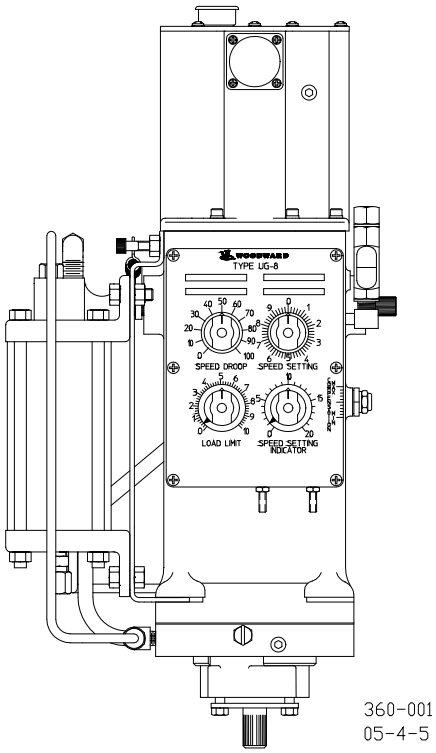
WOODWARD

Product Manual 36063
(Revision C, 12/2013)
Original Instructions



UG-8D MAS
mA Speed Setting

4–20 mA Speed Setting, Start Fuel Limit, 4–20 mA Terminal Shaft Indicator, Booster Bracket

Installation and Operation Manual

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

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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

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 Out-of-date translations are marked with ⚠.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

Manual 36063

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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

This manual contains information on installation, operation, adjustment, and troubleshooting for the 4–20 mA speed setting system, start fuel limit, terminal shaft indicator, and booster bracket for the UG-8 governor. The manual does not describe the operation of the UG-8D governor. For information on the UG Dial governor, see manual 03040, and for information on the UG-8D MAS, see manual 03047.

IMPORTANT **All drawings in this manual are for reference only.**

Description

4–20 mA Speed Setting

The speed setting system consists of an electronic final driver, which accepts the 4–20 mA signal and drives the stepper motor, which is mounted inside the UG-8 cover. This unit rotates the speeder rod, which sets the speed of the UG-8D governor.

The final driver is housed in a cast aluminum case (see Figure 1-4).

The stepper motor and the feedback potentiometer are mounted on a special bracket inside the cover, which is a part of the UG-8D (see Figure 1-5).

Start Fuel Limit

The start fuel limit is based on a solenoid that will cooperate with an adjustable bushing/plunger combination, which also mounted inside the cover (see Figure 3-2).

The start fuel limit is only active when the solenoid is energized during engine start-up, and will be de-energized after the engine has started.

The solenoid will make an oil flow possible between the control side of the power piston and the adjustable bushing of the start fuel limiter. The plunger, which is directly mounted on the power piston, will open the control port in the bushing.

The start fuel limit is adjustable from 25–90%.

Terminal Shaft Indicator

The terminal shaft indicator consists of a sensor and a 4–20 mA converter. The sensor is mounted inside the cover of the UG-8D, and is connected to the power piston link (see Figure 3-1). The 4–20 mA converter electronics are mounted in a separate box (see Figure 3-1).

IMPORTANT **The terminal shaft indicator is only available in combination with the start fuel limit.**

Booster Bracket

The booster is mounted on the side of the UG-8D governor on a bracket.

The tubing needed for proper working of the booster, is fitted directly from the UG-8D governor to the booster with special tubing (see Figure 2-2).

The booster will be activated by adding an air-signal to the air inlet during the start procedure.

Applications

The speed setting system is designed around the UG-8D governor to enable its speed to be set from remote location using a 4–20 mA current loop.

The start fuel limit is added to prevent the engine from smoking during the start-up procedure.

The terminal shaft indicator can be used on engines, which do not have a fuel rack sensor, even though a 4–20 mA signal is needed for some applications.

The booster is designed to give enough pressure below the power piston during a start up, so the UG-8D will move the fuel rack into the increase direction, in spite of a low governor rotation speed.

Some of the UG-8 auxiliary functions (such as solenoid shutdowns) can be incorporated. Please consult Woodward about new applications (see Chapter 6).

Reference Publications

The following publications contain additional product and installation information relating to the UG-8 governor.

Manual	Title
03040	UG Dial Governor
03047	UG-8/UG-40 Governors with Milliamp Speed Setting
03013	Shutdown Solenoid for UG Governors
25071	Oils for Hydraulic Controls
36684	Booster Servomotor

Product Spec	Title
03029	UG-8 Governor
03048	UG MAS Governor with Milliamp Speed Setting

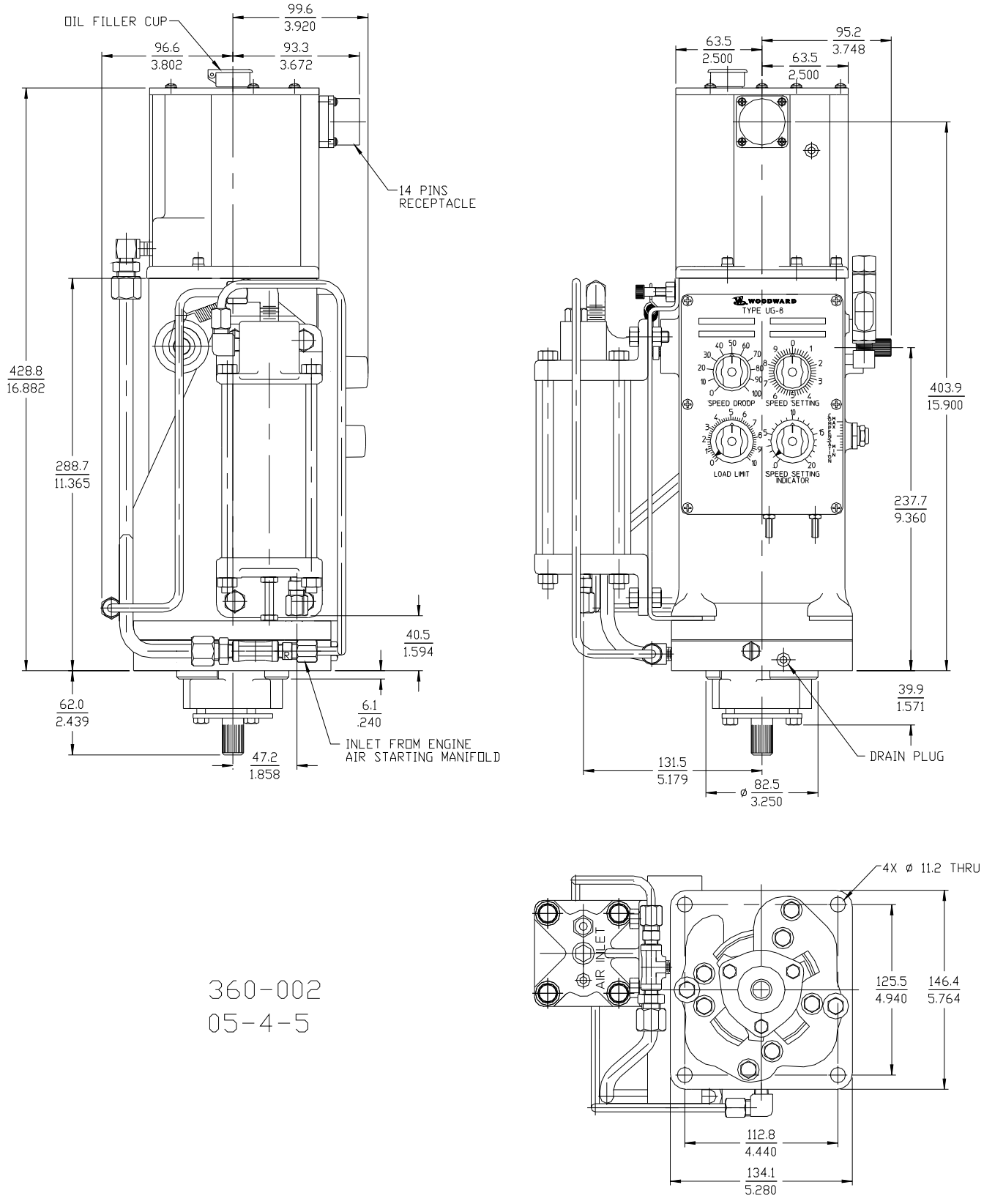


Figure 1-1. Typical Outline Drawing of the UG-8D MAS with Booster Bracket

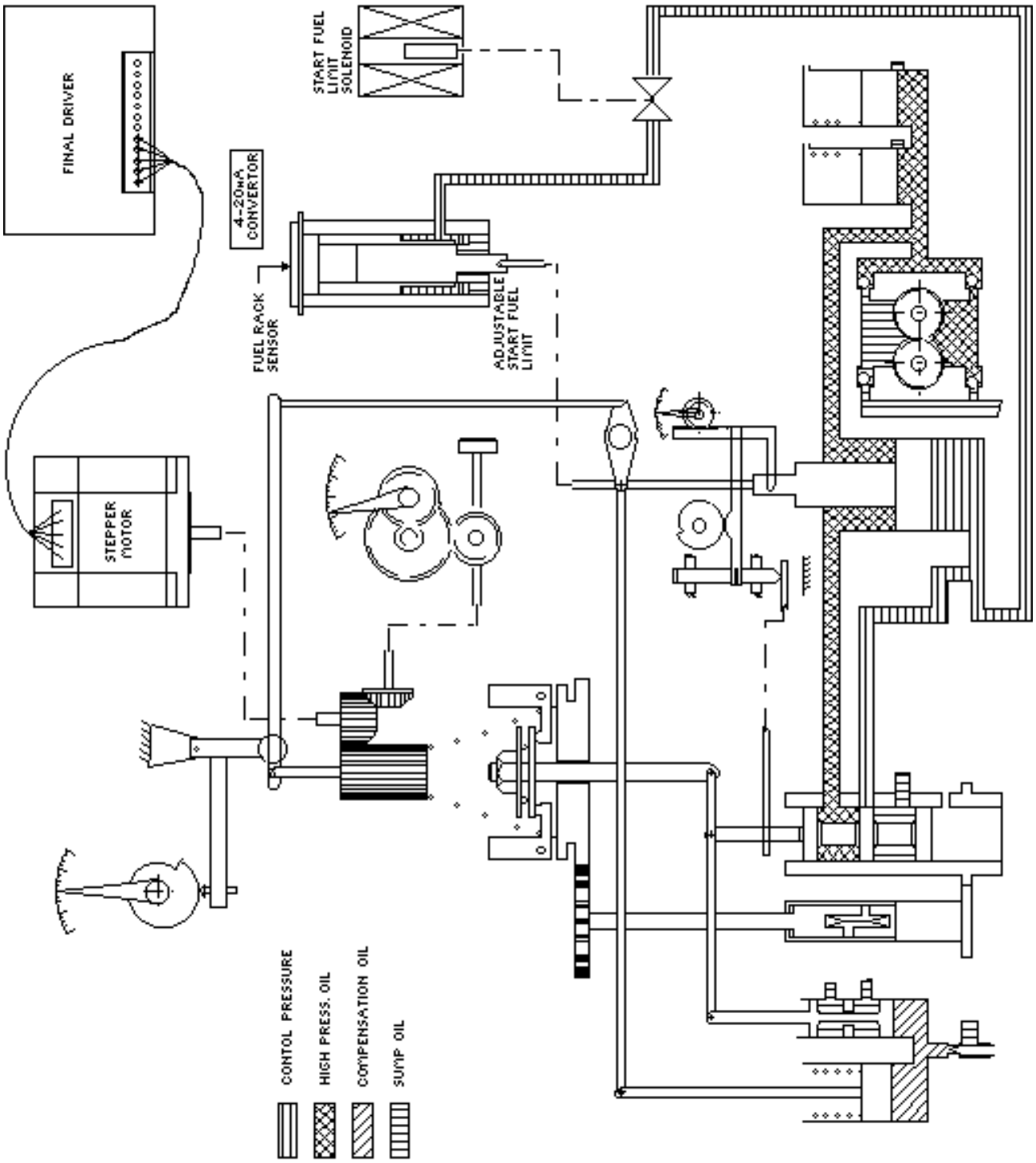


Figure 1-2. Schematic Diagram of the UG-8D MAS with Start Fuel Limit and Terminal Shaft Indicator

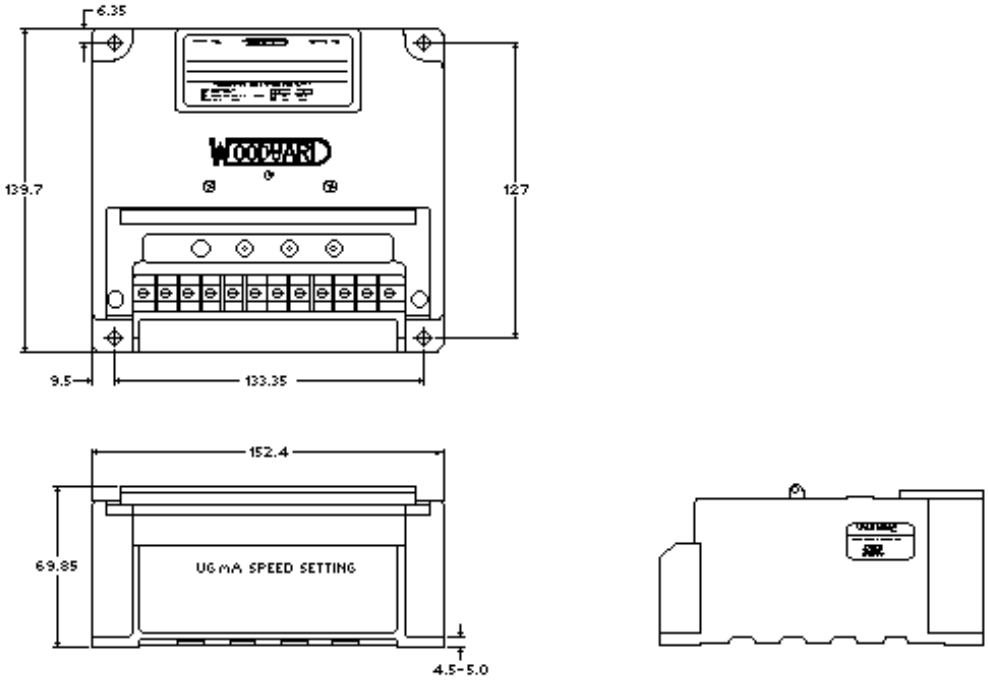
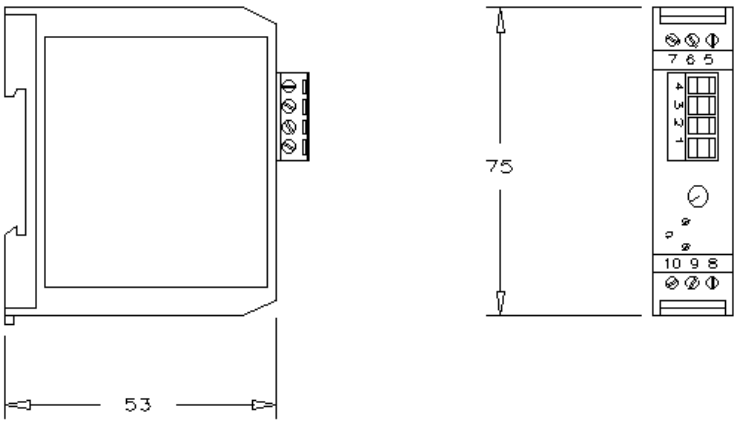


Figure 1-3. Outline Drawing of the UG MAS Final Driver Box



DESCRIPTION OF TERMINALS 1 TO 10

TERM. 1 : + POTENTIOMETER
TERM. 2 : WIPER OF POTENTIOMETER
TERM. 3 : – POTENTIOMETER
TERM. 4 : SHIELD
TERM. 5 : + 24 VDC SUPPLY
TERM. 6 : GND
TERM. 7 : GND
TERM. 8 : 4 –20 mA OUTPUT SIGNAL
TERM. 9 : GND
TERM. 10 : GND

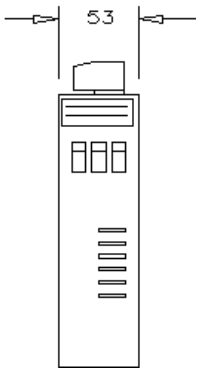


Figure 1-4. Outline Drawing of the 4–20 mA Converter Box of the Terminal Shaft Indicator

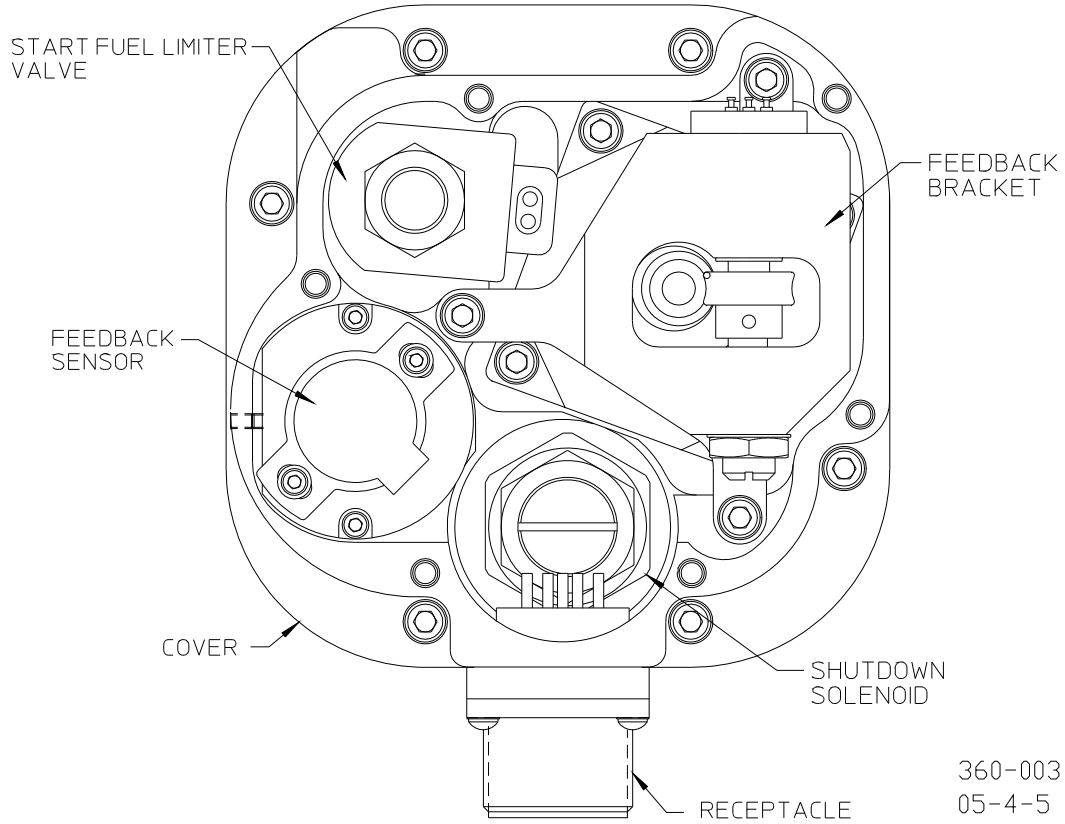


Figure 1-5. Top View of UG-8D MAS Cover

Chapter 2.
Installation

Introduction

The UG-8D MAS consists of three items the cover assembly, the final driver, and the 4–20 mA converter box. Both the final driver, and the 4–20 mA converter module are packed in a box separate from the UG-8D MAS. The cover assembly is mounted on top of the governor. This chapter covers mounting, connecting, and power requirements for these items.

Unpacking

Before handling the final driver and the 4–20 mA converter box, read page ii on electrostatic discharge awareness. Check all items for damaged, loose or broken parts. If any damage is found notify the shipper immediately.

Power Requirements

The final driver and the 4–20 mA converter box both require a voltage source of 18 to 32 volts for operating power. If a battery is used for operating power, an alternator or other battery-charging device is necessary to maintain a stable supply voltage.

At 24 Vdc, current is approximately 0.8 A when the motor is stationary and approximately 2.0 A when changing the motor position. The peaks at the moment the motor starts are slightly higher than 2 A.

At 18 Vdc, fuse at 4 A to 5 A.

NOTICE

To prevent damage to the electronics, make sure that the alternator or other battery-charging device is turned off or disconnected before disconnecting the battery from the final driver or the 4–20 mA converter.

Location Considerations

Consider these requirements when selecting the mounting location for the electronic control units:

- Adequate ventilation for cooling
- Space for servicing and repair
- Protection from direct exposure to water or to a condensation-prone environment
- Protection from high voltage or high current devices, or devices which produce electromagnetic interference
- Avoidance of vibration
- Selection of a location that will provide an operating temperature range of –40 to +85 °C (–40 to +185 °F).

The electronics must NOT be mounted on the engine, but as close to the UG-8D governor as possible. Try to avoid connections in excess of 10 meters (33 feet).

Electrical Connections

External wiring connections and shield wiring requirements for the final driver and the 4–20 mA converter box are shown in the plant-wiring diagram (see Figure 2-1).

These wiring connections and shielding requirements are explained in this section.

Shielded Wiring

All shielded cable must be twisted conducted pairs. Do not attempt to tin the braided shield. All signal lines should be sealed to prevent picking up stray signals from adjacent equipment. Connect the shields to the electronics terminal as shown in Figure 2-1. Wire exposed beyond the shield should be as short as possible, not exceeding 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 Woodward application note 50532, *EMI Control for Electronic Governing Systems*, for more information.

Where shielded cable is required, cut the cable to the desired length and prepare the cable as instructed below:

1. Strip outer insulation from BOTH ENDS, exposing the braided or spiral wrapped shield. DO NOT CUT THE SHIELD.
2. Using a sharp, pointed tool, carefully spread the strands of the shield.
3. Pull inner conductor(s) out of the shield. If shield is braided type, twist to prevent fraying.
4. Remove 6 mm (0.25 inch) of insulation from the inner conductor(s).
5. Connect wiring and shield to the terminals.

In installations with severe electromagnetic interference (EMI), additional precautions may be required, such as shielded wire run in conduit, double shielded wire, or other precautions. Contact Woodward for more information.

Final Driver

Power Supply

Connect the 24 Vdc power supply leads to terminals 1 and 2 of the final driver, positive to terminal 1, negative to terminal 2 (see Figure 2-1).

Milliamp Input Signal

The milliamp speed-setting signal from the remote location should be connected to terminals 9 and 10 of the final driver, positive to terminal 9, negative to terminal 10 (see Figure 2-1). This should be a twin-screened cable, and the shield should be connected to a secure ground. If the final driver is mounted on a grounded metal chassis or fixture, the mounting screws of the final driver may be used for this purpose. The screen should be grounded at one end only, preferably at the control end.

Stepper Motor

A total of five wires is required between the final driver and the stepper motor. Each wire should be 0.8 mm² (18 AWG) or larger. The cable can be a five-score screened cable or separate one or two-core screened cable. All screens must be terminated at the final driver end only. The connections between the final driver and the governor pins are:

Pin	Terminal
A	To 7
B	To 6
C	To 4
D	To 5
E	To 3

Feedback Potentiometer

The feedback potentiometer must be wired to the final driver using screened one-, two-, or three-core cable. Each wire should be 0.3 mm² (22 AWG) or larger. All screens must be terminated at the final driver end only. The connections between the final driver and the governor pins are (see Figure 2-1)

Pin	Terminal
F	To 13
G	To 12
H	To 11

Minor Alarm Contact

If the minor alarm function is used, the final driver terminal 8 must be wired to the alarm device so that in case of a minor alarm (such as low lube oil pressure or high cooling water temperature), 24 Vdc is supplied to terminal 8. The 24 Vdc supply voltage of the final driver should be used to feed terminal 8 (see Figure 2-1).

4–20 mA Terminal Shaft Indicator

Power Supply

Connect the 24 Vdc power supply leads to terminals 5 and 6 of the 4–20 mA converter box, positive to terminal 5, negative to terminal 6 (see Figure 2-1).

Rack Sensor Input Signal

The signal from the rack sensor, which is mounted inside the UG-8D cover, should be connected to terminals 1, 2, 3, and 4 on the 4–20 mA converter box. This must be done with a shielded cable, and the shield must be connected to terminal 4 of the 4–20 mA converter box. The shield must be connected to the 4–20 mA converter box only. The connections between the final driver and the governor pins are (see Figure 2-1):

Pin	Terminal
L	To 1
M	To 2
N	To 3
Shield	To 4

Milliamp Output Signal

The 4–20 mA output signal must be connected to terminals 8, and 9, on the 4–20 mA converter box.

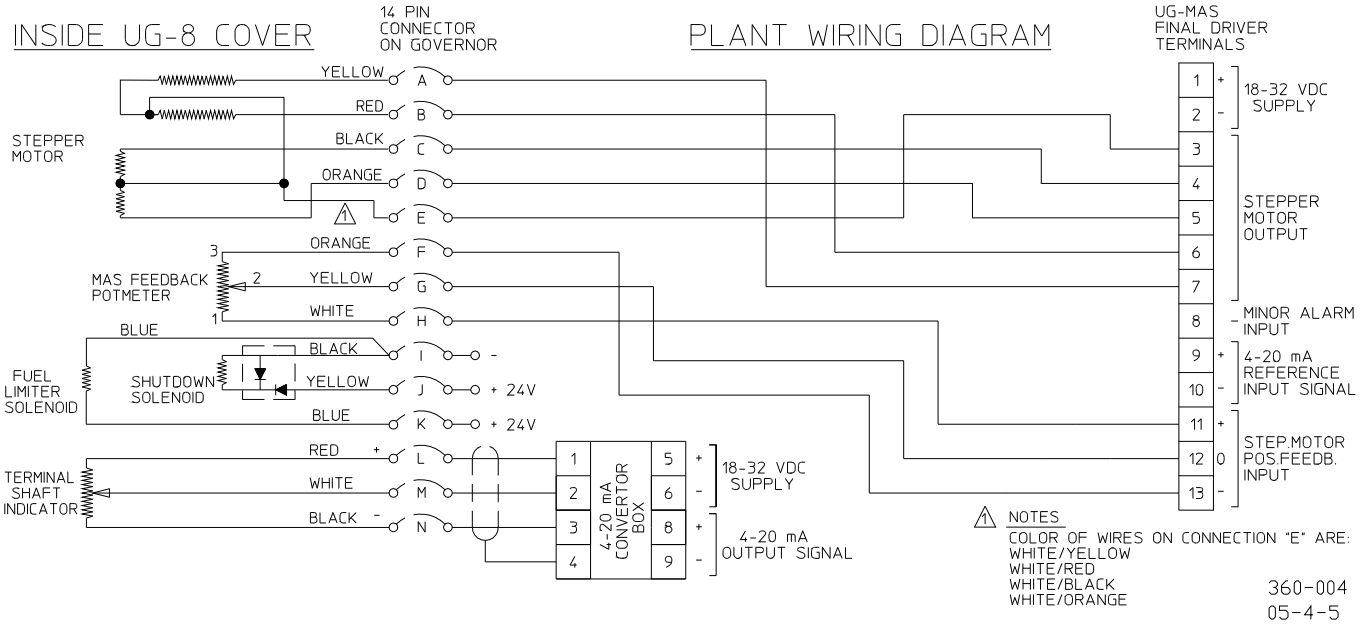


Figure 2-1. Wiring Diagram of the UG-8D MAS and the Terminal Shaft Indicator

Booster Bracket

Mounting

The booster bracket must be mounted on the UG-8D MAS with two of the four mounting screws that are used to mount the governor on the engine. On top of the booster bracket there is another screw with locking nut that will tighten down the bracket (see Figure 2-2).

Tubing

The supply oil and the pressure oil tubing of the booster bracket is factory made tubing, and will fit directly in the governor with the supplied connectors. The air supply must be connected to the air inlet of the booster with the supplied connector. For more information, see Woodward manual 36684, *Booster Servomotor*.

Terminal Return Spring

The return spring lever on the terminal shaft should be located as shown in Figure 2-2.

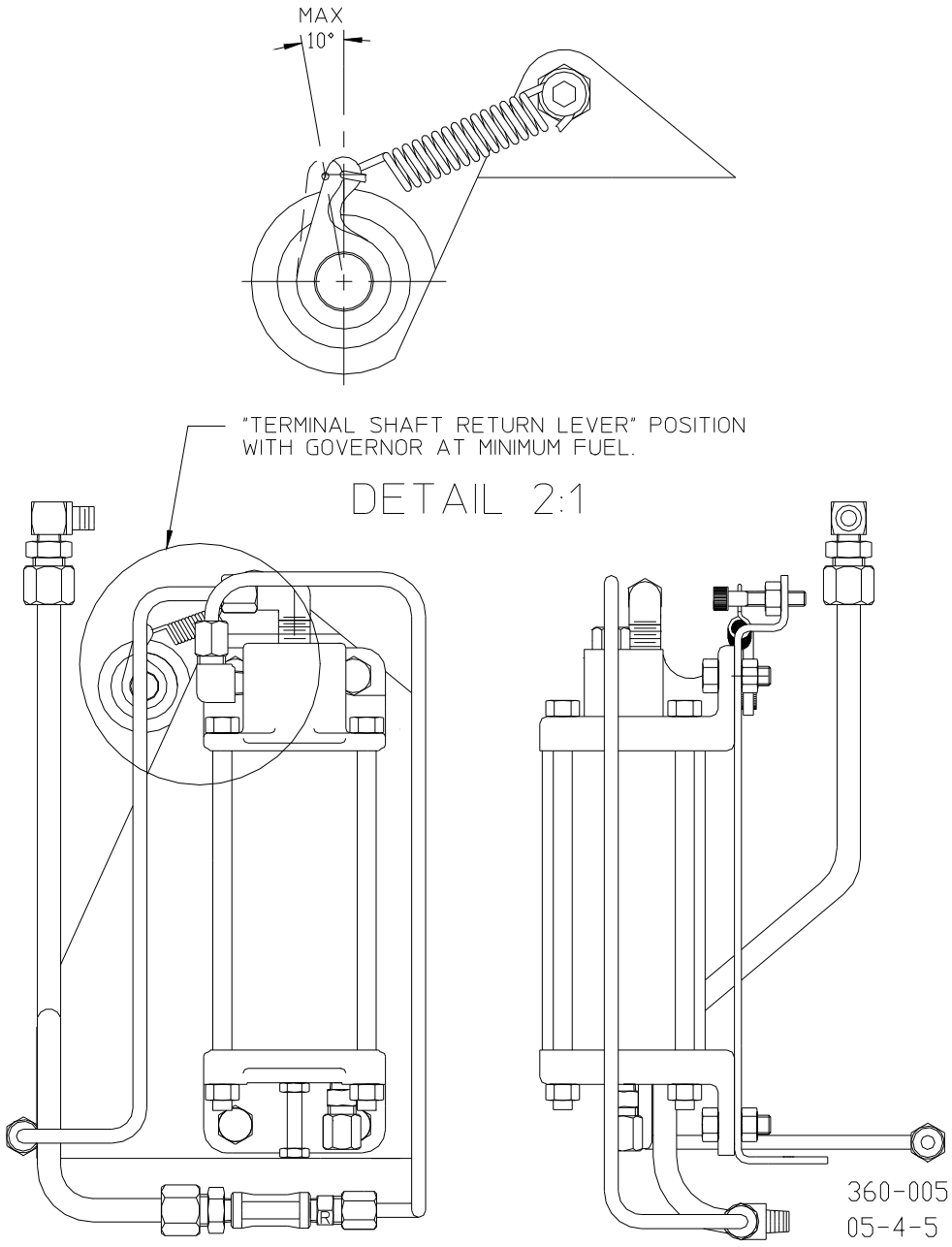


Figure 2-2. Booster Bracket. Including Booster and Tubing

Chapter 3.
Operation and Adjustments

Final Driver

Normal Operation

Once the milliamp speed setting has been properly connected, the engine may be started, stopped, and controlled according to the engine manufacturer's instructions.

The milliamp system is self-starting upon engine cranking, provided the nominal 24 Vdc is supplied to the final driver.

In the event of a fault in the final driver or loss of its 24 Vdc supply, the governor will continue to run at the last speed level that was adjusted by the mA signal, given to the final driver. The speed can then be changed by turning the manual speed setting knob on the front panel of the UG-8D governor.

When installing or first starting a milliamp speed setting, follow the procedures in this chapter.

Initial Start-up

The speed setting system (consisting of a UG-8D governor and a final driver) should be adjusted on the engine to the required speed range and ramp rates.

If the system is already adjusted and only needs to be checked for proper operation, skip the Initial Setup and Control Adjustments sections and follow the Starting Procedure section.

When the system is not yet adjusted or a replacement final driver has been installed, skip the Initial Setup section and follow the Control Adjustments and Starting Procedures sections.

Where replacement items have been fitted in the UG-8D governor assembly (such as a new cover assembly, potentiometer, or a stepper motor), begin with the Initial Setup section and continue through the end of the chapter.

Initial Setup

Where replacement items have been fitted in the UG-8D governor assembly (such as a new cover assembly, potentiometer, or a stepper motor), begin with the Initial Setup section and continue through the end of the chapter.

1. Disconnect the 24 Vdc supply power from the final driver.
2. Set the UG-8D governor at idle speed by turning the manual speed setting knob on the front panel of the governor.
3. Take the complete cover off the governor.
4. Connect a new cover, or a repaired cover, to the final driver as shown in the plant-wiring diagram, without mounting the cover on the UG-8D.
5. Without a mA input signal to the final driver, set the Idle and Rated potentiometers in the middle of their rotation range.

6. Connect the 24 Vdc supply power to the final driver. The stepper motor will now turn to its adjusted direction.
7. Disconnect the 24 Vdc supply power from the final driver.
8. Mount the cover on the governor while keeping the stepper motor shaft and the manual speed setting knob of the UG-8D governor at the position just determined in steps 2 and 6.
9. Continue with the next section.

Control Adjustments

In order to achieve the best results, follow the order of adjustment as given in this section.

Idle Speed Adjustment

This potentiometer modifies the speed setting for a given milliamp input signal. It is normally adjusted at the low speed end of range.

Set the input signal to 4 mA and adjust the IDLE SPEED potentiometer for the desired minimum controlled speed.

Rated Speed Adjustment

This potentiometer determines the speed change over the 4–20 mA input signal range. It should be adjusted at the upper end of the speed range.

Set the input signal to 20 mA and adjust the RATED SPEED potentiometer for the desired maximum controlled speed.

Repeat the Idle Speed and Rated Speed Adjustments until no further adjustment is necessary. If the required speed range cannot be achieved with the potentiometers of the final driver, adjust the stepper motor shaft in the UG-8. Lower range turn stepper motor counterclockwise, higher range turn stepper motor shaft clockwise.

Repeat steps 5 to 7 of the Initial Setup section.

Mechanical Endstops

The mechanical endstops limit the speed range in case of failure of the milliamp speed setting system in order to protect the engine from running at speeds either too low or too high.

1. Remove the aluminum panel at the front of the UG-8D governor.
2. Run the engine at 25 rpm below the normal idle speed. Rotate the left mechanical endstop clockwise until it hits the speed indicator gear. Lock the screw with the lock nut.
3. Run the engine at 25 rpm above the normal rated speed. Rotate the right mechanical endstop clockwise until it hits the speed indicator gear. Lock the screw with the lock nut.

IMPORTANT

If the motor and the coupling are connected incorrectly, the motor will not stop, but the speed setting will not be changed.

Be sure that the stepper motor does not hit against the endstop under normal operation within the 4 to 20 mA range.

Minor Alarm Adjustment

This potentiometer permits the operator to limit the maximum speed of the governor in case of problems such as low lube oil or high cooling water temperature.

1. Run the engine at rated speed using the milliamp speed setting system.
2. Apply 24 Vdc to terminal 8 of the final driver.
3. Rotate the MINOR ALARM potentiometer until the speed of the engine is at the required level.
4. Remove the 24 Vdc from terminal 8 of the final driver.

The engine should now ramp up to the rated speed.

Ramp Rates

The UP RATE and DOWN RATE potentiometers set the minimum time period in which the engine can go from idle to rated and from rated to idle speed.

Rotating the potentiometers counter clockwise will make the engine react more quickly on a mA input signal change, and rotating the potentiometers clockwise will make the engine react more slowly on a mA input signal change.

Starting Procedure

Before starting the engine apply 24 Vdc to the final driver (terminals 1 and 2).

The following adjustments can be made with the engine running under the control of the UG-8D governor as described below.

1. Study the instructions and safety precautions in the engine manufacturer's manual and the Woodward UG Governor manual (number 03040).
2. Remove the 24 Vdc from the final driver.
3. Start the engine.

⚠WARNING

Be prepared to shut down the engine in case of overspeed.

4. Verify that the engine speed is under control of the UG-8D governor by raising and lowering the mechanical speed setting knob on the UG-8D. Set the engine speed to the idle speed level.
5. Set the remote milliamp signal to 4 mA.
6. Restore the 24 Vdc supply to the final driver. The engine should now run at the adjusted low speed level.
7. Set the remote milliamp signal to 20 mA. The engine should now run at the adjusted high-speed level.

If the above steps have been completed successfully, the engine is ready for normal operation with the milliamp speed setting system.

If the milliamp levels do not correspond with the demanded speed levels, repeat this Control Adjustments section.

4–20 mA Converter Box

The 4–20 mA converter box is connected to the UG-8D MAS as shown in the Installation section (see Figure 2-1).

The adjustments of the 4–20 mA output signal must be made on the 4–20 mA converter box, and can be done on the engine while it is not running.

1. Pull, by hand, the fuel rack of the engine to the minimum fuel position and adjust with the zero potentiometer the minimum desired (4 mA) milliamp signal.
2. Push, by hand, the fuel rack of the engine to the maximum fuel position and adjust with the span potentiometer the maximum desired (20 mA) milliamp signal.
3. Repeat steps 1 and 2 until both signals are in the desired value.

If after completing step 3, the terminal is only near the desired range, but not completely, a little adjustment can be made on the senor itself inside the cover.

4. Remove the six screws of the top cover, and remove the top cover.
5. Unscrew the two hex-bolds and adjust the sensor by turning it clockwise or counterclockwise.
6. Fasten the two hex-bolds and repeat steps 1 to 3, until the desired range is reached.

If the above steps have been completed successfully, the terminal shaft indicator is ready for normal operation with other applications that need a milliamp fuel rack signal.

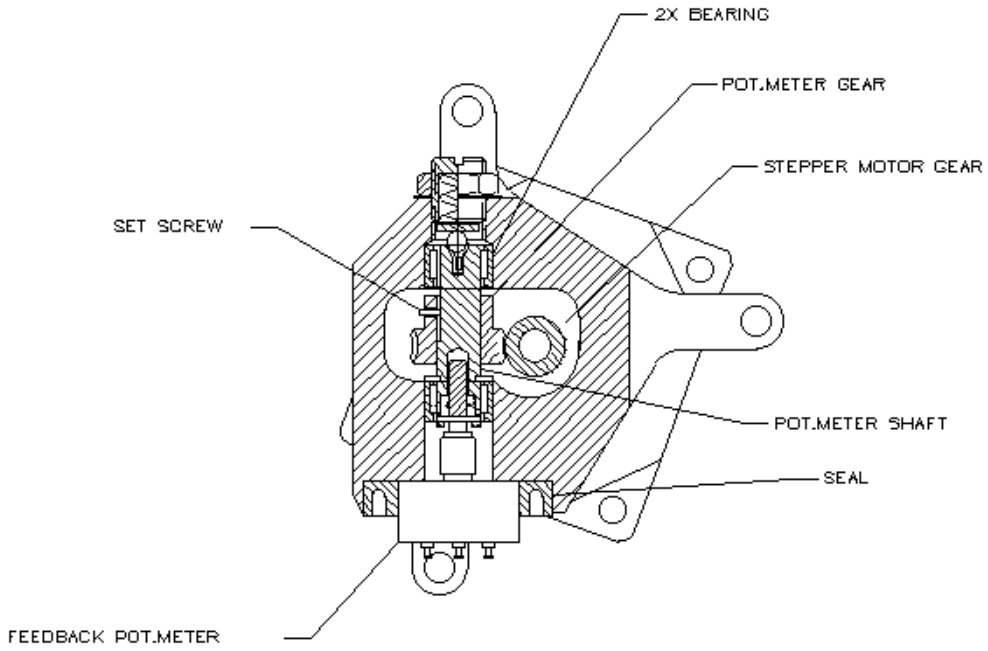


Figure 3-1. Cross Section of Feedback Bracket

Start Fuel Limit

The start fuel limit must be mechanical adjusted inside the cover of the UG-8D MAS (see Figure 3-1). The fuel limit is adjustable from 25% until 90%.

Follow the steps below to adjust the start fuel limit.

1. Remove the six screws of the top cover, and remove the top cover.
2. Unscrew the two hex-bolds and remove the sensor out of the adapter.
3. Remove the retainer ring from the helix bushing.
4. Unscrew the two hex-bolds from the adapter, and lift this out of the fitted bushing.
5. Loosen the setscrew on the side of the housing.
6. Move the fuel limit bushing up or down the fitted bushing until the desired value is reached. Up uses fuel, down uses less fuel.
7. Replace the adapter, retainer ring, sensor, and the top cover.

After replacing all the parts, check the adjustments of terminal shaft indicator. If the values of the terminal shaft indicator are changed, follow the instructions in the 4–20 mA Converter Box section to adjust this.

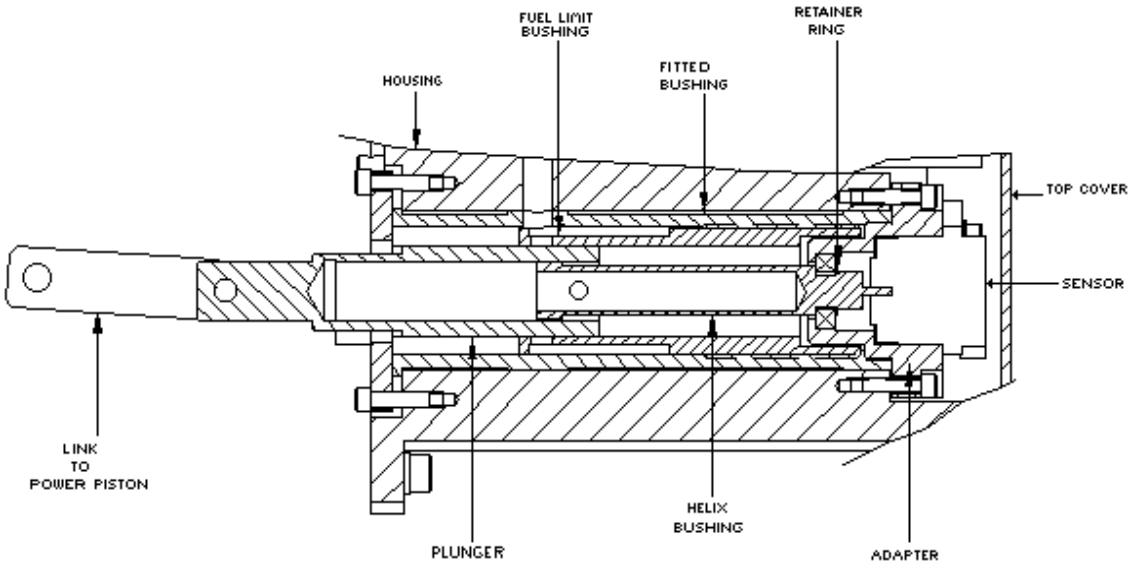


Figure 3-2. Cross Section of the Start Fuel Limit of the UG-8D MAS Governor

Booster Bracket

For proper adjustments of the booster, and the oil volumes of the booster, see Woodward manual 36684 *Booster Servomotor.*

Chapter 4.
Description of Operation

Final Driver

The system consists of a UG-8 Dial Governor with a special cover and a separate final driver (see Figure 1-2).

The cover of the UG-8 includes a stepper motor that is directly connected to the speeder screw in the UG-8 governor. On top of the stepper motor, the position of the motor is measured with a feedback potentiometer connected with a worm and gear.

In operation, the final driver compares the milliamp input signal with the voltage signal derived from the feedback potentiometer and runs the stepper motor to the position in which the milliamp signal corresponds with the feedback signal. This results in a speed setting proportional to the milliamp signal.

Start Fuel limit

The start fuel limit consists of two separate units.

Solenoid-Operated Valve

This solenoid opens a port between the power piston in the UG-8D to a plunger/bushing combination (see Figure 4-1). During the start of an engine, there can be 24 Vdc supplied to the solenoid. The solenoid will make an oil flow possible between the control side of the power piston, and the adjustable bushing of the start fuel limiter.

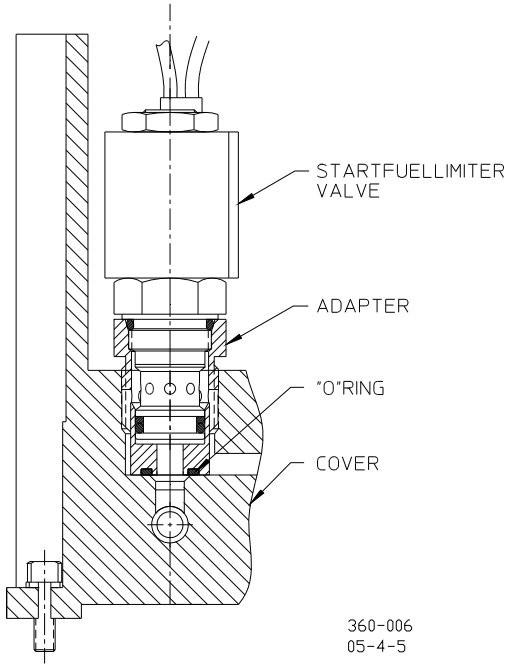


Figure 4-1. Section of the Start Fuel Limit Solenoid

Start Fuel Limit Plunger/Bushing Combination

The plunger, which is directly mounted on the power piston, will open a control port in the fuel limit bushing (see Figure 3-2).

The fitted bushing is mounted inside the housing of the cover. The top end of the fitted bushing is supplied with inner thread; the top end of the fuel limit bushing is supplied with outer thread. This makes it possible to adjust the fuel limit bushing through the fitted bushing. This makes it possible to achieve the right fuel limit point in a range from 25–90%.

At the left side of the housing there is a setscrew to lock the fuel limit bushing. The start fuel limit is adjustable from 25–90%.

4–20 mA Terminal Shaft Indicator

The terminal shaft indicator consists of a helix bushing with a sensor that is mounted inside the UG-8D cover, and a 4–20 mA converter box.

Helix Bushing and Sensor

The sensor is fitted in an adapter on top of the fitted bushing of the start fuel limit (see Figure 3-1). This sensor is connected to a rotating helix bushing, which is driven by the start fuel limit plunger, so there will be a direct connection between the power piston and the sensor.

4–20 mA Converter Box

To provide a 4–20 mA signal, there is a converter box added to the terminal shaft indicator (see Figure 1-2). This converter box will give a supply voltage to the sensor of 10 Vdc. The sensor will divide this voltage, and gives a signal to the converter box.

The electronics convert the voltage into a mA signal, which can be used for several utilities, unless the internal resistance of the utility exceeds 300 Ω.

Booster Bracket

The booster bracket is added to the UG-8D MAS to offer a complete system. This booster will give the extra pressure that is needed during the start up of the engine, because of a low engine speed, and thus a low governor rotation, there will be not enough pressure in the system of the UG-8D to move the fuel rack immediately.

On the booster, oil flow and oil volume are adjustable.

For more information, see Woodward manual 36684, *Booster Servomotor.*

The booster bracket must be mounted with two of the four screws that are also necessary to mount the UG-8D on the drive of the engine.

On top of the booster bracket, there is another screw with locking nut that will tighten down the bracket (see Figure 2-2).

The tubing with connectors for the oil supply from the UG-8D to the booster, and for the pressure oil from the booster to the UG-8D, will be factory mounted on the unit.

The return spring and lever on the terminal shaft is there to prevent overshooting of the start fuel limit. The position of this lever with spring is shown in Figure 2-2.

Chapter 5. Troubleshooting

Introduction

This chapter describes some of the problems that can be seen during the operation of the UG-8D on an engine. The chapter is divided in several parts:

- General Failures concerning the faults that can be seen in the whole unit
- Milliamp Speed Setting Faults
- Start Fuel Limit Faults
- Terminal Shaft Indicator Faults

This chapter only describes possible failures of the extra option in the UG-8D MAS governor. For failures in the UG-8D itself, see Woodward manual 03040, *UG Dial Governor.*

General Failures

The following fault conditions will result in a system malfunction:

- DC power supply below 18 Vdc
- Break in one or more wires from final driver, or 4–20 mA converter box to the UG-8D governor connector
- No oil pressure in the UG-8D system

Before consulting Woodward, please check if all signals are available in the system.

Milliamp Speed Setting Failures

This table lists some of the possible failures in the milliamp speed setting.

Symptom	Possible Cause	Remedy
Engine starts, but will only run on idle speed. There is no reaction on the milliamp input signal to the driver.	Loss of supply voltage.	Check for supply voltage on terminals 1 and 2 on the final driver.
	Loss of milliamp input signal to the final driver.	Check for voltage across terminals 9 and 10 on the final driver (0.6 Vdc for 4 mA).
	IDLE SPEED and/or RATED SPEED potentiometers are incorrectly adjusted.	Check and adjust the idle and rated speed potentiometer according to the procedure in Chapter 3.
	Break in one or more wires between the feedback potentiometer and the final driver.	Check wires and in case of any damage, replace the wires.
	Broken potentiometer, or loss of voltage to potentiometer.	Check potentiometer on resistance, and check the voltage, this voltage must be 5.0 Vdc over terminals 11 and 13.
	Break in one or more wires between final driver and the stepper motor.	Check wires and in case of any damage, replace the wires.
Engine runs well only until a certain speed lower the rated.	Minor alarm breaker closed, so there will be voltage supplied to terminal 8 of the final driver.	Check if there is any alarm active. If there is no alarm active check the voltage between terminal 2 and 8, this must be 0 Vdc.
	Rated Speed potentiometer not well adjusted.	Check and adjust the rated speed potentiometer according the procedure in Chapter 3.

Symptom	Possible Cause	Remedy
Stepper motor does not stop, and the speed setting cannot be changed by the motor.	Motor roll pin is disconnected from the coupling, or the roll pin is damaged	Contact Woodward.

Start Fuel Limit Failures

This table lists some of the possible failures in the start fuel limit system.

Symptom	Possible Cause	Remedy
Engine will not start at all.	Loss of 24 Vdc supply to start fuel limit during start up procedure.	Check for 24 Vdc supply, or broken wires between supply and connector on UG-8D MAS.
	Fuel limit bushing not well adjusted.	Check and adjust the fuel limit bushing according to the procedure in Chapter 3.
Engine runs at rated, but will not pick-up any load higher than a certain point.	24 Vdc supply signal is active after the engine is started.	Check voltage between pins I+K on the connector. This must be 0 Vdc.

4–20 mA Terminal Shaft Indicator Failures

This table lists some of the possible failures in the 4–20 mA terminal shaft indicator system.

Symptom	Possible Cause	Remedy
There is no mA. Signal from the converter box at all.	Loss of supply voltage.	Check voltage between terminals 1+2 on the 4–20 mA converter box. This must be 24 Vdc.
	One or more wires broken.	Check all wires from and to the 4–20 mA converter box and replace them when broken.
Wrong milliamp output signal.	4–20 mA converter box not well adjusted.	Check and adjust level and range potentiometers in the 4–20 mA converter box.
Milliamp output signal is not adjustable between 4 and 20 mA in converter box.	Sensor inside UG-8 cover not well adjusted.	Check and adjust the sensor according to the procedure in Chapter 3.

Chapter 6.
Product Support and Service Options

Product Support Options

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

1. Consult the troubleshooting guide in the manual.
2. Contact the **OE Manufacturer or Packager** of your system.
3. Contact the **Woodward Business Partner** serving your area.
4. Contact Woodward technical assistance via email (**EngineHelpDesk@Woodward.com**) with detailed information on the product, application, and symptoms. Your email will be forwarded to an appropriate expert on the product and application to respond by telephone or return email.
5. If the issue cannot be resolved, you can select a further course of action to pursue based on the available services listed in this chapter.

OEM or Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full-Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.

A current list of Woodward Business Partners is available at **www.woodward.com/directory**.

Product Service Options

Depending on the type of product, the following options for servicing Woodward products may be available through your local Full-Service Distributor or the OEM or Packager of the equipment system.

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime.

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Flat Rate Repair: Flat Rate Repair is available for many of the standard mechanical products and some of the electronic products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option, with the exception that the unit will be returned to you in "like-new" condition. This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:
- return number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:
- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Replacement Parts

When ordering replacement parts for controls, include the following information:
- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

Engineering Services

Woodward's Full-Service Distributors offer various Engineering Services for our products. For these services, you can contact the Distributor by telephone or by email.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact.

Product Training is available as standard classes at many Distributor locations. Customized classes are also available, which can be tailored to your needs and held at one of our Distributor locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact one of the Full-Service Distributors listed at **www.woodward.com/directory**.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory published at **www.woodward.com/directory**.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used In Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Products Used In Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used In Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

For the most current product support and contact information, please visit our website directory at **www.woodward.com/directory**.

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name

Site Location

Phone Number

Fax Number

Prime Mover Information

Manufacturer

Engine Model Number

Number of Cylinders

Type of Fuel (gas, gaseous, diesel, dual-fuel, etc.)

Power Output Rating

Application (power generation, marine, etc.)

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter

Control Description or Governor Type

Serial Number

Control/Governor #2

Woodward Part Number & Rev. Letter

Control Description or Governor Type

Serial Number

Control/Governor #3

Woodward Part Number & Rev. Letter

Control Description or Governor Type

Serial Number

Symptoms

Description

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Revision History

Changes in Revision C—

- Added fuse rating information for driver box (page 7)

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 36063C.

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