A	Motor, A
28 Vdc	10.0 A	—	1.0 A	3.0 A
115 Vdc 50/60 Hz	3.0 A	2.0 A	0.5 A	1.5 A
125 Vdc	—	—	—	—

Alarm Contacts

2 A resistive load @ 28 Vdc

0.3 A resistive load @ 115 Vrms

IMPORTANT

The alarm relay de-energizes when a trip occurs, when speed is below the MPU fail setpoint, and momentarily after reset or power-up. An alarm only annunciates a situation that may require attention, it is not synonymous with a trip.

MPU Measurement Circuit Input Impedance2 k Ω **Accuracy**

0.05% of point + 2 Hz over the operating temperature range

Operating Temperature

-25 to +60 °C (-13 to +140 °F)

Display Operating Temperature

-15 to +60 °C (+5 to +140 °F)

Sample Time

Speed is sampled every 5 milliseconds

Total Response Time

40 ms max

Humidity

US MIL-STD-810D, Method 507.2, Procedure II

Vibration

US MIL-STD-810D, Method 516.3, Procedure I

EMC

Radiated and Conducted Emissions EN 55011, Class A

ESD

IEC 801-2, 8 kV air and 4 kV contact

Radiated Susceptibility

IEC 801-3, 10 V/m, 27-500 MHz

Fast Transients

EC 801-4, 2 kV direct to power leads, 2 kV capacitive to I/O leads

Surge

IEC 801-5, 4 kV differential mode on ac input, 500 V common mode and differential mode on dc input

Conducted Susceptibility

IEC 801-6, 10 V, 0.15–100 MHz, all leads

Weight

7.3 kg (16 lb)

IMPORTANT

In order to meet the overspeed trip specifications of API 612, a cold-coil monitoring device must be wired into an energize to trip version ProTech 203 system.

Modes of Operation

The ProTech 203 system is offered in both de-energize-to-trip versions and energize-to-trip versions. Two normally open and two normally closed relay contacts are provided by the system for use in either version. Figure 3-2 shows the relay field wiring diagram that describes these options.

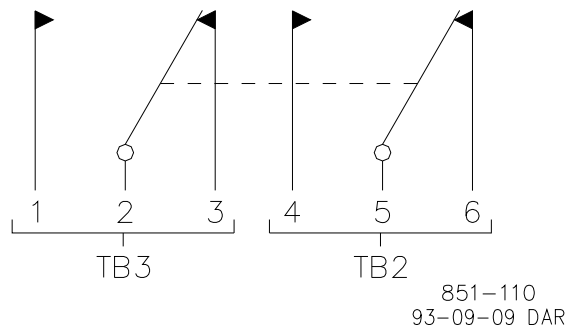


Figure 3-2. Interposing Relay Field Wiring

In the de-energize-to-trip version, the interposing relay is in its energized state during normal operation. TB3 terminals 1 and 2 are connected and TB2 terminals 4 and 5 are connected. During an overspeed trip event, or when power to the ProTech 203 system is lost, the interposing relay is actuated. Then TB3 terminals 2 and 3 are connected and TB2 terminals 5 and 6 are connected.

In the energize-to-trip version, the interposing relay is in its de-energized state during normal operation. TB3 terminals 2 and 3 are connected and TB2 terminals 5 and 6 are connected. Only during an actual overspeed trip event is the interposing relay actuated. Then TB3 terminals 1 and 2 are connected and TB2 terminals 4 and 5 are connected.

IMPORTANT

In the energize-to-trip version, if input power to the ProTech 203 system is lost, the interposing relay will not actuate, and TB3 terminals 2 and 3 and TB2 terminals 5 and 6 will remain connected.

The ProTech 203 system utilizes three separate speed-sensing units that are interfaced to three individual magnetic pickups (MPUs). Each speed sensing unit (A, B, and C) actuates two voter relays that are internally wired in a six relay series/parallel configuration. This six-relay configuration drives the interposing relay shown in Figure 3-3.

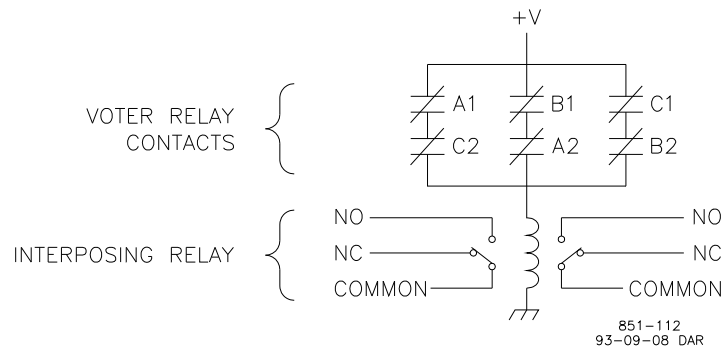


Figure 3-3. Voter Relay Configuration

Whenever two of the three speed-sensing circuits sense an overspeed condition, the voter relay configuration will change state, causing a turbine trip. It should be noted, however, that a single MPU or circuit failure will not cause an inadvertent trip.

This configuration makes testing of the voter relays in the system a relatively simple operation. Six relay status indicator LEDs (STATUS A1, STATUS A2, STATUS B1, STATUS B2, etc.) are mounted on the control panel. Each LED is on when its corresponding relay is tripped. You may overspeed each of the three speed-sensing circuits, one at a time, using a built-in frequency generator. You may then watch the LED indicators and the speed readout to see that each of the six individual voter relays trip at the correct speed. Because of the series/parallel configuration of the trip relays, overspeeding one of the speed sensing circuits at a time will not disturb the load.

Operator Interface

Each speed-sensing unit of the ProTech 203 system includes a touchpad, a two-line by 16-character LCD display, and a potentiometer for adjusting the overspeed test frequency. A single keyswitch is connected to all three speed-sensing units to control whether the system is in the MONITOR or the PROGRAM mode, preventing unauthorized changes.

Power Supply Description

The ProTech 203 consists of three units (A, B, and C). Each unit has its own separate power supply. There are three different versions of power supplies which have the following input voltages: 18–32 Vdc, 90–150 Vdc/88–132Vac, and 180–264 Vac. Each unit can have a different input version of the power supplies.

Each unit power supply produces +5 V and +24 V. These voltages are isolated from the input voltage. The +24 V for all three units are "or-ed" together to provide power to the interposing relay.

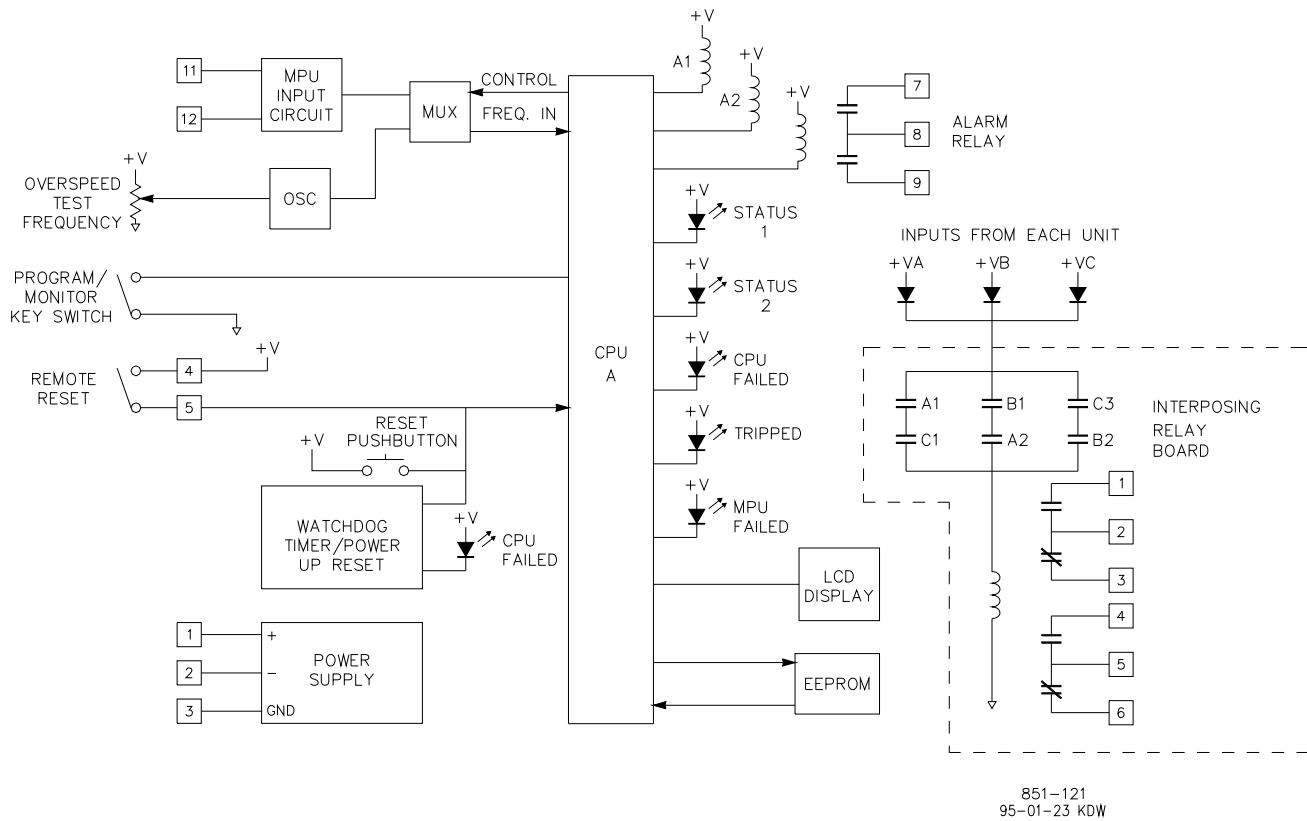
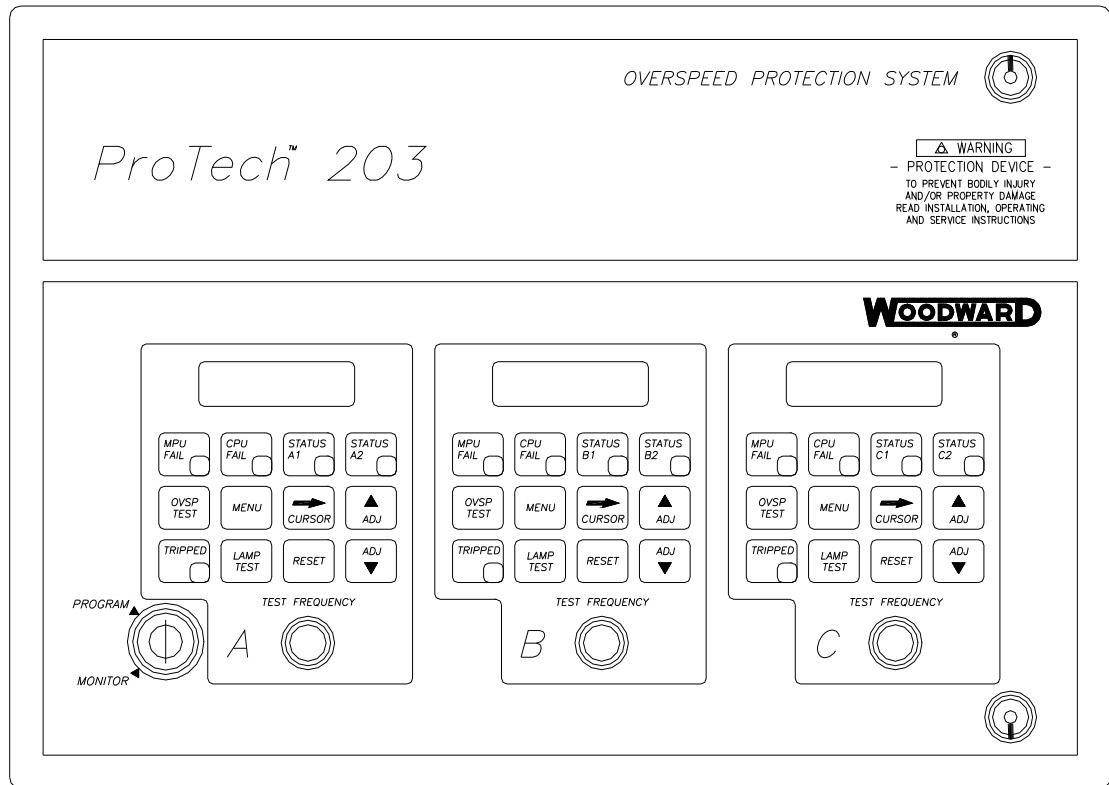


Figure 3-4. Block Diagram of One Unit of the ProTech 203 System

Chapter 4. Configuration and Operation



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Figure 4-1. ProTech 203 Front Panel

The ProTech[®] 203 system can be operated in one of two modes, MONITOR or PROGRAM. Although the system will "run" in either mode, it is recommended that the unit be placed in the PROGRAM mode only during configuration and then placed in the MONITOR mode during normal operation.

The menu key on the touch pad selects which of the following parameters to display:

- PRESENT SPEED
- PEAK SPEED
- TRIP SPEED SETPOINT
- MPU FAILED SETPOINT
- MPU FAILED TIMEOUT
- MPU GEAR TEETH
- TRIP ON MPU FAILURE OPTION
- TRIP CAUSE (if applicable)

PRESENT SPEED is the first parameter displayed. Each subsequent press of the menu key displays the next parameter in the list. Appropriate descriptive units for each parameter are also displayed.

When the keyswitch is in the MONITOR position, the CURSOR, ADJ up, and ADJ down keys have no effect. When the keyswitch is in the PROGRAM position, an annunciator appears in the display, and a cursor appears if a tunable parameter is being displayed. The tunable parameters are:

- TRIP SPEED SETPOINT
- MPU FAILED SETPOINT
- MPU FAILED TIMEOUT
- MPU GEAR TEETH
- TRIP ON MPU FAILURE

If any tunable parameters are changed, the LCD displays CHANGES SAVED for two seconds when the keyswitch is returned to the MONITOR mode.

The CURSOR, ADJ up, and ADJ down keys perform as follows in the PROGRAM mode:

CURSOR—Moves the cursor one position to the right.

ADJ up, ADJ down—For integer values, these keys increase/decrease the displayed value by the power of ten indicated by the cursor position. For example, if the cursor were under the "0" of the value 5014 and the ADJ down key were pressed, the value would change to 4914.

For a time display in minutes and seconds, increase/decrease the displayed value by the number of seconds or minutes indicated by the cursor position. For example, if the cursor were under the "4" in 1 MIN 47 SEC and the ADJ up key were pressed, the value would change to 1 MIN 57 SEC. If the ADJ up were pressed again, the value changes to "2 MIN 07 SEC".

For a YES/NO value, pressing either ADJ up or ADJ down causes the value to toggle to the opposite value.

Pressing and holding the ADJ up or the ADJ down key causes the value, after a short delay, to change at a fixed rate.

If changing a value would cause it to exceed predetermined limits, no change takes place. Table 4-1 gives the allowable range for each tunable parameter.

Table 4-1. Allowable Ranges

Tunable	Minimum	Maximum
Trip Speed Set Point	250 rpm	25 000 rpm
MPU Failed Set Point	100 rpm	25 000 rpm
MPU Failed Timeout	1 sec	533 min 20 sec
Trip on MPU Failure	NO	YES
MPU Gear Teeth	20	120

The LAMP TEST key causes all LEDs to illuminate and the LCD to display all solid block characters for as long as the key is pressed.

IMPORTANT

As used here, "trip" refers to the action of an individual speed-sensing unit in the ProTech 203 system as it de-energizes the alarm relay, turns on the TRIP LED, and de-energizes its voter relays (de-energize-to-trip versions) or energizes its voter relays (energize-to-trip versions). The trip cause becomes the currently displayed parameter.

The possible causes of a trip are:

Display shows	Possible cause
MPU> TRIP SETPOINT	Speed exceeded the TRIP SETPOINT value.
OVERSPEED TEST	Speed exceeded the TRIP SETPOINT value during an overspeed test.
MPU FAIL TIMEOUT	After reset, speed did not reach the MPU FAIL SETPOINT within the MPU FAIL TIMEOUT time.
MPU FAILED	A sudden loss of speed occurred while running.
NO MPU SIGNAL	The contact input was open while speed was below the MPU FAIL SETPOINT.
NO RESET	The unit was not reset before re-starting the turbine after a rolldown.
HARDWARE FAULT	The unit has an internal hardware problem.
INTERLOCK FAULT	An internal cable is disconnected.

Once a unit is tripped, it remains tripped until reset or until the power is cycled.

Programming

Programming of the ProTech 203 system consists of entering values for all the tunable parameters. The procedure for programming each speed-sensing unit is as follows:



In order to ensure proper functioning of the ProTech 203 system, it is imperative that the tunable parameters in each of the units are programmed to result in identical trip points. Failure to do so could result in inadvertent trips or failure to trip at appropriate speed resulting in property damage, injury, or death.

1. Switch the keyswitch to the PROGRAM position.
2. Press the MENU key to step through the parameter menu to the first tunable parameter, TRIP SPEED SETPOINT.
3. Use the CURSOR, ADJ up, and ADJ down keys to enter the proper rpm for your preferred TRIP SPEED SETPOINT.
4. Press the MENU key to step to the next tunable parameter, MPU FAILED SETPOINT.
5. Use the CURSOR, ADJ up, and ADJ down to enter the proper rpm for your preferred MPU FAILED SETPOINT.
6. Press the MENU key to step to the next tunable parameter, MPU FAILED TIMEOUT.
7. Use the CURSOR, ADJ up, and, ADJ down keys to enter the appropriate time interval.
8. Press the MENU key to step to the next tunable parameter, MPU GEAR TEETH.
9. Use the CURSOR, ADJ up, and ADJ down keys to enter the number of gear teeth on the gear being monitored by the MPU connected to this unit.

10. Press the MENU key to step to the next tunable parameter, TRIP ON MPU FAILURE.
11. Use the ADJ up or ADJ down key to enter a "yes" or "no" response.
12. Duplicate this procedure for the other two units.
13. Return the keyswitch to the monitor position. The LCD displays CHANGES SAVED for two seconds.

For your convenience, a programming worksheet is provided below. The worksheet should help ensure proper programming and provide you with a hard copy record of the values entered. Feel free to copy the worksheet for future use.

ProTech 203 Programming Worksheet

UNIT A	UNIT B	UNIT C
TRIP SPEED SETPOINT _____	TRIP SPEED SETPOINT _____	TRIP SPEED SETPOINT _____
Prime mover speed in rpm at which user expects unit to de-energize its alarm relay, turn on the TRIP LED, and energize/de-energize, (depending upon the version chosen) its voter relays .		
MPU FAILED SETPOINT _____	MPU FAILED SETPOINT _____	MPU FAILED SETPOINT _____
The prime mover speed must exceed this value within the MPU FAILED TIMEOUT period or the unit will trip. If the TIMER STARTS on RESET option is set to "Yes", the speed must also exceed this value whenever the contact input is open or the unit will trip.		
MPU FAILED TIMEOUT _____	MPU FAILED TIMEOUT _____	MPU FAILED TIMEOUT _____
Time period after a reset, during which the prime mover speed must exceed the MPU FAILED SETPOINT or unit will trip.		
MPU GEAR TEETH _____	MPU GEAR TEETH _____	MPU GEAR TEETH _____
Number of gear teeth the MPU is looking at.		
TRIP ON MPU FAILURE _____	TRIP ON MPU FAILURE _____	TRIP ON MPU FAILURE _____
"Yes" or "no" option. If an MPU loss-of-signal occurs, the MPU FAIL LED turns on and the alarm relay de-energizes. If the TRIP ON MPU FAILURE option is set to "yes", the unit trips; this option applies only to a sudden loss of MPU signal while running. Trips due to an MPU timer timeout or an open contact input are not affected by this option.		
TIMER STARTS ON RESET _____	TIMER STARTS ON RESET _____	TIMER STARTS ON RESET _____
"Yes" or "No" option. If set to "No", the MPU fail timer starts when start key is pressed or when the contact input opens. If set to "Yes", the MPU fail timer starts when the reset key is pressed or remote reset contact opens.		
ALARM IF SPEED < MPU FAIL SETPOINT _____	ALARM IF SPEED < MPU FAIL SETPOINT _____	ALARM IF SPEED < MPU FAIL SETPOINT _____
This option only applies when the "TIMER STARTS ON RESET" option is set to "Yes". If this option is set to "Yes", the alarm relay de-energizes whenever speed is below the MPU fail set point.		

Operation

Start-up

Each of the three ProTech units must be reset before the turbine is started. A unit is reset by pressing the front panel RESET button or by momentarily closing the remote reset contact (TB5-4 to TB5-5). After the power-up self-tests, each ProTech unit begins executing its speed-sensing algorithm. If the speed does not exceed the MPU FAIL SETPOINT speed within the MPU FAIL TIMEOUT value, the unit trips. At this time the MPU FAIL LED turns on and remains on until the next reset. The unit also trips if the contact input is ever open while speed is below the MPU FAIL SETPOINT. If the contact input is not used, TB5-14 and TB5-15 must be jumpered together. These trips are not affected by the TRIP ON MPU FAILURE option.

Normal Operation

Once the MPU FAIL SETPOINT has been exceeded, each ProTech unit monitors speed for an overspeed condition (present speed > MPU FAIL SETPOINT) or for a loss-of-signal condition. As the speed exceeds the currently displayed peak speed, the peak speed is updated.

If an overspeed is detected, the unit trips. As the speed exceeds the currently displayed peak speed, the peak speed is updated and stored in non-volatile memory. The operator interface is still active. That is, all parameters can be displayed, and tunable parameters can be changed.

Peak speed is not stored in non-volatile memory if an overspeed condition has not occurred.

To reset a unit's peak speed, place the key switch in the PROGRAM position, then press the RESET key. The message "RESET PEAK? ADJ UP = YES ADJ DOWN = NO" appears. Press the ADJ UP key to reset the peak speed. After pressing either the ADJ UP or the ADJ DOWN keys, the unit resumes normal operation. If neither key is pressed within 10 seconds, a "no" response is assumed and the prompt disappears. Return the keyswitch to the MONITOR position.

An MPU loss-of-signal occurs when an MPU frequency of less than 100 Hz is measured and the previously measured frequency was greater than 120 Hz. The alarm relay de-energizes, and the MPU FAIL LED turns on and remains on until a reset or until power is cycled. If the TRIP ON MPU FAILURE option is "yes", a trip occurs. If the previously measured speed is less than 120 Hz, it is assumed that a normal roll-down has occurred. The MPU FAIL LED does not turn on, the alarm relay does not de-energize, and no trip occurs.

After a normal roll down, each ProTech unit monitors the MPU. If the MPU frequency exceeds 110 Hz, the unit trips and annunciates the cause as NO RESET.

Overspeed Test

The overspeed test function is activated when the keyswitch is in the PROGRAM position and the operator presses and holds the OVSP TEST button on the touchpad. The microcontroller switches the source of the MPU signal from the MPU input to an on-board oscillator. The test speed is annunciated on the LCD. If the test speed is adjusted above the trip set point, using the Test Frequency potentiometer on each unit, a trip occurs. MPU loss-of-signal checking is disabled, and the peak speed value does not change during overspeed test. When the OVSP TEST button is released, the microcontroller switches the source of the MPU signal back to MPU input and normal operation is restored. **Each ProTech unit must be reset to clear its trip condition.**

IMPORTANT

Each individual unit may be tested as described above while the entire system remains on-line. In this case, the two units not being tested take over full control of the overspeed protection for the prime mover.

IMPORTANT

It is recommended that the overspeed test be performed on each unit on a weekly basis and that an actuating equipment integration assessment be performed any time the prime mover is taken off-line.

Hardware Faults

If the microcontroller determines that the EEPROM is not responding correctly, a trip occurs. The trip cause is annunciated as "HARDWARE FAULT". If this type of fault occurs, reset the unit. If the fault continues to occur, replace the unit and return it for repair.

If the microcontroller determines that the data in EEPROM has been corrupted, the display shows "EEPROM DATA LOST". If this type of fault occurs, reset the unit. If the fault continues to occur, replace the unit and return it for repair.

The microcontroller monitors an interlock signal which indicates that the internal hardware cables are connected correctly. If this signal indicates a missing interlock, a trip occurs. The cause of the trip is annunciated as "INTERLOCK FAULT". If this fault occurs, check all cable connections.

If a monitor circuit determines that the microcontroller is not functioning, a trip occurs. The CPU FAIL LED turns on. If this fault occurs, replace the unit and return it for repair.

Chapter 5.

Troubleshooting and User Repairs

Troubleshooting

The following troubleshooting guide will help isolate problems in the ProTech® 203 device, actuating system, plant wiring, MPUs, or elsewhere. Make the checks in the order indicated.

IMPORTANT

To check the ProTech control thoroughly, troubleshoot each unit (A, B, and C) separately. A unit consists of one complete speed-sensing circuit, including the power supply, I/O module, and display board.

Symptom	Cause	Remedy
Prime mover overspeeds after operating at rated speed for some time	Prime mover	Check for proper operation of the prime-mover fuel system. If actuator moves toward minimum fuel during overspeed, problem is in the fuel system.
Prime mover does not trip on overspeed	Power is not applied to an energized-to-trip ProTech model	Apply power to all ProTech units.
	The ProTech device is not connected or is incorrectly connected to the external actuating system	Check that the ProTech device is installed properly.
	Incorrect set point values configured for one or more units	Check the MPU GEAR TEETH and TRIP SPEED SETPOINT configurations for each unit to verify that they are appropriate for prime mover and the individual MPUs.
	If two or more units show a TRIPPED indication, the cause is the external actuating system down-line from the ProTech device	Check for incorrect field wiring and inoperable or incorrectly calibrated actuating equipment.
Prime mover trips inappropriately	More than one unit has been overspeed tested at one time	Reset the units.
	Incorrect set point values configured for one or more units	Check the MPU GEAR TEETH and TRIP SPEED SETPOINT configurations for each unit to verify that they are appropriate for prime mover and the individual MPUs.

Symptom	Cause	Remedy
Inappropriate trip during start-up	Contact input was left open and TIMER STARTS ON RESET option is set to "Yes"	If contact input is not used, jumper together TB5-14 and TB5-15 of each unit.
	Incorrect set point values configured for one or more units	Prime mover is not ramping to configured speed in the allotted time. Verify that the MPU FAIL SETPOINT and MPU FAIL TIMEOUT are appropriate for the prime mover.
	Incorrect MPU signal	Check that all MPUs are correctly wired to the ProTech device and are functioning properly.
Inappropriate trip. Hardware fault annunciated	EEPROM doesn't respond correctly	Reset the unit.
		If fault continues, replace unit (see "User Repairs" section below).
Inappropriate trip. Interlock fault annunciated	Cables aren't connected correctly	Check ProTech internal cabling and installation procedure.
Inappropriate trip. CPU FAIL LED lit	The ProTech microcontroller is not functioning	Replace the entire unit (see "User Repairs" section below).
Prime mover won't start	One or more de-energize to trip units do not have power	Check power supply fuses, wiring, and power sources.
	One or more ProTech units need to be reset	Press the RESET key.
	A de-energized-to-trip ProTech model is installed when an energized-to-trip model is appropriate—or vice versa	Verify the type of ProTech model in Chapter 1.
	Actuating wiring from the ProTech device is incorrect	Check actuating system for proper normally open or normally closed wiring.
Unit has LCD display, but no LEDs display—or vice versa	Unit is faulty	Replace the entire unit (see "User Repairs" section below).
Unit has neither LCD nor LED display	Unit has no power	Check that power is applied to the unit.
	Power supply fuses need to be replaced	Replace unit's power supply board fuse (see "User Repairs" section below).
	Power supply board is faulty	Replace the entire unit (see "User Repairs" section below).
Unit is not operating; STATUS 1 & 2 and TRIPPED are illuminated	Unit needs to be reset	Press the RESET key.
Unit won't RESET	Remote RESET contacts are closed	Check that the remote RESET operates as a momentary contact.

User Repairs

The ProTech device is highly reliable and should require minimal hardware repairs. Use the above troubleshooting guide to determine the course of action if a problem does occur.

In some cases, you will need to return the ProTech system to the supplier from whom you purchased it. However, in other cases, the Troubleshooting Guide will suggest one of the following remedies:

Changing a power-supply board fuse

Replacing an entire unit (including display, I/O, and power supply boards) while the other two units continue to function so that the ProTech device stays on-line



WARNING

EXPLOSION HAZARD—Substitution of components may impair suitability for Class 1, Division 2.

Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Changing a Power Supply Board Fuse

Tools Needed

- a #2 Phillips screw driver
- a 1/4-inch nut driver
- a small flat blade screw driver
- a 5/32 inch Allen wrench

Appropriate replacement fuses are CSA- and UL-approved, slow-blow, 5 x 20 mm fuses.

Table 5-1. Power Supply Fuse Data

Power Supply Voltage	Fuse Amperage
24 Vdc	1.0 A
120 Vac/dc	0.8 A
220 Vac	0.8 A

Procedure for Changing a Power Supply Board Fuse

1. Shut off the power to the unit in which you're replacing a fuse.



WARNING

HIGH VOLTAGE—Failure to disconnect power to the unit you're replacing, prior to proceeding can result in exposure to potentially lethal voltage and therefore possible injury or death.

- To open the front door, turn the two door latches (counterclockwise) see (Figure 5-1).

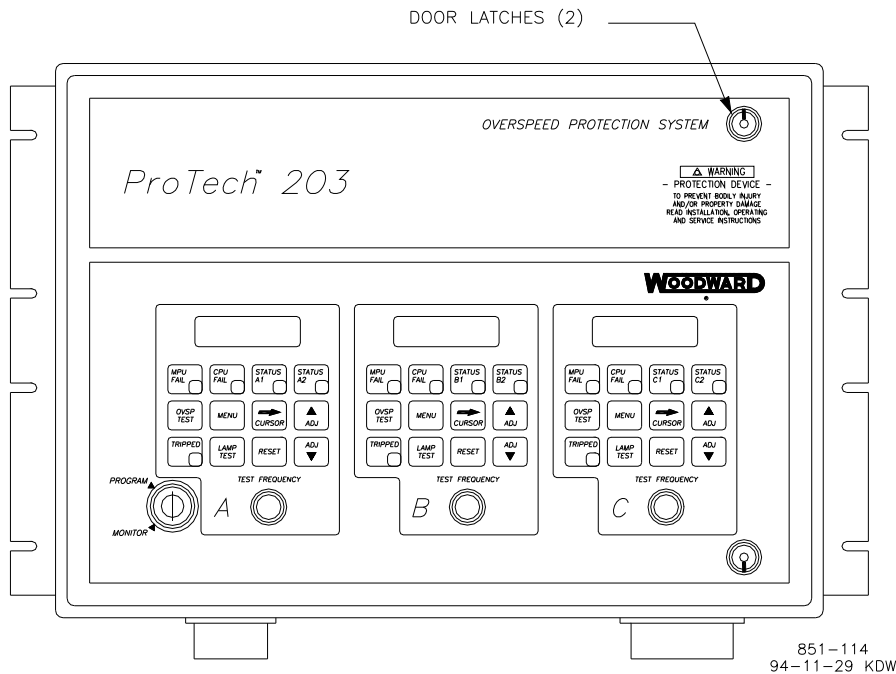


Figure 5-1. ProTech System Front Door

- If you're replacing a fuse in Unit A, remove the ribbon-cable clamp and retain for use when re-installing the cover (Figure 5-2).

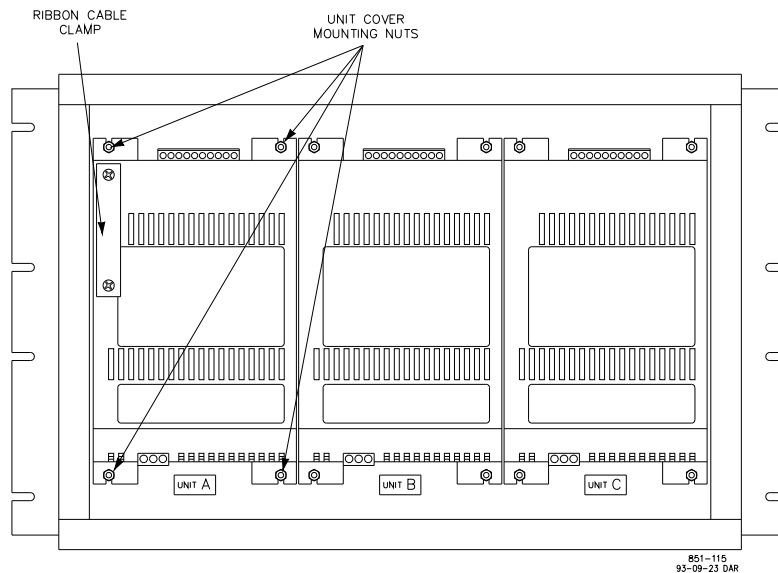


Figure 5-2. Unit Covers Inside the ProTech Device

- Unplug the power supply board terminal block, then unplug the I/O board terminal block (Figure 5-2).
- Remove the four nuts on the unit's cover, and carefully lift the cover off (Figure 5-2). Retain the cover and the nuts to be reinstalled after changing the fuse.

6. With the cover off, the power supply board fuses will be visible in the lower left hand corner of the power supply board, just above the power supply terminal block.
7. Remove the fuses and examine them for defects. Replace any defective or suspect fuse.
8. Replace the unit's cover and snugly secure the four nuts that hold the cover in place.
9. If you've been working on Unit A, replace the ribbon-cable clamp onto the cover (Figure 5-2).
10. Plug in the unit's terminal blocks.
11. Close and latch the front door.
12. Re-power the unit.
13. On the unit's keypad, press RESET to activate the unit's operation.

Changing a ProTech Unit On-line

IMPORTANT

To ensure compatibility, the *entire* unit must be replaced as a matched set. Do not mix and match boards between units.

Tools and Supplies Needed

- a #2 Phillips screw driver
- a 1/4-inch nut driver
- a small flat blade screw driver
- heat sink compound

Procedure to Remove a Unit from the ProTech Chassis

1. Shut off the power to the unit you're replacing.

WARNING

HIGH VOLTAGE—Failure to disconnect power to the unit you're replacing, prior to proceeding can result in exposure to potentially lethal voltage and therefore possible injury or death.

2. To open the front door, turn the two door latches (counterclockwise) (Figure 5-1).
3. If you're replacing Unit A, remove the ribbon-cable clamp and retain for use when installing the replacement unit (Figure 5-2).
4. Unplug the power supply board terminal block, then unplug the I/O board terminal block (Figure 5-2).

5. Remove the four nuts on the unit's cover, and carefully lift the cover off (Figure 5-2). Retain the cover and the nuts to be reinstalled with the replacement unit.

NOTICE

Be very careful not to drop any of the nuts or screws as you remove or replace them. It may be possible for them to get under one of the adjacent unit covers or contact the exposed back of one of the display boards on the front cover. If this happens, it is possible for the part to cause a short on a unit under power and therefore a possible turbine trip.

6. Unscrew the four long screws holding the two-board pack together (Figure 5-3).

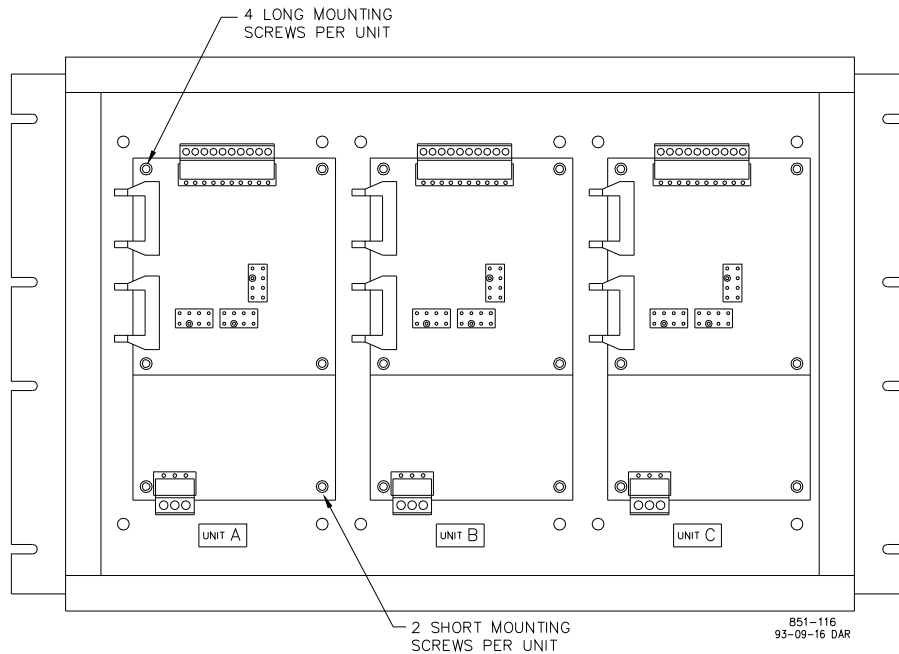


Figure 5-3. Board Locations

7. Disconnect the ribbon cables from the top (I/O) board, and remove the board from the unit (Figure 5-3).
8. Using a small flat blade screw driver, remove the nylon screw holding the transistor against the heatsink.

IMPORTANT

Be careful not to drop or lose the ceramic insulator located under the transistor. Retain it for reinstallation.

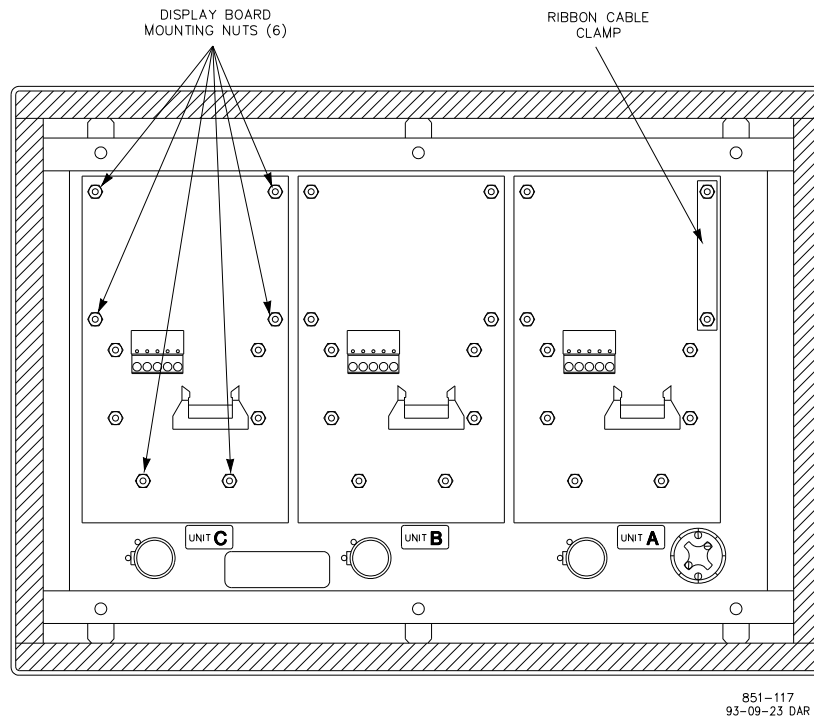
9. Remove the two remaining screws securing the power supply board to the chassis.
10. Unplug the ribbon cable from the power supply board, and remove the board.
11. Unplug the terminal block and ribbon cable from the corresponding display board.

12. Remove the six nuts holding the display board to the ProTech system chassis front door. Note the nuts' locations in Figure 6-4 so that you don't loosen the 4 nuts that attach the LCD (display) to the circuit board.

IMPORTANT

If removing Unit A, retain the two cable clamps for re-installation.

13. Holding the display board's terminal block and ribbon cable connector, "walk" and lift the board off of the door



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Figure 5-4. Display Boards

NOTICE

Do not use screw drivers or other objects to lift or pry the display board. Doing so may damage other ProTech components.

Procedure to Install a New Unit

1. Insert and position the new display board in place (Figure 5-4).
2. Replace the six display board nuts, tighten until they are snug (if replacing unit A, re-install the ribbon-cable clamps).
3. Plug in the ribbon cable, then the terminal block to the display board.
4. Insert and position the new power supply board (Figure 5-3).

IMPORTANT

Add heatsink compound to the underside of the transistor located on the power supply board.

5. Replace the two short screws that secure the lower portion of the board to the chassis.

6. Replace the nylon screw through the transistor and ceramic insulator into the heat sink spacer located on the chassis.

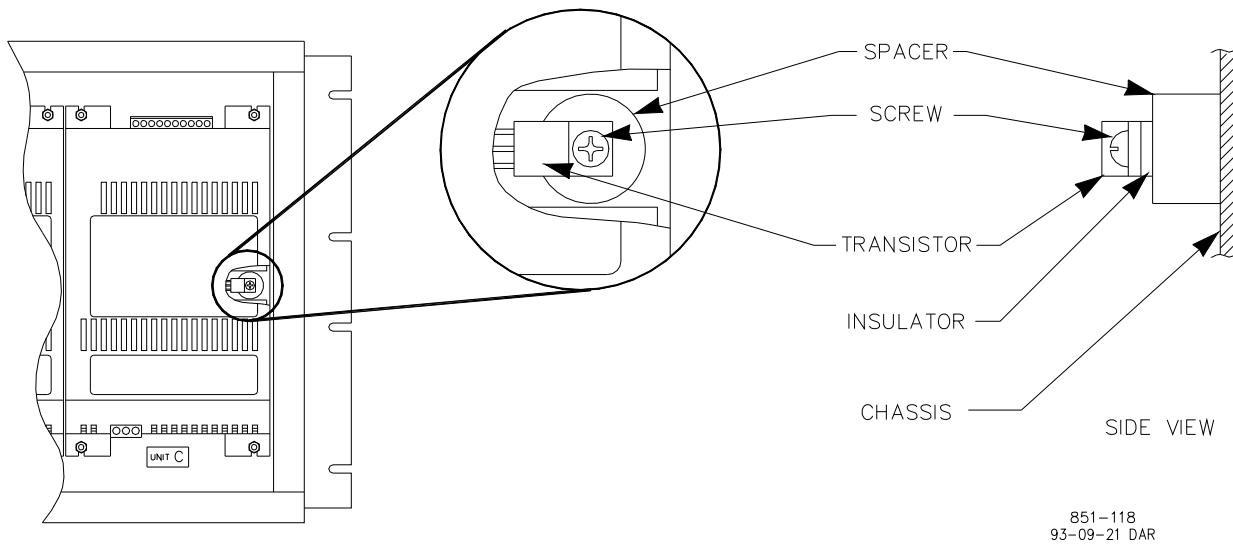


Figure 5-5. Heat Sink Spacer Location

NOTICE

Ceramic insulator must be installed between the transistor and the heatsink spacer. Failure to do so will result in line voltage being shorted to chassis ground and immediate failure of the unit upon application of power.

7. Plug the ribbon cable back into the power supply board.
8. Insert and position the I/O board on top of the power supply board (Figure 5-3).
9. Replace the four long screws through the corners of both the I/O and power supply boards.
10. Attach both ribbon cables to the I/O board (Figure 5-1).
11. Replace the unit's metal cover. To avoid future confusion, make sure the proper cover is on the proper unit. This is important because each cover is labeled with the unit I.D. letter as well as the correct voltage to be applied to that unit.
12. Snugly secure the four cover nuts.
13. If you've replaced Unit A, replace the ribbon-cable clamp onto the cover (Figure 5-2).
14. Plug in the unit's terminal blocks.
15. Close and latch the front door.
16. Re-power the unit you just replaced.
17. On the replaced unit's display, press RESET to activate that unit's operation.

Chapter 6.

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 85196.



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as well as authorized distributors and other authorized service and sales facilities throughout the world.**

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