

4024 All Electric Governor System



DESCRIPTION

The 4024 EPG is a three-component governing system for 24 Vdc operation. The system includes an electronic speed control, a magnetic pickup, and a long-life, all-electric actuator.

The actuator is designed to be installed on the prime mover and mechanically linked to the fuel control. The actuator provides 42 degrees of rotation. Actuators move toward increase with increased electric-drive signal from the control. A return spring is required to move in the decrease direction. A rotary return spring may be ordered with the actuator, or a return spring may be installed by the user.

Pulse-width modulating the output to the actuator rather than having a constant-voltage drive keeps the driver from becoming too hot.

The speed control is housed in a rugged aluminum casting which permits installation on the engine skid. In operation, the control compares the actual speed of the engine with the desired speed, then calculates an error signal and causes the actuator to correct the off-speed condition.

The actuator portion of the system may be installed in a vertical or horizontal position. The control box may be mounted on the skid, but is not designed for installation on the engine itself.

APPLICATIONS

The 4024 EPG system is designed to provide electronic control to diesel, gas, and gasoline fueled engines which require up to 5.4 N·m (4 lb-ft) of torque to operate the fuel rack or fuel valve.

The system is particularly suited to engines or turbines without a mechanical drive or hydraulic oil supply for the governor.

STANDARD FEATURES

4024 control electronics include adjustable speed, stability, and start fuel position limit.

The start fuel position limit prevents the actuator from exceeding a preselected position until after speed increases to 90 percent of rated. The fuel limit is activated when speed drops to near zero. If start fuel limit is not desired it may be adjusted out of the way.

Stability and gain adjustments provide the response rate and response magnitude to fit the individual engine.

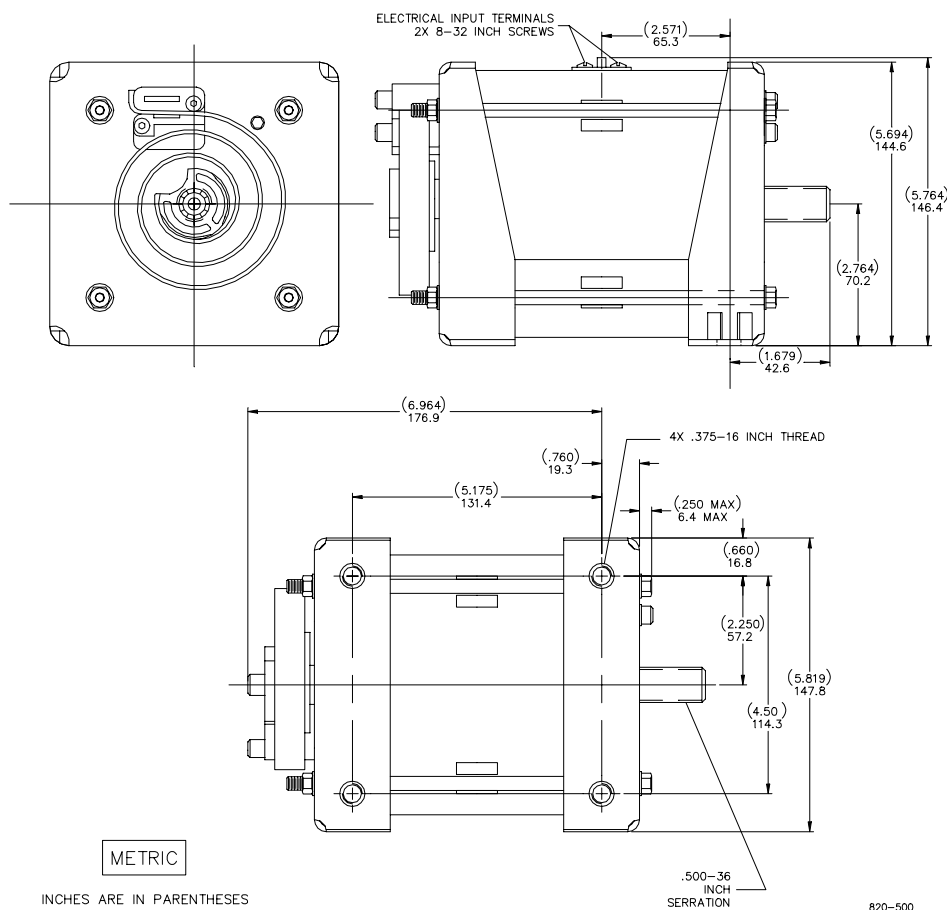
Rated speed is adjusted as desired. Idle speed is adjusted with a potentiometer from 25 to 100 percent of rated.

The system includes circuitry which allows an auxiliary input for load sharing through a load sensor. Ramp generators may be added or a capacitor can be added to provide a non-linear ramp between idle and rated and between rated and idle.

- No Mechanical Drive or Hydraulic Supply is Required for Governor
- Stalled Work Rating of 5.4 J (4 ft-lb) Increase Direction, 4.6 J (3.4 ft-lb) Decrease Direction
- Start Fuel Limit Included with All Controls
- Economical All Electric Governor System for Larger Diesel Engines
- Accepts Load Sharing Accessories

ACTUATOR SPECIFICATIONS

- Output Shaft**.....500-36 (inch) serration on output shaft. Side opposite linkage used for return spring.
- Operating Temperature Range**.....-34 to +100 °C (-30 to +212 °F).
- Construction**Aluminum and steel parts. All parts treated for corrosion resistance. Not painted. Sealed bearings and low moving mass provide long service-free life.
- Weight**.....The 4024 actuator weighs about 18 kg (40 lb).
- Vibration Tested**Tested to US Mil-Std-810C, curve T, 30 G. Shock tested to US Mil-Std 901C, 400 lb hammer. Rotor design is balanced to minimize vibration-induced output-shaft motion.
- Electrical Characteristics**.....Resistance 1.4 ±14 Ω at 20 °C. Inductance +45 mH at 500 Hz. Current=7 A maximum continuous, 10 A maximum transient.
- Return Spring**.....With actuator at 0°, return-spring torque is at 1.1 N·m (10 lb-in). With actuator at 42°, return-spring torque is at 11.3 N·m (100 lb-in).



4024 Actuator Outline (CCW version shown)

EPG CONTROL SPECIFICATIONS

Speed Range

A switch selects one of the following ranges (rating is based on frequency of sensed gear not necessarily engine rpm):

- 750 to 1500 Hz
- 1200 to 3000 Hz
- 2800 to 6000 Hz
- 5800 to 12 000 Hz
- 7500 to 15 000 Hz

Response

Response of the controls is different for diesel and gas turbine applications than for gasoline and gas fueled (spark ignited) engines.

Fuse and Wiring

4 mm² (12 AWG) stranded wire used to connect the battery source to the control and the control to the actuator. Wire must be as short as possible, total distance from battery to control and from control to actuator not to exceed 6.7 m (22 ft). A 15 A fuse is required between battery and control.

Battery

Voltage source must be between 18 and 32 Vdc. Leads from battery to the control must be direct and not pass through any distribution points.

Magnetic Pickup

Must provide 1.5 Vrms minimum and at least 10% of rated speed while cranking.

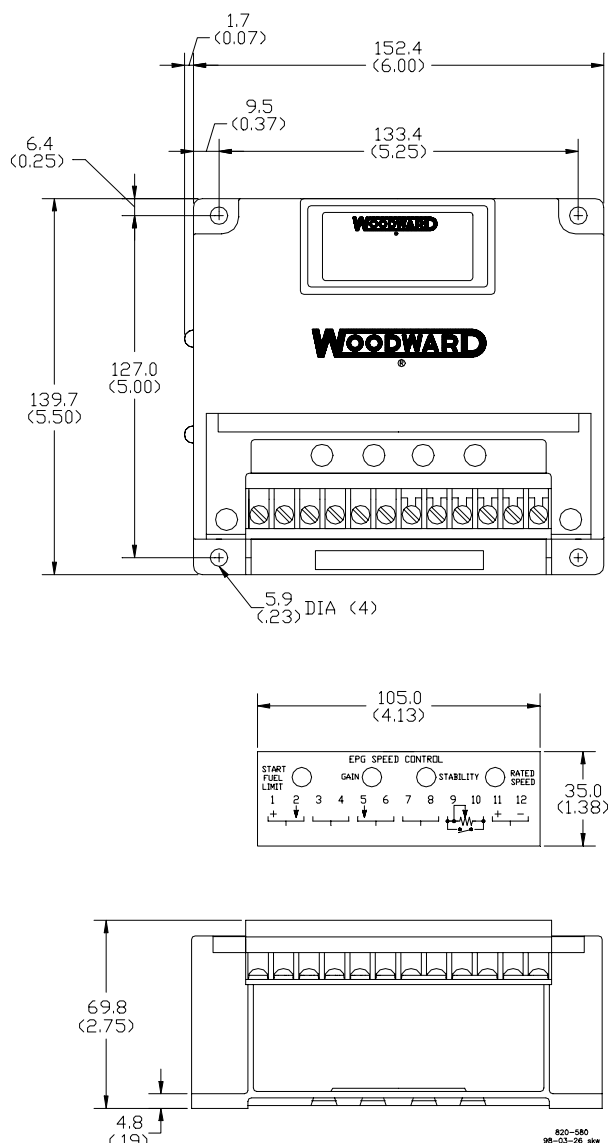
Magnetic pickup device is available from Woodward.

Steady State Speed Band

The control typically maintains ± 0.250 of 1% of rated speed.

Ambient Temperature Range

-40 to +75 °C (-40 to +167 °F)



4024 Control Box Outline

4024 PART NUMBERS

Actuator

Model 4024, 24 Vdc, CW output	8256-060
Model 4024, 24 Vdc, CCW output.....	8256-080
Model 4024, 24 Vdc, with position feedback, CW output.....	8256-097
Model 4024, 24 Vdc, with position feedback, CCW output	8256-100

Speed Control (Isochronous)

Model 4024, 24 Vdc, speed control for natural gas or gasoline, with start fuel limit.....	8290-147
Model 4024, 24 Vdc, speed control for diesel or turbine, with start fuel limit	8290-148

Driver/Wiring Harness/Linkage Kit

Model 4024 Actuator Driver, 1-5 Vdc or 4-20 mA input	8290-153
Wiring Harness for Model 4024 with position feedback, low profile kit	8293-538
Wiring Harness for Model 4024 with position feedback, low profile harness	5416-985
General Linkage Kit for Model 4024 (1 lever [3699-027], 2 rod ends)	8293-093
Lever for Model 4024, EG-10P (.5x36 serrations).....	3699-027

Installation Kits

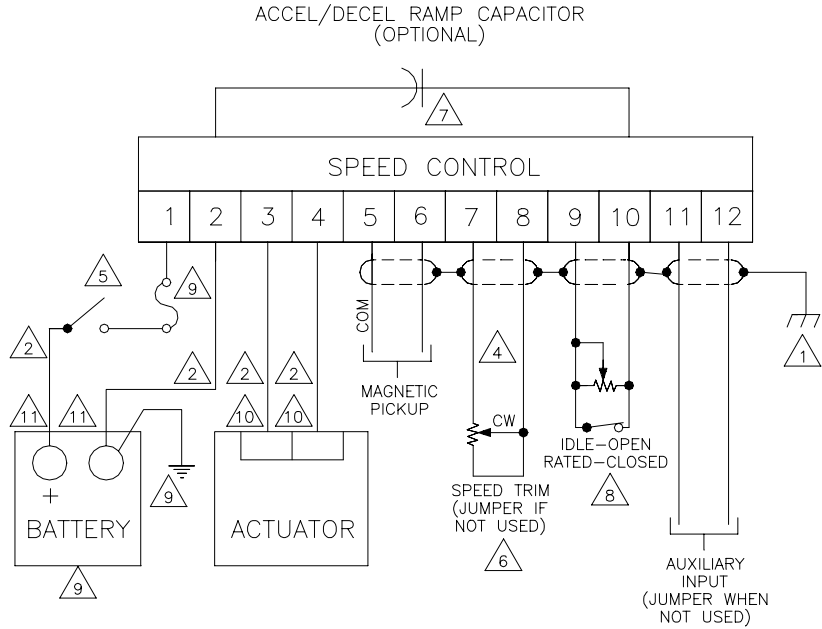
Caterpillar Engine, 3408, 3412, Speed Setting Lever	8924-743
Detroit Diesel Engine, V71 16 cylinder or V92 12/16 cylinder.....	8923-072
Detroit Diesel Engine, V149	8923-071
Detroit Diesel Engine, 24V71	8923-383

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1. SHIELDED WIRES TO BE TWISTED PAIRS OR TWISTED 3 CONDUCTOR, GROUNDED AT ONE END ONLY.
2. NO. 12 AWG STRANDED WIRE. MUST BE AS SHORT AS POSSIBLE. TOTAL DISTANCE FROM BATTERY TO CONTROL AND FROM CONTROL TO ACTUATOR NOT TO EXCEED 22 FT.
3. VOLTAGE SOURCE MUST BE 18 TO 30 VDC.
4. OPEN FOR MINIMUM FUEL. DO NOT USE EITHER THE MINIMUM FUEL OPTION, OR DISCONNECT THE ACTUATOR LEADS, OR DISCONNECT THE POWER TO THE CONTROL AS PART OF ANY EMERGENCY STOP SEQUENCE.
5. FOR POSITIVE GROUND SYSTEMS, SWITCH AND FUSE TO BE LOCATED IN SERIES WITH BATTERY (-) AND TERMINAL 2. POSITIVE TERMINAL BECOMES CHASSIS GROUND. LEADS FROM BATTERY TO TERMINALS 1 AND 2 MUST BE DIRECT AND NOT PASS THROUGH DISTRIBUTION POINTS. USE 15 AMP FUSE AND SWITCH.
6. APPROXIMATE SPEED CHANGE WITH TRIM POTENTIOMETER:

$$\pm 2/55\% \text{ USING A } 1\text{K OHM POTENTIOMETER.}$$

$$\pm 5\% \text{ USING A } 2\text{K OHM POTENTIOMETER.}$$
7. ABOUT ONE SECOND RAMP TIME PER 50 μ F. CAPACITOR SPECIFICATION: 200 μ F MAXIMUM, 15 WVDC MINIMUM. LESS THAN 30 μ A DC LEAKAGE CURRENT OVER TEMPERATURE RANGE.
8. IDLE RANGE ABOUT 25% TO 100% OF RATED USING 50 K POTENTIOMETER. FOR FIXED IDLE SPEED, CALCULATE THE VALUE TO THE RESISTOR:

$$R = 17 \text{ K OHM } \left(\frac{\text{RATED SPEED}}{\text{IDLE SPEED}} \right)$$

JUMPER IF IDLE SPEED IS NOT USED.
9. USE A 15 AMP FUSE (3 AG OR GBB TYPE).
10. POLARITY NOT IMPORTANT.
11. CONNECT CONTROL WIRES ONLY AT BATTERY POSTS, NOT AT OTHER CONNECTOR POINTS.

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Plant Wiring Diagram

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