Service Information

PRODUCT SERIES: DPG-2100

DYNA Programmable Governor for Isochronous Generators
Calibration and Troubleshooting for DPG-2101, DPG-2102, DPG-2103, DPG-2104

DPG-2100

The DPG-2100 governors are state of the art digital controllers. The controller can be used on both diesel and gas engines. The DPG-2100 series eliminates the need to have multiple controllers on the shelf. The governor can operate over a frequency range of 1000 to11,000Hz, and over a nominal voltage range of 9 to 30 VDC

Low Cost

User Friendly/Operator Adjustable

.25% Precision Frequency Control

Superior Temperature Stability

Reverse Battery Protection

9 - 30 VDC Input Voltage Range

Actuators: DYNA 2000
DYNA 2500
Power Flows
DYNA 7000
DYNA 70025

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1.0 INTRODUCTION

The DPG-2100 is a very versatile controller that provides 0.25% frequency control with superior temperature stabilitycompared to an analog controller.

1.1 General Information

Engine governing is adjustable over a wide range of engine set speeds. An engine's set speed, also known as its target speed, can be any frequency from 1,000 Hertz to 11,000 Hertz. The following formula shows the relationship between engine RPM and Hertz.

$$\text{(MPU signal in Hertz)} = \frac{\text{(EngineRPM)x (\# of Flywheel Teeth)}}{\text{60 sec}}$$

A magnetic pickup or MPU provides the engine speed signal to the controller in Hertz. The controller compares this signal to the user programmed set speed, also in Hertz, to determine whether fuel to the engine needs to increase or decrease in order for the engine speed to equal the target speed.

The fuel flow is controlled with an actuator. The actuator may be part of a throttle body or connected to a separate throttle body with mechanical linkage. The controller provides a drive signal to the actuator to cause more or less fuel to flow through the throttle body thus affecting the engine's speed.

1.2 Actuator Compatability

Actuators:

- DYNA 2000
- DYNA 2500
- Power Flows
- DYNA 7000
- DYNA 70025

2.0 SPECIFICATIONS

Operating Voltages:
9 VDC minimum to 30 VDC maximum

Maximum output current: 7 amps continous,
14 amps ten seconds maximum

Steady State Speed Band: ± .25% over temperature range of -40°F to +180°F, -40°C to +85°C

Ambient Operating Temperature:
-40°F to +180°F, -40°C to +85°C

Sealing: Oil, water, and dust resistant via conformal coating and die cast enclosure

Connections: Euro-style terminal strip

Weight: .6lbs, .28kilograms

Input signal: 0-1000 Hz startup
1000-11,000 Hz normal operation

Mechanical Vibration: Suitable for mounting per SAE J1455; 1 to 500Hz, 5G amplitude

Input signal frequency from mag pickup:
Freq. (HZ)= (Engine rpm *flywheel teeth) ÷ 60 sec.

Controller Adjustment: Set speed using increase/decrease pushbuttons and Gain (270 degree adjustment)

Temperature Stability: .007 Hz @ 70°C

Input signal voltage from mag pickup:
2.5 VAC RMS minimum during cranking

Models (Replaces):
DPG-2101 (DYN1-1070x)
DPG-2102 (DYN1-1072x)
DPG-2104 (DYN1-1078x)

Diagnostic LED:
Off - no power or reverse battery exists
1Hz - power on
3Hz - receiving speed signal
On - service required

3.0 USER INTERFACE

The DPG-2100 provides two buttons for adjusting the engine set speed or selecting a setup mode:

3.1 Keypad

- INC - is used to increase the set speed
- DEC - is used to decrease the set speed
- Pressing INC and DEC at the same time and holding them for at least 5 seconds is done to switch between GAIN ADJUST MODE and INTEGRAL LIMIT ADJUST MODE. These modes are explained in the following sections.

NOTE: Whenever power is first applied to a controller that is off, it starts up in GAIN ADJUST MODE.

The DPG-2100 provides a potentiometer, labeled GAIN, used for two separate adjustments:

- Overall gain setting adjustments, or
- Integral limit setting adjustments.

3.2 LED

The LED (Light Emitting Diode) is used as a status and operating mode indicator.

- When the LED is off, it indicates that one of the following is true:
  - Not currently being powered.
  - Reverse powered (check polarity of supplied power).
  - Detecting an error

  If a voltage between 9 volts DC and 30 volts DC is being properly supplied across the BAT+ and BAT- terminals of the controller and the LED is off then refer to the troubleshooting section.

- A slow blinking LED indicates all of the following:
  1. The unit is powered.
  2. The unit is in the GAIN ADJUST MODE (the gain setting can be adjusted).
  3. There is no MPU (Magnetic Pick-Up) signal. This means the engine is not running. If the engine is running and the LED is blinking slow then refer to the troubleshooting section for help in diagnosing why the MPU signal to the controller is missing.

- A fast blinking LED indicates all of the following:
  1. The unit is powered.
  2. The unit is in the GAIN ADJUST MODE (the gain setting can be adjusted).
  3. There is an engine speed signal at the controller's MPU terminals.

- When the LED is on and not blinking it indicates the following;
  1. The unit is powered.
  2. The unit is in INTEGRAL LIMIT ADJUST MODE. The integral limit setting can be adjusted. In this operating mode it is not evident from the LED whether the engine is running or not.

⚠ **WARNING**
The engine should not be running when adjusting the integral limit.

NOTE: The slow blink rate = ½ Hertz (the LED is turned on for 1 second followed by off for 1 second then on again and so on). The fast blink rate is 3 times faster than the slow blink rate.

4.0 USER ADJUSTABLE PARAMETERS

Parameter	Factory Setting	Minimum Setting	Maximum Setting
Set Speed	1,000 Hertz	1,000 Hertz	11,000 Hertz
Gain	20%	1%	100%
Integral Limit	75%	20%	100%

The following sections describe how to adjust these parameters as needed.

5.0 SET SPEED AND GAIN SETTINGS

The SET SPEED and GAIN adjustments work together. These adjustments are made while the engine is running.

NOTE: The factory setting for the SET SPEED is 1000 Hertz. The factory setting for the GAIN potentiometer is 20%.

The INC and DEC buttons are active whenever the controller is powered. The set speed is increased using the INC button. A momentary INC button press and release will increase the set speed by 1 Hertz. Press and hold the INC button to increase the set speed rapidly. The set speed is decreased using the DEC button.

The gain adjustment is used to modify how fast the controller responds to engine speed changes due to changing loads on the engine. Higher gain settings are more sensitive to changes in engine speed than are lower gain settings. Gain settings too high or too low can hinder the controller's ability to maintain a steady engine speed at the set speed.

As a general rule low set speeds require low gain settings. Likewise, higher set speeds require higher gain settings. For example: A set speed of 5040 Hertz will typically require a gain setting between 40% and 60% while a set speed of 3000 Hertz often works best with a gain setting between 20% and 40%.

GAIN ADJUST MODE is active when the LED is blinking either fast or slow. If the controller is powered and the LED is on and not blinking the controller is currently in INTEGRAL LIMIT ADJUST mode. To put the controller back in GAIN ADJUST MODE do one of the following:

- Turn the power to the controller off then back on, or
- Press and hold, for approximately 5 seconds, both the INC and DEC buttons until the LED starts blinking then release the buttons.

The following procedure describes how to adjust the engine set speed and the gain setting together.

6.0 CALIBRATION

The DPG-2100 is a very versatile controller. The speed range is 1000 Hz. to 11,000 Hz. The wide range of speed adjustment also has wide range of gain adjustments. The speed adjustment and gain adjustment ranges are in direct relationship with each other. Therefore, when adjusting the controller speed it will be necessary to adjust gain also**.**

NOTE: Controllers are factory adjusted to 1000 Hz.

> ⚠ **WARNING**
> **Barber-Colman requires an independent overspeed shut down device to prevent loss of engine control which may cause personal injury and/or equipment damage.**

6.1 Please read this entire procedure first before making any adjustments.

6.2 With no power to the governor, verify that gain is set to 20% or factory default.

6.3 Start the engine and adjust the speed by pressing increase/decrease speed buttons until targeted speed is achieved or engine begins to hunt. Use a customer-supplied tachometer or frequency meter to verify speed.

6.4 If the engine begins to hunt adjust the gain to remove the hunt. The isochrounous governor holds a fixed speed. If the engine varies speed slowly (oscillation rate < 1Hz) then increase the gain (in small increments) until oscillation disappears. For a fast hunt, which is defined as a 1Hz or greater oscillation, decrease the gain in small increments. This adjustment may need to be made as engine speed is adjusted to the target speed.

6.5 Once the engine is set to the target speed it will be necessary to upset the engine governor to verify the performance of the system. This can be done by a very fast interruption (too long may cause shutdown) of the +MPU signal from the terminal or by bumping the linkage if available.

6.6 If after the engine governor has been upset, the engine begins to hunt, adjust the gain. For a slow hunt increase the gain; if the hunt is fast decrease the gain. If the engine response is slow, slowly increase the gain at ½ division increments. If the engine droops at full load, decrease the gain until the frequency is at target. When gain adjustments are made it will be necessary to recheck the performance of the engine by repeating step 5. This will help set the governor response to fuel burn rate of the engine.

7.0 INTEGRAL LIMIT SETTING

The INTEGRAL LIMIT is another adjustment that is available. The integral limit setting should only be adjusted when the engine is not running.

NOTE: The factory setting for the integral limit equals 75% initially. The integral limit can be set anywhere between 20% and 100%.

The integral limit feature may be useful in minimizing engine speed overshoot related to integral windup. When the engine is unable to carry a load the integral term of the PID equation will continue to grow which can cause a delay in reducing fuel to the engine when the load is removed or reduced.

The INTEGRAL LIMIT setting is used to stop integration whenever the actuator drive signal is above a specific percentage of the maximum signal possible. In the INTEGRAL LIMIT ADJUST MODE the potentiometer is used to set the actuator drive signal percentage above which integration is stopped.

INTEGRAL LIMIT ADJUST MODE is active when the LED is not blinking and on. See the following procedure for instructions describing how to adjust the integral limit setting.

8.0 ADJUSTING THE INTEGRAL LIMIT

⚠ **WARNING**
The engine should not be running when adjusting the integral limit.

8.1 Apply power to the governor.

8.2 Record the current GAIN potentiometer setting.

8.3 Press both the DEC and INC buttons simultaneously for at least 5 seconds and the LED will stop flashing and remain turned ON.

8.4 The system is now in the INTEGRAL LIMIT adjust mode and the buttons can be released.

8.5 Turn the potentiometer to the desired position; for example to set the INTEGRAL LIMIT to 50% adjust the GAIN potentiometer to 50.

8.6 Press both the DEC and INC buttons simultaneously for at least 5 seconds and the LED will start flashing again.

8.7 The system has now been returned to the GAIN adjust mode and the buttons can be released.

8.8 Return the GAIN potentiometer to the setting recorded in step 3.

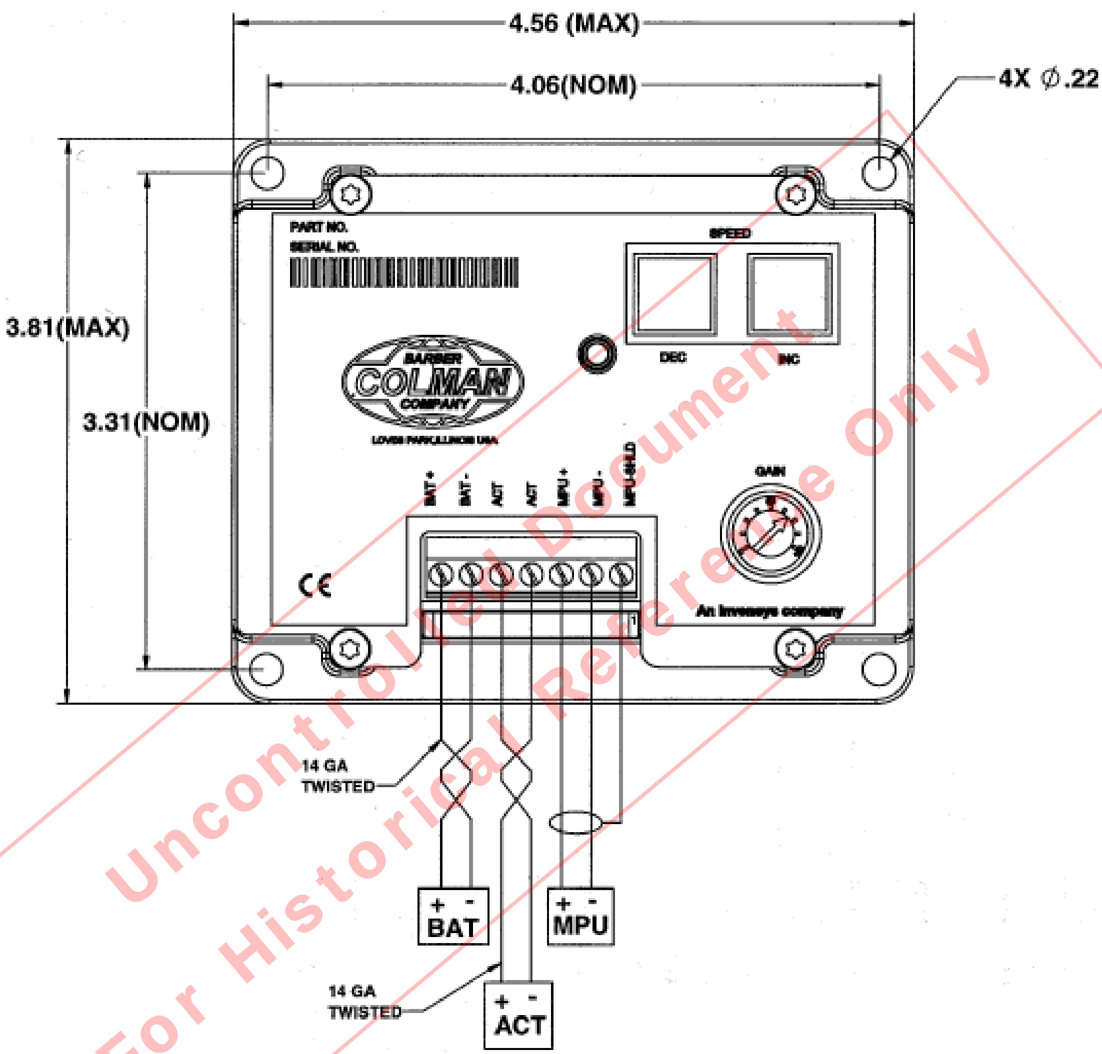
8.9 INTEGRAL LIMIT adjustment is complete.

NOTE: The INTEGRAL LIMIT is preset at the factory to 75%.

9.0 WIRING

9.1 TYPICAL WIRING DIAGRAM

General information, wiring and calibration procedure for the DPG-2100 Series controllers for the linear governor system.



9.2 TERMINAL IDENTIFICATION

All four DPG-2100 model controllers are wired as shown in Figure 1 Wiring Diagram.

1. **BATT +** to battery positive
2. **BATT -** to battery negative
3. **ACT** to actuator lead, no polarity
4. **ACT** to actuator lead, no polarity
5. **MPU +** to positive lead of magnetic pickup
6. **MPU -** to negative lead of magnetic pickukp
7. **MPU SHIELD** to drain wire

Controllers meet current CE directives for electro-magnetic compliance (emc).

10.0 TROUBLESHOOTING

Normally governor LED flashes at a ½ Hz rate when CPU is functioning properly. Applying a starting speed will cause the actuator to go to full speed. LED flashes at 1 ½ Hz rate when an MPU signal is detected.

PROBLEM	DETECTION	CORRECTIVE ACTION
System appears dead. No LED, fails to move actuator.	Check Battery Voltage at controller with power switch turned "ON". Measure DC battery voltage between (Bat.+ and Bat.-) Check polarity of the Battery + and Battery -	If no voltage, check connections to battery. Correct wiring
LED blinking slow and engine being cranked.	Check linkage. Manually operate linkage to see that it is not sticking or binding.	Free Linkage.
	No signal or weak signal from magnetic pickup. Measure AC voltage between terminals MPU + and MPU – on the controller while cranking engine. Voltage should be 2.5 volts RMS or greater. (AC input impedance of meter must be 5000 ohms.)	Check for damage to or improper adjustment of magnetic pickup. Replace or readjust.
LED blinking fast but actuator does not move to open.	Check Actuator output with power "on" to controller. Measure the following terminals on the controller box with respect to bat -. All points should read Battery (+/- 95%) A) 1. Act to Battery - = Battery voltage 2. Act to Battery - = Battery voltage (+ or – 1.5 VDC) B) Following checks are terminals on the actuator and battery– on the controller. 1) Low voltage (1.0-2.0VDC) at either actuator terminal 2) Battery voltage at both actuator connectors 3) Battery voltage at one actuator lead but not at the other	Replace Controller if 95% of battery voltage is not present. Broken actuator lead Broken actuator lead Check actuator
Actuator lever goes to full fuel whenever the power is turned "ON" and engine is not running	Check controller and actuator wiring 1) Turn power off to controller 2) Remove wiring to actuator terminals on controller and measure resistance between each lead and chassis ground. 0.0- ohms indicates shorted leads. 3) Normal resistance	Correct or replace actuator wiring. Replace controller because it should not cause actuator lever to go to full fuel with engine not running.
Engine hunts during operation External linkage	1) Linkage or rod end bearing sticking or binding. 2) Improper linkage arrangement. (Stroke too short or improper non-linear linkage used) 3) Improper governor adjustment	Lubricate or replace See installation information Readjust calibration
Engine hunts during operation Internal/External linkage	1) Inadequate power supply voltage. a) Turn power switch "OFF" b) Remove actuator leads from controller. c) Connect actuator leads to battery+ and battery- direct to battery. 2) Actuator should go to full fuel. 3) Internal style actuator should give a click noise when actuator hits the stops. 4) External style actuator should be visibly in the fuel position. 5) The actuator should go to full fuel and the DC voltage must be greater than 80% of supply. 24 VDC @ 80% = 19.2 VDC 12 VDC @ 80% = 9.6 VDC Note: With the power switch in the "OFF" position when testing is completed remove actuator leads from battery and reconnect actuator leads to controller.	If actuator doesn't make full fuel, then check actuator leads. If voltage is less than specified, check for loose or poor connections to battery, or get larger supply leads or larger power supply.

WARNING
Barber-Colman requires an independent overspeed shut down device to prevent loss of engine control which may cause personal injury and/or equipment damage.

- NOTE -
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