

**Speed Setting Potentiometers  
used on 2301, 2500, and 8290 Systems**

**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

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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.



### Translated Publications

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## 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.

## Speed Setting Potentiometer

### 2301 Electric Governor

The 2301 electric governor is one in which its actuator output (terminal) shaft position is directly proportional to the input signal from its electric control unit. It can be used in an isochronous (constant speed) mode for single engine operation or when paralleled with similar units on an isolated bus. It can also be used in the droop mode for paralleling dissimilar units or operating on an infinite bus. The 2301 governor is used in the same type of service as many other governor models. It is particularly well suited, when used with some types of proportional actuators, to engines operated in tandem to drive a common load. In such installations, one electric control is used to furnish the same input signal to the proportional actuator on each engine. Since each actuator receives the same current, their output shafts take the same position and give each engine the same amount of fuel.

The 2301 electric governor consists of an electric control unit, a speed setting potentiometer, and a hydraulic actuator. It may include various control functions such as frequency sensing, load sensing, speed sensing and acceleration and deceleration rate control (ramp generator). Each function is usually on a separate chassis. The electric control receives the input signals. Its output serves as the input signal to the actuator. The actuator output controls the flow of energy medium to the prime mover. The speed setting potentiometer, used to adjust speed settings, provides one of the inputs to the electric control.

The operation of the 2301 type governor is different and distinct from other electric governors. The steady-state output of the electric control is a level of voltage determined by the actuator terminal shaft position required to maintain a particular load on the prime mover. The voltage is always the same polarity. This type of control unit requires an actuator in which the output shaft takes a position proportional to the voltage of the input signal.

In contrast, the electric control unit of the EG series electric governor emits a nominally zero signal during conditions of on-speed, steady-state operation, and a larger voltage signal only during off-speed or load-changing periods. In this type of system, the direction of actuator operation depends on signal polarity.

### Speed Setting Potentiometer

In any governor, some means of setting desired speed and referencing the actual speed to desired speed is required.

In the 2301 governor a 6.6 volt reference signal is furnished for speed setting. A voltage divider is used to connect a portion of this voltage into a summing point where it is compared to a voltage developed by a speed sensing circuit. The error signal thus generated is used to control prime mover speed.

The total resistance across the voltage divider should be 900 to 1100 ohms. Virtually any combination of fixed resistors and/or potentiometers may be used to obtain the desired range and sensitivity, as long as the total resistance is maintained.

Note that the maximum range of speed setting is dependent on the amplifier used. The 12 volt amplifier is limited to a 3-to-1 range. The 24 volt amplifier is normally limited to a 10-to-1 range, but may be increased by special circuitry. Contact Woodward for more information concerning a specific application.

Three arrangements commonly used are shown in Figure 1. In the first circuit a potentiometer is used to adjust the speed reference within the range of the amplifier. By having a larger fixed resistance below the potentiometer and a smaller resistance above it, control over a higher part of the speed range is achieved, and vice versa. A ten-turn potentiometer is often used in this circuit.

When a more precise speed adjustment is required, the second circuit shown in Figure 1 may be used. The bracket assembly (5438-121) shown on the cover contains both the fixed resistors mentioned above as well as the 10-turn potentiometer. This potentiometer is sealed to provide protection from corrosive atmospheres and dust. The bracket assembly can be substituted for the dual potentiometer coarse-fine speed setting bracket used on some of the systems.

## Troubleshooting

With a high impedance voltmeter, check across terminals 9 and 6 of the amplifier chassis for 5 to 6 Vdc. If voltage is incorrect, the amplifier is faulty. If proper voltage is obtained, disconnect voltage divider from terminals 9, 10, and 6 of the amplifier and check continuity with ohmmeter. If any circuit is open, or wiper contact is erratic (shown by fluctuations of the ohmmeter needle when any of the potentiometers are turned), replace defective part or assembly, or repair when possible.

## Associated Manuals

82570	<i>EGB-1P/2P Governor/Actuator</i>
82560	<i>EG-3P Actuator</i>
82510	<i>Magnetic Pickups and Proximity Switches for Electronic Controls</i>

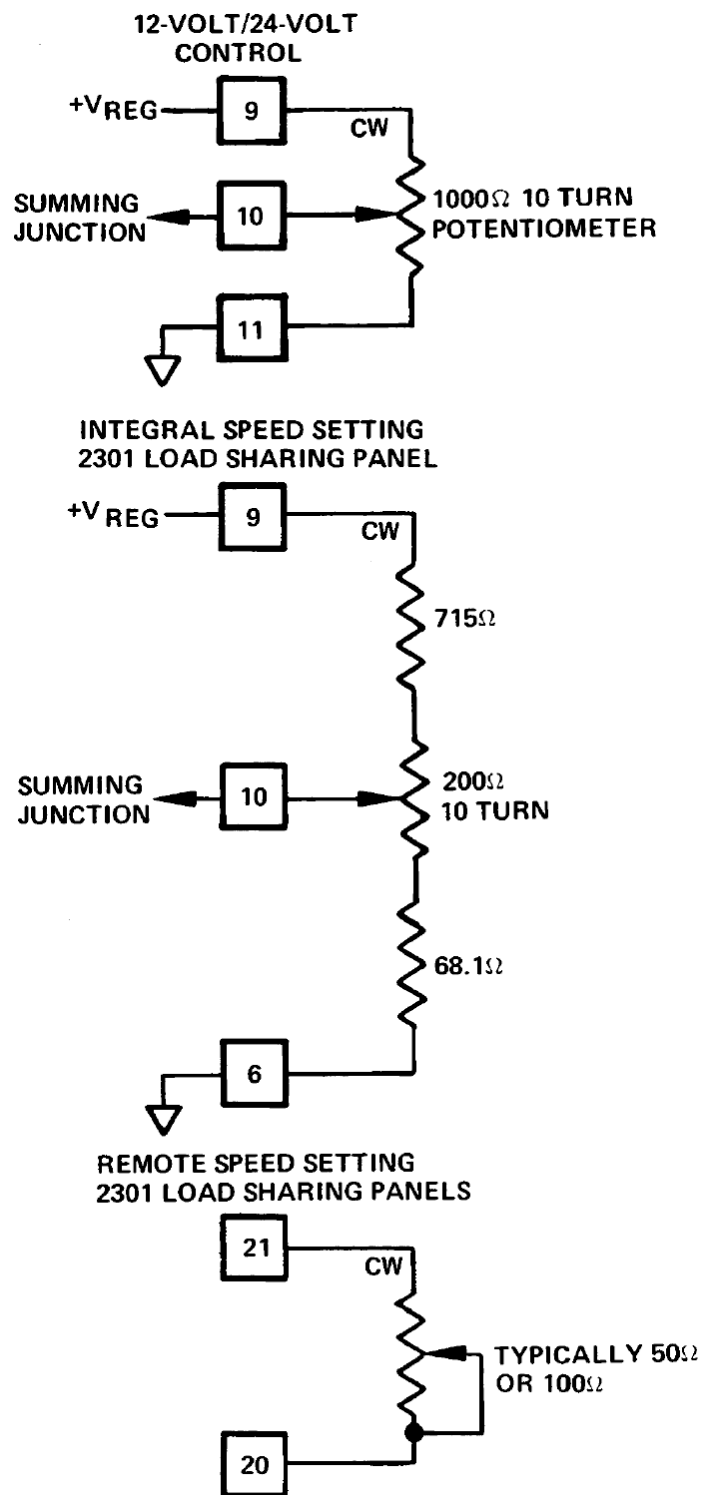


Figure 1. Potentiometer Arrangements

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**Please reference publication 82514E.**



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