INSTALLATION INSTRUCTIONS

Original Issue Date: **3/06**
Model: **20–150 kW Generator Sets, Northrop Grumman**
Market: **Industrial**
Subject: **Governor Service Kit GM38323 and Programming Kit GM39344**

Introduction

The digital isochronous governor programming kit includes the programming CD-ROM and cable for connecting the governor controller to the user's PC.

The programming kit or Parameter Setup Tool (PST) software tells the governor controller how to operate the generator set governing system for that application.

Access and download the PST software by going to the following website:

http://www.woodward.com/software/Download/SWProductDetail.cfm?FileID=201

The digital isochronous governor kit replaces discontinued generator set governors. See Figure 1. **Replacement governors are shipped unprogrammed.** After installing and wiring the new governor service kit, download the PST software and follow the instructions to change the default settings.

Service Kit	Governor Assembly	Replaces
GM38323	GM17644-4 (DPG-2101-002)	324515 (DYN1-10784-000-1-12)
		336236 (DYN1-10704-000-1-12)
		GM17644-3 (DPG-2104–xxx)

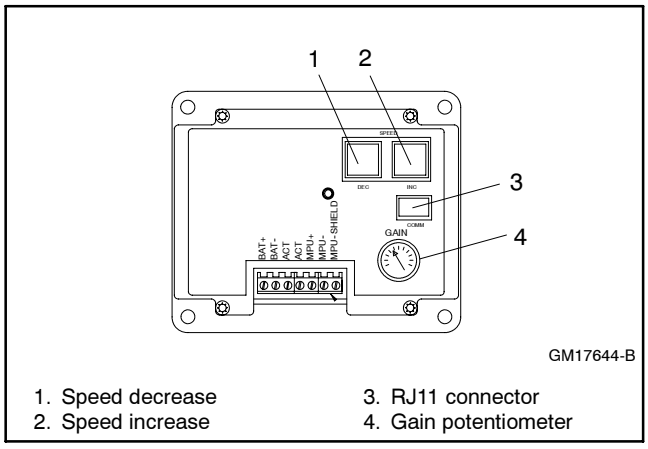
Figure 1 Service Kits and Discontinued Governors

The PST software overwrites any original programs in the governor controller's nonvolatile memory. Make a backup copy of the files onto a disk and store the disk in a safe place.

Read the entire procedure before beginning. Install the software onto a PC. Carefully follow these instructions and any additional instructions that appear on the screen during the download procedure. The instructions provided here assume you know how to operate a PC.

Loading incorrect or incomplete files may cause permanent damage to the governor controller's logic circuit board. Verify that the CD-ROM file contains settings for your specific generator set and engine. Do not attempt to modify the data files.

Note: Some existing governor controllers do not require programming. Only governor controllers with a RJ11 connector (see Figure 2) need programming.



1. Speed decrease
2. Speed increase
3. RJ11 connector
4. Gain potentiometer

Figure 2 Governor Controller Functions

Before replacing the governor, verify that replacement is necessary by using Appendix D, Diagnostics and Troubleshooting.

Kit Components

- COMM port cable (9-pin RS-232 DB9F serial port connector to a RJ11M plug)
- CD-ROM includes
  - Parameter Text Files
  - Governor Parameter Detail Form
  - Governor Parameter Summary Form
  - TT-1399 Governor Programming Instructions
  - Woodward PST (parameter setup tool)

Features and Specifications

The microprocessor-based, digital isochronous governor allows adjustment of set speed and gain. Other adjustments include acceleration, deceleration, ramp rates, idle speed set, and hold time. The COMM port provides simple programming when connected to the user's PC. See Figure 2 for governor controller illustration and Figure 3 for specifications.

Specifications	Value
Maximum controlled output current	7 amps
Maximum current surge	14 amps for 10 seconds
Input signal from magnetic pickup	2.0 VAC RMS min. during cranking
Ambient operating temperature	-40°C to +85°C (-40°F to +185°F)
Environmental protection	Oil, water, dust resistant via conformal coating and die cast enclosure
Electrical connections	Euro-style terminal strip

Figure 3 Specifications

Other features include:

- 0.25% frequency control.
- Reverse battery protection.
- 9-30 VDC input.
- Smoke control on startup.
- Serial communication port.

Keypad Functions

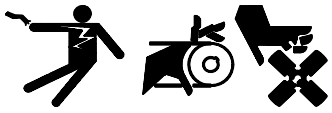
The governor controller keypad provides functions as described below. Refer to Figure 2 illustration.

The Set Speed A and Gain (OVG @ Set Speed A) values can be changed using the governor controller keypad and potentiometer adjustment.

Safety Precautions

Observe the following safety precautions while installing the kit.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Read the entire installation procedure and compare the kit parts with the parts list in this publication before beginning installation. Perform steps in the order shown.

Special Equipment Needed

- Load bank sized at 25% of the generator set standby rating (minimum).

1 Hardware Installation Procedure

1.1 Remove the generator set from service.

1.1.1 Place the generator set master switch in the OFF/ RESET position.

1.1.2 Disconnect the power to the battery charger, if equipped.

1.1.3 Disconnect the generator set engine starting battery(ies), negative (–) lead first.

1.2 Locate and remove the existing governor controller.

1.2.1 Locate the governor controller mounted in the controller. See Figure 4 or Figure 5.

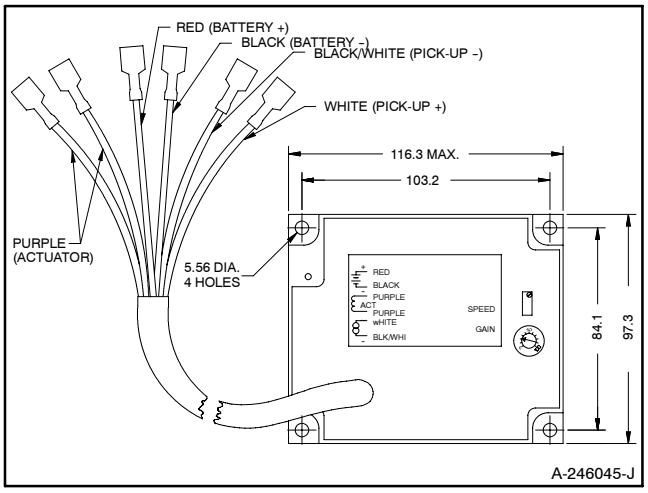


Figure 4 Governor Controller 324515 and 336236

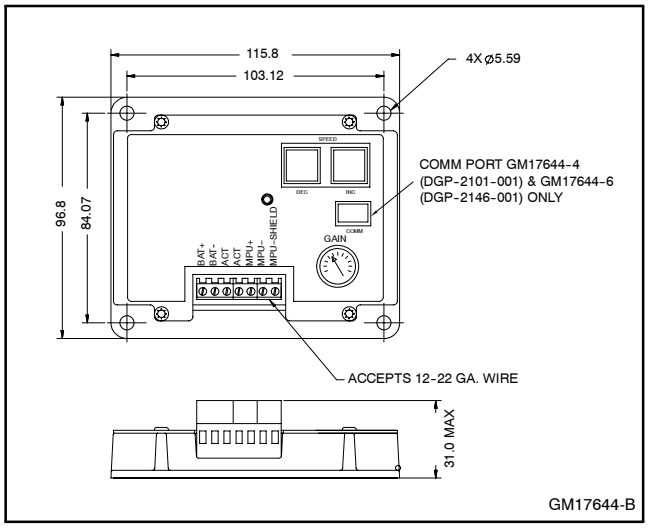


Figure 5 Governor Controller Dimensions, GM17644 Series

1.2.2 Label the individual leads to the governor controller as needed using masking tape or other means.

1.2.3 Disconnect the wiring to the governor controller.

1.2.4 Remove the existing hardware and governor controller.

1.3 Mount and connect new governor controller.

1.3.1 Remove the remaining terminals from the engine wiring harness.

1.3.2 **Governor controllers 324515 and 336236 only.** Strip lead ends of engine wiring harness and tin with rosin-core solder.

1.3.3 Mount the new governor controller using the existing hardware or user-supplied hardware.

1.3.4 Attach the engine wiring harness to the governor controller as shown in Figure 6.

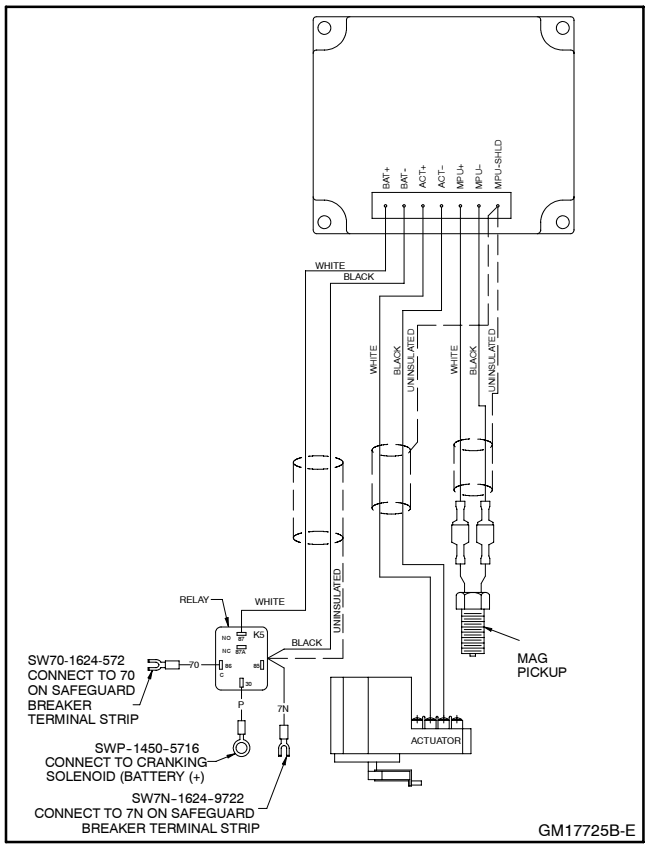


Figure 6 Governor Controller Connections

1.4 Restore the generator set to service.

1.4.1 Check that the generator set master switch is in the OFF position.

1.4.2 Reconnect the generator set engine starting battery, negative (–) lead last.

1.4.3 Reconnect power to the battery charger, if equipped.

1.5 Program the governor controller.

Following the instructions in the Software Installation Procedure.

Note: Before proceeding to step 2, install the PST software by following the directions in **Appendix A, Download and Install PST Software**. This installation only needs to be done once on each PC.

2 Software Installation Procedure

2.1 Determine the governor assembly part number and engine model number.

Before beginning the programming procedure, the user must determine the governor assembly part number and engine model number. The selection of the correct Parameter Text File later in this procedure depends on knowing these numbers.

2.1.1 The **governor assembly part number** is stamped on the replacement governor included in the service kit. Knowing the service kit number and using Figure 1 will also provide the governor assembly part number.

2.1.2 The **engine model number** may be shown on the engine nameplate attached to the generator set engine block. Other sources for finding the engine model number include the respective generator set spec sheet and documentation included with the generator set sales invoice and/or warranty registration.

2.2 Connect the governor controller to the user-supplied PC.

2.2.1 Place the generator set master switch in the OFF/RESET position.

2.2.2 Connect the supplied cable included in the kit from the user-supplied PC 9-pin RS-232 serial port to the governor controller RJ11 connector (telephone jack). See Figure 2.

2.3 Open the CD-ROM files.

The instructions provided here assume you know how to operate a PC.

2.3.1 Login to the user-supplied PC.

2.3.2 Load the supplied CD-ROM from the kit in the PC.

2.3.3 Copy the Parameter Text files to your PC hard drive. The default folder is *ProgramFiles\Kohler\PST*.

2.3.4 Energize the governor controller by moving the white lead/70A from the normally open K5 contact to the normally closed K5 contact. See Figure 7. Connecting to the normally closed contact will energize the governor controller without starting/ running the generator set.

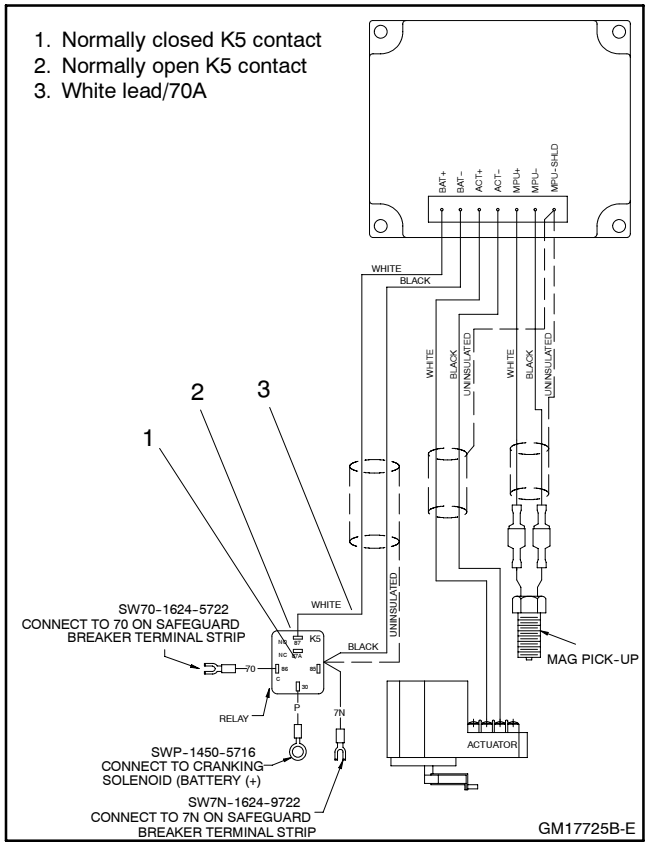


Figure 7 Energizing Governor Controller

2.3.5 See **Appendix B, Parameter Definitions,** for detailed explanations of each parameter and **Appendix C, Parameter Defaults Reference**.

2.4 Program the governor controller and save the files.

2.4.1 Double click on PST icon to start programming software.

If you get an error message as shown in Figure 8, verify the cable connection. It may also be necessary to use the Port menu to choose a different communication port depending on the configuration or the laptop.

2.4.2 Use the part number data determined in step 1 and select the Parameter Text file by clicking *File-Open-"?.Txt".*

The Read All values on the PC screen (see Figure 9) are the values shown on the printed Parameter Summary form.

2.4.3 Click *Write All*. The selected parameter text file is then sent to the governor controller. Wait until download is complete when the *Write All* button reappears.

2.4.4 Close the PST software.

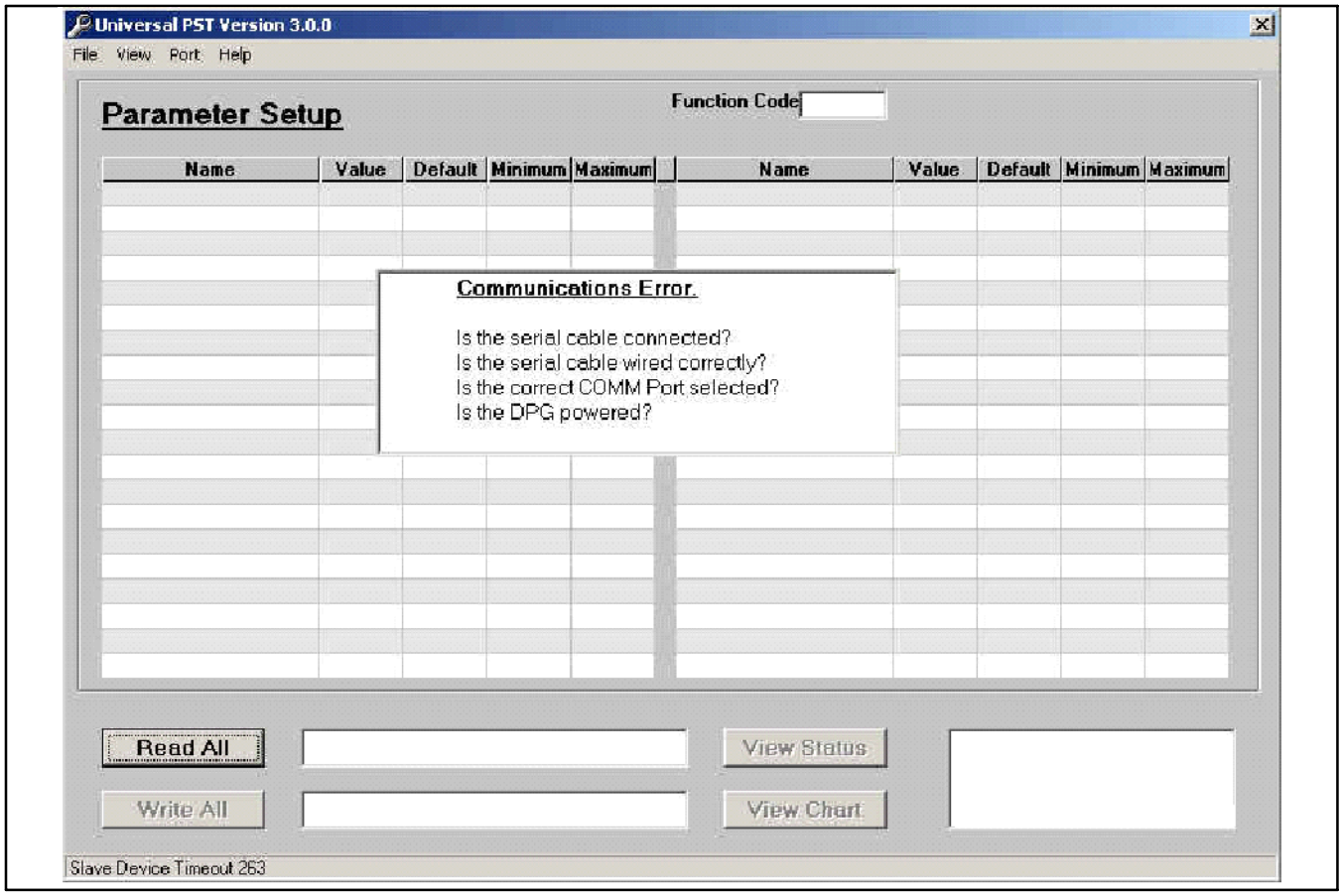


Figure 8 Communication Hookup Error Message Pop-Up

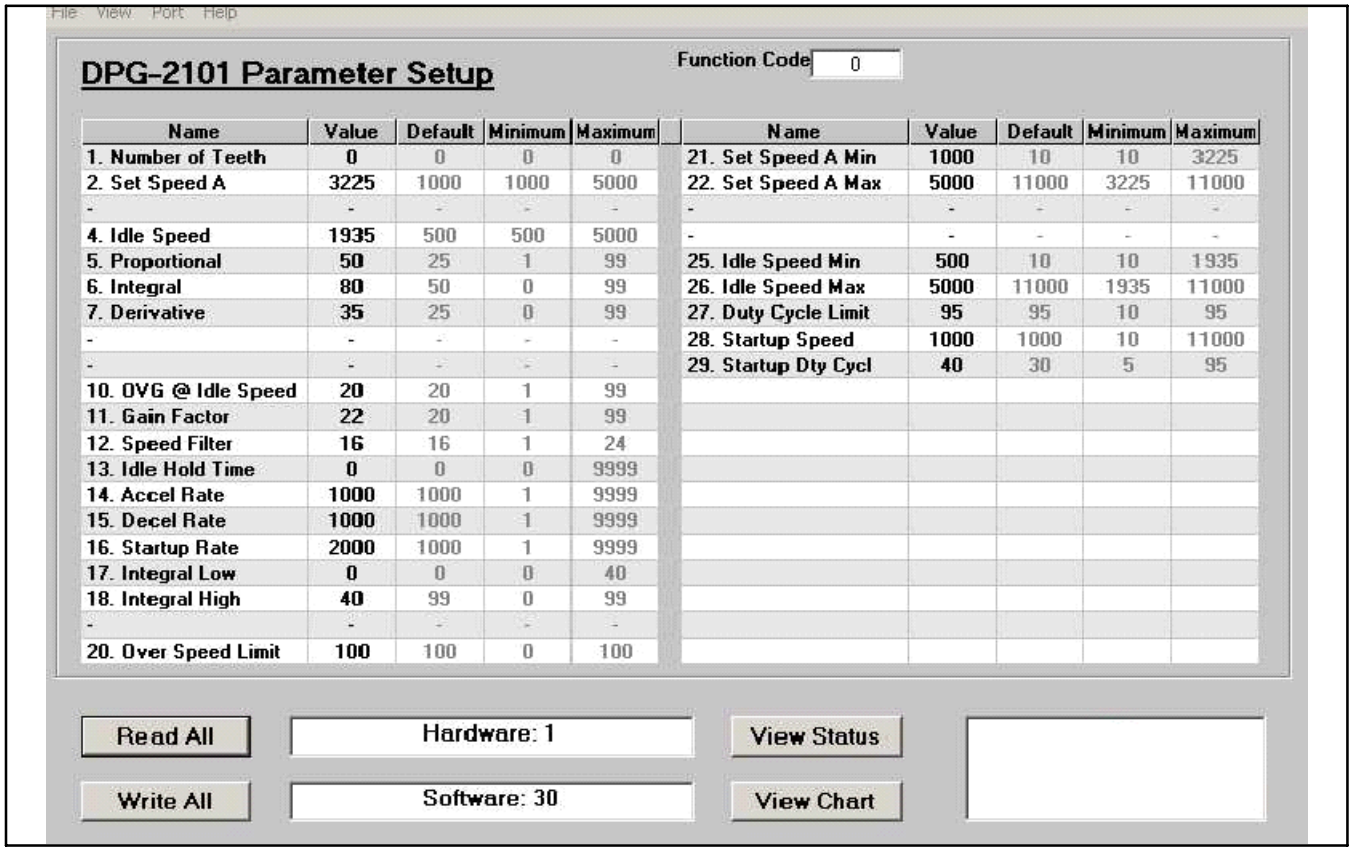


Figure 9 Screen Showing *Read All* Data (typical values shown)

2.5 Disconnect the governor controller from the user-supplied PC.

2.5.1 Check that the generator set master switch is in the OFF position.

2.5.2 Move the white lead/70A from the normally closed K5 contact back to the normally open K5 contact. See Figure 7.

2.5.3 Disconnect the supplied cable included in the kit from the user-supplied PC 9-pin RS-232 serial port and the governor controller RJ11 connector (telephone jack).

2.5.4 Store the cable and CD-ROM together for later use as needed.

2.6 Adjust the gain potentiometer.

2.6.1 Select a load bank based on the generator set standby rating for 1/4 load.

2.6.2 Connect the load bank to the generator set output leads.

2.6.3 Place the generator set master switch in the RUN position to start the generator set.

2.6.4 Increase the gain potentiometer to 50%.

2.6.5 Apply approximately 1/4 load to the generator set.

2.6.6 Determine if the engine is hunting by listening for engine speed changes/surges.

2.6.7 If no hunting is present, increase the gain by small increments until hunting is detected and then decrease the gain by 10% for the optimal setting.

If hunting can not be induced at any gain setting, set the gain potentiometer to 80%.

2.6.8 Place the generator set master switch in the OFF/RESET position to stop the generator set.

2.6.9 Remove the load bank from the generator set.

2.6.10 Restore the generator set to service.

3 Troubleshooting

See **Appendix D, Diagnostics and Troubleshooting,** for help in diagnosing generator set/engine problems relating to the governor controller.

4 Parts List

Governor Service Kit GM38323

Qty.	Description	GM38323
1	Digital isochronous governor	GM17644-4

Governor Programming Kit GM39344

Qty.	Description	GM39344
1	Cable (RS11), 3 m (10 ft.)	GM34410
1	Adapter, cable (RS11 to serial port)	GM39345
1	CD-ROM	GM39346

Appendix A PST Software

The PST software enables the user to adjust parameter settings and monitor governor operation when a user-supplied PC is connected to the governor controller via the COMM port. Access and download the PST software using the website shown on page 1.

Features

- Automatic configuration to each generator set when communication is established.
- Read/write access to all of a generator set's programmable parameters and features.
- Display of each parameter's default, minimum, and maximum values.
- Diagnostics utilizing automatic refresh of the generator set's status.
- Saving and reloading generator set setup information to and from a file for reuse.
- Single button read for acquiring current parameter values.
- Single button write to program a generator set with previously saved setup values.
- Engine speed monitoring via a chart recorder to aid in governor tuning.
- Saving chart recorder data to a Microsoft® Excel compatible file.
- Help information on each of the governor's parameters.
- Help information on using the PST software.

PC System Requirements

- 100% IBM® PC compatible with a 133 MHz or higher Pentium® compatible CPU.
- Microsoft Windows® 98SE (second edition), Windows NT® Workstation Version 4.0, Windows® 2000, or Windows XP® operating system.
- Display resolution with SVGA (800 x 600) or higher.
- CD-ROM drive and minimum of 4 MB hard drive space for installation.
- One 9-pin RS-232 DB9M serial port.
- PCs using USB ports will require a serial adapter.
- Stable power supply. A laptop system with a fully charged battery or desktop system running with a battery backup system is recommended.

PST Software User Interface Overview

The PST software for generator set applications has two main display modes—Table View and Chart View. Table view is the PST software default setting.

Table View

In the table view, the user can perform the following items:

- View the current values for all user-programmable parameters in the Parameter Setup panel's table.
- Edit a parameter's value by double clicking on a cell in the *Value* column of the table.
- Left click Read All to refresh the values in the table shown on the Parameter Setup panel.
- Left click Write All to transmit setup values to the governor controller.
- Left click View Status to display read only parameters in the View Status panel.
- Left click View Chart to set the display mode to Chart View.

Chart View

In the chart view, the user can perform the following items:

- View the current values for all user-programmable parameters in the Parameter Setup panel's table.
- Edit a parameter value related to governor tuning. These same parameters are also on the main parameter setup table.
- Left click Data File to open a file for saving chart recorder data.
- Left click Data Reset to start data collection to the open file at the beginning.
- Left click Pause Chart to stop the chart recorder, which also stops writing data to the file. Left click Continue to start the chart recorder function.
- Adjust the horizontal and vertical settings for the chart recorder.
- Left click View Table to set the display mode back to Table View.

PST Software Menu Items

Use the following menus as needed:

File Menu

- Open a previously saved setup data file.
- Save the setup data to a file.
- Exit the program.

View Menu

- Select the Parameter Table view (Table View).
- Select the Chart Recorder view (Chart View).

Port Menu

- Select the PC's serial port connected to the governor controller.

Help Menu

- Help on the PST software for generator sets.
- Help on the governor controller that is currently in communication with the PC.
- Information about the PST software for generator set application.

Parameter Setup

The Parameter Setup panel displays a table where each row shows the name of a user-programmable parameter, the current value, and the parameter's (default, minimum, and maximum) values.

To modify a parameter's current value, select the value by double clicking the left mouse button on a cell in the table. The selected cell will be highlighted and the value can be modified. After entering the new value, press the PC Enter key to change the governor controller value.

To get help on a particular parameter, left click the parameter's value, then press <Control> F on the PC.

To see the current values for all of the generator set's parameters, left click Read All.

Left click Write All to transmit all parameter values to the governor controller automatically. The Write All button is very useful when reusing saved setup data to configure a new system the same as a previously created one. Load an existing set of previously saved parameter values into the Parameter Setup table using Open a Setup Data File from the File menu and then left click Write All.

Status View

The Status View panel is displayed only after left clicking View Status. The Status View panel is part of the Table View display mode.

The Status View panel displays a table where each row shows the Name of a read only parameter and its current Value when Auto Read is ON.

Left click Start Monitoring to have the PST software program automatically refresh the values. Left click Stop Monitoring to disable automatic refresh.

Tuning View

The Tuning View panel is displayed only after left clicking View Chart. The Tuning View panel is part of the Chart View display mode.

To modify a tuning parameter's current value, select the value by double clicking the left mouse button on a cell in the table. The selected cell will be highlighted and the value can be modified. After entering the new value, press the PC Enter key to change the governor controller value.

Chart Recorder

The Chart Recorder is part of the Chart View display mode. Each time Chart View is entered, the last Data File is reset, the vertical scale defaults to a preset value, and the horizontal scale defaults to 20 seconds.

The vertical and horizontal scale options control the chart recorder's display characteristics. Use the horizontal scale to provide a chart recorder display at 60, 30, 20, 10, or 5 second intervals. Larger values compress the display while smaller numbers expand the display.

The Data File button opens a dialog box to name the file and path where chart recorder data is saved.

Use the Data Reset button to start data collection over using the current data file. The progress bar to the right of this button indicates the capacity of the data file. Each data file can hold approximately 10 minutes of data and the data is sampled 100 times per second. The progress bar displays the message The Data File is Full when it can no longer accept chart recorder data.

The Pause Chart button stops the chart recorder and data file updates. Left click this button, which is now named Continue, to activate the chart recorder.

Use the View Table button to return to the Table View display mode. Be sure to open a new Data File before returning to Table View if the data already collected needs saving. The active Data File is automatically reset each time the Chart View display mode becomes active.

Download and Install PST Software

Before going to the generator set jobsite, It is recommended to access and download the PST software to your PC hard drive where a Internet connection is available.

The instructions provided here assume you know how to operate a PC.

1. Login to the user-supplied PC.
2. Login to the Internet.
3. Access the website shown on page 1 and click download.
4. Click new registration, complete the registration information, and then click register.
5. The website will start the PST software download which is about 25 MB.
6. Copy the PST software files to a designated folder on your PC hard drive.
7. Log off the Internet.
8. Unzip the files to a designated folder on your PC hard drive.
9. Open the readme.txt file and review the contents.
10. Run the setup.exe file. Use the readme.txt file as needed.
11. Follow the prompts as directed.

Use this appendix for definitions of each of the calibration values. Appendix C, Parameter Default Settings, lists the default settings.

When changing values using the keypad, the PST software display on the user's PC will not automatically update. To refresh the PST software display, the user must select a different parameter with the PC mouse and then go back to the desired value. The PST software provides *Read All* button that will refresh all of the parameter values.

1. **Number of Flywheel Teeth.** Enter the value from the Governor Parameter Summary. This display is not required. Displayed speeds can be changed between Hz and rpm.

2. **Set Speed A.** Enter the value from the Governor Parameter Summary.

3. Parameter not used.

4. **Idle Speed.** Enter the value from the Governor Parameter Summary.

5. **Proportional.** Enter the value from the Governor Parameter Summary.

   A speed change creates a speed error (the difference between the target speed and the actual speed.) The Proportional gain controls the size of the governor output response to a step change in the speed error. See Figure 10.

6. **Integral.** Enter the value from the Governor Parameter Summary.

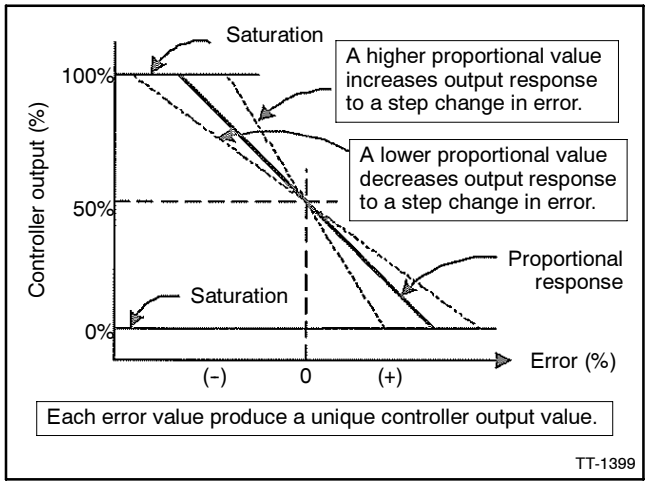


Figure 10 Proportional Value

The Integral value acts to drive the speed error to zero. In a Proportional only control with constant load, there will be a constant speed error that inversely relates to the Proportional gain of the system.

The Integral value is key to isochronous speed control. This value eliminates the difference between the programmed set speed and the actual speed. The Integral gain changes the time it takes to drive the error to zero. The Integral value eliminates the speed offsets due to Proportional gain and should not be set to zero. See Figure 11.

7. **Derivative.** Enter the value from the Governor Parameter Summary. See Figure 12.

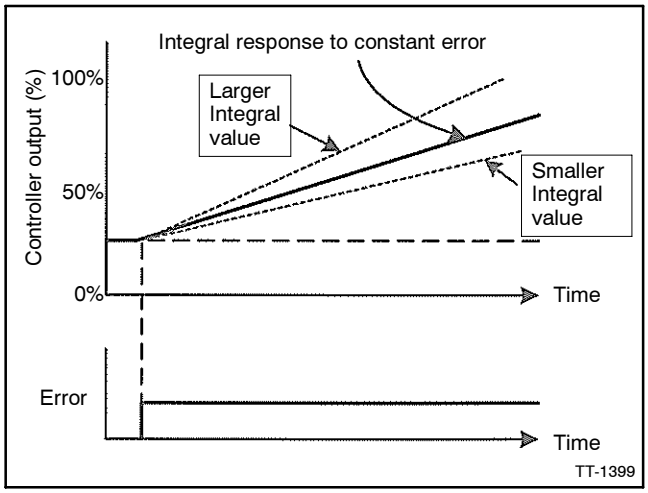


Figure 11 Integral Value

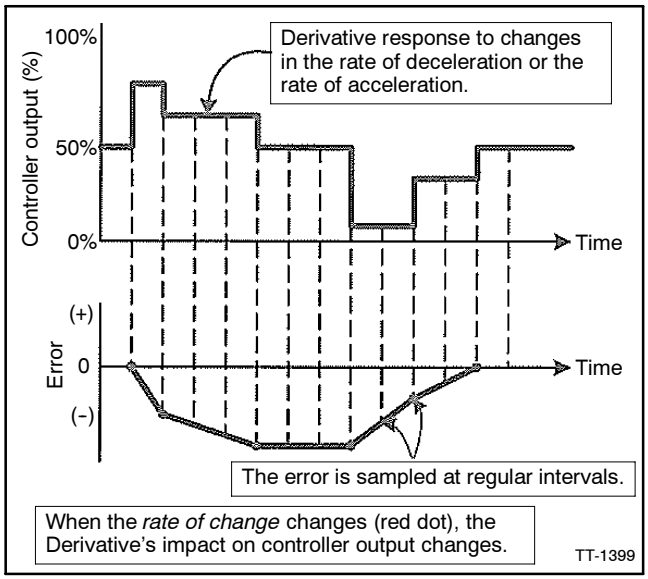


Figure 12 Derivative Value

The Derivative responds to the rate of change in the speed error. This parameter is primarily used to dampen very rapid oscillations resulting from large speed changes. The Derivative responds to engine acceleration or deceleration. When the engine speed approaches the target speed at a fast rate, the Derivative acts to minimize or eliminate overshoot. A zero value is allowed but systems typically require some Derivative gain to improve overall engine speed control.

8. Parameter not used.

9. Parameter not used.

10. **Overall Gain (OVG) @ Set Speed A.** Set the default setting from the Governor Parameter Summary.

    This gain value acts as a multiplier on the three Proportional, Integral, and Derivative (PID) values of Speed A.

11. **Gain Factor.** Enter the value from the Governor Parameter Summary.

    The Gain Factor permits more range of adjustment from the PID values. When any of the PID reaches their adjustment limit, the Gain Factor can be modified for more range of the PID and OVG values.

12. **Speed Filter.** Enter the value from the Governor Parameter Summary.

    Value indicates the number of speed signal pulses to use when calculating an average engine speed and is used to dampen out speed measurement variations that can make PID tuning difficult.

    Too much filtering slows down the governor's response to speed change and too little filtering can make the governor overly sensitive and tuning difficult. As a general rule, less filtering is needed when the number of engine cylinders increases because there is less time for the engine speed to slow down before the next engine cylinder firing.

    Note: Use 24 for four-cylinder engines (20–50REOZJ models) and 16 for six-cylinder engines (100–150ROZJ models).

13. **Idle Hold Time.** Use the default value.

    The Idle Hold Time specifies how long after starting the engine stays at idle speed before finishing the ramp to the target speed. The time value has a resolution of one-tenth of a second.

    During the startup sequence, the governor increases the engine speed from the engine's crank speed to the active target speed at the Startup Rate specified. When the Idle Hold Time is nonzero, the initial target speed will be the idle speed. After the Idle Hold Time times out, the governor uses the Startup Rate to ramp the engine to the selected Set Speed (A or B). The startup sequence is complete after the engine speed reaches the specified set speed.

14. **Accel Rate.** Use the default value.

    This value specifies how fast the governor should increase the engine's speed when a new higher speed is made active.

15. **Decel Rate.** Use the default value.

    This value specifies how fast the governor should decrease the engine's speed when a new higher speed is made active.

16. **Startup Rate.** Enter the value from the Governor Parameter Summary.

    This value achieves a smooth controlled engine start. On diesel engines, this value minimizes exhaust smoke at startup. When used in conjunction with the idle speed and Idle Hold Time, a brief warmup cycle can be programmed.

    The Startup Rate specifies how fast the governor should increase the engine speed when the engine is started. The governor increases the engine speed from the engine's crank speed to the active target speed at the rate specified. The governor brings the engine to the idle speed for the Idle Hold Time, then continues increasing the engine speed at this same ramp rate until the engine reaches the selected target speed (Set Speed A or B).

    Note: In cases where the target speed is less than the idle speed and the Idle Hold Time is nonzero, the startup ramp sequence ends when the idle speed is reached. The Decel Rate is then used to ramp the engine speed down to the target speed from the idle speed.

The ramp up pauses at the Startup Speed until the governor senses an magnetic pickup (MPU) signal greater than the Startup Speed. This prevents the startup ramp from reaching completion before the engine has started.

The governor treats MPU frequencies below the Startup Speed as an indication that the engine is cranking but has not yet started. The governor treats MPU frequencies above the Startup Speed as an indication that the engine has started and the governor increases the engine speed until the selected set speed is reached.

Note: In cases where the target speed is less than the Startup Speed, the startup ramp sequence ends when the target speed is reached.

During the startup sequence, the governor increases the engine speed from the engine's crank speed to the active target speed at the Startup Rate specified. When the Idle Hold Time is nonzero, the initial target speed is the idle speed. After the Idle Hold Time times out, the governor uses the Startup Rate to ramp the engine to the selected set speed (Set Speed A or B). The startup sequence is complete after the engine speed reaches the selected set speed.

17. **Integral Low Limit.** Use the default value.

    The Integral Low Limit value reduces underspeed duration after a long or sustained overspeed condition was present. The low limit helps reduce the duration and amount of engine underspeed by maintaining a minimum actuator position.

    Note: Setting an improper value can prevent the governor from reaching target speed.

18. **Integral High Limit.** Enter the value from the Governor Parameter Summary.

    The Integral High Limit value reduces overspeed duration after a long or sustained underspeed condition was present. The high limit helps reduce the duration and amount of engine overspeed by maintaining a maximum actuator position.

    Note: Setting an improper value can prevent the governor from reaching target speed.

19. Parameter not used.

20. **Overspeed Limit.** Use the default value.

    This value determines the engine speed that triggers the governor output minimum fuel. The parameter's value is in terms of a percentage over the highest set speed.

    Note: The governor controller must be turned off to clear the overspeed detection before the engine can be restarted.

21. **Set Speed A Min.** Enter the value from the Governor Parameter Summary.

    Use Set Speed A minimum to set the lowest value allowed for adjustments of Set Speed A.

22. **Set Speed A Max.** Enter the value from the Governor Parameter Summary.

    Use Set Speed A maximum to set the highest value allowed for adjustments of Set Speed A.

23. Parameter not used.

24. Parameter not used.

25. **Idle Speed Min.** Enter the value from the Governor Parameter Summary.

    The idle speed minimum value is the lowest value allowed for adjustments of idle speed.

26. **Idle Speed Max.** Enter the value from the Governor Parameter Summary.

    The idle speed maximum value is the lowest value allowed for adjustments of idle speed.

27. **Duty Cycle Limit.** Enter the value from the Governor Parameter Summary.

    The duty cycle maximum value sets the absolute maximum amount of drive signal to the actuator and serves as a mechanism for fuel limiting. Fuel limiting is achieved by setting the maximum duty-cycle or ontime allowed during one cycle of the pulse width modulation (PWM) signal controlling the actuator drive circuit.

28. **Startup Speed.** Use the default value.

    The Startup Speed value allows the governor to determine whether the engine is cranking or running whenever an engine speed signal is present.

    The Startup Speed value should be at least 10% higher that the fastest engine cranking speed but lower than the engine's idle speed.

    If the Startup Speed is too low (less than crank speed) the governor's target speed is ramped to the active Set Speed (Idle, Set Speed A or B) before the engine has started. When the engine does not start, it may overspeed or output excessive smoke because the startup ramp, having already completed, no longer controls the rate of engine speed increase.

    If the Startup Speed is too high (above the active set speed) then the Startup Speed becomes the target speed that the governor must reach before the governor considers the startup sequence complete. Typically, the startup sequence ends when the engine speed reaches the active set speed. The active set speed is the idle speed if the Idle Hold Time parameter is a nonzero value or the selected set speed (either Set Speed A or B).

29. **Startup Duty Cycle.** Enter the value from the Governor Parameter Summary.

    The Startup Duty Cycle value is used to preload the PID values with a PWM duty cycle value that provides an actuator output signal sufficient to allow enough fuel to idle the engine.

    If the Startup Duty Cycle value is too low, the engine crank time may be longer than desired because the governor's actuator output starts from a value much smaller than needed to begin opening the fuel valve.

    If the Startup Duty Cycle value is too high, the engine may overspeed because the actuator opens more that needed to start the engine.

Appendix C Parameter Default Settings

No.	Parameter Name	GM17644-4 Default Settings	John Deere, 20–40REOZJ, 4045DF150	John Deere, 50REOZJ, 4045TF150	John Deere, 100REOZJ, 6068TF250	John Deere, 150ROZJ, 6081AF001
1	Number of Flywheel Teeth	0	0	0	0	0
2	Set Speed A, Hz	1000	3550	3225	3225	3225
—	—	—	—	—	—	—
4	Idle Speed, Hz *	50	2130	1935	1935	1935
5	Proportional	25	35	35	45	50
6	Integral	50	25	70	60	80
7	Derivative	25	39	39	35	35
—	—	—	—	—	—	—
—	—	—	—	—	—	—
10	OVG @ Idle	20	20	20	20	20
11	Gain Factor	20	5	5	8	22
12	Speed Filter	16	16	16	16	16
13	Idle Hold Time, sec.	0	0	0	0	0
14	Accel Rate, Hz/sec.	1000	1000	1000	1000	1000
15	Decel Rate, Hz/sec.	1000	1000	1000	1000	1000
16	Startup Rate, Hz/sec.	1000	2000	2000	2000	2000
17	Integral Low Limit	0	0	0	0	0
18	Integral High Limit	99	99	40	40	40
—	—	—	—	—	—	—
20	Overspeed Limit, Hz † (see NOTE)	6000	6000	6000	6000	6000
21	Set Speed A Min., Hz	10	1000	1000	1000	1000
22	Set Speed A Max., Hz	11000	5000	5000	5000	5000
—	—	—	—	—	—	—
—	—	—	—	—	—	—
25	Idle Speed Min., Hz	10	500	500	500	500
26	Idle Speed Max., Hz	11000	5000	5000	5000	5000
27	Duty Cycle Limit	95	95	95	95	95
28	Startup Speed, Hz	1000	1000	1000	1000	1000
29	Startup Duty Cycle	30	40	40	40	40

* Idle speed frequency is set so engine runs at 900 rpm in idle mode.

† Overspeed limit for DPG-2101-001, revision E and prior, Woodward governor control is 100%.
Overspeed limit for DPG-2101-002, revision NEW and later is 6000 Hz.

NOTE: The original Barber-Colman governor is an analog type and is not programmable.

Appendix D Diagnostics and Troubleshooting

Use troubleshooting chart 1 to help diagnose generator set/engine problems relating to the Woodward governor controller (based on Woodward document 36526).

LED Indications

LED State	Fault
Off	Governor controller is either not currently powered or is being reverse powered. (Check polarity of supplied power.) If correctly powered, governor controller is malfunctioning.
Blinking Slow (1/2 Hz)	Governor controller is powered, but not sensing a speed signal. OK if engine is not running. If the engine is running, this indicates a fault with the speed signal.
Blinking Fast (1 1/2 Hz)	Governor controller is powered and an engine speed signal is being detected. If the engine is not running, this indicates electrical noise on the speed signal wires.
ON and Not Blinking	Governor controller is powered and is malfunctioning. Replace governor controller.

Troubleshooting Chart 1

Symptom	Possible Cause	Remedy
LED display does not light up when the governor controller is powered	BAT+ and BAT- leads are reversed.	Check and correct wiring.
	Battery voltage is too low. Governor controller supply voltage should be 9-30 VDC.	Charge or replace the battery.
	Governor controller is defective.	Replace governor controller.
Unable to modify parameters	The parameter's value is the maximum value allowed.	Enter acceptable value.
	The parameter's value is the minimum value allowed.	Enter acceptable value.
	PST software not communicating with the controller.	Check cable connection.
	Keypad is defective.	Replace governor controller.
Engine does not start	Actuator leads not connected or shorted.	Check and correct actuator wiring.
	No fuel source.	Check fuel supply, fuel line, and shutoff valves.
	Battery voltage is low.	Charge or replace the battery.
	Set speed is lower than crank speed.	Increase the set speed value.
	Startup rate setting is too low. The target speed ramps up too slow.	Increase the startup rate value.
	Startup limit is too low, limiting the actuator drive signal too much.	Increase the startup limit value.
	No magnetic pickup (MPU) speed signal present. Magnetic pickup should be 2.0 VRMS minimum.	Adjust the MPU gap. Try reversing the MPU leads; otherwise, replace the MPU.
	If a speed signal is present, measure the actuator output duty cycle.	If not greater than 5%, restore all parameter values to factory default settings and crank the engine again.
	Final target speed must be greater than crank speed before the governor will attempt to drive the actuator open.	Increase the final target speed value and/or decrease the crank speed value.
Engine overspeeds at startup	The proportional value is too low.	Increase the proportional value.
	The appropriate overall gain (OVG) value is too low.	Increase the appropriate OVG value.
	The startup ramp rate is too high.	Decrease the startup ramp rate value.

Symptom	Possible Cause	Remedy
Engine does not reach set speed	Improper Proportional, Integral, and Derivative (PID) tuning values.	Check and adjust the PID values.
	Integral value is too low or zero.	Increase the integral value.
	PID values are too low. A tuning that is too soft can prevent the governor from delivering the needed actuator drive signal to reach the set speed.	Check and adjust the PID values.
	PID values are too high. Tuning is too hot or oversensitive to small speed errors causing the governor to make large, rapid changes in actuator drive signal, creating an average signal that is inadequate.	Decrease PID tuning values.
	The integral low limit setting is too high.	Return the integral low limit value to the default setting of zero.
	The integral high limit setting is too low.	Return the integral high limit value to the default setting of 99.
Engine takes too long to reach the set speed	Improper PID tuning values.	Check and adjust the PID values.
	Integral setting is too low.	Increase the integral value.
	Startup rate setting is too low.	Increase the startup rate value.
	Accel rate setting is too low.	Increase the Accel rate value.
	Speed filter setting is too high.	Decrease the speed filter value.
Engine does not track speed setting changes	Is the LED flashing fast (3 Hz)?	If no, check speed sensing circuit.
	Is the selected set speed parameter being modified?	If yes, speed setting display is unavailable during changes.
	A PID value or an OVG value is too high.	Decrease the PID values or OVG value.
	A PID value is too low or zero.	Increase the PID value.
	Accel rate is set too low.	Increase the Accel rate value.
	Decel rate is set too low.	Increase the Decel rate value.
Excessive smoke at startup	Improper PID tuning values.	Check and adjust the PID values.
	The startup rate is too high.	Use a lower startup rate value.
	The startup limit is too high.	Use a lower startup limit value.
	No/low MPU speed signal present. MPU should be 2.0 VRMS minimum.	Adjust the MPU gap. Try reversing the MPU leads; otherwise, replace the MPU.
Slow response to load changes	Gain value set too low.	Decrease the gain value.
	Improper PID tuning values.	Check and adjust the PID values.
	Speed filter setting is too high.	Decrease the speed filter value.
Engine instability with no load	Improper PID tuning values.	Check and adjust the PID values.
	Speed filter setting is too low.	Increase the speed filter value.
	Fuel flow is restricted.	Check actuator linkage.
	Battery voltage is too low.	Charge or replace the battery.
Engine instability with load	Improper PID tuning values.	Check and adjust the PID values.
	Fuel flow is restricted.	Check actuator linkage.
	Battery voltage is too low.	Charge or replace the battery.
Engine unable to carry rated load	PID values may be too high, causing the governor to overreact and make large, rapid changes in PWM duty cycle output to the actuator.	Check and decrease the PID values.
	Improper PID tuning values.	Check and adjust the PID values.
	Fuel flow is restricted.	Check actuator linkage.
Load share does not work (load share model)	No/low ILS input signal present. ILS should be 2.375–2.625 VDC.	Check ILS wiring; otherwise, replace the ILS.
	ILS signal wiring having electrical interference problems.	Use shielded wiring.
Droop does not work (load share model)	The no load and full load values are not calibrated.	Perform the droop calibration procedure.
	Difference between no load and full load calibration values is too small. Should be >100 for best performance.	Adjust the no load and/or full load calibration values.
	Actuator linkage range too small.	Modify or adjust actuator linkage to increase range of actuator loading.

Use troubleshooting chart 2 to help diagnose generator set/engine problems relating to the Barber- Colman governor controller (based on Barber- Colman document Dyna 130-2 for governor controller 324515).

Troubleshooting Chart 2

Item	Symptom	Detection	Remedy
1	Engine does not crank over when start switch is operated	Check proper battery connections and voltage.	Repair, change, or replace as required.
		Check wiring to start switch and solenoid.	Repair or replace as required.
		Check starter in accordance with engine manual.	Repair or replace as required.
		Check tripped overspeed switch.	Reset speed switch.
2	Engine cranks but does not fire or start	Check for fuel in tank.	Fill tank.
		Carefully loosen nut at injector and crank engine, checking for fuel.	If fuel, check engine manual. If no fuel, proceed to step 3.
3	No fuel to injectors	Loosen return fuel line connector and check for fuel while cranking.	If no fuel, check line to fuel pump and pressure supply, if any. If fuel, proceed to next step.
4	No fuel to injectors, but fuel to pump	While cranking engine, check for voltage at actuator terminals on fuel pump cover. Should be approximately 75% or greater of cranking voltage.	If voltage is present, proceed to step 5. If no voltage, proceed to step 6.
5	No fuel to injectors, fuel to pump, and voltage to actuator terminals	Place a low impedance 0–10 amp ammeter in one line to actuator. May need to check polarity first with voltmeter if polarized ammeter. Crank engine and check for 4.3 ±1.5 amps for 12 VDC and 2.5 ±1.3 amps for 24 VDC system.	If no current, internal wiring, or coil open in cover assembly. Remove and replace. If shows proper current, check cover or replace fuel pump assembly.
6	No fuel to injectors, fuel to pump, and **no** voltage to actuator terminals	Check for DC voltage at actuator output terminals of governor control box while cranking. Should be approximately 75% or greater of cranking voltage.	If voltage is present, repair or replace wire from control box to actuator. If no voltage at actuator terminals while cranking, proceed to step 7.
7	No voltage at actuator terminal while cranking	Check for proper DC supply voltage to governor control box while cranking.	If no voltage, check and repair wiring.
		Check for 2.5 VAC minimum at magnetic pickup input terminal to governor control box while cranking.	If no voltage or low voltage, check or replace magnetic pickup and/or wiring. If voltage above 2.5 VAC, proceed to step 8.
8	DC voltage and magnetic pickup voltage are okay, but no voltage out actuator terminals when cranking	Remove all wires but DC input power and magnetic pickup. While cranking engine, slowly turn SPEED potentiometer on box clockwise at least ten turns, checking for DC voltage at actuator terminals of control box with actuator leads disconnected. **Warning:** Turn SPEED potentiometer counterclockwise ten turns before connecting other wires and starting engine.	If no voltage, replace governor control box. If voltage is present, check and correct wiring of disconnected wires.
9	Engine runs but will not produce maximum power	Check to determine that throttle shaft lever and/or shutoff lever are at proper position.	Shutoff lever must be at maximum position and throttle shaft lever 12% above maximum operating speed.
		Check that DROOP is properly set.	Turn DROOP adjustment screw counterclockwise until it stops. Turn the screw two full turns clockwise.
		Check that L potentiometer is properly set on controller.	Note position of L potentiometer. Turn slowly clockwise to increase current to actuator. If engine still does not produce full power, return L potentiometer to original position.
10	Engine speed erratic at high loads	Make certain throttle shaft lever and DROOP are properly set.	Set per step 9.
11	Engine speed surges, jitters, or operates erratically at all or some speeds and loads	Refer to calibration and troubleshooting for the appropriate controller.	Follow procedure.

Use troubleshooting chart 3 to help diagnose generator set/engine problems relating to the Barber- Colman governor controller (based on Barber- Colman document F-24419-1 for governor controller 336236).

Troubleshooting Chart 3

Symptom	Detection	Remedy
System appears dead (actuator fails to move to full fuel)	Check battery voltage at controller with power switch ON. Measure DC battery voltage between the red (+) and black (-) leads. Battery voltage should be present.	Check connections to battery.
	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 the white and black/white leads on controller while cranking engine. Voltage should be 2.5 volts RMS or greater (AC input impedance of meter must be 5000 ohms/volt or greater).	Check for damage to or improper adjustment of magnetic pickup. Replace or readjust.
	Check actuator with power ON to controller. Measure following terminals on control box with respect to the black lead. All points should read BATTERY VOLTAGE (+0.00/-0.75 VDC). 1. Purple lead to black lead on controller. 2. Second purple lead to black lead on controller (continue this test only if battery voltage is not present). 3. Following checks are terminals on the actuator and the black lead on controller: a. Low voltage (1.0-2.0 VDC) at either actuator connector. b. Battery voltage at both actuator connections. c. Battery voltage at one actuator lead but not at the other.	Replace controller if battery voltage is not present at both purple leads. Broken actuator lead. Broken actuator lead. Replace actuator.
Actuator lever goes to full fuel whenever the power is turned ON and engine is not running	Check controller by removing the actuator lead to purple lead and turning power ON to controller. 1. Actuator goes to full fuel. 2. Actuator does not go to full fuel. **Note:** Turn off power and reconnect purple lead.	Check for shorted actuator lead. Replace controller because it should not cause actuator lever to go to full fuel with engine not running.
Actuator hunts during operation	Linkage or rod end bearings sticking or binding.	Lubricate or replace.
	Improper linkage arrangement (stroke too short or improper nonlinear linkage used).	See installation information.
	Improper governor adjustment.	Readjust calibration.
	Inadequate power supply voltage. 1. Turn power switch OFF. 2. Connect both leads to actuator at purple leads of control box. 3. Connect one actuator lead to the red lead and one actuator lead to the black lead of the control box. 4. Momentarily turn ON the DC power. 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:** Reconnect actuator leads properly after completing this test.	If actuator does not get to full fuel, check actuator leads. If voltage is less than specified, check for loose or poor connections to battery or get larger supply leads or power supply.