02008

WOODWARD

FUEL LIMITER
REVERSE ACTING
MODEL 8272-789

Installation and Operation

WOODWARD GOVERNOR COMPANY

MANUAL 02008

WARNING

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.

The engine, turbine, or other type of prime mover should be equipped with an overspeed (overtemperature, or overpressure, where applicable) shutdown device(s), that operates totally independently of the prime mover control device(s) to protect against runaway or damage to the engine, turbine, or other type of prime mover with possible personal injury or loss of life should the mechanical-hydraulic governor(s) or electric control(s), the actuator(s), fuel control(s), the driving mechanism(s), the linkage(s), or the controlled device(s) fail.

CAUTION

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 PCB with your hands or with conductive devices.

Chapter One
Introduction

A fuel limiter is an electronic device that limits the maximum drive signal to an actuator. The amount of drive current reaching the actuator is determined by the input to the limiter.

The 1-5 Vdc input signal may be from a manifold-pressure sensor, a load sensor, or from a sensor that monitors some other process-related parameter. The fuel limiter also receives an actuator signal from a reverse acting 2301A control. (200 mA signal is minimum fuel, 0 mA is maximum fuel.) This signal is called the "control signal" to the limiter.

Fuel limiters are commonly used to reduce diesel emissions during starting and to provide more efficient engine load or speed increases.

The start-fuel-limiting application reduces smoke by limiting the maximum actuator signal that reaches an actuator during starting.

The fuel limiter consists of a printed-circuit board enclosed in a sheet-metal box. All adjustments and connections for external wiring are accessible from the front of the control.

Chapter Two
Description of Operation

Figure 2-1 is a block diagram of the 8272-789 fuel limiter. The limiter is designed to provide a maximum actuator signal on a schedule determined by the setting of the slope and level potentiometers for Limiter 1 and Limiter 2.

In operation the limiter modifies a 1-5 volt signal that is proportional to inlet-manifold pressure. This modified signal is then used by the limiter to generate a signal that is reflective of the position on the slope. A modified control-actuator signal is compared with this signal and the highest signal is generated by the current driver to provide a 40-160 mA signal for the actuator on the engine.

The limiter prevents over fueling the engine when the inlet manifold pressure is too low to properly mix a certain amount of fuel. This operation will prevent unnecessary smoke and will also provide more efficient engine load or speed increases.

If the contacts between terminal 12 and 13 are closed the fuel limiter functions are both disabled and the actuator signal will always exactly track the control signal. Should these contacts open the limiter will follow the highest signal from either the speed control or from the limiter schedules.

If the contacts between 14 and 13 or 14 and 15 are closed that respective fuel limiter slope will be disabled and the remaining slope will still be limiting the actuator based on the 1-5 Vdc input. These contacts should only be closed to disable one fuel limiter schedule or the other. Close the contacts between 12 and 13 to disable both limiters at the same time.

NOTE

If the circuit between terminals 12 and 13 is closed the contacts between terminals 14 and 15 and 14 and 13 must be open. If either of the slope contacts (14-15 or 14-13) are closed at the same time as terminals 12-13 the limiter circuits maybe stressed and/or over heated.

CAUTION

The fuel limiter, when active, limits the drive-signal current to the actuator. The actual position of the fuel-rack may vary, depending on temperature, actuator calibration, linkage wear, or other factors.

The fuel limiter must be powered up at all times the engine is running. Should the limiter lose power, the actuator signal will be interrupted. With no control signal the electric side of the reverse acting actuator will call for maximum fuel.

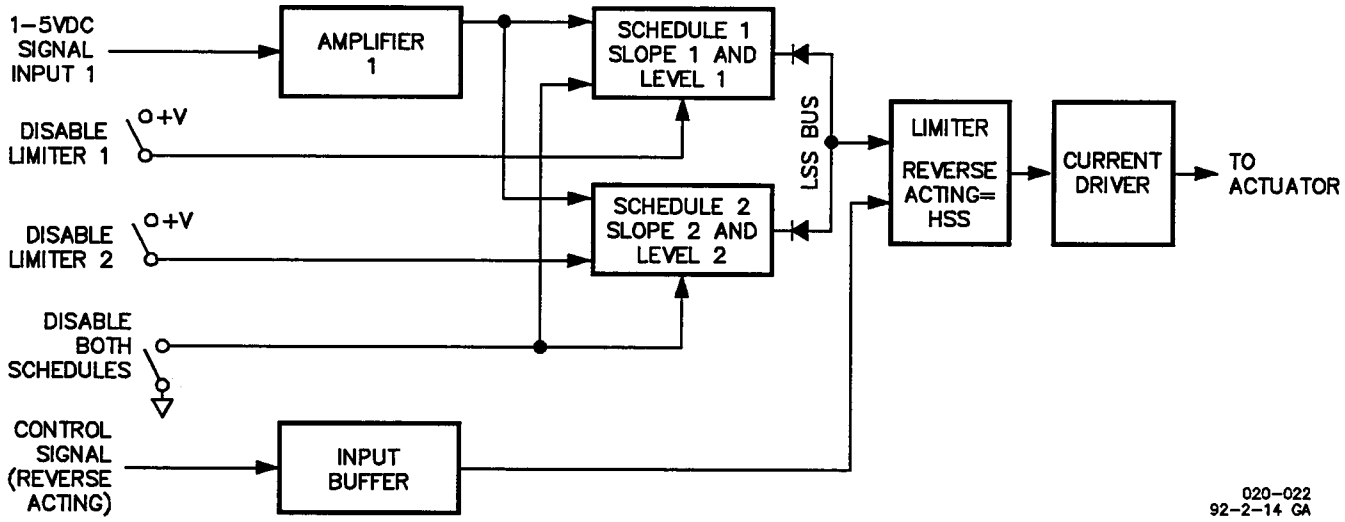

Figure 2-1. Block Diagram of 8272-789 Fuel Limiter

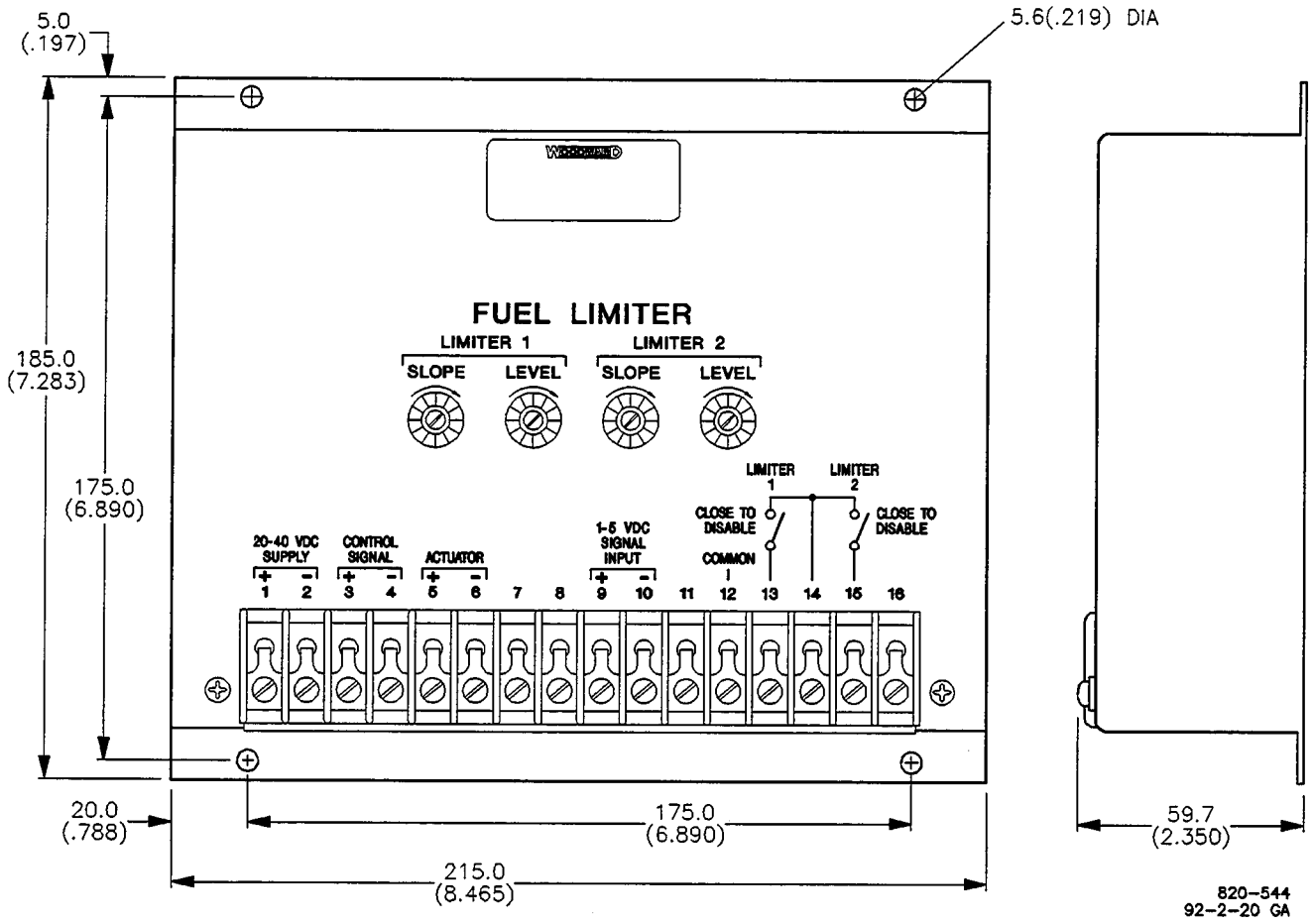

Figure 3-1. Outline Drawing of Fuel Limiter 8272-789

Chapter Three
Installation

INTRODUCTION

This chapter contains general installation instructions for the fuel limiter. Power requirements, environmental precautions, and location consideration are included. Electrical wiring instructions are included.

UNPACKING

The Fuel Limiter is shipped in a foam protected box. Should any damage be discovered while unpacking the limiter, immediately contact the shipper and Woodward.

The limiter is packaged in a special antistatic protective bag. Leave the control in its protective bag until ready to install. An antistatic bag should always be used when the control box is moved or replaced.

INSTALLATION

POWER REQUIREMENTS

The fuel limiter requires a voltage source of 20 to 40 Vdc for operating power. If a battery is used for operating power, provide a battery charger to maintain a stable dc supply voltage.

CAUTION

Do not exceed the allowable range for the supply voltage. Over 40 volts will damage the control. Severe voltage spikes also can damage electronic controls.

LOCATION CONSIDERATIONS and MOUNTING THE CONTROL

The fuel limiter is designed to operate within a temperature range of -40 degrees to 160 degrees Fahrenheit. The unit may be mounted in any position, provided adequate ventilation is allowed for cooling.

The fuel limiter is shipped with a throwaway cover on the bottom of the box. Detach and discard the cover, being careful not to touch the printed-circuit board.

Install the box in an off-engine location. Consider the needs for adequate ventilation, space for servicing and repair, proximity to auxiliary electrical equipment, and to extreme heat or vibration.

The control box is open on the bottom. Do not attempt to seal the unit to the installation surface as this would disrupt expected air movement and might cause over heating of the unit. Additional air circulation or cooling will not be required.

ELECTRICAL CONNECTIONS

The plant wiring diagram (Figure 3-2) shows all external wiring connections needed for installation. Be sure to follow all shielding requirements.

SHIELDED WIRING

All shielded cable must be twisted-conductor pairs. Do not attempt to tin the braided shield. See the plant wiring diagram for shield requirement. Connect shield to system ground (chassis) at one point at the limiter end only. The end away from the limiter must be left unconnected. Do not run shielded lines in a conduit with high-current carrying cables.

Shields on the wires to the actuator and on the input from the manifold pressure sensor should be grounded at the limiter. The shield on the wires from the control to the limiter should be grounded at the control and left open at the limiter.

Ground shields at one end only. Do not ground at both ends.

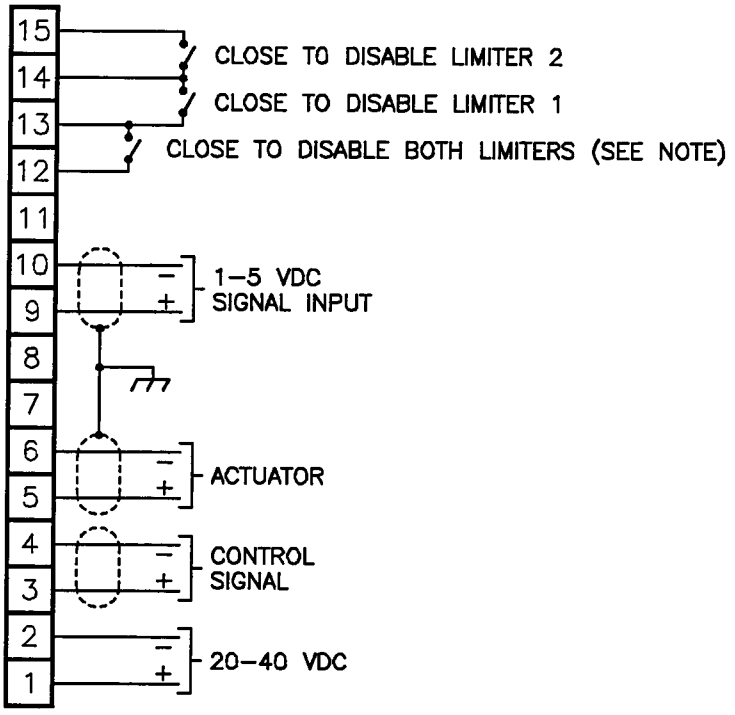

Figure 3-2. Plant Wiring Diagram

Chapter Four
Limiter Adjustment and Trouble Shooting

INTRODUCTION

Fuel Limiter schedules are adjustable, but adjustment is not recommended in a field application. The engine manufacturer usually adjusts the individual unit to match an individual engine, then seals the adjustments to prevent movement.

This chapter provides guidelines for adjustment in cases where the limiter has been replaced or where application of the engine has changed and adjustment is necessary.

TROUBLE SHOOTING PROCEDURE

The solid-state circuitry in the limiter should not shift limiting schedules during the life of the limiter. Should an engine that has been operating acceptably start to smoke or exhibit other indications of limiter problems first check the manifold pressure sensor, the turbo, the waste gate, the linkage from the actuator to the fuel control, the wiring (pay particular attention to the shielding), and the condition of the engine itself.

In most installations the limiter can be bypassed and the actuator signal from the control run directly to the actuator. This may help determine if the limiter is at fault.

Operational Test

1. Remove the limiter from the control system. Connect a 35 ohm, 25 watt resistor between the actuator output terminals 5 (+) and 6 (-). (The resistor is used to simulate the actuator. Connect an ammeter capable of reading 0-200 mA across terminals 5 (+) and 6 (-).

2. Connect a 24 Vdc power supply, minimum capacity of 1.5 amps, to terminals 1 (+) and 2 (-).

3. Connect a variable 1-5 Vdc power supply to terminals 3 (+) and 4 (-).

4. Connect a variable 1-5 Vdc power supply to terminals 9 (+) and 10 (-).

5. Jumper terminal 12 to terminal 13. (There must be no connection between terminals 13, 14, and 15.)

6. As the control signal power supply across terminals 3 and 4 is varied an identical signal should be read across terminals 5 and 6.

7. Remove the jumper between terminals 12 and 13. Set the input at terminals 3 and 4 at maximum (6 Vdc or 160 mA). Set the input of the

variable power supply across terminals 9 and 10 at 5 Vdc.

8. Observe the voltage across terminals 5 and 6 increase as the input to terminals 9 and 10 is decreased. (The accompanying graph shows relative output in mA for given limiter voltage inputs. Notice that the output decreases as the manifold signal increases. This is correct for a reverse acting control system.) The graph shows the factory setting for the limiter. The engine manufacturer may have changed this setting and the user cannot expect the limiter output to exactly follow the graph.

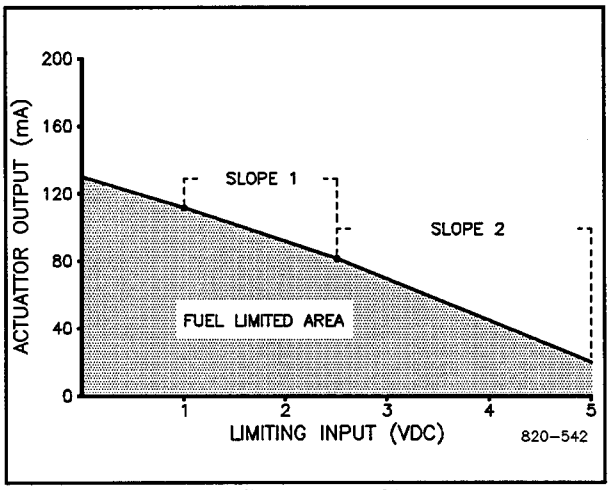

Figure 4-1. Limiter Levels and Slopes

9. If the troubleshooting observations are as outlined the operator can assume the limiter is operating correctly . Be careful when replacing the limiter in the control system to attach all wiring according to the plant wiring diagram and to complete all shielding requirements.

LIMITER ADJUSTMENT

The desired limiter slopes must be determined before setting up the limiter. Until the starting and ending level of each slope is known a new limiter cannot be adjusted. (Most actuators are almost exactly linear (the actuator output position moves in direct proportion to the magnitude of the control signal). However, linkage between the actuator and the fuel control can modify this linearity. If the adjustment of the fuel level (power output) of the engine is not exactly proportional to the control signal to the actuator the levels and slopes of the limiter may have to be modified.

1. Set up the limiter as described in steps 1, 2, 3, and 4 above.

2. Set the voltage input to terminals 3 and 4 to 0 Vdc.

3. Close contacts between terminals 14 and 15 to deactivate the second slope. Open contacts between 12-13 and 13-14.

4. Set both Level potentiometers fully clockwise (CW).

5. Set both Slope potentiometers fully counterclockwise (CCW).

6. Set the variable supply for the minimum manifold signal at terminals 9 and 10. Set the variable supply at Terminals 3 and 4 for the maximum signal (6 volts).

7. Adjust the Level 1 potentiometer CCW until the actuator signal at terminals 5 and 6 reaches the voltage for maximum limiting.

8. Set the supply at terminals 9 and 10 for the desired level for the end of Slope 1 and start of Slope 2.

9. Adjust the Slope 1 potentiometer CW until the actuator output from the limiter reaches the desired level for this position on your graph.

10. Check the output of limiter for desired range. Repeat steps 6 through 9 until the output of the limiter matches your graph.

11. Open contacts between terminals 14 and 15 and close contacts between 13 and 14 to activate the second slope and deactivate the first slope.

12. Adjust the Level 2 potentiometer CCW until actuator voltage reaches the same level as in step 9.

13. Adjust the supply at terminals 9 and 10 for the desired level at maximum manifold pressure.

14. Adjust the Slope 2 potentiometer CW until the actuator output reaches the level as shown on your graph.

15. Check output of the limiter for desired range. Repeat steps 11 through 14 until the output of the limiter matches your graph.

16. Open the contacts bewtween terminals 13 and 14. Adjust supply at terminals 9 and 10 from minimum to maximum (1-5 Vdc). Measure the output at terminals 5 and 6. The voltage should follow the desired limiting schedule without any "bumps" in the output. If there are noticeable steps in this output repeat steps 6 through 15.

Chapter 5
Repair and Replacement Procedures

INSTRUCTIONS FOR RETURNING EQUIPMENT FOR REPAIR

If any part of the electronic control is to be returned to Woodward Governor Company for repair, attach a tag to the part with the following information:

- Name and location where the control is installed.
- Complete Woodward Governor Company part number(s) and serial number(s).
- Description of the problem.
- Instructions describing the desired type of repair.

NOTE

Before handling any electronic component, read Manual 82715, "Guide for Handling and Protection of Electronic Controls."

Use the following materials when returning a complete control:

- Antistatic packing materials that will not damage the surface of the unit.
- At least four 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.

REPLACEMENT PARTS INFORMATION

When ordering replacement parts for electronic controls, include the following information:

- The part number (8272-789) from the enclosure nameplate.
- The unit serial number, which is also on the nameplate.

For more information on replacement parts, contact Woodward Governor Company, Engine and Turbine Controls Division, PO Box 1519, Fort Collins, Colorado 80522, USA. Telephone (303)-482-5811, or contact your nearest Woodward Governor Company service facility.

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Woodward Governor Company
Attention: Technical Publications
PO Box 1519
Fort Collins CO 80522-1519, USA

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WOODWARD

Industrial Controls
Woodward Governor Company, PO Box 1519 (1000 East Drake Road), Fort Collins CO 80522-1519, USA
Phone (1)(970) 482-5811 • Fax (1)(970) 498-3058

Global Services
Woodward Governor Company, PO Box 3800 (3800 North Wilson Avenue), Loveland CO 80539-3800, USA
Phone (1)(970) 663-3900 • Fax (1)(970) 962-7050

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