John Deere

4024

Woodward Set-Up

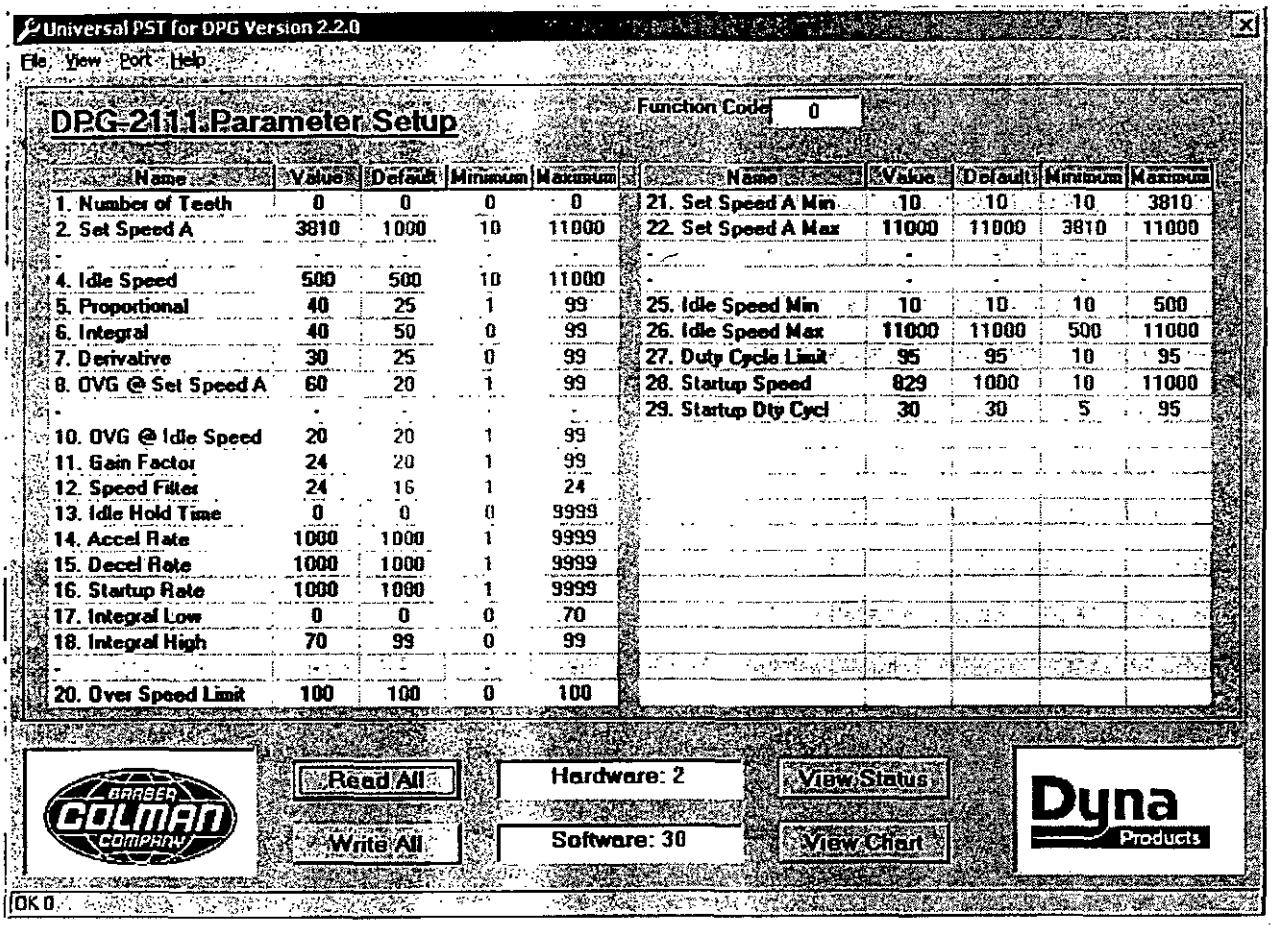
07/14/04

1. Start the engine generator set with the woodward cable connected.

2. Run the John Deere Woodward software.

3. Read the program on the woodward. If it doesn't match the following reprogram it to this setting first.

4. Make sure it matches this:



5. Run the engine and see if it hunts.

6. If the engine hunts change any of the following Proportinal, Integral, Derivative, and the OVG @ Set Speed A. To change one of these terms click on it with the mouse. Hit Enter type in the new term and hit Enter again. This will write the term and make the engine change.

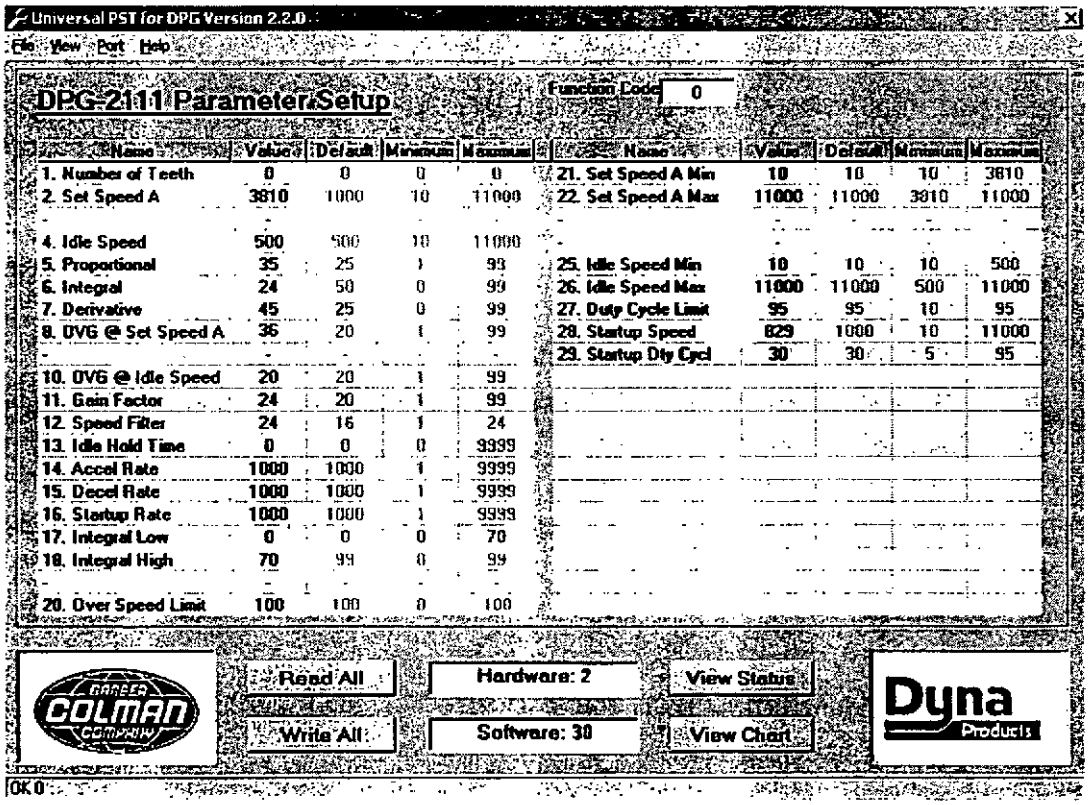
7. Write down what you changed to stabilize the unit. This must be done at no load before the water temp gets to 150°F.

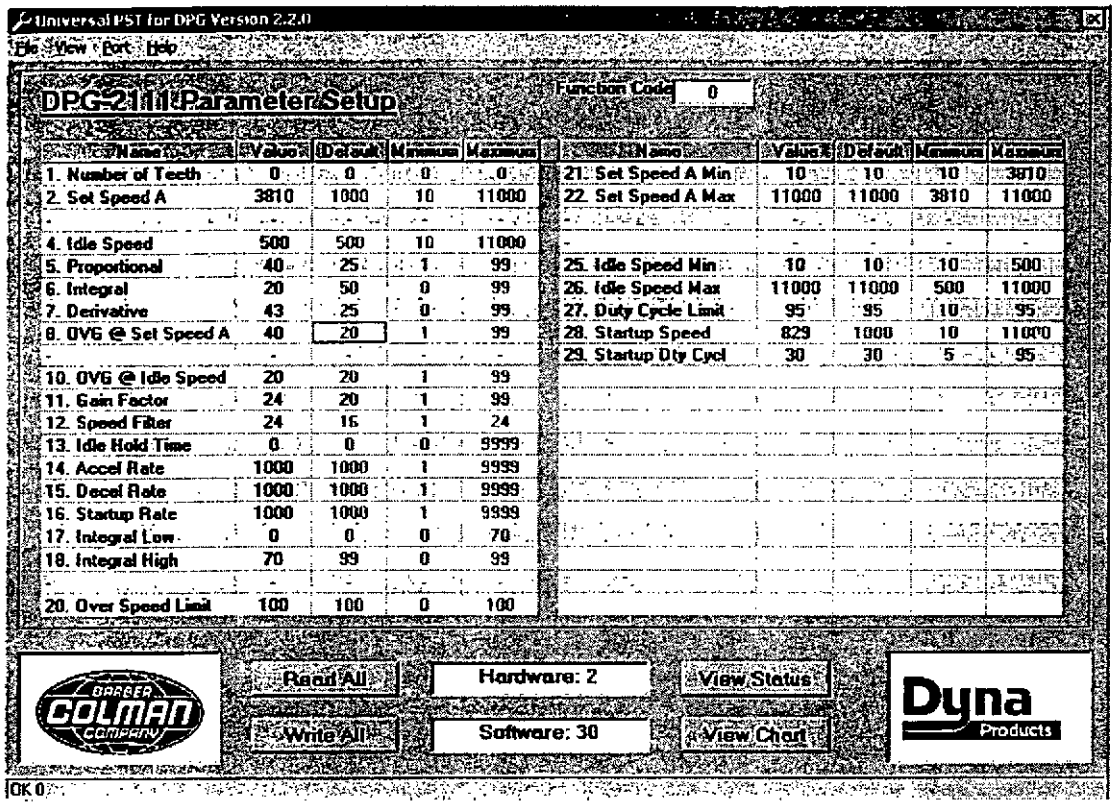
8. Run the unit at full Load and do your load steps above 150°F. Adjust the Proportinal, Integral, Derivative, and the OVG @ Set Speed A; until the unit stabilizes with the full load drops. Note those numbers. If they vary from the Cold engine numbers try using numbers 1/3 the way between the Hot run numbers to the Cold numbers. Stay closer to the hot numbers.

9. Run the load steps again. If everything stabilizes drop load and run the engine @ no Load for 5 min. Click on the write all button with your mouse. (If there are white puffs of smoke shut unit down for replacement oil (fuel rail) thermostat.)

10. If engine overspeeds at start up loosen the jam nut over the set screw found in the front of the engine. Back out the set screw carefully by hand until you feel resistance. Turn it back in ½ turn. Tighten the nut back down.

11. Included are a few combinations found to work on other units tested by Katolight to Date.





12. Proportional: has been set around 30-45. It is used mainly to bring the engine speed back to 60 Hz. If the rest of your engine response is ok.

13. Integral: has been set around 20-40. It is used to reduce cycling… be careful with this term. Integral numbers too low lead to long engine crank times.

14. Derivative: has been set around 30-50. It is used to reduce hunting time.

15. OVG @ Set Speed A: has been set around 35-60. It is the Gain function for this governor.

16. Do not adjust the proportional any more than you have to. Most of the adjustment should be able to be done with the Gain, Integral, and Derivative.3

17. If you have problems revert back to original John Deere Settings and start from there.

USER MANUAL

PRODUCT SERIES: DPG-21XX-001

DYNA Programmable Governor for Isochronous Generators

GOVERNOR OVERVIEW

The DPG-21XX-001 is used primarily to govern diesel or gas fueled engines of generator sets.

This microprocessor based, digital controller performs across a wide speed range and allows adjustment of Set Speed and Gain with the built-in user interface.

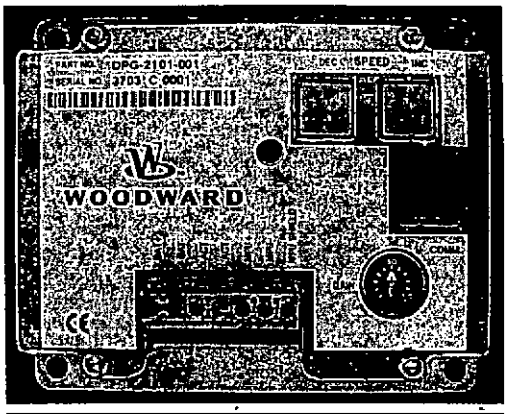
The COMM port provides access to all other governor settings to allowing adaptation to each application.

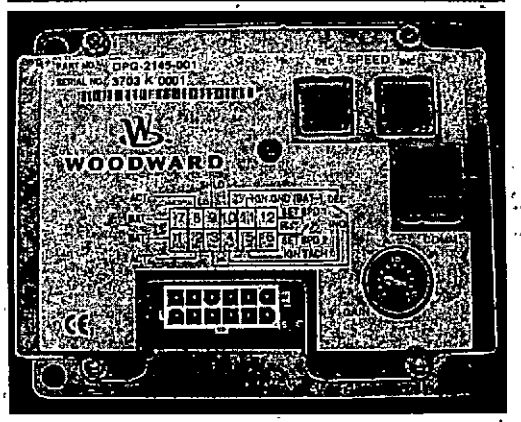
Separately programmable Proportional, Integral, and Derivative gains are provided for tailoring governor response to many engine applications.

Properly tuned, this governor delivers fast engine response to speed or load change while providing precise stable isochronous operation.

Other adjustments include Acceleration and Deceleration Ramp Rates, Idle Speed Set and Hold Time, and more.

The governor's internal FAILSAFE reacts instantly to loss of the engine speed signal allowing the actuator to return to minimum fuel.





Actuator Compatibility:

DYNA 2000
DYNA 2500
DYNA 7000
DYNA 70025
Power Flow Gas Valves
FRA 2400
DYNA 8000
DYNA 8200
DYNA 8400

Other Models Available:

DPG-2200 Series – for Genset Applications
DPG-2300 Series – for Off-road Vehicles
DPG-2401 Series – for EFC Valve Applications

Isochronous Speed Control

User Friendly/Operator Adjustable

Precision Frequency Control

Superior Temperature Stability

Reverse Battery Protection

9 - 30 VDC Input Voltage Range

Remote Setup

Serial Communication Port

Woodward
620 West Howard Street
Niles, IL 60714 USA
www.woodward.com

Tel: 847-967-7730
Fax: 847-967-7832
E-mail:
info_niles@woodward.com

WARNING: Always disconnect power before making external connections to the control unit, to protect against electrical shock.

WARNING: As a safety measure, the engine should be equipped with an independent over speed shutdown device in the event of a failure that may render the governor inoperative.

WARNING: Actuator failure can occur when using a nominally rated 12Volt Actuator in a 24Volt system. This failure may occur if the maximum available current flows through the actuator. The maximum current can be limited by reducing the power supply voltage to 12 VDC nominal, for the actuator.

NOTE: Woodward believes that all information provided herein is correct and reliable but reserves the right to update at any time. Woodward does not assume any responsibility for its use unless otherwise expressly undertaken.

Table of Contents

1 Governor Specifications

The governor's main electrical and mechanical specifications are listed here along with several performance characteristics. The DPG-21XX-001 Series Governors are available in five hardware configurations.

1.1 Configurations

Model #	Connector Style Options		Speed Sensing Options		Adjustable Set Speeds	Remote Speed INC and DEC
	7-wire Euro	12-pin Molex	Magnetic Pickup	Ignition Sense		
DPG-2101-001	*		*		1 + idle	
DPG-2111-001	*		*		1 + idle	
DPG-2146-001	*			*	1 + idle	
DPG-2145-001		*		*	2 + idle	*
DPG-2155-001		*	*		2 + idle	*

1.2 Electrical

Operating Voltages:	9 VDC minimum to 30 VDC maximum
Maximum Controlled Output Current:	7 amps
Maximum Surge Current:	14 amps for ten seconds
Connections:	Terminal Strip with 7 terminals or A Quick connector with 12 pins
Input Signal from the Magnetic Pickup:	2.0 VAC RMS minimum during cranking
Input Signal from the Engine's Ignition System:	40 Volts minimum during cranking

1.3 Mechanical

Ambient Operating Temperature:	-40°F to +185°F, -40°C to +85°C
Sealing:	Oil, water, and dust resistant via conformal coating and die cast enclosure
Weight:	.6lbs, .28kilograms

1.4 Performance

Steady State Speed Band:	± .25% over Ambient Operating Temperature range
Engine Speed MPU Measurement Range:	10 MPU Hertz to 14,000 MPU Hertz
Governing Speed Range with MPU:	500 MPU Hertz to 11,000 MPU Hertz
Engine Speed Ignition Measurement Range:	2 Hertz to 350 Hertz
Governing Speed Range with Ignition:	25 Hertz to 300 Hertz

2 User Interface Operation

2.1 *Keypad* *(Not available on the DPG-2111-001)*

The DPG-21XX-001 provides two buttons for adjusting the engine set speed.

- INC - is used to increase the *selected* Set Speed (A or B)
- DEC - is used to decrease the *selected* Set Speed (A or B)

2.2 *Gain Potentiometer*

The DPG-21XX-001 provides a potentiometer, labeled GAIN, used to adjust the Overall Gain at Set Speed A. This is one of the governor's tuning parameters. On the DPG-2111-001, the gain potentiometer adjustment range is +/-20% on the nominal value entered for the Gain at Set Speed A parameter. For all other models, the gain potentiometer adjustment range is 1 to 99.

2.3 *LED*

The LED (Light Emitting Diode) is used as a status 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).

If a voltage between 9 volts DC and 30 volts DC is being properly supplied across the BAT+ and BAT- connector pins 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 controller is not seeing a speed signal.

This means the engine is not running. If the engine is running or cranking and the LED is blinking slow then refer to the troubleshooting section for help in diagnosing why the speed signal to the controller is missing.

A fast blinking LED indicates all of the following:
1. The unit is powered.
2. There is an engine speed signal at the controller's tachometer inputs.

When the LED is on and not blinking it indicates the following;
1. The unit is powered.
2. Controller fault.

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.

2.4 *COMM Port*

All governor adjustments require that the controller be connected, via the COMM port, to a computer running the Universal PST application. The Universal PST is an MS Windows based application available from the software download page at www.dynaproducts.com. The Universal PST chapter of this manual describes how to acquire, install and use the Universal PST application.

3 Parameter Reference

This chapter provides information regarding each of the parameters that can be adjusted when a computer is connected to the controller via the COMM port. Universal PST (described in the following chapter) is required to make adjustments to the parameters described in this chapter, with the exception of Set Speed A, Set Speed B, and Gain at Set Speed A. It contains 27 subsections. Each subsection provides information about a single parameter.

The following tables list each of the parameters and their default, minimum, and maximum values. Several of the parameters have minimum and maximum values set by other parameters. *Speed* and *Rate* values are shown as Hertz values.

	Parameter List for the DPG-2101-001 and the DPG-2146-001 (ignition) (these controllers use the 7-terminal Euro style screw terminal connector)			
	Parameter Name	**Default**	**Minimum**	**Maximum**
Opt.	1. # of Flywheel Teeth or (Pulses per revolution)	0	0	572
Req.	**2. Set Speed A**	**1000 (25)**	**Set Speed A Min**	**Set Speed A Max**
	3. not available			
Opt.	4. Idle Speed	50 (20)	Idle Speed Min	Idle Speed Max
Req.	**5. Proportional**	**25**	**1**	**99**
Req.	**6. Integral**	**50**	**0**	**99**
Req.	**7. Derivative**	**25**	**0**	**99**
Req.	**8. Gain at Set Speed A**	**Use the controller's built-in GAIN potentiometer**		
	9. not available			
Opt.	10. Gain at Idle Speed	20	1	99
Req.	**11. Gain Factor**	**20 (40)**	**1**	**99**
Req.	**12. Speed Filter**	**16 (4)**	**1**	**24**
Opt.	13. Idle Hold Time	0	0	9999
Opt.	14. Accel Rate	1000 (3000)	1	9999
Opt.	15. Decel Rate	1000 (3000)	1	9999
Opt.	16. Startup Rate	1000 (3000)	1	9999
Opt.	17. Integral Low Limit	0	0	Integral High Limit
Opt.	18. Integral High Limit	99	Integral Low Limit	99
Opt.	19. Password	0	0	99
Opt.	20. Over-speed Limit	100	0	100
Opt.	21. Set Speed A Min	10 (2)	10 (2)	Set Speed A
Opt.	22. Set Speed A Max	11000 (300)	Set Speed A	11000 (300)
	23. not available			
	24. not available			
Opt.	25. Idle Speed Min	10 (2)	10 (2)	Idle Speed
Opt.	26. Idle Speed Max	11000 (300)	Idle Speed	11000 (300)
Opt.	27. Duty cycle Max	95	10	95
Opt.	28. Startup Speed	1000 (25)	10 (2)	11000 (300)
Opt.	29. Startup Duty cycle	30	5	95

Req. = Parameter adjustment required to achieve Basic Governing
Opt. = Parameter use is optional

Default, Minimum and Maximum Values in parenthesis apply when the controller uses ignition pulses to sense engine speed, which would be the case for a DPG-2146-001 controller

	Parameter List for the DPG-2155-001 and the DPG-2145-001 (ignition) (these controllers use the 12-terminal quick connect)			
	Parameter Name	**Default**	**Minimum**	**Maximum**
Opt.	1. # of Flywheel Teeth or (Pulses per Revolution)	0	0	572
Req.	**2. Set Speed A**	**1000 (25)**	**Set Speed A Min**	**Set Speed A Max**
Opt.	3. Set Speed B	1000 (25)	Set Speed B Min	Set Speed B Max
Opt.	4. Idle Speed	50 (20)	Idle Speed Min	Idle Speed Max
Req.	**5. Proportional**	**25**	**1**	**99**
Req.	**6. Integral**	**50**	**0**	**99**
Req.	**7. Derivative**	**25**	**0**	**99**
Req.	**8. OVG @ Set Speed A**	**Use the controller's built-in GAIN potentiometer**		
Opt.	9. OVG @ Set Speed B	20	1	99
Opt.	10. OVG @ Idle Speed	20	1	99
Req.	**11. Gain Factor**	**20 (40)**	**1**	**99**
Req.	**12. Speed Filter**	**16 (4)**	**1**	**24**
Opt.	13. Idle Hold Time	0	0	9999
Opt.	14. Accel Rate	1000 (3000)	1	9999
Opt.	15. Decel Rate	1000 (3000)	1	9999
Opt.	16. Startup Rate	1000 (3000)	1	9999
Opt.	17. Integral Low Limit	0	0	Integral High Limit
Opt.	18. Integral High Limit	99	Integral Low Limit	99
Opt.	19. Password	0	0	99
Opt.	20. Overspeed Limit	100	0	100
Opt.	21. Set Speed A Min	10 (2)	10 (2)	Set Speed A
Opt.	22. Set Speed A Max	11000 (300)	Set Speed A	11000 (300)
Opt.	23. Set Speed B Min	10 (2)	10 (2)	Set Speed A
Opt.	24. Set Speed B Max	11000 (300)	Set Speed B	11000 (300)
Opt.	25. Idle Speed Min	10 (2)	10 (2)	Idle Speed
Opt.	26. Idle Speed Max	11000 (300)	Idle Speed	11000 (300)
Opt.	27. Dutycycle Max	95	10	95
Opt.	28. Startup Speed	1000 (25)	10 (2)	11000 (300)
Opt.	29. Startup Dutycycle	30	5	95

Req. = Parameter adjustment required to achieve Basic Governing
Opt. = Parameter use is optional

Default, Minimum and Maximum Values in parenthesis apply when the controller uses ignition pulses to sense engine speed, which would be the case for a DPG-2145-001 controller.

Note: All *Speed* and *Rate* values are shown as Hertz values (parameters 2-4, 14-16, 21-26). Changing the value of parameter number 1 will cause different default values to be displayed based on the Hertz to RPM formula.

	Parameter List for the DPG-2111-001 (these controllers use the 12-terminal quick connect)			
	Parameter Name	**Default**	**Minimum**	**Maximum**
Opt.	2. # of Flywheel Teeth or (Pulses per Revolution)	0	0	572
Req.	**2. Set Speed A**	**1000**	**Set Speed A Min**	**Set Speed A Max**
Opt.	3. not available			
Opt.	4. Idle Speed	50	Idle Speed Min	Idle Speed Max
Req.	**5. Proportional**	**25**	**1**	**99**
Req.	**6. Integral**	**50**	**0**	**99**
Req.	**7. Derivative**	**25**	**0**	**99**
Req.	**8. OVG @ Set Speed A**	**20**	**1**	**99**
		The controller's built-in GAIN ADJUST potentiometer provides a +/-20% adjustment range of the nominal gain value entered.		
Opt.	9. not available			
Opt.	10. OVG @ Idle Speed	20	1	99
Req.	**11. Gain Factor**	**20**	**1**	**99**
Req.	**12. Speed Filter**	**16**	**1**	**24**
Opt.	13. Idle Hold Time	0	0	9999
Opt.	14. Accel Rate	1000	1	9999
Opt.	15. Decel Rate	1000	1	9999
Opt.	16. Startup Rate	1000	1	9999
Opt.	17. Integral Low Limit	0	0	Integral High Limit
Opt.	18. Integral High Limit	99	Integral Low Limit	99
Opt.	19. Password	0	0	99
Opt.	20. Overspeed Limit	100	0	100
Opt.	21. Set Speed A Min	10	10	Set Speed A
Opt.	22. Set Speed A Max	11000	Set Speed A	11000
Opt.	23. not available			
Opt.	24. not available			
Opt.	25. Idle Speed Min	10	10	Idle Speed
Opt.	26. Idle Speed Max	11000	Idle Speed	11000
Opt.	27. Dutycycle Max	95	10	95
Opt.	28. Startup Speed	1000	10	11000
Opt.	29. Startup Dutycycle	30	5	95

Req. = Parameter adjustment required to achieve Basic Governing
Opt. = Parameter use is optional

Note: All *Speed* and *Rate* values are shown as Hertz values (parameters 2,4, 14-16, 21-22,25-26). Changing the value of parameter number 1 will cause different default values to be displayed based on the Hertz to RPM formula.

3.1 # of Flywheel Teeth or Pulses per Revolution (optional)

This parameter provides the conversion factor needed to display speeds as RPM values instead of Hertz values. Adjusting this parameter is optional. The default value of 0 disables Hertz (Hz) to RPM conversions so all set speeds are displayed in Hertz. Setting this parameter to a value other than zero enables Hertz to RPM conversion.

Adjust this parameter to a value equal to the exact number of pulses seen by the governor in one revolution of the engine to display set speeds in RPM. The formula used to convert the speed signal from a Hertz value to a RPM value is:

$\frac{[(Hertz)\times(60s)]}{[Pulses\_per\_rev]} = [EngineRPM]$	For example: $\frac{[(3960Hz)\times(60s)]}{[132Pulse\_per\_rev]} = [1800RPM]$

The following derivation of the above formula can be used to convert from RPM to Hertz.

$$\frac{[(EngineRPM)\times(Pulses\_per\_rev)]}{[60s]} = [Hertz]$$

DPG-2101-001, DPG-2111-001 and DPG-2155-001 controllers
To use this parameter correctly on governors sensing engine speed with a magnetic pickup, you must know the exact number of flywheel teeth that pass by the magnetic pickup in one revolution of the engine.

DPG-2145-001 and DPG-2146-001 controllers
To use this parameter correctly on governors sensing engine speed via ignition pulses, you must know the exact number of ignition pulses that occur in one revolution of the engine.

3.2 Set Speed A (required)

This parameter is adjustable both from the controller's DEC and INC keys and by using the Universal PST application. However, when the value is changed using the controller's keypad, the value displayed by the Universal PST does not automatically update. To refresh the value displayed on the PC the user must select a different parameter with the mouse pointer then reselect the value of Set Speed A. The Universal PST application also provides a [Read All] button that can be used to perform a complete refresh of all parameter values.

SET SPEED A is the governor's target speed after startup when Set Speed B is not selected. The startup sequence is complete when the target speed and the engine speed reach the set speed.

NOTE: If parameter number 1 is used, then the Universal PST will display speeds and ramp rates as RPM values instead of Hertz values.

On DPG-2145-001s and DPG-2155-001s, when a two-position switch is connected between SET SPD 1 (pin 12) and SET SPD 2 (pin 6) then an open switch selects SET SPEED A as the governor's target speed. If the governor's SET SPD inputs are not used then SET SPEED A is automatically the active target speed after the startup sequence is completed. See the chapter Installation Instructions for details about wiring in a switch to use the speed select feature available on DPG-2145-001 and DPG-2155-001 model controllers.

3.3 Set Speed B (optional) (available only on DPG-2145-001 and DPG-2155-001)

SET SPEED B becomes the governor's target speed on DPG-2145-001s and DPG-2155-001s, when SET SPD 1 (pin 12) and SET SPD 2 (pin 6) of the connector are tied together. In other words, when a two-position switch is connected between SET SPD 1 (pin 12) and SET SPD 2 (pin 6) then a closed switch selects SET SPEED B as the governor's target speed.

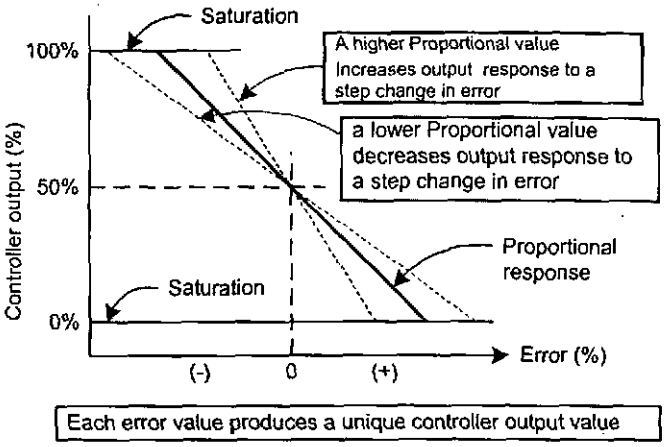
See the chapter Installation Instructions for details about wiring in a switch to use the speed select feature available on DPG-2145-001 and DPG-2155-001 model controllers.

3.4 *Idle Speed (optional)*

The IDLE SPEED is the governor's target speed for the IDLE HOLD TIME (see parameter 13) when the engine is started. When the idle hold timer reaches zero, the target speed will be become either SET SPEED A or SET SPEED B depending on the state of the SPEED SEL input terminal.

3.5 *Proportional (required)*

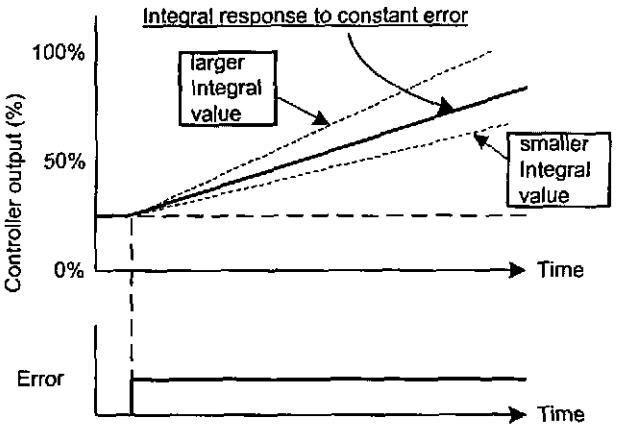
The proportional term is one of the interrelated PID terms that determine how well a DPG controller governs the engine's speed. A speed change creates a speed error (the difference between the target speed and the actual speed.) The proportional gain controls the size of the governor output response to a step change in the speed error.



3.6 *Integral (required)*

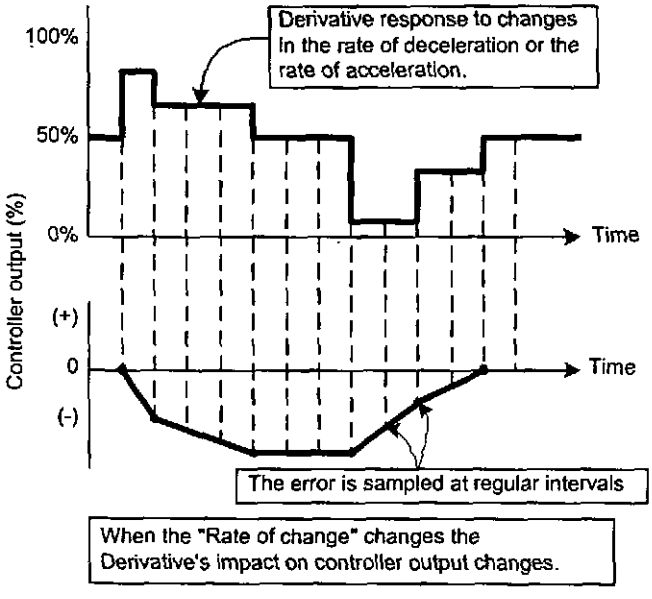
The integral term is one of the interrelated PID terms that determine how well a DPG controller governs the engine's speed. The integral term acts to drive speed error to zero. In a proportional-only control with constant load, there will be a constant speed error that inversely relates to the proportional gain of the system. The integral term is key to isochronous speed control. The term eliminates the difference between the programmed set sped and the actual speed. The integral gain changes the time it takes to drive the error is to zero.

Note: Integral is needed to eliminate speed offsets due to proportional gain and should never be left at zero.



3.7 *Derivative(required)*

The derivative term is one of the interrelated PID terms that determine how well a DPG controller governs the engine's speed. 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 rapid engine acceleration or deceleration. If 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.



3.8 *Gain at Set Speed A (required)*

This gain acts as the multiplier on the three PID terms (proportional, integral, and derivative) when Set Speed A is selected as the active target speed. For all models except for the DPG-2111-001, the controller's built-in gain potentiometer is adjustable from 1 to 99.

On the DPG-2111-001, the controllers built-in gain potentiometers adjustable range is +/-20% of the nominal gain value entered for the Gain at Set Speed A parameter. Universal PST is required to modify the nominal value of the Gain at Set Speed A parameter.

For example, the Gain at Set Speed A has a value of 35. The following equations determine the gain potentiometer range of adjustment.

(Gain at Set Speed A) - [(Gain at Set Speed A) * (0.20)] = Min Gain Pot Setting

(35) - [(35) * (0.20)] = 28

(Gain at Set Speed A) + [(Gain at Set Speed A) * (0.20)] = Max Gain Pot Setting

(35) + [(35) * (0.20)] = 42

3.9 *Gain at Set Speed B (optional) (available only on DPG-2145-001 and DPG-2155-001)*

This gain acts as the multiplier on the three PID terms (proportional, integral, and derivative) when Set Speed B is selected as the active target speed. This gain term is adjustable from 01 to 99.

3.10 *Gain at Idle Speed (optional)*

This gain acts as the multiplier on the three PID terms (proportional, integral, derivative) when the Idle Speed is the active target speed. The idle speed set point is active only during startup when the idle hold timer is running. This gain term is adjustable from 01 to 99.

3.11 *Gain Factor (required)*

The gain factor parameter is used to obtain more range of adjustment from the PID terms. In other words, if any of the PID terms or the Gain terms reach their adjustment limits then this value can be modified to provide for more range of adjustment in the PID and Gain terms.

For example, if the PID terms are set to 90, 80, and 50 respectively and the Gain Factor is set to 20, then doubling the Gain Factor by setting it to 40 allows the PID terms to be halved to 45, 40, and 25 respectively. These new settings are equivalent to the previous settings with respect to the governor's tuning response and now allow the PID terms to be adjusted higher if needed.

3.12 *Speed Filter (required)*

This parameter indicates the number of speed signal pulses to use when computing an average engine speed and is used to dampen out speed measurement variations that can make PID tuning difficult. But keep in mind the following.

- Too much filtering will slow down the governor's response to speed changes.
- Too little filtering can make the governor overly sensitive and tuning difficult.

There is measurable acceleration and deceleration that occurs between cylinder firings. As a general rule, less filtering is required the more engine cylinders there are. This is because the number of acceleration-deceleration cycles increases and these oscillations will have lower amplitude. With more cylinders there is less time for the speed to slow down before the next cylinder firing.

Rotational mass also affects the amount of speed signal filtering needed. The more rotational mass, the less filtering is needed. The less rotational mass, the more filtering is needed.

For installations using a magnetic pickup to sense engine speed
Typically the value 24 works well on small 3 or 4 cylinder engines. A value of 16 is recommended for 6 or 8 cylinder engines. The following formula can also be used to derive a good starting point for the speed filter value for a given engine application. Round the result to the nearest integer. The maximum value allowed is 24.

[(#_of_flywheel_teeth) / (#_of_engine_cylinders)] * 0.75 = speed_filter_value

For installations using ignition pulses to sense engine speed
It is recommended that the Speed Filter be at least equal to the number of ignition pulses per one revolution of the engine. A good starting point would be 2 times the number of ignition pulses per one revolution of the engine.

[(pulses_per_rev) * (2)] = speed_filter_value

3.13 Idle Hold Time (optional)

The idle hold time specifies how long, after starting, the engine is to stay at the idle speed before finishing the ramp to the target speed. The time value has a resolution of one-tenth of a second.

3.14 Accel Rate (optional)

This rate specifies how fast the governor should increase the engine's speed when a new higher target speed is made active. The parameter value is specified in Hertz per second based on the following formula.

[(higher_speed_in_Hertz) – (lower_speed_in_Hertz)] / (ramp_time_in_seconds) = accel_rate_value

For example, suppose Set Speed A is 3300 Hertz and Set Speed B is 3960 Hertz. The governor is currently controlling the engine at 3300 Hertz (Set Speed A), when Set Speed B becomes the active target speed. It is desired that the new speed of 3960 be reached in precisely 2 seconds. The following formula determines the value needed by Accel Rate to increase the engine speed from Set Speed A to Set Speed B in 2 seconds.

[(Set Speed B) – (Set Speed A)] / (N seconds) = accel_rate_value in Hertz per second

[3960 – 3300] / 2 = 330 Hertz per second

3.15 Decel Rate (optional)

The Decel Rate specifies how fast the governor should decrease the engine's speed when a new lower target speed is made active. The parameter value is specified in Hertz per second based on the following formula.

[(higher_speed_in_Hertz) – (lower_speed_in_Hertz)] / (ramp_time_in_seconds) = decel_rate_value

For example, suppose Set Speed A is 4170 Hertz and Set Speed B is 3475 Hertz. The governor is currently controlling the engine at 4170 Hertz (Set Speed A), when Set Speed B becomes the active target speed. It is desired that the new speed of 3475 be reached in precisely 1.5 seconds. The following formula determines the value needed by Decel Rate to decrease the engine speed from Set Speed A to Set Speed B in 1.5 seconds.

[(Set Speed A) – (Set Speed B)] / (N seconds) = decel_rate_value in Hertz per second

[4170 – 3475] / 1.5 = 463 Hertz per second

3.16 Startup Rate (optional)

This parameter is used to achieve a smooth controlled engine start. On diesel engines this feature is also useful for minimizing exhaust smoke at startup. When used in combination with the Idle Speed and Idle Hold Time, a brief warm-up cycle can be programmed.

The startup rate specifies how fast the governor should increase the engine speed when the engine is started. The rate value indicates Hertz per second. The formula to use for determining a precise Startup Rate is shown below.

[(final_target_speed_in_Hertz) – (crank_speed_in_Hertz)] / (ramp_time_in_seconds) = startup_rate_value

The ramp up will pause at the STARTUP SPEED until the governor senses an MPU signal greater than the STARTUP SPEED. This prevents the startup ramp from reaching completion before the engine has even started. The governor considers MPU frequencies below the STARTUP SPEED as indicating that the engine is cranking but has not yet started. MPU frequencies above the STARTUP SPEED are taken to indicate that the engine has started and the governor will increase the engine speed until the selected set speed is reached.

Exception 2 – In cases where the target speed is less 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. If the IDLE HOLD TIME is nonzero the initial target speed will be the IDLE SPEED. After the IDLE HOLD TIME the governor then uses the STARTUP RATE to ramp the engine to the selected set speed (SET SPEED A or SET SPEED B). The startup sequence is complete once the engine speed reaches the selected set speed.

NOTE:
When parameter number 1 is used the ACCEL RATE, DECEL RATE, and STARTUP RATE parameters are displayed as a RPM quantity per second instead of a Hz/sec value. The given rate formulas can be used to compute rates in terms of RPM values by substituting the Hertz speed values with RPM speed values.

3.17 Integral Low Limit (optional)

The integral low limit prevents "integral windup" in the negative direction. In other words, the integral low limit parameter is used to reduce under speed duration after a long or sustained over speed condition was present. The low limit helps reduce the duration and amount of engine under speed by maintaining a minimum actuator position.

When smaller pulse width modulated (PWM) duty cycle values do not reduce the engine speed any further but an off speed (measured speed greater than the target speed) remains, letting the Integral term grow more negative is not beneficial. Unused negative integration would cause a slower recovery from an under speed condition.

The integral low limit specifies the PWM duty cycle where the integrator's influence on lowering PID output must stop. The default value is 0%. The value can be adjusted from 0% to 90% in 1% increments.

CAUTION: Use carefully, improper use can prevent the governor from ever reaching the target speed. The first line of defense in reducing over speed or under speed errors is a well-tuned governor via the PID terms.

3.18 Integral High Limit (optional)

The integral high limit prevents "integral windup" in the positive direction. In other words, the integral high limit parameter is used to reduce over speed duration after a long or sustained under speed condition was present. The high limit helps reduce the duration and amount of engine over speed by maintaining a maximum actuator position.

When larger PWM duty cycle values do not increase the engine speed any further but a negative off speed (measured speed less than the target speed) remains, letting the Integral term grow more positive is not beneficial. Unused positive integration would cause a slower recovery from an over speed condition.

If an engine overload situation causes the engine speed to remain below the target speed for some period of time, then the integral portion of PID output would grow larger than otherwise needed (would windup). So when the load is removed the engine may over speed because it takes time for the integral portion of PID output to shrink or "unwind". This is where reducing the Integral Limit High value can help by preventing excessive windup in the PID output's integration term.

The integral high limit specifies the PWM duty cycle where the integrator's influence on raising PID output must stop. The default value is 99%. The value can be adjusted from 99% down to 10% in 1% increments.

CAUTION: Use carefully, improper use can prevent the governor from ever reaching the target speed. The first line of defense in reducing over speed or under speed errors is a well-tuned governor via the PID terms.

3.19 Password (optional)

The password protect parameter is provided to protect against inadvertent parameter changes that may occur whenever the keys are pressed and a parameter modification is not intended. The password protect parameter has three possible settings: DISABLED, LOCKED, and UNLOCKED

DISABLED – This setting turns off any password protection. Use this setting if password protection is not desired. This is the default setting as shipped from the factory. Entering a value of [99] sets the password protect parameter to the disabled mode. When the password protect parameter is selected, the LED display will show [Pd] for 2 seconds indicating the password disabled mode, then the value [00.] is displayed. The user can then edit the value.

LOCKED – This setting means that password protection is active and only parameter viewing is allowed (parameter editing is disabled). Enter a value of [22] to set password protect to locked mode. For 2 seconds after selecting the password protect parameter the LED display will show [PE.] for this mode and the rightmost decimal point will be on (no blinking), then the value [00.] is displayed. The user can then edit the value.

UNLOCKED – This setting means that password protection is active but parameter editing is allowed. Entering a value of [30] while in LOCKED mode will UNLOCK parameter editing. The user is free to edit parameters. If there is no keypad activity for 5 minutes, the controller returns to LOCKED mode.
If not already in the UNLOCKED mode, the user must get into the UNLOCKED mode in order to enter a 99 to disable password protection.

3.20 Over Speed Limit (optional)

This parameter is used to determine the engine speed that will trigger the governor to output minimum fuel. The parameter's value is in terms of a percentage over the highest set speed. In other words, an over speed condition is detected if the engine speed reaches a speed of [OVER SPEED LIMIT %] greater than the highest set speed.

For example: If the highest set speed is 1800 RPM and this parameter is set to 20, then an over speed condition will be detected at 2160 RPM (the value that is 20% greater than 1800). Formula: 1.20 * 1800 RPM = 2160 RPM

The default value of 100 is used to disable over speed detection. Use values less than 100 to enable the over speed limit function and set the limit speed to [(1 + (overspeed_limit_value/100)) * (highest_set_speed)].
NOTE: The governor must be turned off to clear the over speed detection before the engine can be re-started.

NOTE:
When parameter 1 is used the SET SPEED A MIN, SET SPEED A MAX, SET SPEED B MIN, SET SPEED B MAX, IDLE SPEED MIN, and IDLE SPEED MAX parameters are displayed as RPM values instead of Hertz values.

3.21 Set Speed A Min (optional)

Set Speed A Min is used to set the lowest value allowed for Set Speed A adjustments. This parameter can be set to any value within the range of 10 Hertz (2 Hertz ignition) and the current value of the Set Speed A parameter.

3.22 Set Speed A Max (optional)

Set Speed A Max is used to set the highest value allowed for adjustments of Set Speed A. This parameter can be set to any value within the range bordered by current Set Speed A and 11,000 Hertz (300 Hertz ignition).

3.23 Set Speed B Min (optional) (available only on DPG-2145-001 and DPG-2155-001)

Set Speed B Min is used to set the lowest value allowed for adjustments of Set Speed B. This parameter can be set to any value within the range of 10 Hertz (2 Hertz ignition) and the current value of Set Speed B.

3.24 Set Speed B Max (optional) (available only on DPG-2145-001 and DPG-2155-001)

Set Speed B Max is used to set the highest value allowed for adjustments of Set Speed B. This parameter can be set to any value within the range bordered by current Set Speed B and 11,000 Hertz (300 Hertz ignition).

3.25 Idle Speed Min (optional)

Idle Speed Min is used to set the lowest value allowed for adjustments of Idle Speed. This parameter can be set to any value within the range of 10 Hertz (2 Hertz ignition) and the current value of Idle Speed.

3.26 Idle Speed Max (optional)

Idle Speed Max is used to set the highest value allowed for adjustments of Idle Speed. This parameter can be set to any value within the range bordered by current Idle Speed and 11,000 Hertz (300 Hertz ignition).

3.27 Duty cycle Maximum (optional)

The Duty cycle Maximum parameter sets the absolute maximum amount of drive signal that can be output to the actuator and thus serves as a mechanism for fuel limiting. Fuel limiting is achieved by setting the maximum duty cycle or on-time allowed during one cycle of the PWM (pulse-width-modulation) signal controlling the actuator drive circuit. The value assigned to the duty cycle limit parameter is a percentage, and is limited to values in the range 10% to 95%. The default value is 95%.

3.28 Startup Speed (optional)

The Startup Speed parameter should be set to an engine speed at least 10% higher than the fastest engine cranking speed but lower than the engine's idle speed. This allows the governor to determine whether the engine is cranking or running whenever an engine speed signal is present.

If the Startup Speed value is set too low (less than crank speed) the governor's target speed will be ramped to the active set speed (Idle, Set Speed A, or Set Speed B) before the engine has started. So, when the engine does 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 value is set 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 in nonzero or the "selected set speed" (either Set Speed A or Set Speed B).

To determine the proper value for this parameter the crank speed must be known. There are two ways to determine the engine crank speed.

1) Use a meter to measure the frequency across the MPU+ and MPU- terminals of the governor during cranking or
2) Use a PC running the Universal PST application and read the value of the Measured Speed in the View Status panel when the engine is cranking. Note –from the Universal PST's startup screen press the View Status button, then press the Start Monitoring button to begin reading values.

3.29 Startup Dutycycle (optional)

The Startup Dutycycle parameter is used to preload the PID output with a PWM dutycycle value close to that needed for the actuator to allow enough fuel to idle the engine.

If the value is too low, then 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 value is too high, then the engine may overspeed because the actuator opens more than needed to start the engine.

There are two ways to determine a good value to use for this parameter.

1) Use a meter to measure the duty cycle across the ACT terminals of the governor while the engine is running. Note: To determine if your meter is reading the correct value, first apply power to the governor but do NOT start the engine, second measure the duty cycle across the ACT terminals (#3 and #4). The reading should be 5 for 5%. If the reading is 95, then reverse the leads.
2) Use a PC running the Universal PST application and read the value of the PWM command in the View Status panel when the engine is cranking. Note: From the Universal PST's startup screen press the View Status button then press the Start Monitoring button to begin reading values.

4 Universal PST (Parameter Setup Tool)

This chapter provides the information needed to use a computer with your governor. Here you will find instructions for wiring the governor's COMM port to a computer's serial port and instructions for acquiring, installing, and running the Universal Parameter Setup Tool (Universal PST).

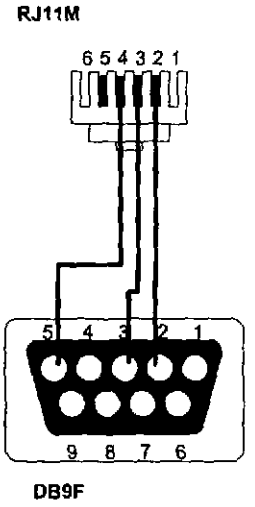
The Universal PST is a Microsoft Windows application available from Barber-Colman DYNA Products that enables you to adjust parameter settings and monitor governor operation.

The Universal PST also includes a graphical chart recorder that displays engine speed in real-time. This provides a visual representation of the governor's response to changes in speed or load, which can be very helpful in achieving precise tuning.

4.1 Wiring the COMM Port to a PC

A serial cable wired as shown is required to connect the governor's COMM port to a PC's serial port.

RJ11 or RJ12 Position	DPG-2XXX-001 Signal	Connects to:
1	No connection	N/C
2	Transmit data to the PC	PC receive (RxD) DB9 pin 2
3	Receive data from the PC	PC transmit (TxD) DB9 pin 3
4	COMMON	PC common DB9 pin 5
5	+5 VDC (Do NOT connect at the PC end)	N/C
6	No connection	N/C



NOTE: The wiring information shown above is from the document DYNA-316.

4.2 Universal PST Requirements

This program requires an Intel Pentium class machine running Microsoft Windows 98se (Second Edition), NT4, 2000, or XP. The display resolution needs to be set to SVGA (800x600) or higher.

NOTE: The Universal PST program is not supported on Microsoft Windows 95. The program may work on Microsoft Windows ME (Millennium Edition), but this has not been tested.

4.3 Acquiring Universal PST

The Universal PST application is available from our website. If you have an internet connection you can download a copy from www.dynaproducts.com.

What to download

The files *ReadMeFirst.txt* , *Universal_PST.zip* , and *PST_CONFIG.mdb* are available for download on the Product Software page at the www.dynaproducts.com website.

Requesting the Universal PST on CD-ROM

If you do not have an internet connection, or have problems downloading the large zip file, contact the Barber-Colman DYNA Products sales department to request a CD-ROM copy of Universal PST for a nominal charge. Telephone: (815) 637-3000

4.4 *Installing Universal PST*

The installation procedures are slightly different depending on whether you downloaded the zip file or have the CD-ROM version. The instructions provided here assume you know how to user your computer.

The ReadMeFirst.txt file provides instructions regarding application installation using the downloaded zip file. Basically, the program installation files must first be extracted from the zip file into a temporary folder on your computer's hard drive. Then you run the setup.exe program and follow the instructions the setup program gives you.

NOTE: the zip file format is WinZip® compatible. The WinZip® application is not provided. If you are running Microsoft Windows XP, it has built-in resources to extract the files from Universal_PST.zip. Refer to your computer's documentation or online help files for instructions regarding creating folders, installing, and running applications.

4.5 *Universal PST for DPG Features*

Universal PST for DPG features include:

- automatic configuration to each DPG when communications established
- read/write access to all of a DPG's programmable parameters and features
- display of each parameter's default, minimum, and maximum values
- diagnostics utilizing automatic refresh of DPG status
- saving and reloading DPG setup information to and from a file for reuse
- single button read to get the current values of all parameters
- single button write to program a DPG with previously saved setup values
- engine speed monitoring via a chart recorder to aid in tuning the governor
- saving chart recorder data to a Microsoft Excel compatible file
- help information on each DPG-2000 Governor parameter and tuning
- help information on using the PST

4.6 *Universal PST User Interface overview*

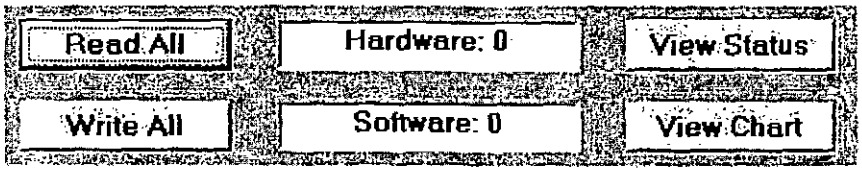
Universal PST for DPG has two main display modes.

- TABLE VIEW and
- CHART VIEW.

NOTE: The program starts in TABLE VIEW

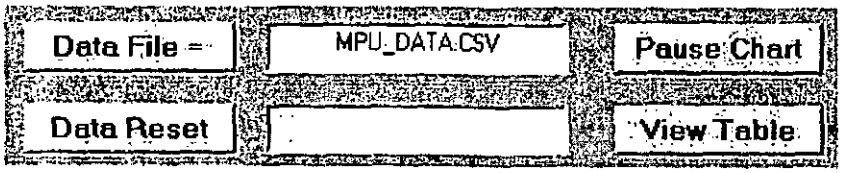
IN TABLE VIEW THE USER CAN

- 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
- press the <Read All> button to refresh the values in table shown on the Parameter Setup panel
- press the <Write All> button to transmit setup values to the governor
- press the <View Status> button to display read only parameters in the Status View panel
- press the <View Chart> button to set the display mode to CHART VIEW
- Select items from the menu.



IN CHART VIEW THE USER CAN

- View the current values for all user programmable parameters in the Parameter Setup panel's table
- Edit parameter values related to governor tuning. These same parameters are also on the main parameter setup table.
- Press the <Data File => button to open a file for saving chart recorder data.
- Press the <Data Reset> button to start data collection to the open file at the beginning.
- Press the <Pause Chart> button to stop the chart recorder, which also stops writing data to the file. Press the <Continue> button to turn the chart recorder back on.
- Adjust the horizontal and vertical scale settings of the chart recorder.
- Press the <View Table> button to set the display mode back to TABLE VIEW.
- Select items from the menu.

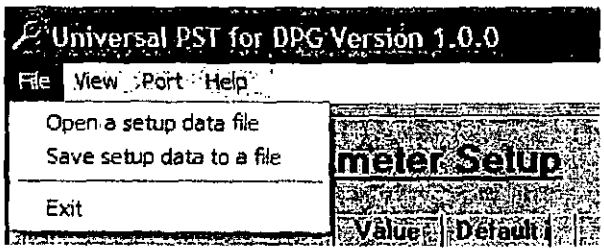


NOTE: Pressing a button means positioning the mouse pointer over the button and clicking the left mouse button. Parameter EDITING requires positioning the mouse pointer over a parameter's "Value" and double-clicking the left mouse button to highlight the particular value.

4.7 Universal PST for DPG Menu Items

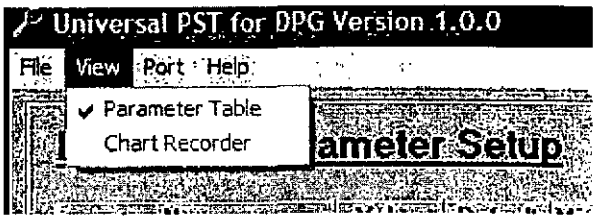
Use the File menu to

- open a previously saved setup data file
- save setup data to a file
- exit the program



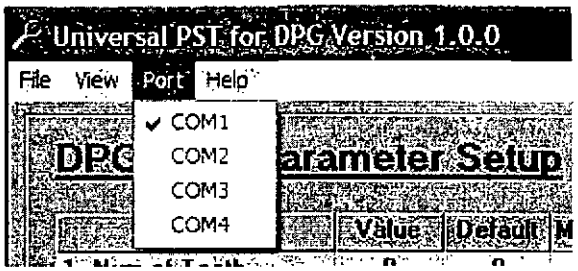
Use the View menu to

- select Parameter Table view (TABLE VIEW)
- select Chart Recorder view (CHART VIEW)



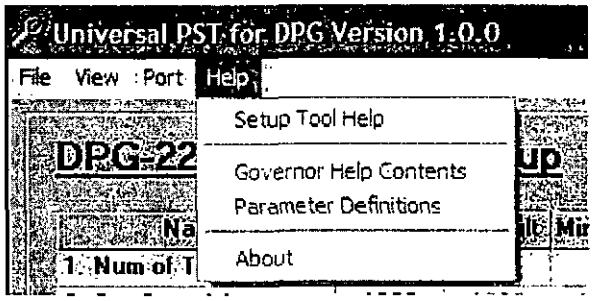
Use the Port menu to

- select the PC's serial port that is connected to the DPG-2000



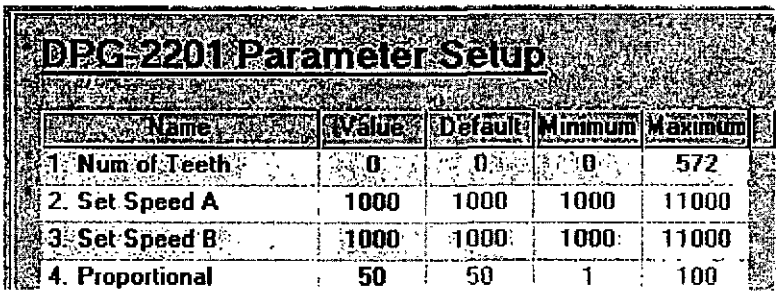
Use the Help menu to access

- help on the Universal PST for DPG
- help on the DPG-2000 product that is currently in communication with the PC
- information about the Universal PST for DPG application



4.8 Parameter Setup

The Parameter Setup panel displays a table where each row shows the Name of a user programmable parameter, its current Value, and the parameter's Default, Minimum, and Maximum values.

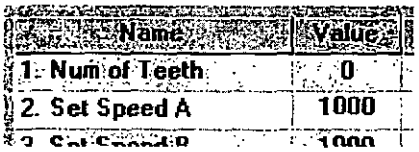


Name	Value	Default	Minimum	Maximum
1. Num of Teeth	0	0	0	572
2. Set Speed A	1000	1000	1000	11000
3. Set Speed B	1000	1000	1000	11000
4. Proportional	50	50	1	100

To modify a parameter's current value, it must first be selected.

Do this by double-clicking the left mouse button on a cell in the table that is at the intersection of the parameter's row and the Value column. The selected cell will be highlighted and the value can now be modified. When done modifying the value, press the computer keyboard's <Enter> key to transmit the new value to the governor.

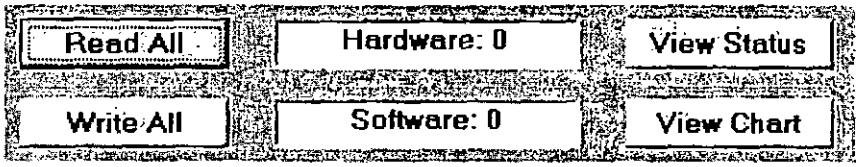
NOTE: Pressing a button means positioning the mouse pointer over the button and clicking the left mouse button. Parameter EDITING requires positioning the mouse pointer over a parameter's "Value" and double-clicking the left mouse button to highlight the particular value.



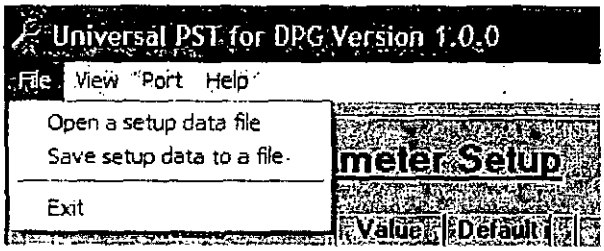
To get help on a particular parameter, single click the left mouse button on a parameter's Value, then press <Ctrl><F1> on the computer's keyboard. <Ctrl><F1> means press and hold the <Ctrl> key while the <F1> key is pressed and released.

To get the current values for all of a DPG-2XXX's parameters, press the <Read All> button.

Use the <Write All> button to transmit all parameter values to the governor automatically.



The <Write All> button is very useful when reusing saved setup data to configure a new system the same as a previous one. Simply load an existing set of previously saved parameter values into the Parameter Setup table using *Open a setup data file* from the *File* menu then press the <Write All> button.

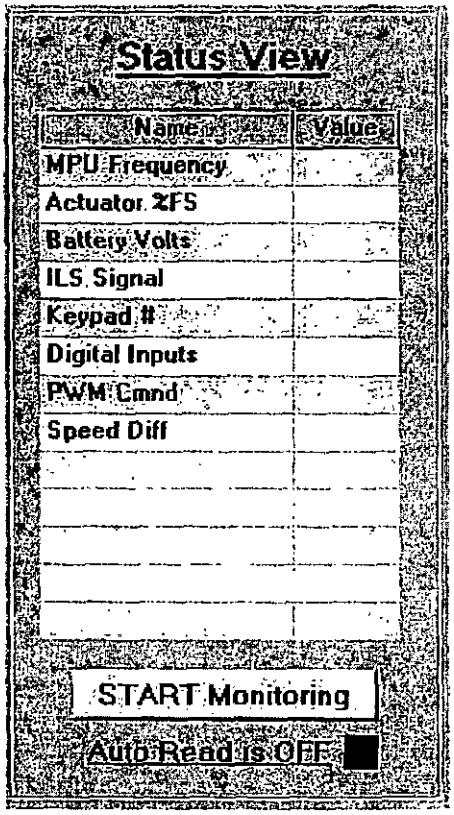


4.9 *Status View*

The Status View panel is displayed only after pressing the <View Status> button. 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")

Press (left mouse click) the <START Monitoring> button to have the Universal PST program automatically refresh the Values. Press the <STOP Monitoring> button to disable automatic refresh.

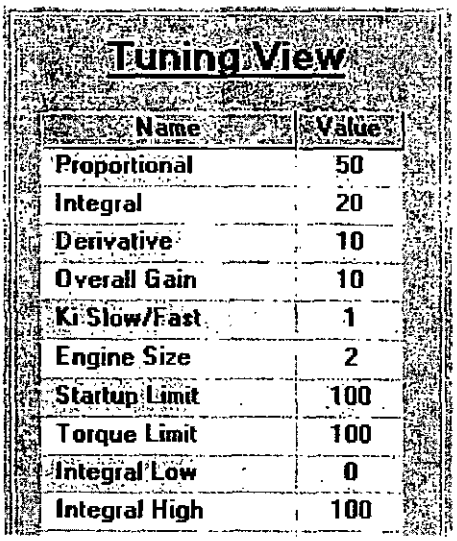


4.10 Tuning View

The Tuning View panel is displayed only after pressing the <View Chart> button. The Tuning View panel is part of the CHART VIEW display mode.

To modify a tuning parameter's current value, it must first be selected. Do this by double-clicking the left mouse button on a cell in the table that is at the intersection of the parameter's row and the Value column.

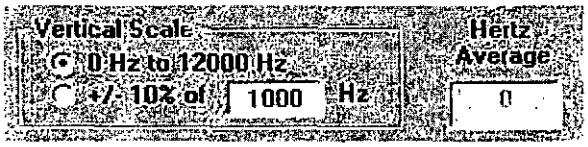
The selected cell will be highlighted and the value can now be modified. When done modifying the value, press the computer keyboard's <Enter> key to transmit the new value to the governor.



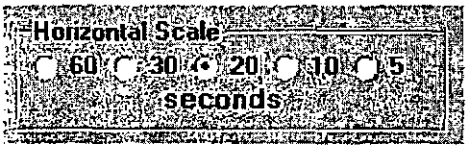
4.11 Chart Recorder

The chart recorder is part of the CHART VIEW display mode. Each time CHART VIEW is entered the last used Data File is reset, the Vertical Scale defaults to [0 Hz to 12000 Hz], and the Horizontal scale defaults to 20 seconds.

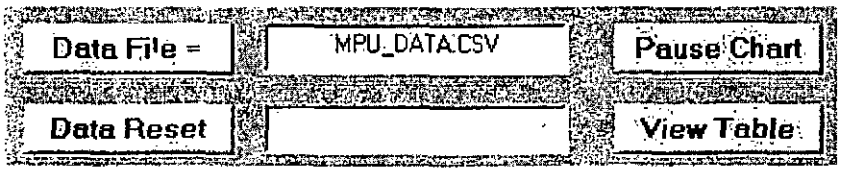
The Vertical Scale options and the Horizontal Scale options control the chart recorder's display characteristics.



On the Vertical Scale, use the [+/- 10% of ____ Hz] option to zoom in on the current Hertz Average.



Use the Horizontal scale to have the chart recorder display 60, 30, 20, 10, or 5 seconds of collected engine speed data. Larger values compress the display while smaller numbers expand the display. A Horizontal scale setting of 20 seconds is approximately the same as a 5millimeters per second paper travel speed of a conventional paper tape chart recorder.



The <Data File => button opens a dialog box to name the file and path where chart recorder data will get saved.

The <Data Reset> button is used to start data collection over using the current Data File. The progress bar shown to the right of this button indicates how full the Data File is. Each data file can hold approximately 10 minutes of data. The progress bar will display the message "The Data File is FULL" when no longer accepting chart recorder data.

The <Pause Chart> button stops chart recorder and Data File updates. Press this button, which is now named <Continue> to turns the chart recorder back on.

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 to be saved. The active Data File is automatically reset each time CHART VIEW display mode becomes active.

5 Calibration Instructions

5.1 Basic Adjustments

The controller is programmed at the factory with default parameter settings. These settings allow the controller to operate but will usually require some further adjustments to obtain the best system performance. In order to bring the engine up to a single speed for the first time, the installer will probably need to make adjustments to the parameters shown in the table.

The parameters listed in the table are the primary ones to modify to get the governor tuned and the engine running smooth. It is recommended that you work with them first and leave all the other parameters at their default values until you are satisfied with the basic engine tuning.

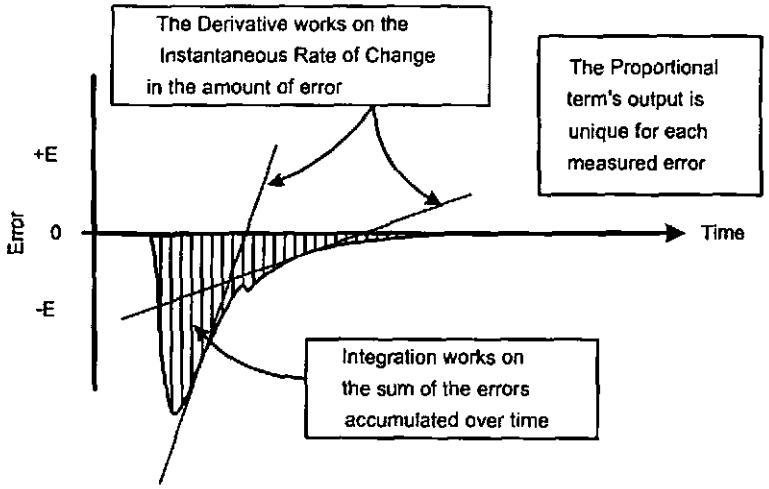
ID#	Parameter Name	Default Value
2	SET SPEED A	1000
5	PROPORTIONAL	25
6	INTEGRAL	50
7	DERIVATIVE	25
8	OVG @ SET SPEED A	20
11	GAIN FACTOR (note 1)	20 or 40
12	SPEED FILTER (note 2)	16 or 4

Note 1: Modify Gain Factor only if you run out of adjustment in a PID or OVG term.
Note 2: For the Speed Filter , typically the value 24 works well on small 3 or 4 cylinder engines. A value of 16 is recommended for 6 or 8 cylinder engines.

5.2 Tuning Methodology

Once the engine is running, the following procedure may be used to discover more optimum values for PID and the overall gain parameters. The goal would be to find PID values that allow the controller to govern the engine well at a variety of different speeds and loads while only requiring gain adjustment at those different speeds.

Step:
1. Set the integral and derivative terms to 0.
2. Set the overall gain low (<20).
3. Increase the proportional term until you get continuous oscillations greater than 2Hz.
4. Reduce the proportional term by 25% to 50%.
5. Now experiment with small value changes in the derivative to dampen out "ringing" in response to load transients.
6. Add some integral to eliminate any steady-state error in the engine's speed and help decrease error recovery time.
7. The overall gain can be increased to improve response time while keeping the ratios of the PID terms relative to each other constant.



During each of the steps 3 through 6 you need to disturb the system by adding and removing a load from the engine to check the governor's response to the load transition. **START WITH SMALL LOADS.**

Note that without integral a speed error may persist after a load-on/load-off transition. So during steps 3-5 you should temporarily increase the integral to get the engine speed back to the set speed, then reset the integral to a lower value again while working to find good proportional and derivative values. Repeat steps 3-7 as needed to find a Proportional value, Integral value, and a Derivative value that work well with a variety of overall gain values and different load transients.

6 Installation Instructions

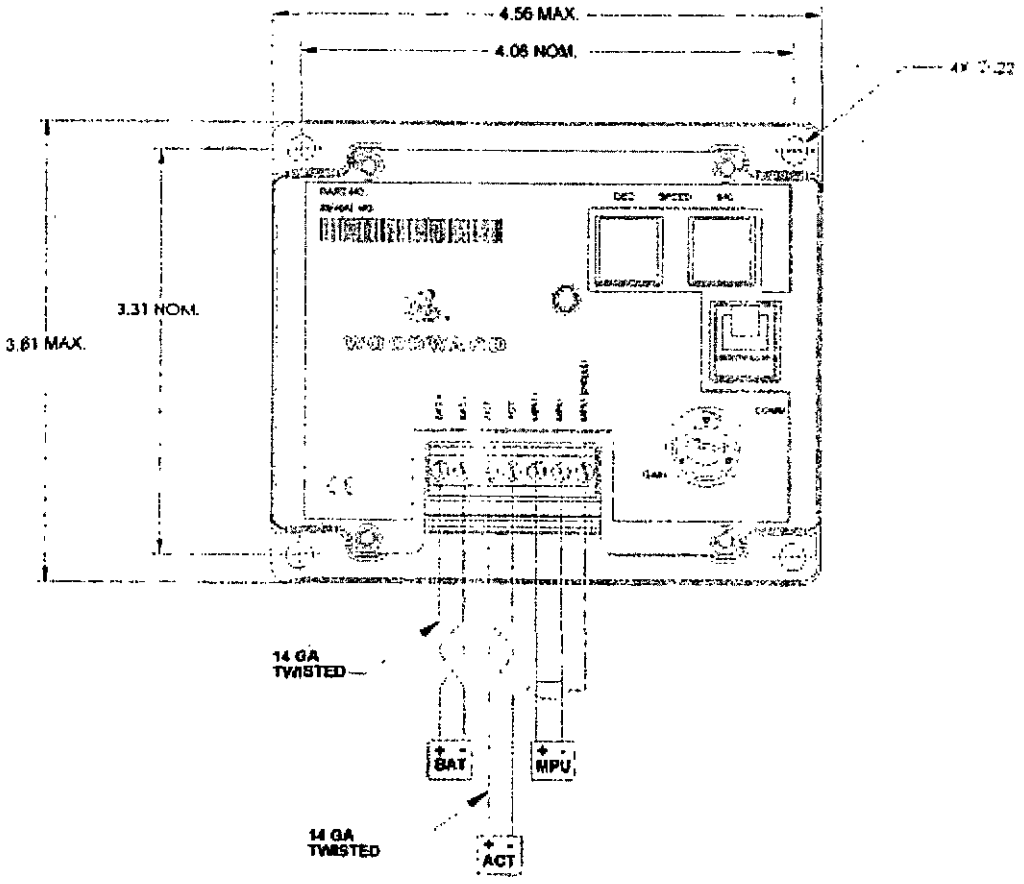
6.1 Recommended Mounting

The Governor Controller is designed to be panel mounted. The mounting should protect the controller from exposure to rain, weather, and direct sunlight. The controller should not be mounted on the engine or in an environment that exceeds the Mechanical Specifications outlined in section 1.2 of this manual. The Controller should be mounted in a position to allow access to the user interface, the Comm port and the terminal strip.

6.2 DPG-2101-001 Terminal Descriptions

#	Name	Function
1	BAT+	Battery positive (Supply voltage range is 9VDC-30VDC)
2	BAT-	Battery negative
3	ACT	Actuator Drive output
4	ACT	Actuator Drive return
5	MPU+	Magnetic Pickup Signal Input
6	MPU-	Magnetic Pickup Ground
7	SHIELD	Ground connection for cable shielding

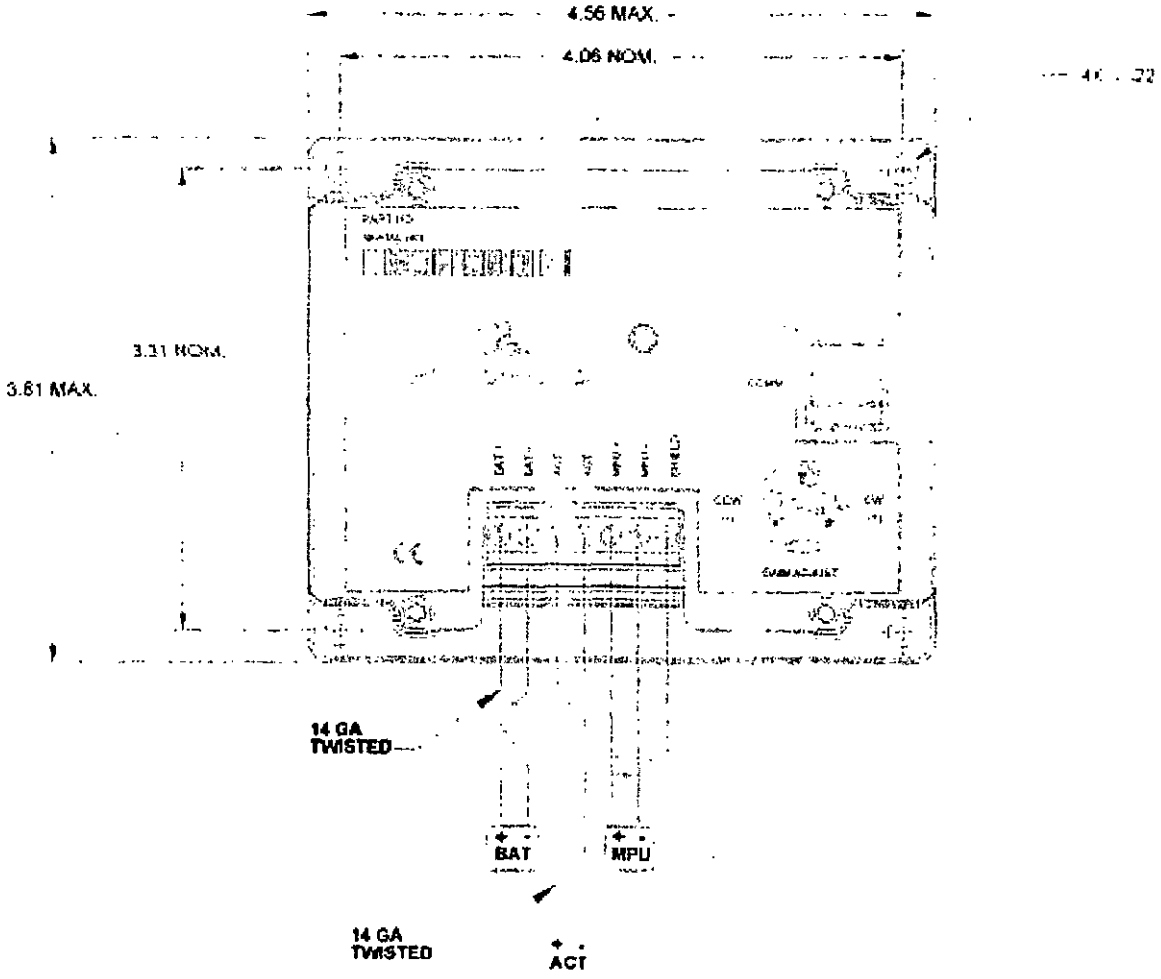
6.3 DPG-2101-001 Wiring Diagram



6.4 DPG-2111-001 Terminal Descriptions

#	Name	Function
1	BAT+	Battery positive (Supply voltage range is 9VDC-30VDC)
2	BAT-	Battery negative
3	ACT	Actuator Drive output
4	ACT	Actuator Drive return
5	MPU(+)	Magnetic Pickup Signal Input
6	MPU(-)	Magnetic Pickup Ground
7	SHIELD	Ground connection for cable shielding

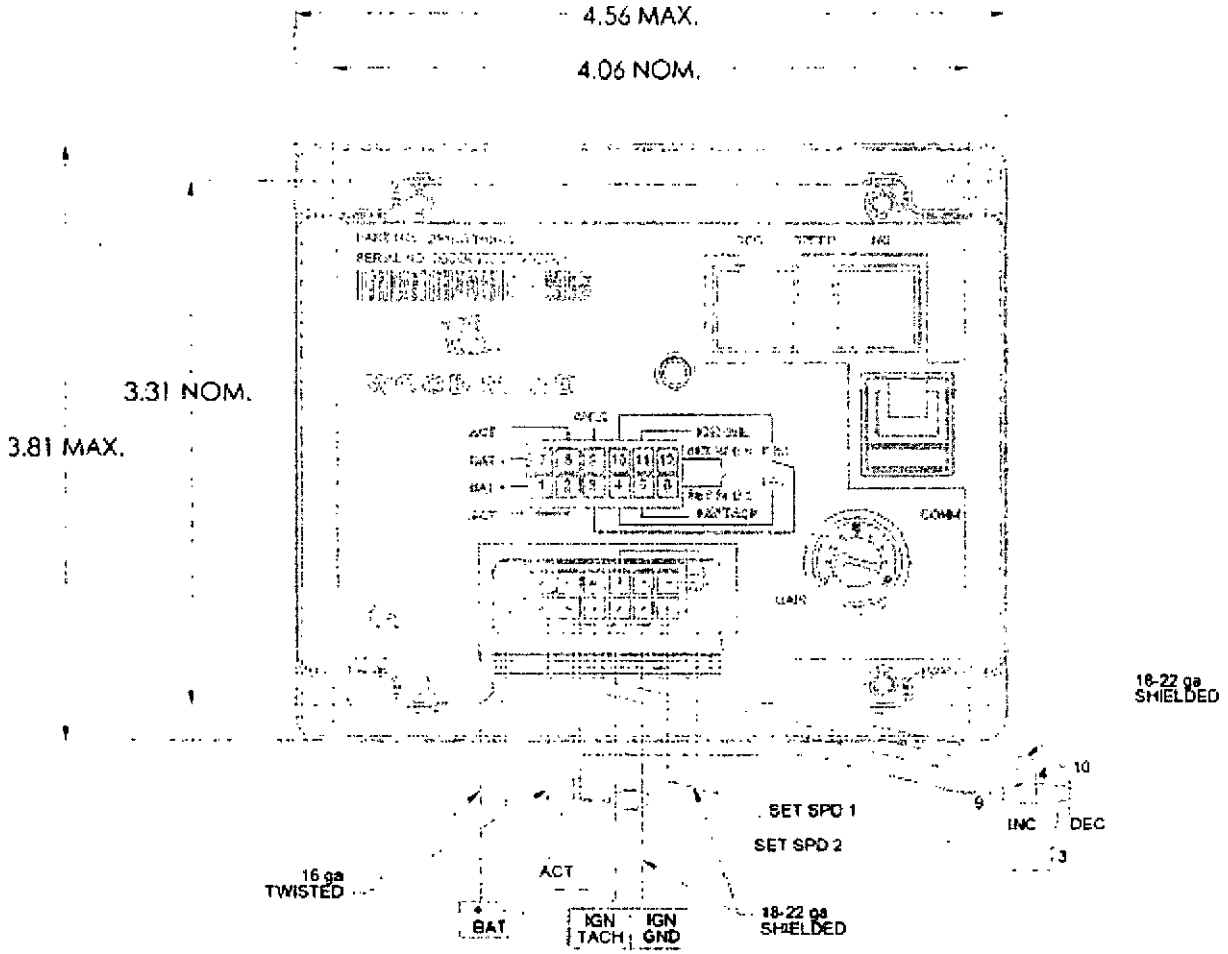
6.5 DPG-2111-001 Wiring Diagram



6.6 DPG-2145-001 Terminal Descriptions

#	Name	Function
1	BAT+	Battery positive (Supply voltage range is 9VDC-30VDC)
2	ACT	Actuator drive output
3	*Not labeled*	Digital input common
4	INC	Digital input to Increase selected set speed (active when tied to pin 3)
5	IGN TACH	Ignition tachometer signal input
6	SET SPD 2	Set Speed B selected when this pin tied to pin 12
7	BAT-	Battery negative
8	ACT	Actuator Drive Return
9	SHLD	Ground connection for cable shielding
10	DEC	Digital input to Decrease selected set speed (active when tied to pin 3)
11	IGN GND	Ignition ground signal
12	SET SPD 1	Set Speed A selected when this pin is open

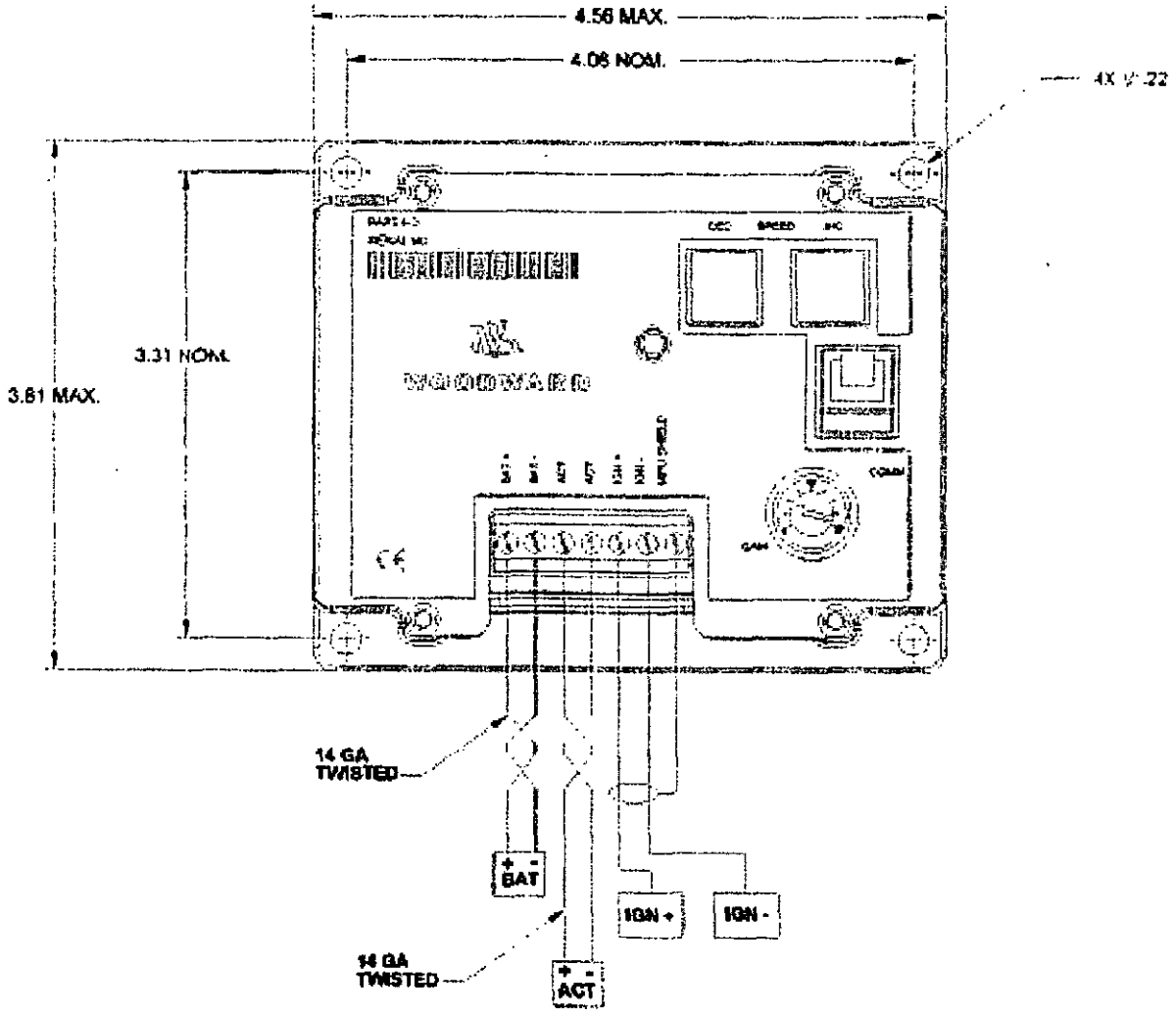
6.7 DPG-2145-001 Wiring Diagram



6.8 DPG-2146-001 Terminal Descriptions

#	Name	Function
1	BAT+	Battery positive (Supply voltage range is 9VDC-30VDC)
2	BAT-	Battery negative
3	ACT	Actuator Drive output
4	ACT	Actuator Drive return
5	IGN TACH	Ignition tachometer signal input
6	IGN GND	Ignition ground signal
7	SHIELD	Ground connection for cable shielding

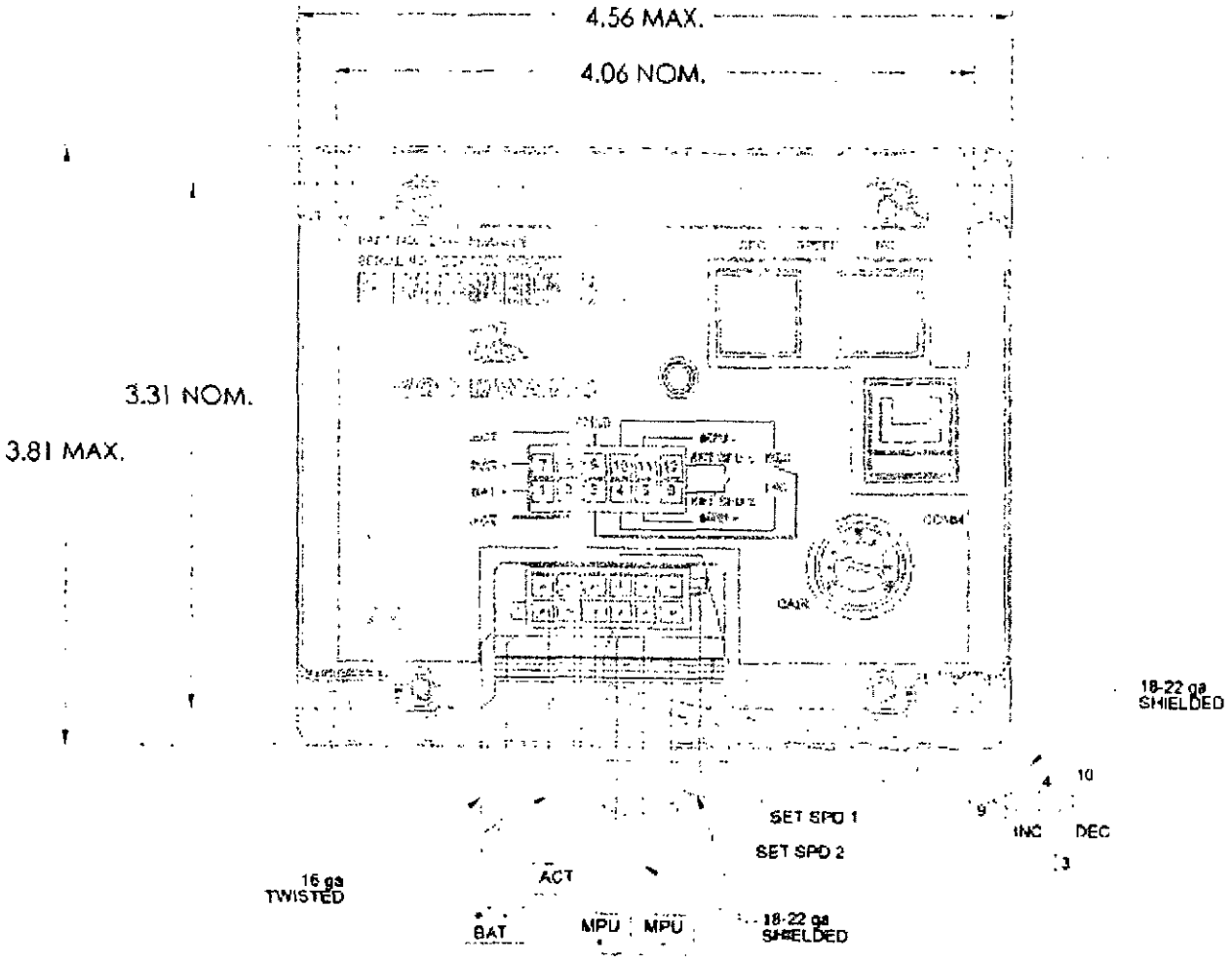
6.9 DPG-2146-001 Wiring Diagram



6.10 DPG-2155-001 Terminal Descriptions

#	Name	Function
1	BAT+	Battery positive (Supply voltage range is 9VDC-30VDC)
2	ACT	Actuator drive output
3	*Not labeled*	Digital input common
4	INC	Digital input to Increase selected set speed (active when tied to pin 3)
5	MPU+	Magnetic Pickup Signal Inputs
6	SET SPD 2	Set Speed B selected when this pin tied to pin 12
7	BAT-	Battery negative
8	ACT	Actuator Drive Return
9	SHLD	Ground connection for cable shielding
10	DEC	Digital input to Decrease selected set speed (active when tied to pin 3)
11	MPU-	Magnetic Pickup ground
12	SET SPD 1	Set Speed A selected when this pin is open

6.11 DPG-2155-001 Wiring Diagram



7 Diagnostics & Troubleshooting

7.1 LED Indications

LED State	Meaning
Off	The controller is either not currently being powered, or is being reverse powered (check polarity of supplied power). If correctly powered then the controller is malfunctioning.
Blinking Slow (½Hz)	The controller is powered but not sensing a speed signal. OK if engine is not running. If the engine is running then this indicates a fault with the speed signal.
Blinking Fast(1½Hz)	The controller is powered and an engine speed signal is being detected. If the engine is not running then this indicates electrical noise on the speed signal wires.
On and Not blinking	The controller is powered and is malfunctioning. Replace the controller.

7.2 Table

SYMPTOM	REMEDY
LED Display Does Not Light Up When Governor Is Powered	• BAT + and BAT – leads are reversed. Check wiring. • Battery voltage too low. Should measure between 9 and 30 VDC • Controller is defective. Replace it.
Unable to Modify Parameters	• The parameter's value is at the maximum value allowed. • The parameter's value is at the minimum value allowed. • Universal PST not communicating with the controller • Keypad Failure, replace unit.
Engine Does Not Start	• Actuator leads not connected or shorted. • No Fuel Source. Turn on fuel source. • Battery voltage is low. Charge or replace the battery. • Set speed is lower than crank speed. Increase the set speed. • Startup Rate setting is too low. The target speed ramps up too slow. • Startup Limit is too low, limiting the actuator drive signal too much. • Is the MPU speed signal present? It should read 2.0VRMS minimum. Adjust magnetic pickup (MPU) gap. Try reversing the MPU leads. • If a speed signal is present, measure actuator output duty cycle. If not greater than 5%, then 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.
Engine Over Speeds at Startup	• Increase the Proportional value. • Increase the appropriate Gain value. • Decrease the Startup Ramp Rate.

Troubleshooting Table continued

SYMPTOM	REMEDY
Engine Does Not Reach the Set Speed	• Improve PID tuning. • Integral too low or zero • 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. • PID values are too high. Tuning is too hot or over sensitive to small speed errors which causes the governor to make large rapid changes in actuator drive signal which creates an average signal that is inadequate. • The Integral Low Limit setting is too high. Return the value to the default setting of zero. • The Integral High Limit setting is too low. Return the value to the default setting of 99.
Engine takes too long to reach the set speed.	• Improve PID tuning. • Integral setting is too low. • Startup Rate setting is too low. • Accel Rate setting is too low. • Speed Filter setting is too high.
Engine Does Not Track Speed Setting Changes	• Is the LED blinking fast (3Hz)? No = not sensing speed • Is the selected set speed parameter being modified? • A PID value or an Gain value is too high. • A PID value is too low or zero. • Accel Rate is set too low. • Decel Rate is set too low.
Sluggish Response to load changes	• Gain too low. • Improve PID tuning. • Speed Filter setting is too high.
Engine Instability With No-load	• Improve PID tuning. • Speed Filter setting is too low. • Fuel is restricted. Check actuator linkage. • Battery voltage is too low.
Engine Instability With Load	• Improve PID tuning. • Fuel is restricted. Check actuator linkage. • Battery voltage is too low.
Engine Unable to Carry Rated Load	• PID values may be too high causing the governor to over react and make large rapid changes in PWM duty cycle output to the actuator. • Improve PID tuning. • Fuel is restricted. Check actuator linkage.

7.3 *Contact your Local Distributor for Service*

DYNA PRODUCTS DISTRIBUTORS		
Geographic Area	Distributor	Telephone
UNITED STATES OF AMERICA		
Colorado, Kansas, Montana, Nebraska, New Mexico, Oklahoma, Utah, Wyoming, *& Western North & South Dakota*	Advanced Ignition &Controls	303-766-1477
Illinois, Iowa, Indiana, Michigan, Minnesota, Missouri, Wisconsin, *& Eastern North & South Dakota*	Contact Factory	815-637-3793
Alaska, Arizona, California, Hawaii, Idaho, Nevada, Oregon, Washington	Berge's Engines & Control Systems	626-333-7093
Florida, Georgia, North Carolina, & South Carolina Puerto Rico	Davidson Sales Co.	386-274-2079
Louisiana and	Enpro Ignition & Control Sys. Inc./ LA.	504-392-1800
East Texas	Enpro Ignition–East Texas Office	281-331-5531
Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia and West Virginia	Gerhardt's Inc.	302-324-9511
West Texas and New Mexico	Gerhardt's Inc.-West Texas Office	915 563-4302
Alabama, Arkansas, Kentucky, Mississippi, and Tennessee	Underwood Sales Co., Inc	901-332-4701
CANADA		
Alberta, Manitoba,Saskatchewan	Alberta Governor Service, Inc.	780-437-4673
Quebec, & All Atlantic Provinces	Energy Products of Canada	514-342-2744
Ontario	Jack A. Frost, Ltd.	905-624-5344
British Columbia, Alberta, Manitoba, Saskatchewan	Power Instrumentation & Controls	780-436-9047 604-596-7344
INTERNATIONAL		
Argentina	Palmero	(54)-261-4-932-000
Australia	Electric Skill Control Systems PTY.LTD.	(61)-89-3581-988
Brazil	CRAM/Polimaq	(54)-11-4629-0600
Chile	Diperk	(56)-2-697-2929
Columbia	Lister-Petter Diesel, S.A.	(57)-1-420-0277
Ecuador	Comatecnica, CIA LTD	(593)-22-462-959
France	DSF Tecnologies, S.A.	(33)-4-92-388-820
Germany	Roeder Praezision, GMBH	(49)-6103-4002-650
Great Britain & Ireland	Precision Controls LTD.	(44)-161-476-4606
Hong Kong	Barcol-Air China LTD.	(852)-243-52638
India	Pushkaraj Enterprises	(91)-20-447-7910
Indonesia	PT Idjen Inti Prakarsa	(62)-21-631-9681
	PT Tanudaja	(62)-21-549-4707
Italy	DSF Tecnologia S.R.L.	(39)-02-9108-0209
Japan	Ranco Japan Ltd.	(81)-3-3261-4293
Korea	Barcol-Air Korea, Inc.	(82)-2-599-8087
Mexico	IDIMEX (Injectores Diesel de Mexico, S.A.	(525)-588-9466
Mid East	Black Box Automation & Controls	(961)-03-302-708
Netherlands, Belgium & Luxembourg	Imtech Marine & Offshore	(31)-10-487-1911
New Zealand & South Pacific Island Region	Echo Mechanical & Electrical NZ.LTD.	(64)-3448-6352
Norway	Nesco-Utech	(47)-69-236-000
Philippines	Barcol-Air Trading	(63)-2-687-1761
Portugal	DSF Tech.S.A.	(34)-918-082-003
Singapore, Pakistan	Barcol-Air Engineering PTE LTD	(65)-6542-8155
Spain (Barcellona)	T.C.A.	(34)-93-409-1280
Spain (Madrid)	T.C.A.	(34)-91-736-2400
Switzerland	Energotech AG	(41)-41-740-0030
Taiwan	Jenn Sen M. & E. Co., LTD.	(886)-2-2985-0810
Venezuela	E.S.E.S.A. (Energy Systems & Engineering)	(58)-244-663-3881

DPG-21XX-001 INSTALLATION RECORD & PARAMETER QUICK REFERENCE

Customer: _____ Phone #: _____
Distributor: _____ Phone #: _____
Installation Site: _____ Installation Date: _____
Engine Information: _____ Actuator Model #: _____
# of Cylinders: _____ Fuel Type: _____ Actuator Serial #: _____
Magnetic Pickup: _____ DPG-Model Number: _____
DPG-21nn-001 Serial #: _____

NOTES: _____

Record an installation's DPG-21nn-001 Parameter Values in the User Setting column of the following table.

ID#	PARAMETER NAME – parameter definition	Default Values	User Setting
1.	**# OF FLYWHEEL TEETH** – is a factor used to display speed as RPM instead of Hz values	0	
2.	**SET SPEED A** - the governor's target speed after startup unless set speed B is selected.	1000 (25)	
3.	**SET SPEED B** *(not available on DPG-2101-001, DPG-2111-001, and DPG-2146-001s)* - is the governor's target speed when the SPEED SEL terminal is at 5 volts DC.	1000 (25)	
4.	**IDLE SPEED** - is the governor's target speed for the IDLE HOLD TIME when the engine first starts. If the value of the IDLE HOLD TIME parameter is zero the IDLE SPEED is not used.	500 (20)	
5.	**PROPORTIONAL** - is the gain applied to the speed error.	25	
6.	**INTEGRAL** - is the gain on the reset time and is used to eliminate the speed offset due to proportional gain.	50	
7.	**DERIVATIVE** - is the gain on the response to the rate of speed change.	25	
8.	**GAIN at SET SPEED A** - is a multiplier used on the three PID terms when Set Speed A is the target speed.	20	
9.	**GAIN at SET SPEED B** *(not available on DPG-2101-001, DPG-2111-001, and DPG-2146-001s)* - is a multiplier used on the three PID terms above when Set Speed B is the target.	20	
10.	**GAIN at IDLE SPEED** - is a multiplier used on the three PID terms above when Idle Speed is the target.	20	
11.	**GAIN FACTOR** - is a multiplier applied to the PID terms that can be used to give those terms more range.	20 (40)	
12.	**SPEED FILTER** - is the number of flywheel teeth on magnetic pickup based controllers or the number of ignition pulses to use when computing an average engine speed.	16 (4)	
13.	**IDLE HOLD TIME** - is the period of time that the engine will remain at the Idle Speed during the startup sequence before ramping to either Set Speed A or Set Speed B.	0	
14.	**ACCEL RATE** - is the rate, in Hertz (or RPM) per second, used to ramp to a new higher target speed.	1000 (3000)	
15.	**DECEL RATE** - is the rate, in Hertz (or RPM) per second, used to ramp to a new lower target speed.	1000 (3000)	
16.	**STARTUP RATE** - is the rate in Hertz (or RPM) per second at which the governor will ramp to the selected target speed when the engine is started. Useful in limiting smoke at engine startup.	1000 (3000)	
17.	**INTEGRAL LOW LIM** - is the duty cycle percentage where integration stops when the governor is trying to decrease engine speed. It limits integral wind-down. Use with caution.	0	
18.	**INTEGRAL HIGH LIM** - is the duty cycle percentage used to limit integral windup when the governor is trying to increase engine speed. Use with caution.	99	
19.	**PASSWORD** - is a key used to lock or unlock the capability to modify the parameter values. It is also used to activate the droop calibration procedure.	0	
20.	**OVERSPEED LIMIT** - is the percent over the higher of Set Speed A or Set Speed B that will cause the governor to output the minimum signal to the actuator.	100	
21.	**SET SPEED A MIN** - sets the lowest value allowed for Set Speed A's adjustable range.	10 (2)	
22.	**SET SPEED A MAX** - sets the highest value allowed for Set Speed A's adjustable range.	11000 (300)	
23.	**SET SPEED B MIN** *(not available on DPG-2101-001, DPG-2111-001, and DPG-2146-001s)* - sets the lowest value allowed for Set Speed B's adjustable range.	10 (2)	
24.	**SET SPEED B MAX** *(not available on DPG-2101-001, DPG-2111-001, and DPG-2146-001s)* - sets the highest value allowed for Set Speed B's adjustable range.	11000 (300)	
25.	**IDLE SPEED MIN** - is the lowest value allowed for the Idle Speed setting.	10 (2)	
26.	**IDLE SPEED MAX** - is the highest value allowed for the Idle Speed setting.	11000 (300)	
27.	**DUTYCYCLE MAX** - sets the absolute maximum amount of drive signal that can be output to the actuator and thus serves as a mechanism for fuel limiting. Adjustable in 1% steps.	95	
28.	**STARTUP SPEED** – is the engine speed value the governor uses to determine whether the engine is cranking or running.	1000 (25)	
29.	**STARTUP DUTYCYCLE** – is used to set the initial actuator drive signal needed to begin supplying fuel to the engine when the governor first detects a speed signal.	30	

Default Values in parenthesis apply when the controller uses ignition pulses to sense engine speed, which would be the case for the DPG-2145-001 and DPG-2146-001 controller

Additional Installation Notes

PRODUCT FEEDBACK FORM

Customer: _____ Phone #: _____
Contact: _____ Phone #: _____
E-Mail: _____ Fax #: _____

DPG Model #: _____ DPG Serial #: _____

Unit purchase from: _____

1. Did this product meet your requirements?

2. Was the User Manual helpful and easy to follow?

3. Did you have any problem obtaining, installing, or using the Universal PST software available from our web site?

4. Was the connection diagram clear and easy to follow?

5. Did you have any problems with the wiring installation?

6. Did the controller features function as described in the manual?

7. Did you have any problems with setting individual parameters?

8. Did you have any specific problems with the installation of this governor control?

   If yes, how were you able to fix this problem?

9. Was the troubleshooting section of this manual helpful in solving a problem?

Please return this form to us along with a copy of the INSTALLATION RECORD & PARAMETER QUICK REFERENCE sheet filled in with your parameter settings.

Barber-Colman Dyna Products
PO BOX 2940
Loves Park, IL 61132-2940

FAX: 815-877-0150

Thank you for choosing

WOODWARD

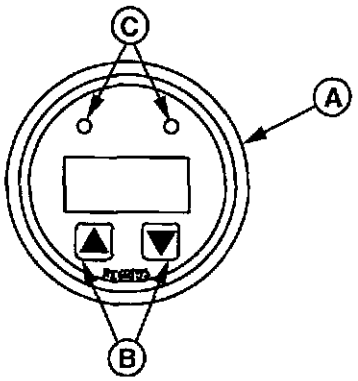
Using Diagnostic Gauge To Access Engine Information

The diagnostic gauge (A) allows the operator to view many readouts of engine functions and diagnostic trouble codes (DTCs). The gauge is linked to the electronic control system and its sensors. This allows the operator to monitor engine functions and to troubleshoot the engine systems when needed.

Press the two touch switches (B) to view the various engine functions in sequence. The displays can be selected as either customary english or metric units.

The following menu of engine parameters can be displayed on the diagnostic gauge window:

- Engine hours
- Engine rpm
- System voltage
- Percent engine load at the current rpm
- Coolant temperature
- Oil pressure
- Fuel economy
- Throttle position
- Current fuel consumption
- Active service (diagnostic) codes
- Stored service (diagnostic) codes from the engine
- Set the units for display
- View the engine configuration parameters
- Accelerator pedal position
- Percentage load at current speed
- Actual engine percent torque
- Engine speed
- Trip distance
- Total vehicle distance
- Engine hours
- Trip fuel
- Total fuel used
- Coolant temperature
- Fuel temperature
- Engine oil temperature
- Engine intercooler temperature
- Fuel deliver pressure
- Engine oil level
- Engine oil pressure



RG10031 –UN–28OCT99

Diagnostic Gauge

A—Diagnostic Gauge
B—Touch Switches
C—Amber and Red Lights

Continued on next page

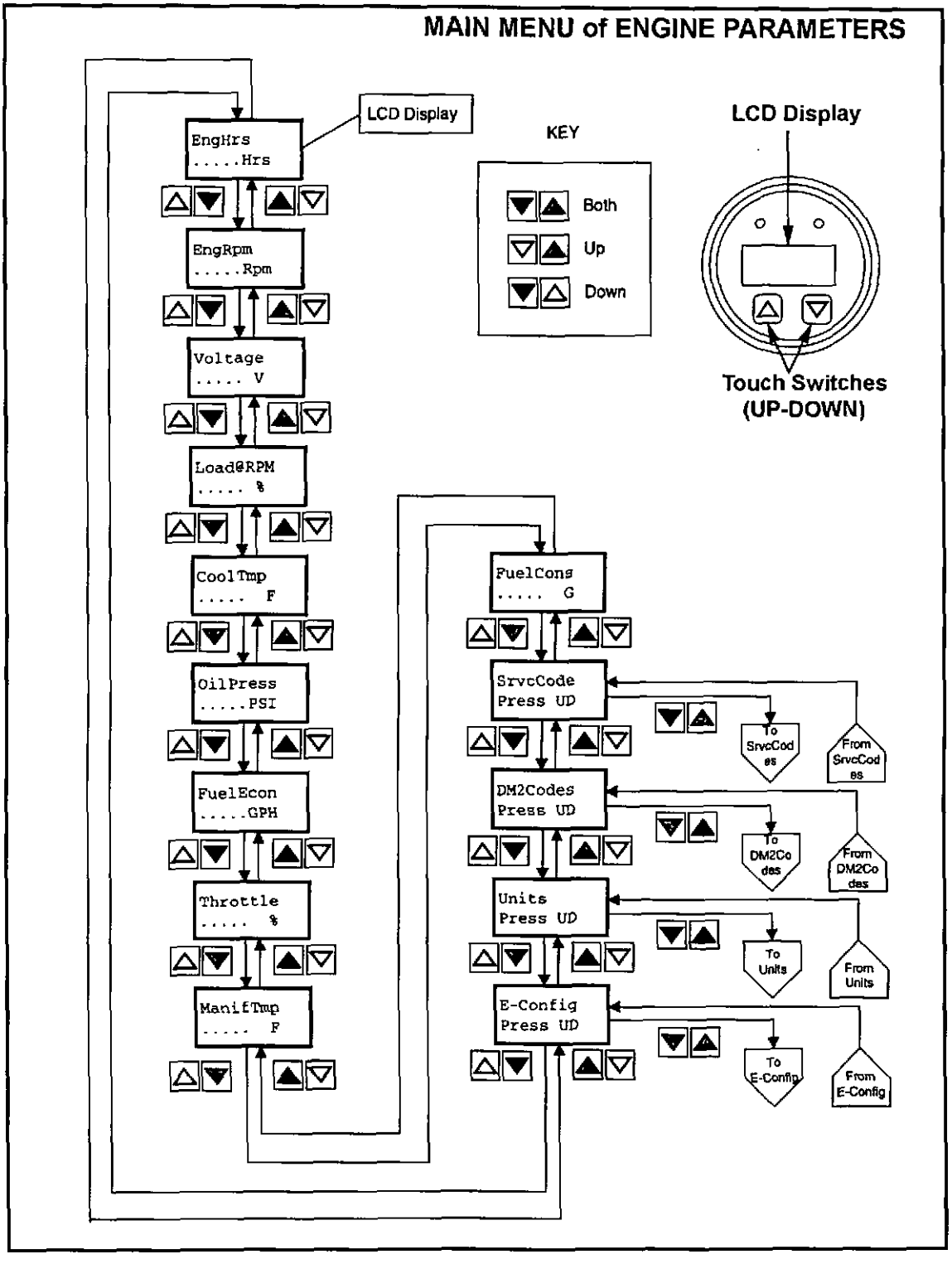
- Coolant pressure
- Coolant level
- Wheel base vehicle speed
- Fuel rate
- Instant fuel economy check
- Average fuel economy
- Barometric pressure
- Air inlet temperature
- Boost pressure
- Intake manifold temperature
- Air filter differential pressure
- Exhaust gas temperature
- Electrical potential (voltage)
- Battery potential (voltage), switched
- Transmission oil pressure
- Transmission oil temperature
- Injector metering rail No. 1 pressure
- Injector metering rail No. 2 pressure
- Estimated percent fan speed

NOTE: Engine parameters which can be accessed will vary with the engine application.

The diagnostic gauge includes a two-line by eight-character backlit Liquid Crystal Display (LCD). The top line displays the data label, i.e. "EngHrs" and the bottom line displays the matching unit information, i.e. "1200 Hrs". The diagnostic gauge uses two touch switches (UP and DOWN) for scrolling through the engine parameter list and viewing the menu list. Two lights (C) (amber and red) are used to signal active trouble messages received by the diagnostic gauge.

DPSG,OUOD007,2840 –19–21OCT99–2/2

Using Touch Switches to Display Information



Using Touch Switches

Continued on next page

The touch switches on the diagnostic gauge allow quick and easy navigation through the menu to find the information needed. The diagram on the previous page is a typical Main Menu of Engine Parameters. The Main Menu has 14 entries; the first 10 are engine data parameters, and the last four are sub-menu entry points. The following two rules are used for accessing the various items on the menus:

1. To scroll through the parameter list, press ***either*** the UP or DOWN touch switches.
2. To select or exit a sub-menu, ***simultaneously*** press the UP and DOWN switches.

Selecting Engine Data Parameters

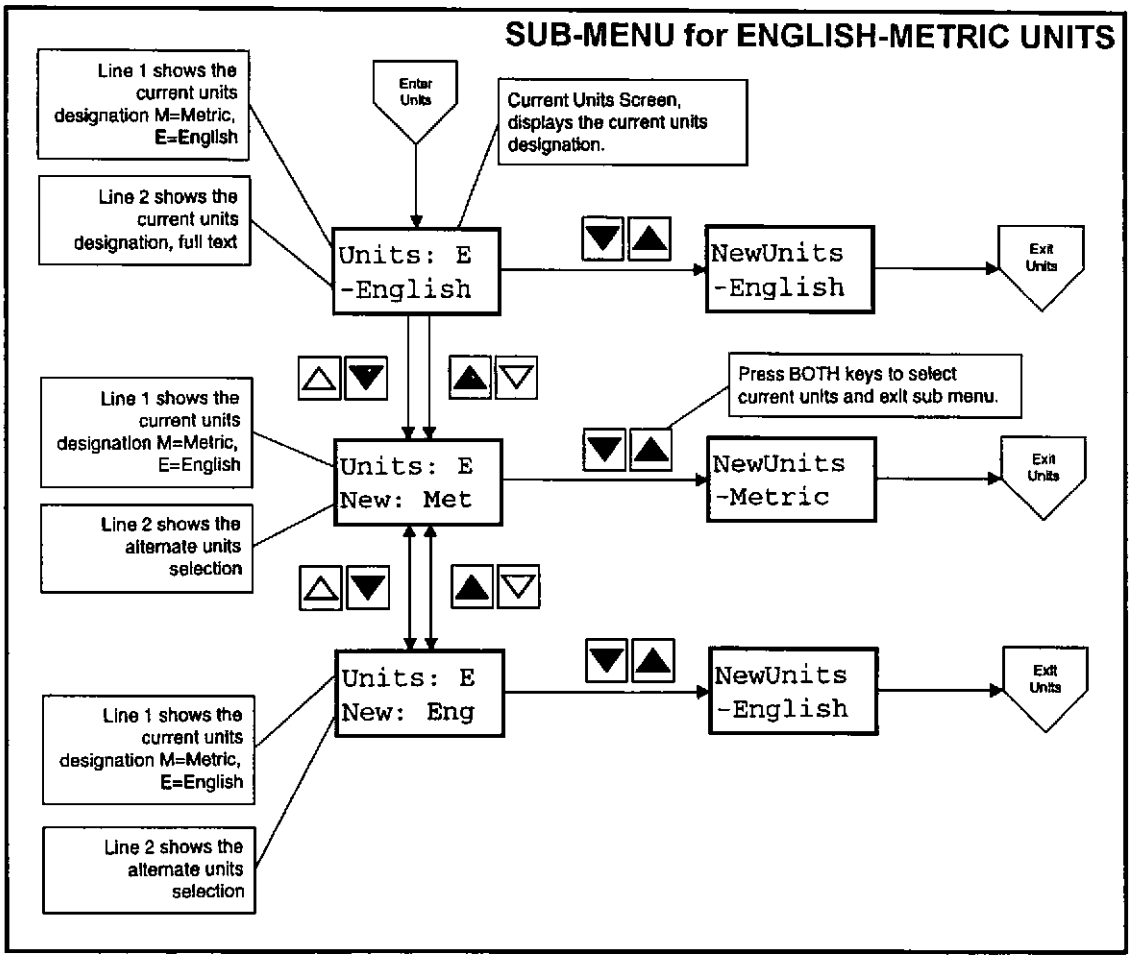
To read any of the engine parameters, press either UP or DOWN switches (as shown on diagram) until the top line of the display shows the desired information.

Selecting Sub-Menus

Press either the UP or DOWN switches until the top line of the display shows the label of the desired sub-menu. Then press **BOTH** the UP and DOWN switches at the same time. This action will select the sub-menu and the next screen on the display will list the Sub-Menu items. This is also the way to access Diagnostic Trouble Codes (DTCs).

DPSG,OUOD007,2841 –19–21OCT99–2/2

Changing Units of Measure (English or Metric)



Changing Units Of Measure

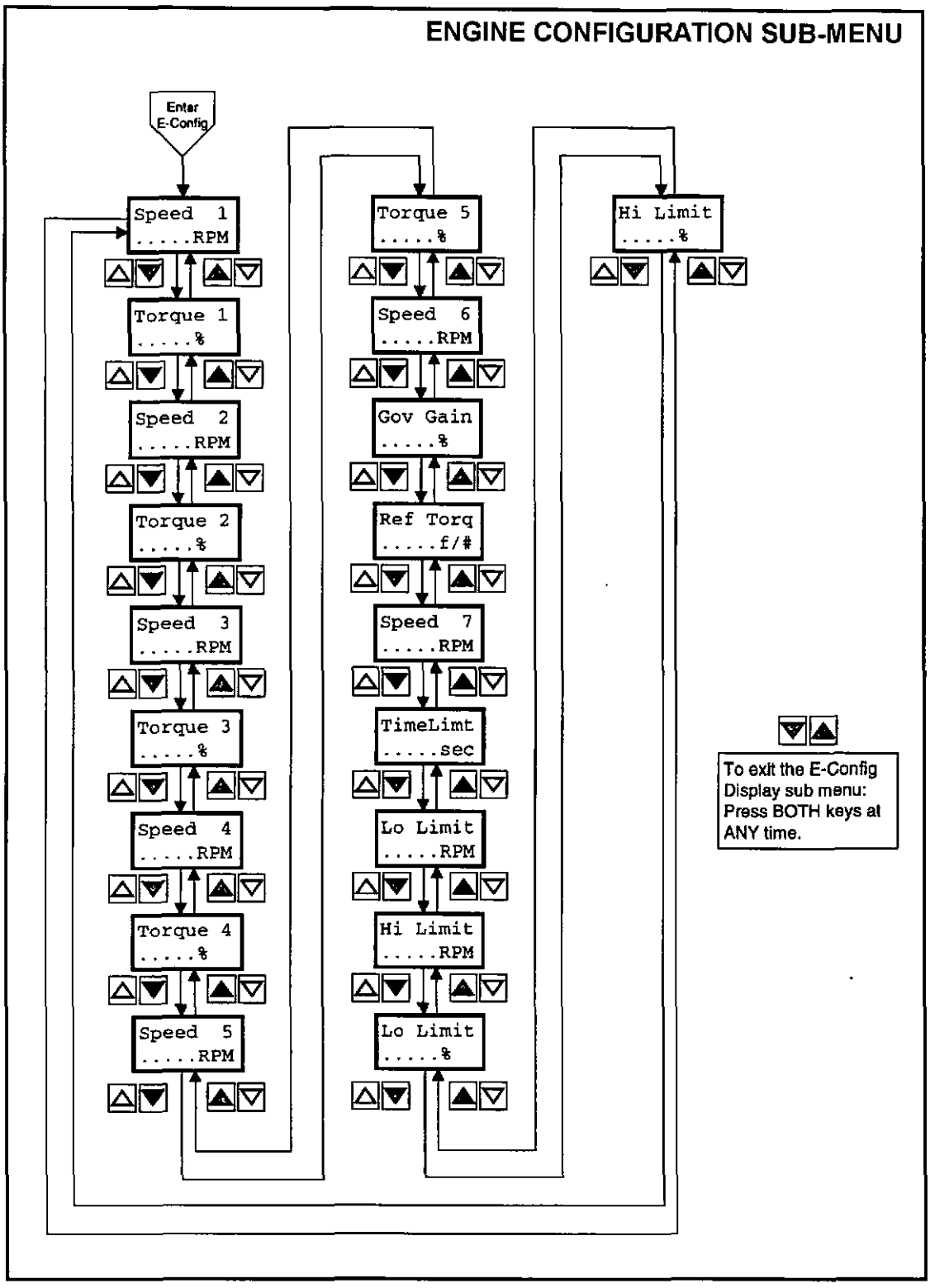
The diagnostic gauge can display engine data in either English or Metric units. To toggle between these, the *Units Sub-Menu*, must be selected.

To select the *Units Sub-Menu*, press the UP or DOWN switches until the top line of the display reads "UNITS". Then press BOTH the UP and DOWN switches at the same time to select the *Units Sub-Menu.* The above diagram shows the steps for selecting the desired units of measure. Two options are available:

1. Press both the switches to retain the current units designation.
2. Press either UP or DOWN switch to toggle the units selection, then press both switches to select the desired unit of measure.

DPSG,OUOD007,2842 –19–21OCT99–1/1

Viewing Engine Configuration Data



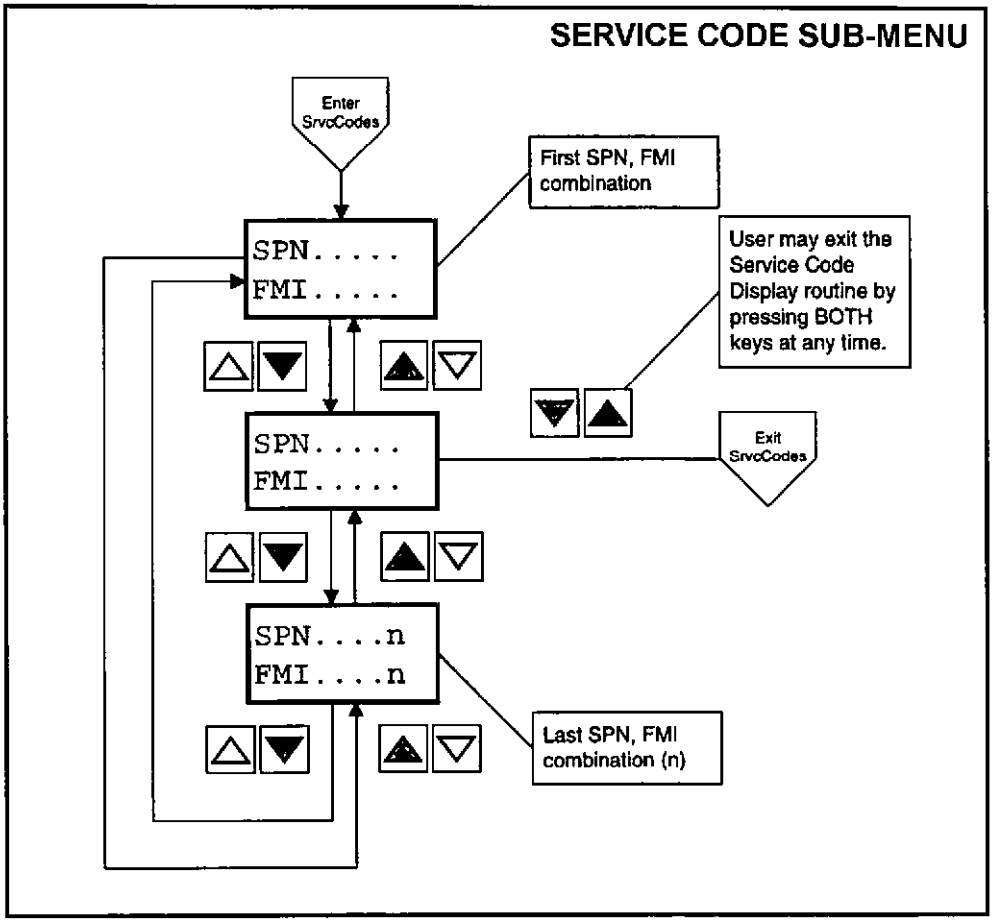
Viewing Engine Configuration Data

Continued on next page

The diagnostic gauge can display the engine configuration data stored in the Engine Control Unit (ECU). To select the *Engine Configuration Sub-Menu* (see diagram on previous page), press the UP or DOWN switches until the top line of the display reads "E-Config". Then press BOTH the UP and DOWN switches at the same time to select the *Engine Configuration Sub-Menu* . The diagnostic gauge will display the engine configuration data as shown in the diagram.

DPSG,OUOD002,1927 –19–19DEC00–2/2

Viewing Active Engine Service Codes/Diagnostic Trouble Codes (DTCs)



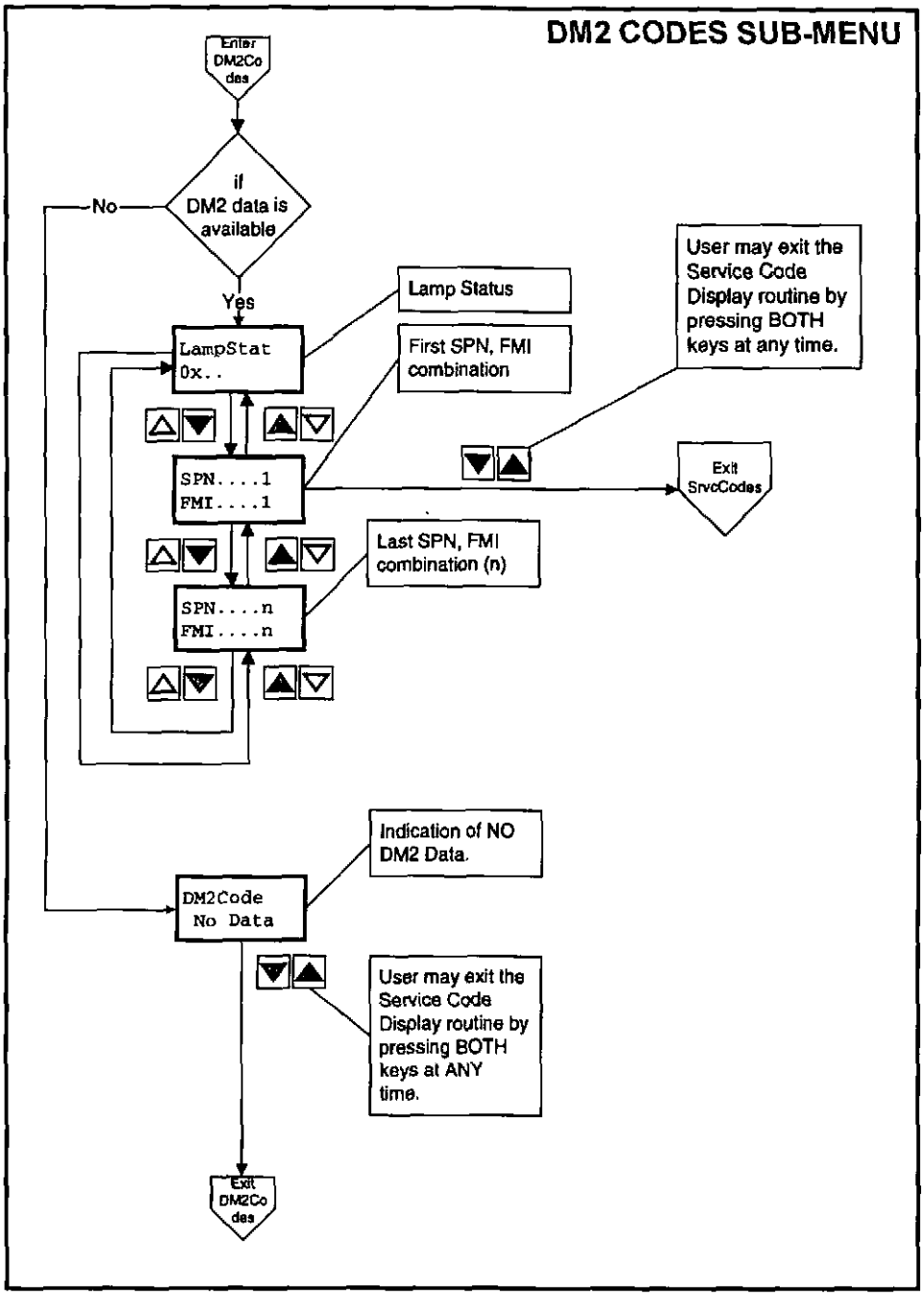
Viewing Active Service Codes/Diagnostic Trouble Codes (DTCs)

The diagnostic gauge continuously monitors all messages broadcast over the Control Area Network (CAN) and displays all active service codes /diagnostic trouble codes (DTCs) at the time the message is broadcast. The word "SrvcCode" is displayed on the second line. The display will cycle every 5 seconds between the currently displayed parameter and the "SrvcCode" message until the active service code (DTC) clears. To view the active codes, select the *Service Code Sub-Menu* by pressing the UP or DOWN switch until the top line of the display reads "SrvcCode". Then press BOTH the UP and DOWN switches at the same time to select the Service Code (DTC) Sub-Menu. The diagnostic gauge has the ability to display all active service codes (DTCs) received. The diagram above titled *Service Code (DTC) Sub-Menu* shows the process for selecting active service codes (DTCs) and their values.

NOTE: For a list of service codes/diagnostic trouble codes (DTCs), refer to the Troubleshooting section later in this manual.

OUOD006,000006A –19–24SEP02–1/1

Viewing Stored Service Codes/Diagnostic Trouble Codes (DTCs) in the Engine ECU



Viewing Stored Service Codes/Diagnostic Trouble Codes (DTCs)

The diagnostic gauge can request stored service codes (DTCs) from the engine. The stored service codes may be used for diagnostic and service needs. To view the stored service codes, it is necessary to select the *DM2 Codes Sub-Menu* by pressing the UP or DOWN switch until the top line of the display reads "DM2 Codes". Then press BOTH the UP and DOWN switches at the same time to select the *DM2 Codes Sub-Menu*. The gauge will display the stored service codes according to the menus shown in the diagram.

OUOD006,000006B –19–24SEP02–1/1

Displaying of Diagnostic Trouble Codes (DTCs)

Use the information below to understand how diagnostic trouble codes (DTCs) are displayed on the instrument panel. Then refer to the list of trouble codes which follows for actual descriptions of each code.

SPN/FMI CODES

DTCs are output according to the J1939 standard as a two part code.

The first part is a two to four-digit Suspect Parameter Number (SPN) followed by a one or two-digit Failure Mode Identifier (FMI) code. In order to determine the exact failure, both parts (SPN and FMI) of the code are needed.

The SPN identifies the system or the component that has the failure; for example SPN 110 indicates a failure in the engine coolant temperature circuit.

The FMI identifies the type of failure that has occurred; for example FMI 3 indicates value above normal. Combining SPN 110 with FMI 3 yields engine coolant temperature input voltage too high.

Contact your servicing dealer for help in correcting diagnostic trouble codes which are displayed for your engine.

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Listing of Diagnostic Trouble Codes (DTCs)

NOTE: Not all of these codes are used in all engine applications.

SPN	FMI	Description
28	3	Analog Throttle (B) Input High
28	4	Analog Throttle (B) Input Low
29	3	Analog Throttle (A) Input High
29	4	Analog Throttle (A) Input Low
91	3	Multi-State Throttle Input High
91	4	Multi-State Throttle Input Low
94	3	Fuel Rail Pressure Input Voltage High
	4	Fuel Rail Pressure Input Voltage Low
	10	Fuel Rail Pressure Loss Detected
	13	Fuel Rail Pressure Higher Than Expected
	17	Fuel Rail Pressure Not Developed
97	0	Water in Fuel Continuously Detected
	3	Water in Fuel Signal Voltage High
	4	Water in Fuel Signal Voltage Low
	16	Water in Fuel Detected
	31	Water in Fuel Detected
100	1	Engine Oil Pressure Extremely Low
	3	Engine Oil Pressure Input Voltage High
	4	Engine Oil Pressure Input Voltage Low
	18	Engine Oil Pressure Moderately Low
105	3	Manifold Air Temperature Input Voltage High
	4	Manifold Air Temperature Input Voltage Low
	16	Manifold Air Temperature Moderately High
107	0	Air Filter Differential Pressure
110	0	Engine Coolant Temperature Extremely High
	3	Engine Coolant Temperature Input Voltage High
	4	Engine Coolant Temperature Input Voltage Low
	16	Engine Coolant Temperature Moderately High
111	1	Engine Coolant Level Low
158	17	ECU Power Down Error
174	0	Fuel Temperature High Most Severe
	3	Fuel Temperature Input Voltage High
	4	Fuel Temperature Input Voltage Low
	16	Fuel Temperature High Moderately Severe
190	0	Engine Overspeed Extreme
	16	Engine Overspeed Moderate
611	3	Electronic Injector Wiring Shorted to Power Source
	4	Electronic Injector Wiring Shorted to Ground
620	3	Sensor Supply 1 Voltage High
620	4	Sensor Supply 1 Voltage Low
627	1	Electronic Injector Supply Voltage Problem
629	13	ECU Error
636	2	Pump Position Sensor Input Noise
	8	Pump Position Sensor Input Missing
	10	Pump Position Sensor Input Pattern Error
637	2	Crank Position Input Noise
	7	ECU/Pump Timing Moderately Out of Sync

Continued on next page

SPN	FMI	Description
	8	Crank Position Input Missing
	10	Crank Position Input Pattern Error
639	13	CAN Bus Error
640	11	Engine Shutdown Vehicle Request Invalid
	31	Engine Shutdown Vehicle Request
651	5	Cylinder #1 Electronic Injector Circuit Open
	6	Cylinder #1 Electronic Injector Circuit Shorted
	7	Cylinder #1 Electronic Injector Mechanical Failure
652	5	Cylinder #2 Electronic Injector Circuit Open
	6	Cylinder #2 Electronic Injector Circuit Shorted
	7	Cylinder #2 Electronic Injector Mechanical Failure
653	5	Cylinder #3 Electronic Injector Circuit Open
	6	Cylinder #3 Electronic Injector Circuit Shorted
	7	Cylinder #3 Electronic Injector Mechanical Failure
654	5	Cylinder #4 Electronic Injector Circuit Open
	6	Cylinder #4 Electronic Injector Circuit Shorted
	7	Cylinder #4 Electronic Injector Mechanical Failure
655	5	Cylinder #5 Electronic Injector Circuit Open
	6	Cylinder #5 Electronic Injector Circuit Shorted
	7	Cylinder #5 Electronic Injector Mechanical Failure
656	5	Cylinder #6 Electronic Injector Circuit Open
	6	Cylinder #6 Electronic Injector Circuit Shorted
	7	Cylinder #6 Electronic Injector Mechanical Failure
898	9	Vehicle Speed Invalid/Missing
970	31	Engine Shutdown - Auxiliary Request
971	31	External Fuel Derate Switch Active
1079	3	Sensor Supply 2 Voltage High
	4	Sensor Supply 2 Voltage Low
1080	3	Fuel Rail Pressure Sensor Supply Voltage High
	4	Fuel Rail Pressure Sensor Supply Voltage Low
1109	31	Engine Protection Shutdown Warning
1110	31	Engine Protection Shutdown
1347	5	Pump Control Valve #1 Error
	7	Fuel Rail Pressure Control Error
	10	Pump Control Valve #1 Fuel Flow Not Detected
1348	5	Pump Control Valve #2 Error
	10	Pump Control Valve #2 Fuel Flow Not Detected
1568	2	Torque Curve Selection Invalid
	9	Torque Curve Selection Missing
1569	31	Fuel Derate
1639	1	Fan Speed Signal Missing
	2	Fan Speed Signal Erratic
	16	Fan Speed Higher Than Expected
	18	Fan Speed Lower Than Expected
2000	9	Vehicle ID Missing
	13	Security Violation

Continued on next page

NOTE: The Diagnostic Gauge on the electronic instrument panel can have communication problems that result in Error Codes being shown on its LCD display window. The following Error Codes all indicate that there is a Diagnostic Gauge communication error with the ECU. Contact your servicing dealer for help in correcting these codes:

EE — Error

ACP — Err
No Addr

ACP — Err
BUS — EP

XXXXX — EP
No Data

XXXXX — BO
No Data

XXXXX — BR
No Data

OUOD006,0000093 -19-30OCT02-3/3

Intermittent Fault Diagnostics

Intermittent faults are problems that periodically "go away". A problem such as a terminal that intermittently doesn't make contact can cause an intermittent fault. Other intermittent faults may be set only under certain operating conditions such as heavy load, extended idle, etc. When diagnosing intermittent faults, take special note of the condition of wiring and connectors, since a high percentage of intermittent problems originate here. Check for loose, dirty or disconnected connectors. Inspect the wiring routing, looking for possible shorts caused by contact with external parts (for example, rubbing against sharp sheet metal edges). Inspect the connector vicinity, looking for wires that have pulled out of connector terminals, damaged connectors, poorly positioned terminals, and corroded or damaged splices and terminals. Look for broken wires, damaged splices, and wire-to-wire shorts. Use good judgement if component replacement is thought to be required.

NOTE: The engine control unit (ECU) is the component LEAST likely to fail.

Suggestions for diagnosing intermittent faults:

- If diagnostic charts on preceding pages indicate that the problem is intermittent, try to reproduce the operating conditions that were present when the diagnostic trouble code (DTC) set.
- If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the diagnostic gauge to see if the fault resets.

Possible causes of intermittent faults:

- Faulty connection between sensor or actuator harness.
- Faulty contact between terminals in connector.
- Faulty terminal/wire connection.
- Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc., can cause faulty signals to be sent to the ECU.

NOTE: Refer to wiring diagrams earlier in this section as a guide to connections and wiring.

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Electronic Engine Controls -- JDEC (12.5 L)

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Continued - -

Electronic Engine Controls -- JDEC (12.5 L)

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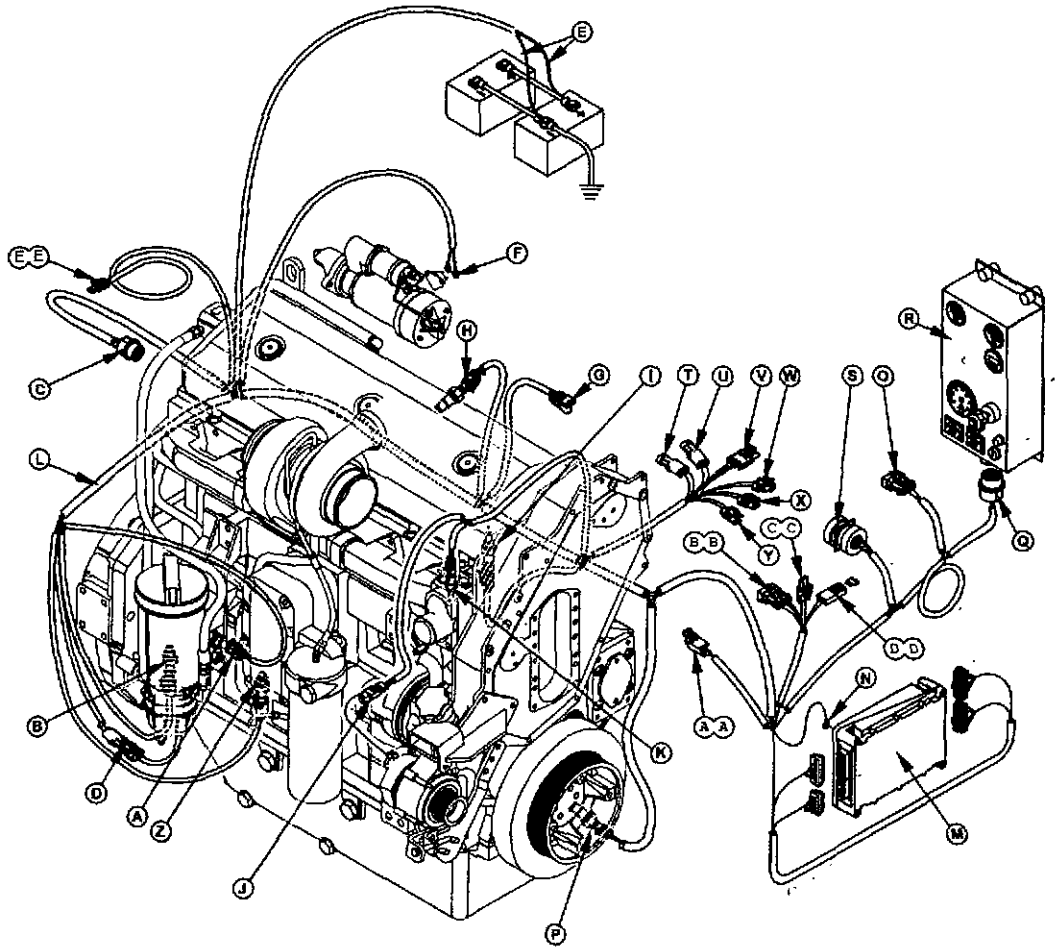


A- FUEL PRESSURE SENSOR
B- FUEL TEMPERATURE SENSOR
C- UNIT INJECTION CONNECTOR
D- WATER IN FUEL SWITCH
E- POWER AND GROUND CONNECTIONS
F- STARTER RELAY CONNECTIONS
G- MANIFOLD AIR PRESSURE (MAP) SENSOR
H- CAM POSITION SENSOR
I- MANIFOLD AIR TEMPERATURE (MAT) SENSOR
(NOT USED ON "A" ENGINES)
J- ALTERNATOR
K- COOLANT TEMPERATURE SENSOR
L- ENGINE WIRE HARNESS
M- ENGINE CONTROL UNIT
N- SYSTEM GROUND
(ECU MUST ALSO BE GROUNDED TO FRAME)
O- CRUISE CONTROL CONNECTOR
P- CRANKSHAFT POSITION SENSOR
Q- INSTRUMENT PANEL CONNECTOR
R- OPTIONAL INSTRUMENT PANEL
S- DIAGNOSTIC CONNECTOR
T- AUXILIARY "WARNING" LAMP CONNECTOR
U- AUXILIARY "STOP ENGINE" LAMP CONNECTOR
V- SECONDARY ANALOG THROTTLE
W- LOW COOLANT LEVEL SWITCH CONNECTOR
X- EXTERNAL DERATE SWITCH CONNECTOR
Y- EXTERNAL ENGINE SHUT DOWN SWITCH CONNECTOR
Z- OIL PRESSURE SENSOR
AA- SAE 1939 CAN CONNECTOR
BB- PERFORMANCE PROGRAM CONNECTOR
CC- TRANSIENT VOLTAGE PROTECTION (TVP) CONNECTOR
DD- MAIN SYSTEM FUSE (30 AMP)
EE- AIR CLEANER RESTRICTION SWITCH CONNECTOR

Figure AG-15 - 01, John Deere Electronic Control System (12.5 L)

INTRODUCTION

The John Deere Electronic Control system used on 12.5L engines is very similar to the systems used on 6.8L and 8.1L engines. It is designed to use the same RE162429 instrument panel with adjustable 2-state throttle used on all 6.8L and 8.1L engines with JDEC controls.

The power connections and 21-pin instrumentation and controls connector are exactly the same as used on the 6.8L and 8.1L engines. Unlike the 6.8L and 8.1L, there are no unterminated wires. Additional wires for special features such as cruise control are located in several special connectors.

FEATURES

Engine Diagnostics and Engine Protection

The ECU can detect abnormal engine operating conditions or faults in several engine systems. Faults are stored in the ECU for later use by service personnel, and are reported to the operator with a Fault Lamp.

The ECU can detect several types of engine problems and may take actions to minimize engine damage that may result if these problems are not corrected. There are two levels of engine problems, "Warning" and "Shutdown."

"Warning" faults are engine problems that may lead to engine failures if not corrected. "Warning" faults include higher-than-normal fuel temperature, lower-than-normal oil pressure, higher-than-normal coolant temperatures, higher-than-normal charge air temperatures, or power derates. The warning lamp will be on when a "Warning" problem is detected.

"Shutdown" faults are engine problems that indicate imminent engine failure. "Shutdown" problems include extremely low oil pressure, extremely high coolant temperatures, loss of coolant, and extremely high fuel temperature. The stop-engine lamp indicates "Shutdown" problems.

ENGINE PROTECTION

Three levels of engine protection are available: No protection, engine protection without shutdown, and engine protection with shutdown.

You must select the level of protection desired by option code when the engine is ordered. All levels may not be offered at every power rating. See the 1600 group descriptions and Engine Performance Curves to determine which injection pump / ECU options include engine protection or shutdown features.

No Protection

Engine ECU's with "No Protection" do not derate the engine when coolant temperature, oil pressure, or charge-air temperature "Warning" faults are detected, and do not shutdown the engine if a "Shutdown" fault occurs. The fault lamp will illuminate when a "Warning" fault is detected by the ECU, and the stop-engine lamp will illuminate when a "Shutdown" fault is detected. The engine operator is responsible for reducing engine speed and power when a "Warning" fault exists and for shutting down the engine when a "Shutdown" fault exists.

Engine Protection Without Shutdown

The Engine Protection feature is only in ECU's with Engine Protection programmed into the ECU. All engine protection sensors including fuel temperature, coolant temperature, and oil pressure must be installed if engine protection is specified. Otherwise, a fault will be detected, and the fault lamp will light.

The engine derate schedules will be active but the engine will not shutdown if a "Shutdown" fault is detected. The warning lamp will be on when a "Warning" fault is detected by the ECU or when the engine is derated by the ECU. The stop-engine lamp will illuminate when a "Shutdown" fault is detected. The engine operator is responsible for shutting down an engine with a "Shutdown" fault.

Engine Protection With Shutdown

The Engine Shutdown feature is only in ECU's with Engine Protection and Shutdown programmed into the ECU. All engine protection sensors, including coolant temperature and oil pressure must be installed if engine protection is specified. Otherwise, a fault will be detected, and the fault lamp will illuminate.

The engine derate schedules will be active and the engine will shutdown in 30 seconds if a "Shutdown" fault is detected. The warning lamp will illuminate when a "Warning" fault is detected by the ECU or when the engine is derated by the ECU. The stop-engine lamp will illuminate for 30 seconds before shutting down when a "Shutdown" fault is detected.

Shutdown Override Control

The operator may delay a shutdown for 30 seconds by pushing the "Shutdown Override" button. The "Shutdown Override" switch resets the shutdown timer to 30 seconds, and may be used repeatedly. However, continuously holding down the "Shutdown Override" switch will not reset the 30 second timer.

On an ECU with the Shutdown feature, shutting down the engine by turning "off" the key switch will reset the engine Shutdown feature and will allow at least 30 seconds of running after restart. After 30 seconds, the engine will again shutdown unless the "Shutdown" fault condition has cleared

LOW OIL PRESSURE

There are two low oil protection features, Low Oil Pressure WARNING and Low Oil Pressure SHUTDOWN. The set-points for Low Oil Pressure WARNING and SHUTDOWN are variable based on engine speed, and are preset at the factory.

At the Low Oil Pressure WARNING set-point the ECU turns on the warning lamp. On systems with the protection option enabled a slow power derate begins. If the oil pressure goes above the Low Oil Pressure WARNING set point, power slowly increases until the power is back to full power. The fault lamp will continue until the power returns to normal even if the fault condition has gone away and the recovery is in process.

At Low Oil Pressure SHUTDOWN set-point the ECU turns on a stop-engine lamp. On systems with the protection option enabled, a faster power derate begins. On systems with the shutdown option enabled, if the oil pressure does not go above the SHUTDOWN set-point within 30 seconds, the engine will shutdown. If oil pressure goes above Low Oil Pressure SHUTDOWN set point within 30 seconds, power derate reverts to the Low Oil Pressure WARNING curve.

COOLANT TEMPERATURE

There are two standard coolant temperature features, High Coolant Temperature WARNING, and High Coolant Temperature SHUTDOWN.

At the High Coolant Temperature WARNING set-point the ECU turns on the warning lamp. On systems with the protection option enabled a slow power derate begins. If the coolant temperature goes below the High Coolant Temperature WARNING set point, power increases slowly until the power is back to full power. The fault lamp will continue until the power returns to normal even if the fault condition has gone away and the recovery is in process.

At High Coolant Temperature SHUTDOWN set-point the ECU turns on the stop-engine lamp. On systems with the protection option enabled a faster power derate begins. On systems with the shutdown option enabled, if the coolant temperature does not go below the SHUTDOWN set-point within 30 seconds, the engine will shutdown. If coolant temperature goes below High Coolant Temperature SHUTDOWN set point within 30 seconds, power derate reverts to the High Coolant Temperature WARNING curve.

WATER IN FUEL

If the water-in-fuel sensor detects the presence of water in the primary fuel filter, a fault code will be generated and the warning light illuminates. On systems with the protection option enabled, a slow power derate begins. The operator has approximately one hour to stop the engine, drain the water from the primary fuel filter, and find and correct the source of the water. If water is still present in the primary fuel filter after one hour, the "Stop Engine" light will illuminate. On systems with the shutdown option enabled, the engine will shut down 30 seconds after the "Stop Engine" light illuminates.

HIGH CHARGE AIR TEMPERATURE

If the air temperature in the intake manifold rises above the maximum allowable temperature, the ECU turns on the warning lamp and generates a fault code. On systems with the protection option enabled, a slow power derate begins. If the temperature drops below the allowable maximum while derated, power slowly increases until the power is back to full power. The fault lamp will continue until the power returns to normal even if the fault condition has gone away and the recovery is in process. There is no shutdown function for High Charge Air Temperature. The maximum derate is 20%.

HIGH FUEL TEMPERATURE

If the fuel temperature rises above a preset "warning" temperature, the ECU illuminates the warning lamp, generates a fault code, and begins to derate. There is no shutdown function for high fuel temperature.

EXTERNAL LOSS OF COOLANT INPUT

The Loss of Coolant feature is an optional customer input. The loss-of-coolant circuit can be used to trigger a derate and shutdown from an external low-coolant indicator such as a Murphy coolant level switch. When a loss-of-coolant signal is detected, the ECU turns on the stop-engine lamp. On systems with the protection option enabled a rapid power derate begins. On systems with the shutdown option enabled, if the Loss-of-Coolant switch does not reset within 30 seconds, the engine will shutdown. If the Loss-of-Coolant switch resets within 30 seconds, power increases at the same rate until back to full power.

The engine will continue to run for 30 second after the external low coolant sensor is triggered. If an immediate shutdown is required, a separate external shutdown circuit is provided.

EXTERNAL DERATE AND SHUTDOWN INPUTS

Two additional inputs are provided for external derates and shutdown. These inputs can be used to allow the OEM to trigger a 20% reduction in engine power or an engine shutdown from external switches, such as a loss-of-prime switch or hydraulic over-temperature switch. These switches are active on all ECUs, even if "No Protection" is specified. They derate or shut down the engine immediately. There is no 30 second delay. If the user doesn't wish to use this feature, the wires should be left disconnected.

ONBOARD DIAGNOSTIC GAUGE REQUIREMENT

All applications using a 12.5L engine with JDEC control system must be equipped with a permanent onboard diagnostic gauge. The RE68155 Diagnostic Gauge is available either separately or as part of the RE162429 instrument panel for this purpose.

The RE68155 Diagnostic Gauge is a complete on-board engine diagnostic and display system. It includes built-in "Warning" and "Stop-engine" lights to alert the operator of problems, and it digitally displays diagnostic codes, rpm, hours, oil pressure, coolant temperature, voltage, engine load, fuel consumption, manifold temperature and other engine parameters.

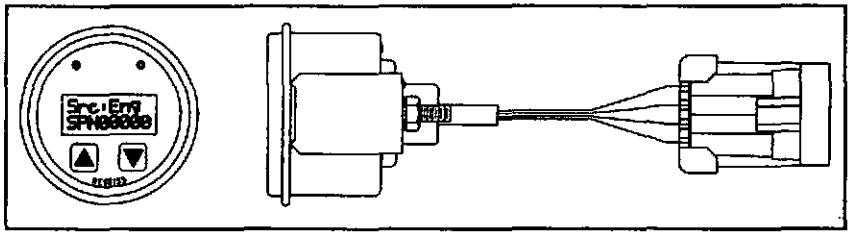


Figure AG-15 - 02, RE68155 Diagnostic Gauge

It can also be used to drive analog gauge displays for rpm, oil pressure, coolant temperature, and many other parameters available on the digital display. The RE68155 diagnostic gauge works with all JDEC control systems. It fits in a standard 2-inch SAE instrument panel opening. It is pre-installed in the RE162429 instrument panel, and included with the RE508625 instrument panel kit.

You can also provide your own SAE J1939-based on-board diagnostic system using the information provided over the SAE J1939 Controller Area Network (CAN) described later in this manual.

Power Bulge Protection

It will not be possible to operate engines continuously at higher than 102% power by keeping in the "Power Bulge" zone of the torque curve. Operation above 102% load will only be allowed for a maximum of 1 minute out of every 10 minutes. After 1 minute of operation at greater than 102% power within a 10 minute time interval, the ECU will automatically derate the engine to no more than 102% of rated power as shown on the "Minimal Power Bulge" portion of the published performance curve. The derate will take about one minute, and will stay in effect until the 10 minute time interval is complete, at which time power bulge operation will be allowed again for up to one minute during the next 10 minute time interval.

Fuel Temperature Compensation

Fuel temperature compensation provides constant power regardless of fuel temperature

Throttle Options

Three throttle inputs are available on the 12.5L engine. There are two analog (potentiometer) throttles, and a special adjustable 2-state throttle. Any of the three inputs can be used alone or in any combination with the other two.

ANALOG (POTENTIOMETER) THROTTLES

The two available analog throttle inputs both can use any 2000-15,000 Ohm potentiometer. Many prefabricated foot and hand throttle assemblies are available from various suppliers including Morse and Williams Controls. When both analog throttles are used, the throttle signals are additive, up to the factory preset fast-idle setting or the maximum speed set with the Adjustable 2-State Throttle. There will be no "dead band" in either throttle. When you move the foot throttle, speed will immediately increase regardless of where the hand throttle is set.

The secondary analog throttle feature is not intended for use with two throttles located remotely from each other. Because the throttle signal is additive, if either throttle is at the full speed position, the other throttle will have no control. Both throttles must be in the slow-idle position for the engine to operate at slow idle.

ADJUSTABLE 2-STATE THROTTLE

An adjustable 2-state throttle feature is available on the 12.5L JDEC System. No mechanical or analog (potentiometer) throttle is required to operate the engine. The Adjustable 2-State throttle allows you to preset one high and one low operating speed, and switch between them electrically without the use of potentiometers or mechanical adjustments of any kind.

If an analog (foot or hand) throttle is desired, you can add up to two throttle potentiometers that would operate between the preset high and low operating speeds. The Adjustable 2-State throttle must be set in the "Low-Speed" position for the Analog throttle to work.

Three switches make up the Adjustable 2-State Throttle: The High/Low Select Switch, the Bump Enable Switch, and the Speed Select Switch.

The High/Low Select Switch

The High/Low Select Switch allows you to choose between two operating speeds. Unless you adjust the speed points differently, the engine will operate at the factory pre-set fast idle speed when the High/Low Select Switch is in the "Fast" position, and it will operate at the factory pre-set slow idle speed when the High/Low Select Switch is in the "Slow" position. However, the preset "Fast" and "Slow" operating speeds may be reset to any desired speeds between factory fast and slow idles using the Speed Select and Bump Enable switches.

The Bump Enable Switch

The Bump Enable Switch serves as a lock for the Speed Select Switch to make sure the operating speed is not changed accidentally or as a result of the Speed Select circuit failure. The Bump Enable Switch must be "On" for the Speed Select Switch to work.

The Speed Select Switch

The Speed Select Switch allows you to adjust either the "Fast" or "Slow" preset speeds. When the High/Low Select Switch is on "High," and the Bump Enable Switch is "On," moving the Speed Select Switch to the "-" (minus) position will decrease the pre-selected "Fast" speed slightly, and moving the Speed Select Switch to the "+" (plus) position will increase the pre-selected "Fast" speed slightly (but not past fast idle). When the High/Low Select Switch is on "Low", and the Bump Enable Switch is "On," moving the Speed Select Switch will adjust the "Slow" pre-set operating speed.

The Speed Select Switch works like the "Accel" and "Coast" buttons on a cruise control. A momentary tap on the switch will bump the speed up or down about 10 rpm. However, if you hold the switch down, speed will continue to ramp up or down continuously until the switch is released, then it will lock in at whatever rpm it has reached at that point.

To permanently set high and low speeds, press the bump enable button (3) three times after adjustment. Both preset speeds (high and low) will be remembered, even if the ignition is turned off or the battery is disconnected.

Cruise Control

The Cruise Control is an off-road type that maintains a constant engine RPM under varying load conditions. An automotive type cruise control maintains a constant road speed.

The Cruise Cancel/Resume function is a one-button, Cancel-then-Resume function. The first time button contact is made with Cruise Control active, the Cruise Control will disengage and the engine speed will drop to idle. If the contact is made again within one minute and with the engine speed above 1300 RPM, the Cruise Control will "Resume." This feature allows the placement of the Cancel/Resume button in a convenient location in the vehicle cab and does not require the use of the normal Cruise controls for momentary interruptions in cruise operation.

The Cancel/Resume function is intended for applications like Ag tractors and sprayers that turn around at the end of each row in a field. This allows the operator to use the throttle and/or brake to turn the vehicle around. When ready to resume field operations, the operator brings the engine speed above 1300 RPM and activates the Cancel/Resume function again to resume cruise speed. An internal timer gives the operator one minute to complete the turnaround maneuver.

The Cruise Control has the normal functions of:

Cruise Control power "ON" or "OFF"
"Set" or "Bump Up" Engine Speed
"Resume" or "Bump Down" Engine Speed
Vehicle brake or clutch pedal to disengage Cruise Control

These feature generally function exactly like an automotive cruise control. Refer to the cruise control wiring instructions later in this section for more details.

The engine speed can be set from two different locations. The primary location is normally in the cab of the vehicle and is used to set a constant engine speed while the vehicle is driven. The secondary cruise control is normally used in a location that provides for engine PTO speed control and is used with the engine in "neutral" or out of gear. Both locations can have the normal Cruise functions.

Selectable Torque Curves and Governor Regulation

The New John Deere ECU can have up to four programmed torque curves. The power levels for each curve are identified in the engine performance curves. The governor can be set for either normal droop or isochronous operation. Normal droop gives a drop in engine speed with an increase in load, or an increase in engine speed with a decrease in load. The normal % droop for your engine is listed in the engine performance curve. When isochronous governing is selected the droop is set to 0%, and there is no change in engine speed with changing loads until the engine's torque limit is reached.

PERFORMANCE PROGRAM CONNECTOR

The ECU can be programmed with multiple power and governor curves. Refer to the specific Engine Performance Curve for your engine to determine what variations are available to you. To switch between the available power and speed regulation curves, insert jumper wires between certain terminals in the wiring harness.

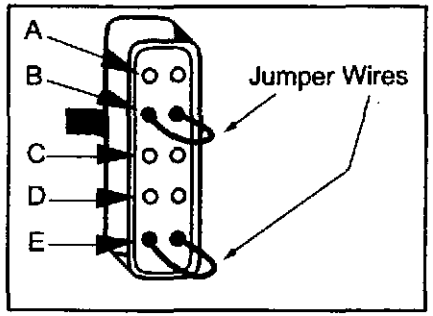


Figure AG-15 - 03, Performance Program Connector

On the engine wiring harness you will find a 10-pin Metri-Pack connector that is capped off and not plugged into anything. This is the Performance Program Connector. To change programming, add and/or remove jumper wires from one or more of the five adjacent pairs of terminals.

Three RE500927 jumper wires are included with each engine. Additional jumper wires can be made with an R65594 Metri-Pack crimping tool (Packard # 6285847), and the following parts:

1 - 18-Gauge GXL Wire, 4 inches long (25 mm)
2 - R104846 Terminals (Packard #12048074)
2 - 57M7258 Seals (Packard #12048086)

Jumpers can be inserted into the connector by hand. However, once installed, they cannot be removed by hand. A special tool (Packard #12094429) is required to remove the connector, or the wire can simply be cut and taped off.

The Performance Program Connector is programmed as follows:

ECU Function	Pins				
	A	B	C	D	E
Intermittent Power, Curve #1	No Jumper Wire	No Jumper Wire	Not Used*	Not Used*	
Continuous Power, Curve #2	**Jumper Wire Installed**	No Jumper Wire	Not Used*	Not Used*	
Intermittent Derate Power, Curve #3	No Jumper Wire	**Jumper Wire Installed**	Not Used*	Not Used*	
Continuous Derate Power, Curve #4	**Jumper Wire Installed**	**Jumper Wire Installed**	Not Used*	Not Used*	
Standard Droop Governor			Not Used*	Not Used*	No Jumper Wire
Isochronous Governor (See gen-set setting notes below.)			Not Used*	Not Used*	**Jumper Wire Installed**

* Locations "C" and "D" are not used at this time. No jumpers should be installed.

Table AG-15 - 01, Performance Program Connector Programming

GOVERNOR SETTINGS FOR GEN-SETS

Isochronus Governing

Most gen-sets are normally operated with the isochronus governor selected. Isochronus governing is intended for use with either stand-alone gen-sets, or gen-sets that are paralleled using a commercial load sharing module.

For stand-alone gen-sets, either prime or standby, the throttle switch can be left in the fast-idle position and/or the analog (adjustable) throttle should be turned all the way up to the max speed position. With the throttle in the fast idle position, the governor will try to maintain exactly 1800 rpm (or 1500 rpm for 50-Hz units).

The isochronus governor programmed into gen-set ECUs is non-linear. It does not increase speed evenly as the throttle is turned up. For an 1800 rpm gen-set, it follows the curve shown below.

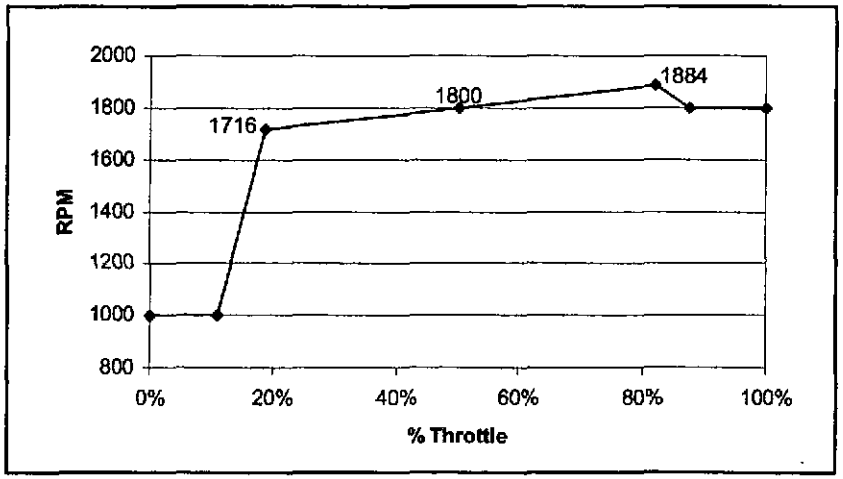


Figure AG-15 - 04, Isochronous Governor

The 1500 rpm ECU behaves similarly. Most of the throttle travel is used to adjust speed within plus or minus 84 rpm of rated speed. This allows very fine adjustment of speed in that range if needed, and it meets the requirements of commercially available load sharing modules. If throttle travel exceeds 82%, speed will reduce until it reaches rated speed at 87.5% travel. Because of this feature, the gen-set will operate at rated speed (1800 or 1500 rpm) when the throttle switch is in the "fast idle" position, or if the analog throttle is turned all the way up, or in the event of a throttle wiring failure, or if no analog or 2-state throttle is installed.

This isochronus governor can be used directly with commercially available load sharing modules. When two or more engines are being controlled by a load sharing module, the load sharing module output can be connected directly to the analog throttle input to the ECU, as shown in the analog throttle wiring section later in this document.

Standard Droop Governing

Standard droop governing is intended for use when sharing load between two John Deere electronically controlled engines without the aid of a commercial load sharing module.

With a gen-set engine in standard droop mode and the throttle control at fast idle, the engine will operate with breakaway at exactly 1800 rpm as shown below (or 1500 rpm on 50 Hz units). Fast idle speed will be 20-60 rpm above rated speed, depending on governor droop for your particular engine. Governor droop for each engine is listed on the certified performance curve.

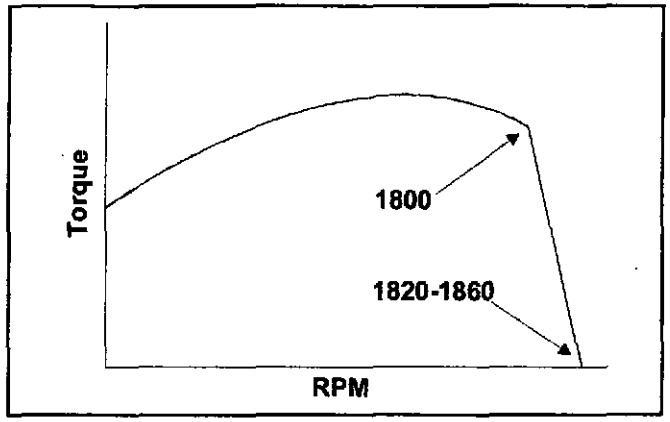


Figure AG-15 - 05, Standard Droop Governor

Multiple John Deere engines with JDEC controls operated in this mode and wired directly in parallel will automatically share load, although frequency will vary with load. This mode is intended for use with other electronically controlled John Deere engines in the same operating mode. It is not intended to be used to parallel with other models of engines, or to parallel with the utility grid directly. To share load at exactly 1800 rpm (60 Hz), a commercial load sharing module must be used.

Controller Area Network (CAN)

The CAN buss is a high speed open interconnect network for electronic systems on on-highway and off-road vehicles and stationary equipment. It allows electronic systems to communicate with each other through a standard architecture of electronic signals over shielded twisted-pair wires. Engines can communicate with throttles, transmissions and brakes. Vehicles can communicate with trailers. Agricultural and construction equipment can communicate with implements and accessories. Stationary equipment can communicate with controllers or other networked equipment. Information on the network can be displayed to the operator on a virtual terminal (instrument panel) or relayed to another location via telemetry. Up to 30 Electronic Control Units or modules can be connected together through a single CAN network segment.

A CAN connection (SAE J1939) is provided in two different locations on the engine wiring harness. A round Deutsch 9-pin connector is provided primarily for service/diagnostic purposes. A Deutsch 3-pin wedge connector, intended for customer computer interface, has also been provided.

The pins in the Deutsch connectors are:

Deutsch 9-pin Round Connector Pin	**Function**
Pin A, Wire #050E (black)	Ground
Pin B, Wire #012C (red)	Power Supply (+12 or +24 volts)
Pin C, Wire #904D (yellow)	CAN_H
Pin D, Wire #905D (dark green)	CAN_L
Pin E, Wire #020D (black)	Shield
Pins F through J	Spare (unused)

Deutsch 3-pin Wedge Connector Pin	**Function**
Pin A, Wire #904A (yellow)	CAN_H
Pin B, Wire #905A (dark green)	CAN_L
Pin C, Wire #020A (black)	Shield

The CAN buss is also accessable through the 21-pin instrumentation and controls connector, which is described in the Instrumentation and Controls Wiring section.

Standard CAN buss messages are listed in the Component Technical Manual. Special CAN messages are required for use with electronically controlled Allison transmissions.

For details on how to use this system, refer to SAE J1939/11 published by the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale PA 15097-0001.

BASIC INSTALLATION

ECU Mounting Requirements

The ECU is enclosed in a "wedge box" style enclosure. The wiring harness is mated to the ECU connector with 4 jackscrews. The recommended torque on the jackscrews is 0.8 to 1.5 NM.

An engine-mounted or remote-mounted ECU can be specified. For an engine-mounted ECU, all mounting hardware will be provided. A remote-mount ECU is normally mounted within the operator compartment or on the operator platform. It should be mounted securely with the four corner mounting holes in a vertical plane with the mating connectors pointing downward. This orientation provides maximum moisture resistance. Other acceptable mounting orientations are shown below. All wiring harnesses must be routed downward from the ECU enclosure so that moisture cannot drain into the connector. A "drip loop" is required when the harness is to be routed above the ECU enclosure.

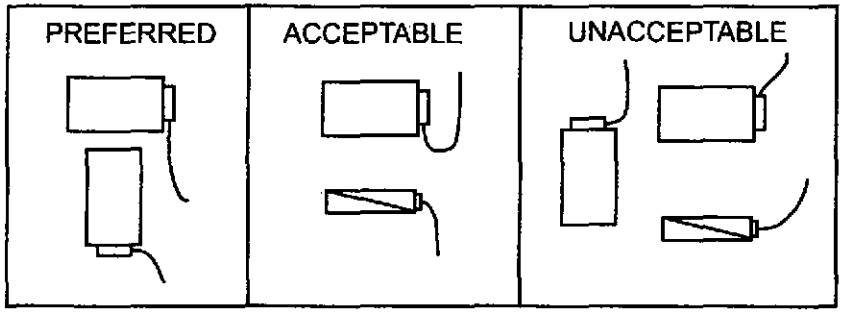


Figure AG-15 - 06, ECU Mounting Position

The ECU is not intended to be mounted in a location that is subject to severe vibration or high shock loading.

The ECU case must be grounded to the chassis to protect against electrostatic discharge. The strap can be as small as 12 gage (primarily for mechanical strength reasons). This is in addition to the ECU ground connection point on the engine/ECU wiring harness.

The engine/ECU wiring harness should be routed to provide access to the diagnostic connectors for service diagnostic work.

Engine Mounted ECU Environment

Special high temperature ECUs are used for engine mounted ECU options. For engine mounted ECUs, the air temperature at the ECU should not exceed 105 °C (221 °F). If the ECU is engine-mounted, it must be in the factory location on the lower right side of the engine, and the engine must be fan cooled. For applications cooled with a heat exchanger, the ECU must be mounted remotely, in the shade, and outside of the engine compartment or any other area where it is exposed to heat from other components. ECUs intended for remote mounting must not be mounted in the engine compartment.

Remote Mounted ECU Environment

For remote (chassis) mounted ECUs, the air temperature at the ECU should not exceed 73 °C (163 °F). Remote mounted ECUs should be mounted in or near the operator's station where environmental conditions are best. For applications cooled with a heat exchanger, the ECU must be mounted remotely, in the shade, and outside of the engine compartment or any other area where it is exposed to heat from other components.

Never cut or splice into the ECU wiring harnesses. Do not wire any other loads into the ECU wiring harnesses.

All wiring must be installed and routed to avoid sharp bends, kinking, pinching, cutting, rubbing or excessive pulling. Use cable clamps or wire ties as needed. Do not over tighten wire ties. Do not run screws through the wiring harnesses. Protective shields may be needed to protect the harnesses from road hazards, sharp surfaces, corrosive materials or excessive heat.

Welding Precautions

Welding causes high currents or electrostatic discharge in electronic components that can cause permanent damage to the ECU. We recommend that "No Welding" signs be prominently displayed on the vehicle chassis. The following steps should be used to protect from damage when welding on the vehicle chassis:

1. Remove the ground connection from the ECU to the vehicle frame.
2. Disconnect the connectors from the ECU.
3. Connect the welder ground close to the welding point and be sure ECU or other electronic components are not in the ground path.

For applications that require routine or daily welding, (i.e., for bucket tooth resurfacing, etc.) contact Sales Engineering.

Power and Ground Connections

After all other wiring is completed, and immediately before operating the system for the first time, the main power and ground connections to the battery should be made. Unterminated system power and ground wires are provided in the engine wiring harness for this purpose. These wires should be connected directly to the battery if possible. The battery can be located up to 10 feet (3 M) from the engine. Connect as follows:

Battery Power (Wire #002C, red, 10 gauge) -
Should be connected directly to the positive terminal of the battery.

Ground (Wire #050G, black, 10 gauge) -
Should be connected directly to the negative terminal of the battery.

If a battery disconnect switch is used on the negative battery terminal, Wire #050E should be connected to the 'disconnectable' side of the switch, not the battery terminal.

The ECU case must also be grounded to the chassis separately to protect against electrostatic discharge. The strap can be as small as 12 gauge (primarily for mechanical strength reasons). This is in addition to the ECU ground connection wire on the engine wiring harness.

12-volt or 24-volt operation must be specified when ordering the engine. The engine ECU has the voltage requirements described in the following table.

12 Volts DC	24 Volts DC	Description
0 to 5.3 volts	0 to 10.6 volts	System does not operate - No ECU damage
5.3 to 9.0 volts	10.6 to 18.0 volts	Cranking Voltage Range - Some features "inactive"
9.0 to 16.0 volts	18.0 to 32.0 volts	Normal Operation - All features "active"
16.0 to 26.5 volts	32.0 to 36.0 volts	Over-voltage, ECU can operate for up to 5 minutes without damage - Some features "inactive"
>26.5 volts	>36.0 volts	ECU damage

Table AG-15 - 02, ECU Voltage Requirements

TRANSIENT VOLTAGE PROTECTION

There are two different Transient Voltage Protection (TVP) modules; 12 volt and 24 volt. The 12-volt TVP module protects the engine ECU from transient voltage spikes (such as alternator load dump) greater than 24 volts. The 24-volt TVP module protects against voltage spikes greater than 36 volts. The TVP module can be wrapped in the wiring harness or mounted in the vehicle. If the TVP module is mounted in the vehicle, it should be mounted vertically with the pigtail wires exiting form the bottom of the module. The mounting location should be away from battery fumes, engine heat and vibration, such as in a control cabinet, vehicle chassis, or cab. Mounting ears of the TVP module may not withstand overtightening of mounting bolts. The TVP module does not protect against sustained over-voltage to the ECU.

The TVP Module mates with the TVP Connector in the engine wiring harness. The TVP module is not always required. Some alternators have internal TVP protection. A TVP module will be provided if needed, depending on the alternator option specified. If you provide your own alternator, a TVP module must be used.

REVERSE CURRENT PROTECTION

The ECU has limited internal reverse current protection if the ECU power supply is connected in reverse. The ECU will not be damaged with reverse voltage up to 26.5 volts on a 12-volt system and 36.0 volts on a 24-volt system. Reverse current at higher voltages will damage the ECU.

Starter Relay

The standard engine wiring harness is designed for use with a starter relay located within 2 feet (600 mm) of the starter. Under no circumstances should the starter solenoid be operated directly from the key switch without a relay.

INSTRUMENTATION AND CONTROLS WIRING

To complete a runable engine, instrumentation and operator controls must be added. There are three ways to add basic instrumentation and operator controls to the system:

1. Use the John Deere RE162429 instrument panel.
2. Use the RE508625 instrumentation and wiring kit to build your own instrument panel
3. Design your own instrumentation and controls (without the RE508625 kit).

Using the RE162429 Instrument Panel

The easiest way to provide all the control system parts that do not come on the engine is to use the John Deere RE162429 instrument panel.

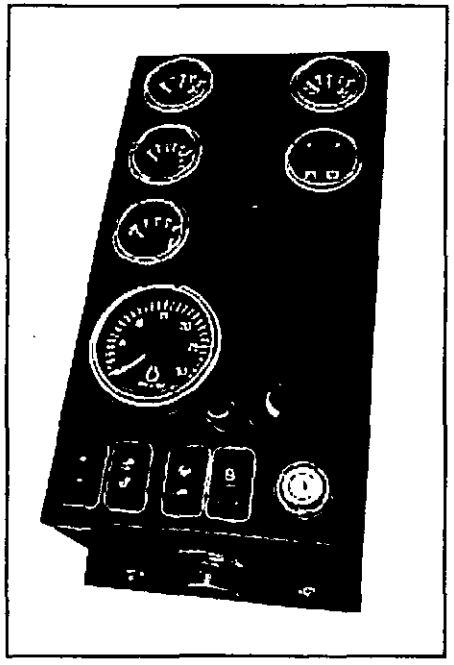


Figure AG-15 - 07, Instrument Panel, RE162429

The 21-pin Deutsch connector on the engine wiring harness plugs directly into the bottom of the RE162429 Instrument panel. To operate an engine with the RE162429 instrument panel, you need only install the engine wiring harness, connect the power and ground to the battery, plug the 21-pin Deutsch connector into the RE162429 Instrument Panel, and turn the key. The RE162429 panel operates on 12 or 24 volts.

The following features are standard on the RE162429 Instrument panel:

STANDARD INSTRUMENT PANEL FEATURES

- Ignition switch
- Panel mounted fuse
- Adjustable 2-state throttle switches
- Shutdown override button
- RE68155 Diagnostic Gauge
- Tachometer
- Oil pressure analog gauge
- Coolant temperature analog gauge.

The following optional features are available. To use the optional features, just order the parts and plug in. Connectors and panel cutouts are provided in the standard panel:

OPTIONAL INSTRUMENT PANEL FEATURES

• RE69667	Analog throttle potentiometer
• RE163436	Percent load gauge
• RE162422	12-volt voltage gauge
• RE163277	24-volt voltage gauge
• RE162427	Audible warning alarm
• RE162449	Backlight dimmer control
• RE162448	Converter for 24-volt backlighting
• RE506969	12-foot extension harness

Using the RE508625 Instrumentation and Wiring Kit

The second easiest way to provide all the control system parts that do not come on the engine is to use the John Deere RE508625 instrumentation and wiring kit.

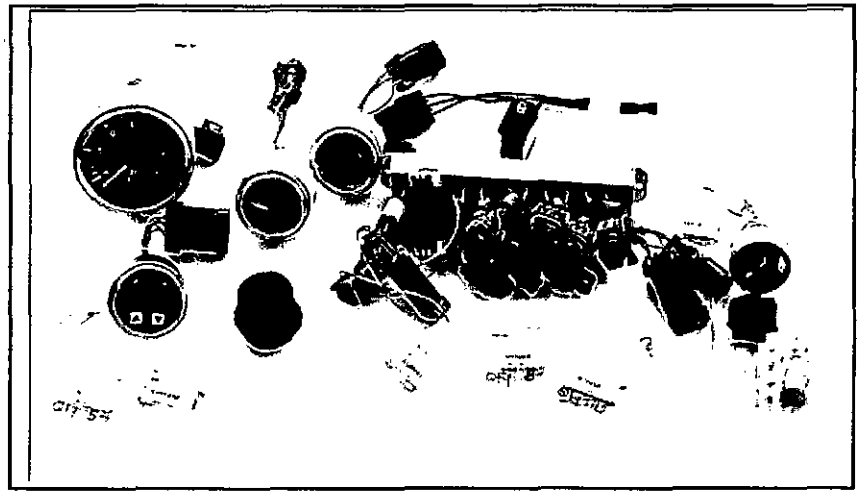


Figure AG-15 - 08, Instrumentation and Wiring Kit, RE508625

The RE508625 instrumentation and wiring kit includes all the parts that are included in the RE162429 instrument panel except for the adjustable 2-state throttle switches, which can be added by purchasing a separate RE508626 switch kit. The RE508625 kit includes ignition switch, shutdown override switch, all needed wiring connectors, and the RE162450 Databus Module which can be used to add up to three additional auxiliary gauge displays (in addition to the included tach, coolant temp, and oil pressure gauges). All you need to add is the actual wires and a throttle control.

All optional features of the RE162429 panel also apply to the RE508625 instrumentation kit.

Making Your Own Instrumentation and Controls

If you choose not to use the RE162429 instrument panel or the RE508625 instrumentation kit, you will have to provide your own ignition switch, fuse holder, throttle device, wiring harness, diagnostics, and any other instrumentation and controls you need.

All required electrical connections to the engine, including throttle, instrumentation, key switch, starter, and alternator connections, are made through a single 21-pin Deutsch connector provided on the engine wiring harness. Several special connectors are provided for optional features.

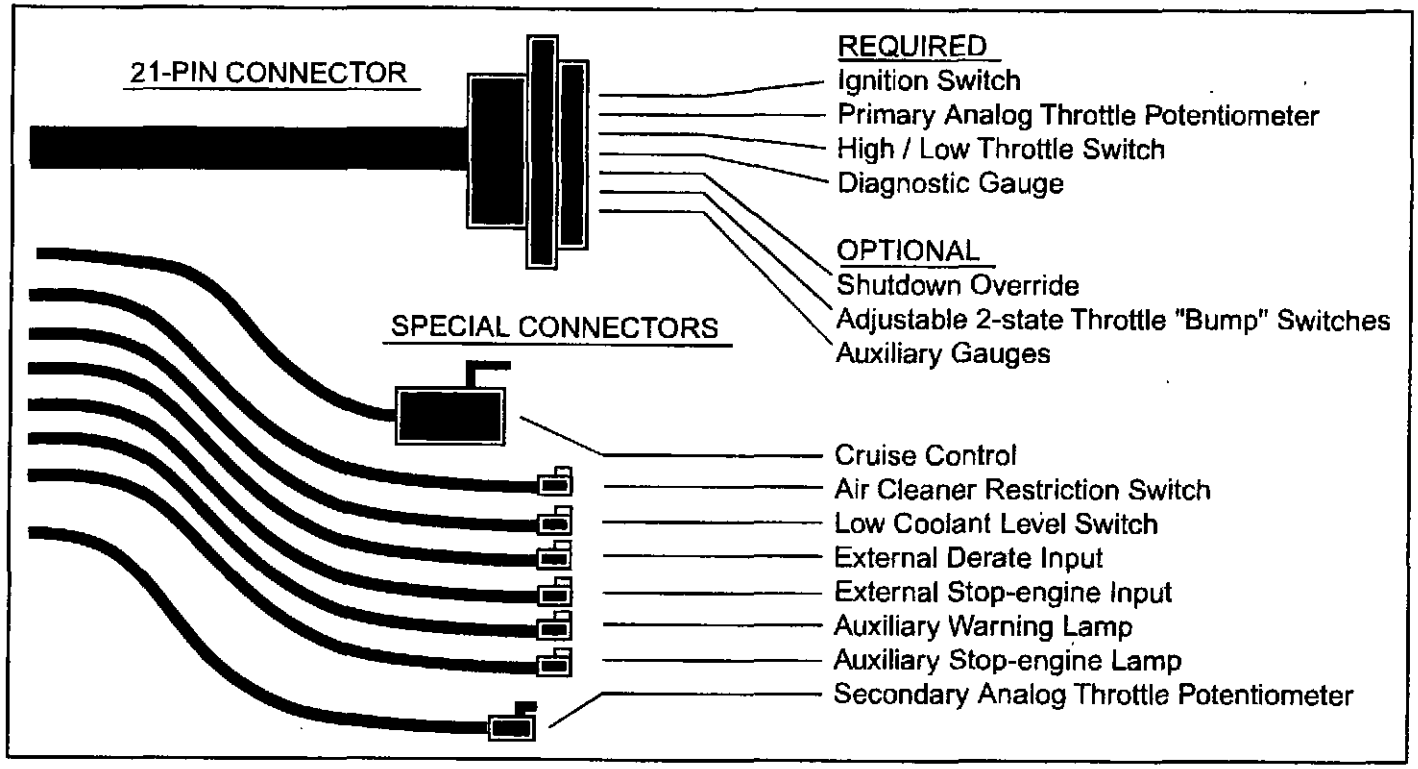


Figure AG-15 - 09, Instrumentation Connections

MINIMUM REQUIRED WIRING

All required wiring attachments can be made through the 21-pin instrumentation and controls connector. Some kind of ignition switch is always required. Diagnostics are also required. For 8.1L and 12.5L engines, you must install the RE68155 Diagnostic Gauge or equivalent CAN-based instrumentation. The RE68155 Diagnostic Gauge is not strictly required on 4.5L and 6.8L engines because they are also equipped with blink-code diagnostics. However, it is still highly recommended because it is the easiest way to meet all diagnostic and wiring requirements. If you do not use the RE68155 Diagnostic Gauge on 4.5L and 6.8L engines, you must provide a warning lamp, stop-engine lamp, hourmeter, and other desired instrumentation such as tachometer, oil pressure gauge, and coolant temperature gauge separately.

For gen-set applications that start and operate at full rated speed only (1500 or 1800 rpm), it is not necessary to connect anything except the key switch and diagnostics.

For industrial applications, the analog throttle circuit must also be completed. If you choose to operate without an analog (potentiometer) throttle, you still must install a resister bridge to terminate the circuit. The high/low speed select switch must also be connected on all industrial (non-gen-set) ECUs. If you choose not to use the high/low select feature, this circuit can be easily terminated with a single resister.

For details on wiring all required and optional circuits, refer to the following sections.

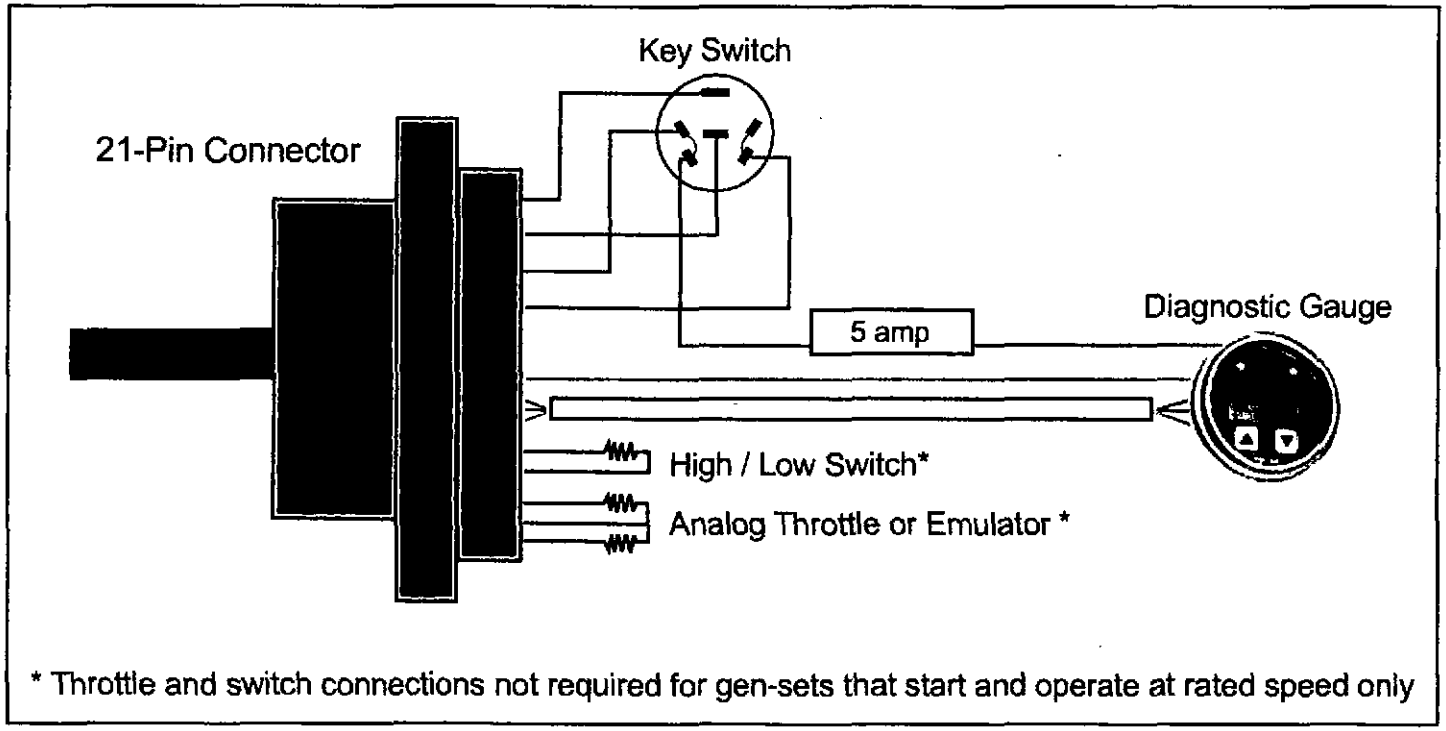


Figure AG-15 - 10, Minimum Required Wiring

BASIC INSTRUMENTATION AND CONTROLS HARNESS

For all required connections, and for the more common optional connections that are made through the 21-pin connector, refer to the following wiring diagram. This diagram provided a complete wiring harness to interface the 21-pin connector with your instrument panel. The connectors shown fit the recommended John Deere gauges, switches, etc. listed. If you choose to use other components, different connectors may be required.

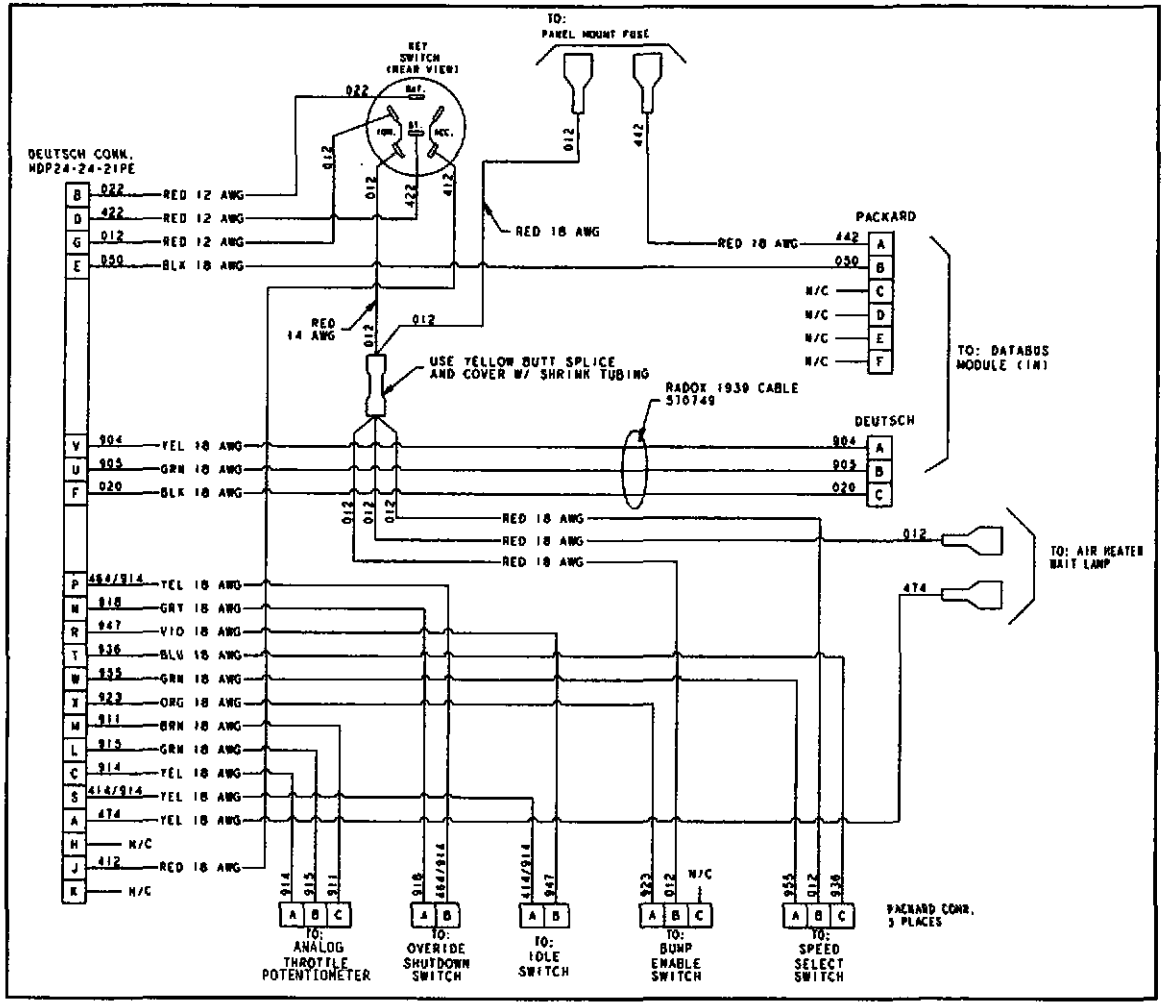


Figure AG-15 - 11, Instrumentation and Controls Connections

Refer to the following sections for details on each connector.

21-Pin Deutsch Instrument Panel Connector

The 21-pin Deutsch connector makes the main connection between the engine and your instrumentation and controls. The RE508625 instrumentation and wiring kit includes this connector. If you provide your own harness, you will have to provide this connector with pin assignments per the following chart. Use (1) 57M7748 Connector (Deutsch HDP24-24-21PE), (5) R78068 12-ga to 14-ga pins (Deutsch 0460-204-12141), (16) R78066 16-ga to 18-ga pins (Deutsch 0460-202-16141), and (3) R78069 plugs (Deutsch 114017).

Instrument Panel Connector Pin Assignments

Pin	Wire	Description	Used On
A	NA	NA	This pin is not currently used.
B	022C	Battery power	To "B" terminal of your ignition switch
C	914B	Sensor return	To the primary analog throttle potentiometer or emulator
D	422	Starter relay	To "Start" terminal on your ignition switch
E	050D	Ground	Grounded on engine side to the battery and ECU. Use for any non-sensor ground (lights, gauge power, etc)
F	020F	CAN shield	To any CAN connectors including the diagnostic gauge
G	012B	Battery power to ECU (switched)	Must be wired to the "Ignition" terminal of key switch
H	N/A	N/A	This pin is not currently used
J	412	Alternator ignition	Must be wired to the "Accessory" terminal of a two-pole ignition switch.
K	N/A	N/A	This pin is not currently used
L	915	Primary analog throttle input voltage	To center (sensing) terminal of the primary analog throttle potentiometer (or throttle emulator)
M	911B	+5 Volts (sensor power)	To the throttle potentiometer
N	918	Shutdown override return	To shutdown override switch
P	464B	Shutdown override	To shutdown override switch
R	947	High/Low speed select	To the High/Low speed select switch
S	414B	High/Low speed return	To the High/Low speed select switch
T	936C	Resume / Coast / Bump Speed Down	To the 2-state throttle speed select switch and/or the cruise control resume/coast switch
U	905E	CAN low	To the 9- and 3-pin CAN connectors, Diagnostic gauge and/or Instrument panel databus module
V	904E	CAN high	To the 9- and 3-pin CAN connectors, Diagnostic gauge and/or Instrument panel databus module
W	955C	Set / Accelerate / Bump Speed Up	To the 2-state throttle speed select switch and/or the cruise control set/accelerate switch
X	923	Bump enable and brake enable	To the cruise brake enable switch and/or 2-state throttle bump enable switch

Ignition Switch

The ignition switch must be connected on all applications. All connections are made through the 21-pin connector. Pin J on the 21-pin connector is the alternator ignition circuit. The alternator ignition must be isolated from switched power to the ECU (pin G) by using a 2-pole ignition switch or the engine may not shut down when the key is turned off.

If necessary to support heavy accessory loads through the key switch (flood lights, electric motors, etc.), battery power to the "BAT" terminal of the key switch can be taken from a separate heavy-duty source instead of Pin B in the 21-pin connector. Pin B is provided for your convenience to simplify wiring on simple power unit installations. However, the fuse and wire gauges are sized for engine fuel system power requirements only. It should not be used if additional loads of more than a few amps will be carried through the key switch. The starter relay and alternator ignition connections can also be made through separate circuits instead of Pins J and D. Only switched power to the ECU must be connected through the 21-pin connector.

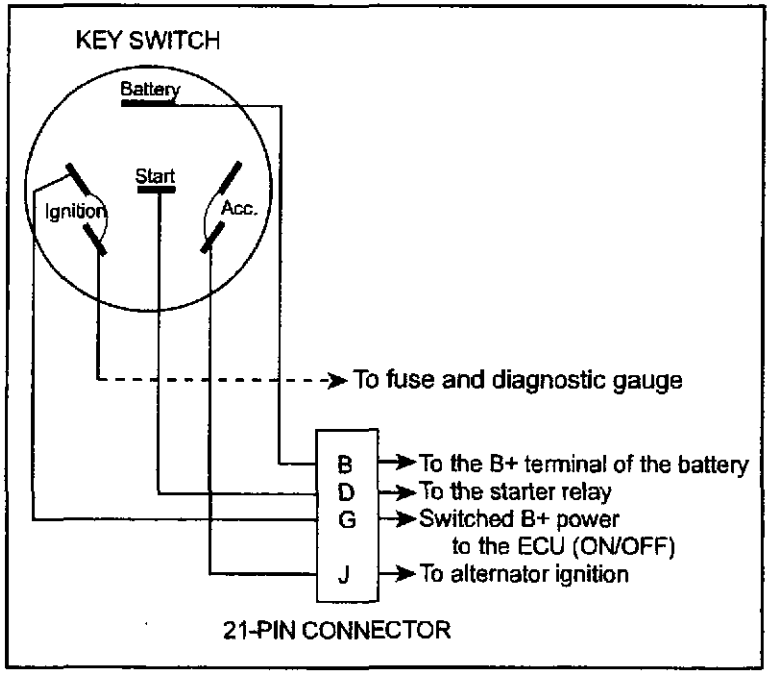


Figure AG-15 - 12, Ignition Switch Connections

Analog Throttle Potentiometer

You must complete this circuit for all industrial applications, even if you don't use the analog throttle feature. If you don't use an analog potentiometer, you must install a throttle emulator (Resister Bridge) that sets the throttle in the low idle range.

If this circuit is not connected on industrial applications, a fault code will be generated. The warning lamp will light and the system will revert to the secondary analog throttle and/or adjustable 2-state throttle inputs. If no throttle input is present on industrial applications, the system will revert to low idle. No connection is required on gen-set applications that are intended to run at rated speed only with no adjustability.

The connector shown below will fit the RE69667 analog throttle or the RE503681 throttle emulator. The harness connection is a Packard Weather Pack 3-cavity, female connector, #12020829, with male terminals, #12124582, and cable seals installed. Note that these are the opposite terminals usually used with this connector.

Pin	Circuit	Color	Size	Destination
C	911	Brown	18 AWG	to Pin M on 21-Pin Connector
B	915	Orange	18 AWG	to Pin L on 21-Pin Connector
A	914	Yellow	18 AWG	to Pin C on 21-Pin Connector

Figure AG-15 - 13, Analog Throttle Potentiometer

If you do not use an analog potentiometer, you must install a resister bridge that sets the throttle in the low idle range. You can either use the RE503681 throttle emulator with the connector shown above, or you can wire your own equivalent resister bridge into the appropriate pins on the 21-pin connector as shown below. The exact size of the resisters is not important, as long as total resistance is 2,000-15,000 Ohms, and the small resister is 6% to 20% of the large resister size.

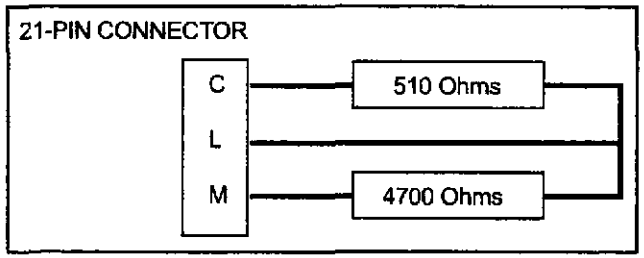


Figure AG-15 - 14, RE503681 Throttle Emulator (or Equivalent)

The RE69667 analog throttle is a multi-turn 5000-Ohm potentiometer throttle designed for stationary applications. Many other throttle styles, including various foot pedal throttles are available from Morse, Williams Controls, and other suppliers. Any potentiometer-style analog throttle will work, as long as total resistance is in the 2,000-15,000 Ohm range.

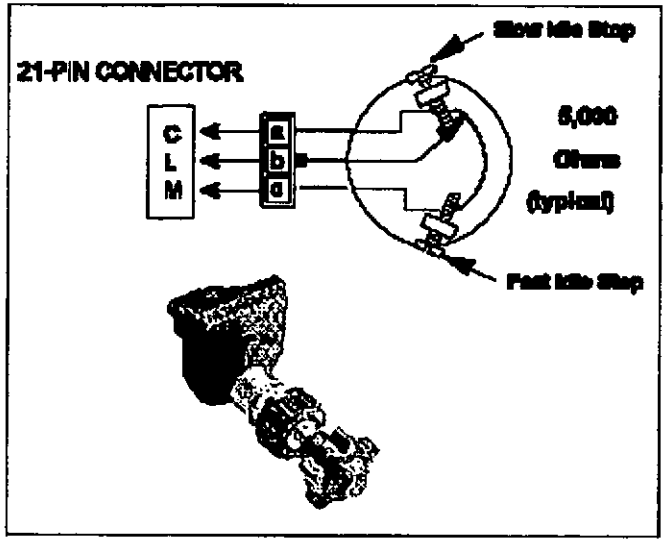


Figure AG-15 - 15, RE69667 Analog Throttle

GEN-SET LOAD SHARING MODULES

A commercial gen-set load sharing module that can provide a throttle input signal in the 1 to 4 volt range can be wired directly to the analog throttle input (pin L). If the load sharing module provides for a reference voltage connection, a 5-volt reference voltage should be taken from Pin M. Sensor ground (Pin C) should not be used to ground the load sharing module. Engine speed stability problems can result under some circumstances. The load sharing module should be grounded directly to the engine cylinder block, or to the negative terminal of the battery.

THROTTLE POTENTIOMETER PRE-ADJUSTMENT PROCEDURE

On industrial applications, if the voltage on 21-pin connector Pin L goes above 4.75 volts or below 0.25 volts, the ECU will generate a fault code and return the engine to slow idle. It does this so that a break or short circuit in the wire does not cause the engine to go to fast idle unexpectedly.

To prevent error codes and unexpected changes in speed, the fast and slow idle stops on the throttle potentiometer must be adjusted so that the voltage on Pin L cannot go below 0.25 volt or above 4.75 volts.

Industrial (non-gen-set) applications also have an Auto-Cal feature that automatically adjusts the analog throttle range to match your sensor. Once the stops are adjusted to limit low and fast idle voltage, the Auto-Cal feature of the ECU will check the exact range of your throttle potentiometer and adjust the ECU to that range. However, your initial installation must be within certain resistance limits for the Auto-Cal feature to work.

Before plugging it into the wiring harness, adjust the throttle potentiometer using the following procedure:

1. With the potentiometer against the slow idle stop, adjust the stop so that the resistance measured between the ground and wiper connections of the potentiometer (21-pin connector Pins C and L) is between 6% and 20% of overall potentiometer resistance.

2. With the potentiometer against the fast idle stop, adjust the stop so that the resistance measured between the power and wiper connections of the potentiometer (21-pin connector Pins M and L) is also between 6% and 20% of overall potentiometer resistance.

This does not have to be a precise adjustment. The Auto-Cal feature will make a precise adjustment automatically. Once it has been done a few times, you will probably find that adjusting each throttle stop screw a predetermined number of turns is accurate enough.

POTENTIOMETER WITHOUT MECHANICAL ADJUSTMENT STOPS

If a potentiometer without fast and slow idle stops is used, additional fixed resistors can be wired in series with 21-pin connector Pins C and M as shown below to prevent the analog throttle voltage from going outside the upper and lower limits and generating a fault code.

For the Auto-Cal system to work properly, each added resistor should be between 6%-20% of the nominal throttle potentiometer resistance. Total resistance of the potentiometer and both resistors should be in the range of 2000 to 15,000 Ohms.

You do not have to connect this circuit for gen-set applications. Gen-set ECUs default to rated speed (1800 or 1500 rpm), and do not generate a fault code if the throttle isn't connected. If the analog throttle is not connected, the engine will run at rated speed (1800 or 1500) only, with no adjustment.

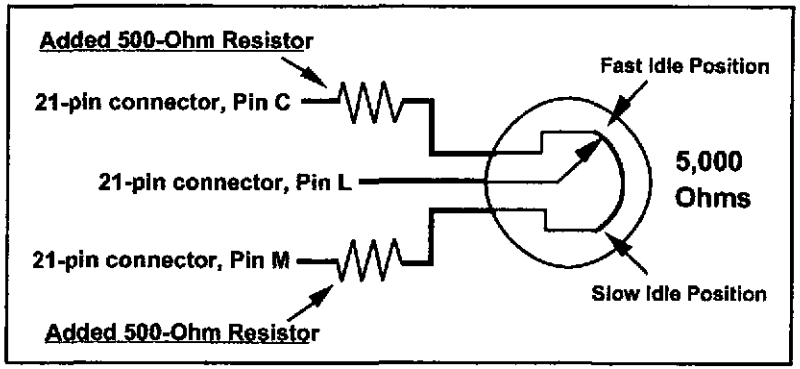


Figure AG-15 - 16,
Potentiometer Without Mechanical Adjustment Stops

Adjustable 2-State Throttle

The Adjustable 2-State Throttle wiring consists of three switches, the High/Low Select ("Idle") switch, the Speed Select ("Bump") switch, and the Bump Enable switch. Only the High/Low Select switch must be connected. The bump feature is optional

HIGH / LOW SELECT ("Idle") SWITCH

The High/Low Select switch circuit must be connected on all Industrial applications, even if you do not intend to use the feature.

The High/Low Select switch is part of the Adjustable 2-State Throttle. The high/low switch switches between preset high speed and low speed operating points (normally the factory high idle and low idle). The switch must be in the low-speed position for the analog (potentiometer) throttle to work. You must either provide a high/low switch or you must terminate the circuit through a resister.

If this circuit is not connected on industrial applications, a fault code will be generated. The warning lamp will light and the system will revert to the analog throttle inputs. If no throttle signal is present on industrial applications, the system will revert to low idle. No connection is required on gen-set applications that are intended to run at rated speed only with no adjustability.

The John Deere RE162425 switch is a single-pole, double-throw switch, designed to be used for the High/Low Select switch. It can be purchased separately, or as part of the RE508626 Switch kit

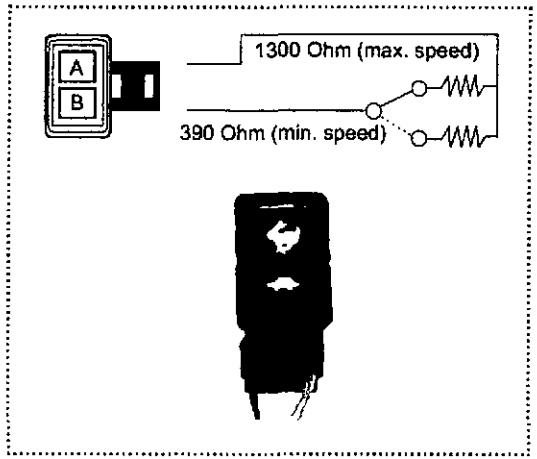
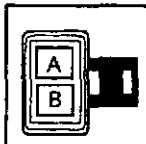


Figure AG-15 - 17, RE162425 High / Low Select Switch

The mating connector to this switch is a Packard Metri-Pack 150 Series two-cavity female connector, #12052641, with #12048074 sealed female terminals, cable seals and a #12052634 TPA or secondary lock.



Pin	Circuit	Color	Size	Destination
A	914	Yellow	18 AWG	to Pin "S" on 21-Pin Connector
B	947	Violet	18 AWG	to Pin "R" on 21-Pin Connector

Figure AG-15 - 18, High / Low Select Pin Connectors

The switch contains two resistors, 390-Ohm and 1.3K-Ohm. When in the slow idle position, the 390-Ohm resistor is placed in the circuit and when in the high-idle position, the 1.3k-Ohm resistor is placed in the circuit.

If you do not use the RE162425 High/Low Selector switch, you must provide your own switch, or terminate the circuit with a resister as shown below.

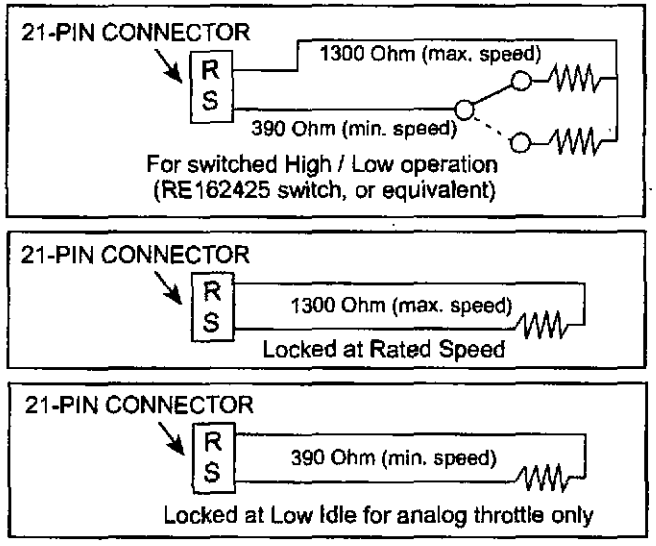


Figure AG-15 - 19, High / Low Select Connect Without RE162425

This connector must not be left open on ECUs equipped with the adjustable 2-state throttle. If the 2-state toggle-switch throttle is not used, one of the two following things must be done:

1. For continuous operation at the factory preset rated speed, with no ability to operate at low idle or any other reduced speed, a 1300-Ohm resistor can be permanently wired between Pins R and S.

2. For use with an analog throttle potentiometer without a 2-state toggle-switch throttle, a 390-Ohm resistor should be permanently wired between Pins R and S.

SPEED SELECT ("Bump") SWITCH

The speed select switch, also known as the "Bump" switch, is used to increase and decrease the minimum and maximum operating speeds. It must be used with the bump enable switch (see below). The bump switch works like the "Accel" and "Coast" buttons on a cruise control. A momentary tap on the switch bumps the speed up or down about 10 rpm. If the switch is held down, speed will continue to ramp up or down continuously until the switch is released, then it will lock in at whatever rpm it has reached at that point. You are not required to connect this circuit unless you intend to use this feature. If you do use this feature, you can use the John Deere RE162423 bump switch shown below, or any single-pole, double-throw, momentary switch with a detented center off position.

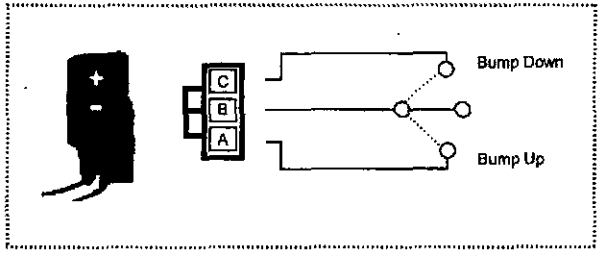
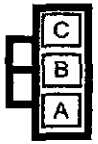


Figure AG-15 - 20, RE162423 Speed Select (Bump) Switch

The mating connector for the RE162423 switch is shown below. It is a Packard Metri-Pack 150 Series three-cavity male connector, #12129615, with #12045773 sealed male terminals, #12048086 cable seals, and #12052845 TPA or secondary locks.



Pin	Circuit	Color	Size	Destination
C	936	Blue	18 AWG	to Pin "T" on 21-Pin Connector
B	012	Red	18 AWG	to IGN circuit from key switch
A	955	Green	18 AWG	to Pin "W" on 21-Pin Connector

Figure AG-15 - 21, RE162423 Mating Connector

If you choose not to use the RE162423 switch, you can use any single-pole, double-throw, momentary switch with a detented center "off" position, wired as shown below

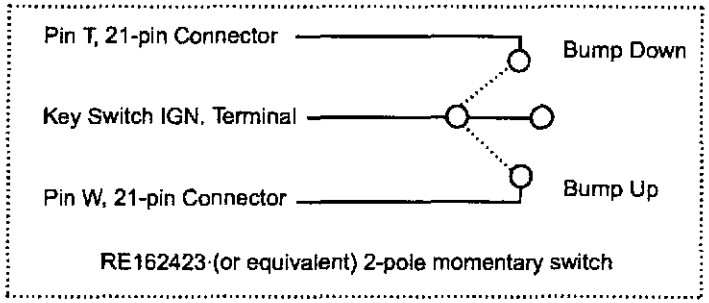


Figure AG-15 - 22, RE162423 Wiring Diagram

To permanently set high and low speeds, press the bump enable button (3) three times after adjustment. Both preset speeds (high and low) will be remembered, even if the ignition is turned off or the battery is disconnected.

If the adjustable 2-state toggle-switch throttle is not used, nothing is required to be plugged in to this connector

BUMP ENABLE SWITCH

The bump enable switch is used in conjunction with the speed select switch to adjust minimum and maximum operating speed. The bump enable switch enables the speed select switch to be read by the ECU. To adjust the minimum or maximum operating speed, the bump enable switch and speed select switch must be operated simultaneously. This prevents unexpected operating speed changes in the event of a failure of the speed select circuit.

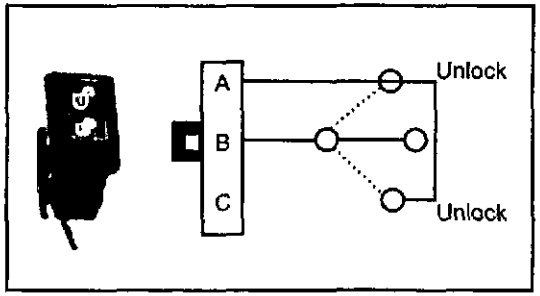


Figure AG-15 - 23, RE162424 Bump Enable Switch

As a convenience for the operator, we offer the RE162424 bump enable switch with two enabling positions, up or down, with the center "off." That way, when placed next to the RE162423 bump switch, both switches can be pressed simultaneously by laying your finger across them. The switch is a single-pole, double-throw, momentary with a detented center "off" position. Both active positions are wired to connect the same two-wire circuit when pressed.

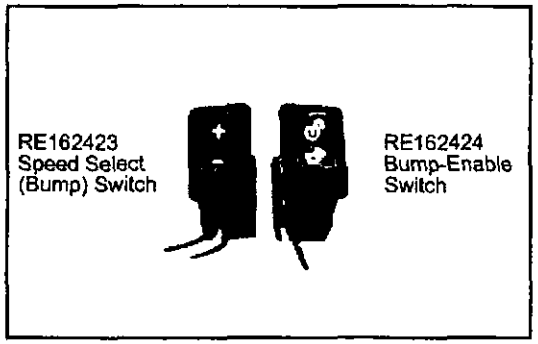
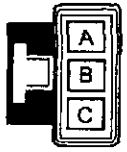


Figure AG-15 - 24, Throttle Switches

The mating connector on the RE162424 bump enable switch is shown below. It is a Packard Metri-Pack 150 Series three-cavity female connector, #12110293, with #12048074 sealed female terminals, #12048086 cable seals, and #12052845 TPA or secondary locks. The unused cavity has a #12059168 cavity plug installed.



Pin	Circuit	Color	Size	Destination
A	923	Orange	18 AWG	to Pin X on 21-Pin Connector
B	012	Red	18 AWG	to IGN circuit from key switch
C		Cavity Plug		Unused

Figure AG-15 - 25, RE162424 Mating Connector

If the RE162424 switch is not used, any similar single-pole, double-throw, momentary switch with a detented center off position switch, or a simple single-pole momentary switch can be wired as shown below to provide the bump-enable function.

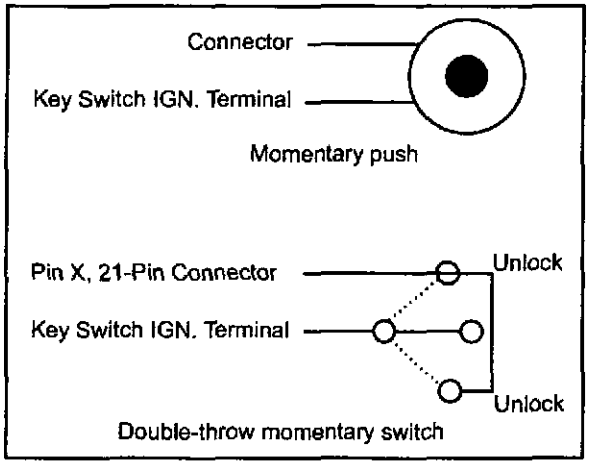


Figure AG-15 - 26, RE162424 Wiring Diagram

If the speed bump feature is not used, this circuit does not need to be connected.

RE68155 Diagnostic Gauge

We require the RE68155 or equivalent SAE J1949 CAN based on-board diagnostic system for all 12.5L applications. The RE68155 Diagnostic Gauge is a complete on-board engine diagnostic and display system. It includes built-in "Warning" and "Stop Engine" lights to alert the operator of any problems, and it digitally displays diagnostic codes, rpm, hours, oil pressure, coolant temperature, voltage, engine load, fuel consumption, manifold temperature and other engine parameters.

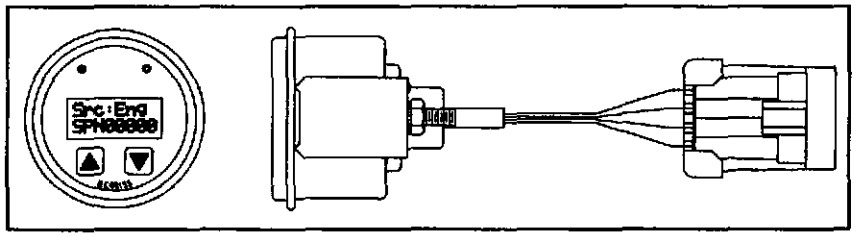


Figure AG-15 - 27, RE68155 Diagnostic Gauge

There are three ways to connect the RE68155 Diagnostic Gauge to your system:

1. Wire the RE68155 Diagnostic Gauge directly to the 21-pin instrumentation and controls connector.
2. Use the RE507276 adapter harness to connect the Diagnostic Gauge to the 9-pin diagnostic connector.
3. Use the RE162450 Databus Module to connect the RE68155 Diagnostic Gauge and up to six auxiliary gauges plus backlighting to the 21-pin instrumentation and controls connector.

WIRING THE DIAGNOSTIC GAUGE DIRECTLY TO THE 21-PIN CONNECTOR

Refer to the following illustration to connect the RE68155 Diagnostic Gauge to the 21-pin instrumentation and control connector.

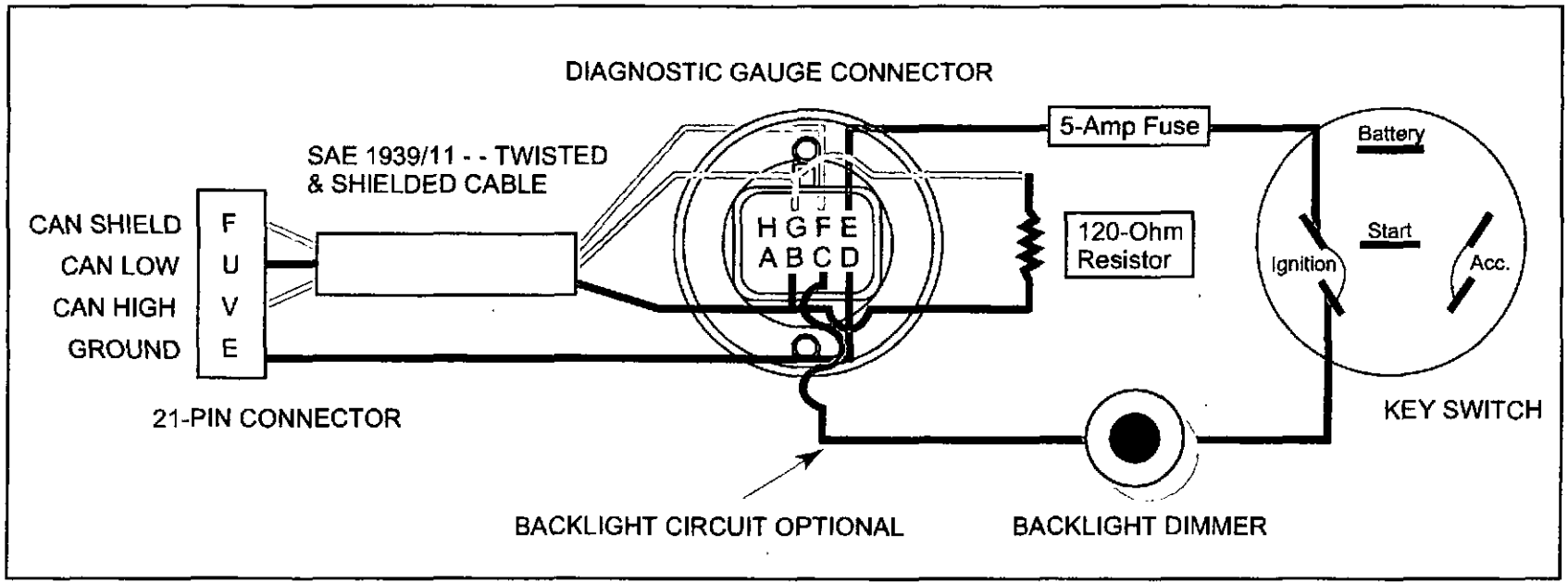


Figure AG-15 - 28, RE68155 Diagnostic Gauge

Pin "E" is the battery connection, and has an allowable voltage range of 9 to 32 volts with respect to Pin D, or ground, for proper operation.

The mating connector for the diagnostic gauge is a Packard Metri-Pack, 150 Series, 8-way female connector.

Part	Part Number
Female connector assembly	12047937
TPA	12066304
Sealed terminals, 16-18 AWG(1.0-.8 sq mm)	12048074
Sealed terminals, 20-22 AWG(.5-.35 sq mm)	12084200
Cable seals, 2.85-2.03 mm dia	12048086
Cable seals, 2.15-1.60 mm dia	12089678
Cable seals, 1.70-1.29 mm dia	12048087

The terminal and cable seals should be selected for the size of wire used. All of the terminal positions on the diagnostic gauge connector are used. If the mating connector does not use a position for a particular application, it should be filled with a cavity plug, part number 12059168, to ensure sealing of the entire connector assembly.

All the connecting wires you need are in the 21-pin instrument panel connector. If you aren't going to use backlighting or auxiliary gauges, you only have to hook up CAN H, CAN L, CAN Shield, power, and ground to the gauge. Power must come from the ignition terminal of the key switch through a 5-amp fuse.

SAE 1939/11-type shielded cable should be used to connect the CAN H, CAN L and CAN Shield wires from the 21-pin connector to the gauge. SAE 1939/11-type shielded cable is available from many commercial sources including Champlain Cable. To make your own cable, the CAN H and CAN L wires need to be twisted together along their entire length, and shielded with a metal cover. The CAN Shield wire should be a bare copper wire running inside (and contacting) the metal shield alongside the twisted CAN H and CAN L wires. It is a good idea to switch to an insulated wire where the wire exits the shield so it does not ground out against anything.

The CAN H and CAN L wires must be connected through a 120-Ohm resister on the end of your harness where they connect to the diagnostic gauge. If you use more than one CAN-based device, only one 120-Ohm resister should be connected. It must be connected at the end of the CAN buss, where the furthest device from 21-pin connector is connected.

If you want backlighting, just follow the schematic and find the corresponding pins you need in the 21-pin connector. If dimming is desired, normally a dimmer (RE162449) is used. This reduces the voltage to the backlighting from full voltage (about 14 volts for a 12-volt system) for full brightness to about 2 volts for the lowest brightness. If a 24-volt system is used, the voltage regulator (RE162448) should be used to provide 12 volts for the backlighting.

The backlight system is an LED. LEDs require about 2 volts to turn on. The voltage range for the backlighting is about 2 volts to 16 volts.

A 5-Amp fuse with the following characteristics (per SAE J1284) must be used:

Rating	Blow Time
110%	100 hours, minimum
135%	1500 seconds, maximum
200%	5 seconds, maximum
350%	0.08 seconds, minimum

USING THE RE507276 DIAGNOSTIC GAUGE ADAPTER HARNESS

An easier way to connect the RE68155 Diagnostic Gauge is to use the RE507276 adapter harness, available through service parts. The RE507276 adapter harness connects with the 9-pin Deutsch diagnostic connector, which is present on every engine wiring harness. It includes connectors for the RE162449 backlight dimmer and the RE162448 24-volt-to-12-volt converter, which is required to operate the 12-volt backlight system with a 24-volt engine electric system. It can also be used with the available RE508492 and RE508493 jumper wires for fixed (constant and non-dimmable) backlighting on 12-volt systems. The RE507276 adapter harness is approximately 12-feet long from the diagnostic port connector to the gauge connector. It includes a standard 3-pin Deutsch CAN connector with 120-Ohm terminator that can be used to transmit the SAE J1939 CAN signal to other devices.

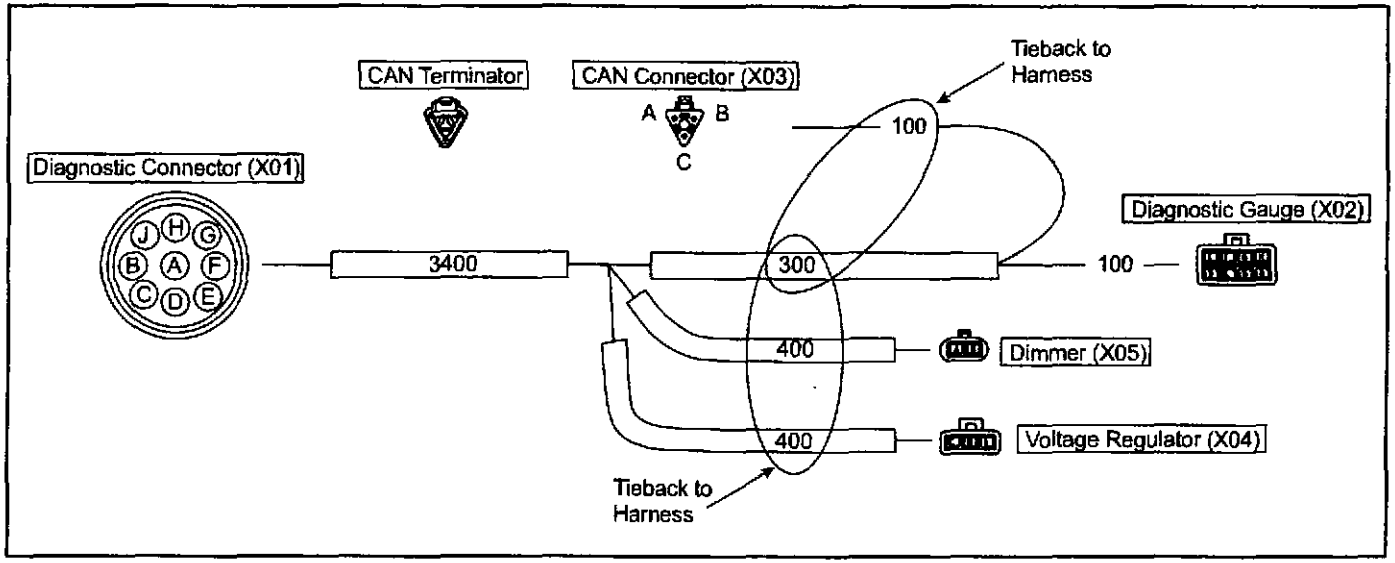


Figure AG-15 - 29, RE507276 Adapter Harness

The RE507276 adapter harness does not connect to any wires in the 21-pin instrumentation and control connector or any unterminated wires. It connects to the 9-pin diagnostic connector that is normally used only for service. It leaves 21-pin connector and unterminated wires free. It does not include wiring for any auxiliary gauges.

Direct Auxillary Gauge Wiring

The RE68155 Diagnostic Gauge can drive the following optional auxiliary gauges:

RE163436	Percent load gauge
RE162422	12- volt voltage gauge
RE163277	24- volt voltage gauge
RE162419	Tachometer
RE162418	Gauge, Oil Pressure
RE162416	Gauge, Coolant Temp
RE162427	Audible warning alarm

These are simple display gauges that operate from a second proprietary buss from the diagnostic gauge.

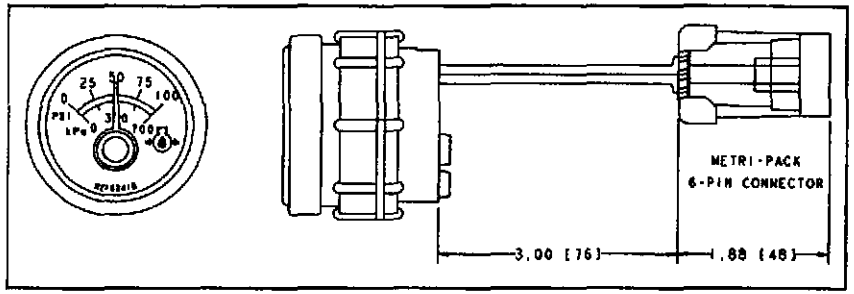


Figure AG-15 - 30, Typical Auxiliary Gauge

The RE162427 audible alarm module is applied in the same way as the analog gauges. The audible alarm module is also prewired for a single-pole, double-throw (normally open / normally closed) relay output. The relay output can drive 0.5 Amps at 125 VAC max, 1 Amp at 24 VDC max, or 62.5 VA, 30 Watts max. To connect to the relay, the RE162427 audible alarm module has a second Metri-Pack connector as shown below. The connector mates with a Metri-Pack 150-series, 3-way connector, part number 12110293.

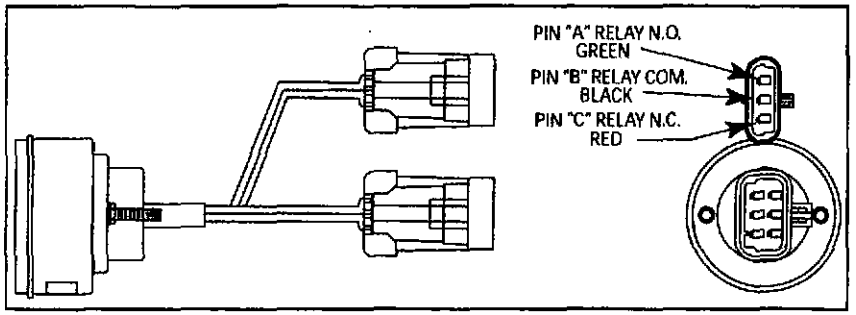


Figure AG-13 - 31, Audible Alarm Module, RE162427

There are two ways to connect the auxiliary gauges, a direct wiring connection, and the RE162450 databus module.

Refer to the following diagram to directly wire auxiliary gauges.

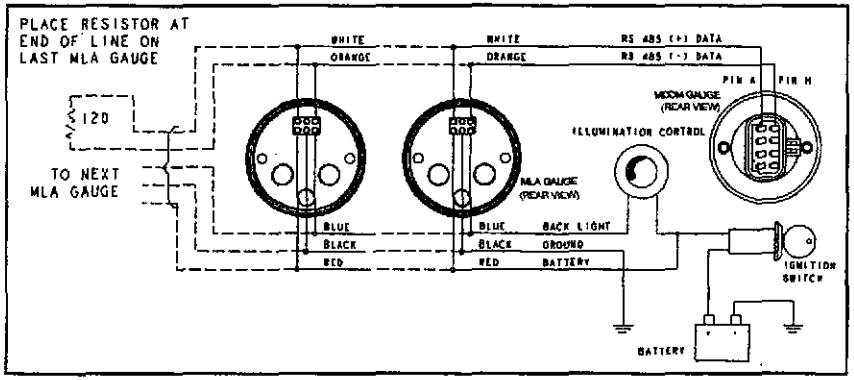


Figure AG-15 - 32, Auxiliary Gauge Wiring Diagram

As many auxiliary gauges as desired can be connected in parallel as shown. The proprietary buss must also be terminated with a 120-Ohm resister, as shown.

Note that the auxiliary gauge signal wires, Pins A and H are not connected on the RE507276 diagnostic gauge adapter harness, although they can be connected to the harness by adding the appropriate terminals and cable seals listed in the chart in the previous section to the Metri-Pack 8-way connector.

Using the RE162450 Databus Module

By far the easiest way to wire the diagnostic gauge and multiple auxiliary gauges is to use the RE162450 Databus Module. It includes shielded wiring and connectors for the diagnostic gauge and up to 6 auxiliary gauges. It also includes plugs for all backlighting accessories and 120-Ohm terminators for the SAE J1939 CAN buss and the proprietary auxiliary gauge buss. It is included with RE162429 panel and RE508625 kit or available separately from parts.

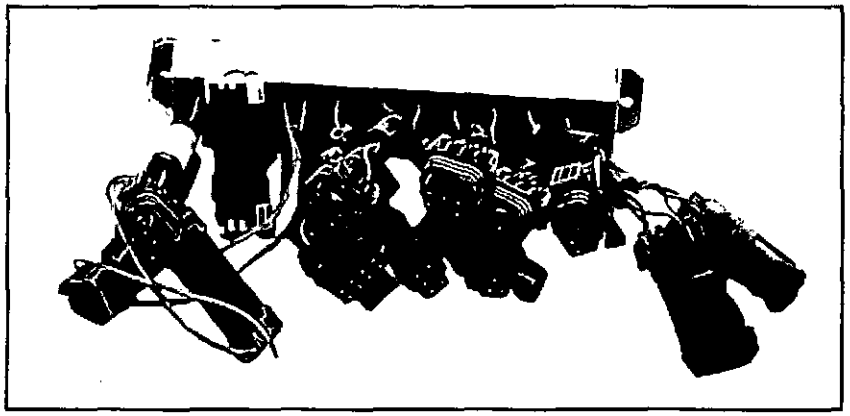


Figure AG-15 - 33, RE162450 Databus Module

The diagnostic gauge, all backlighting accessories, and all six auxiliary gauges plug right into the databus module. Only the CAN link and power and ground connectors have to be provided by the user.

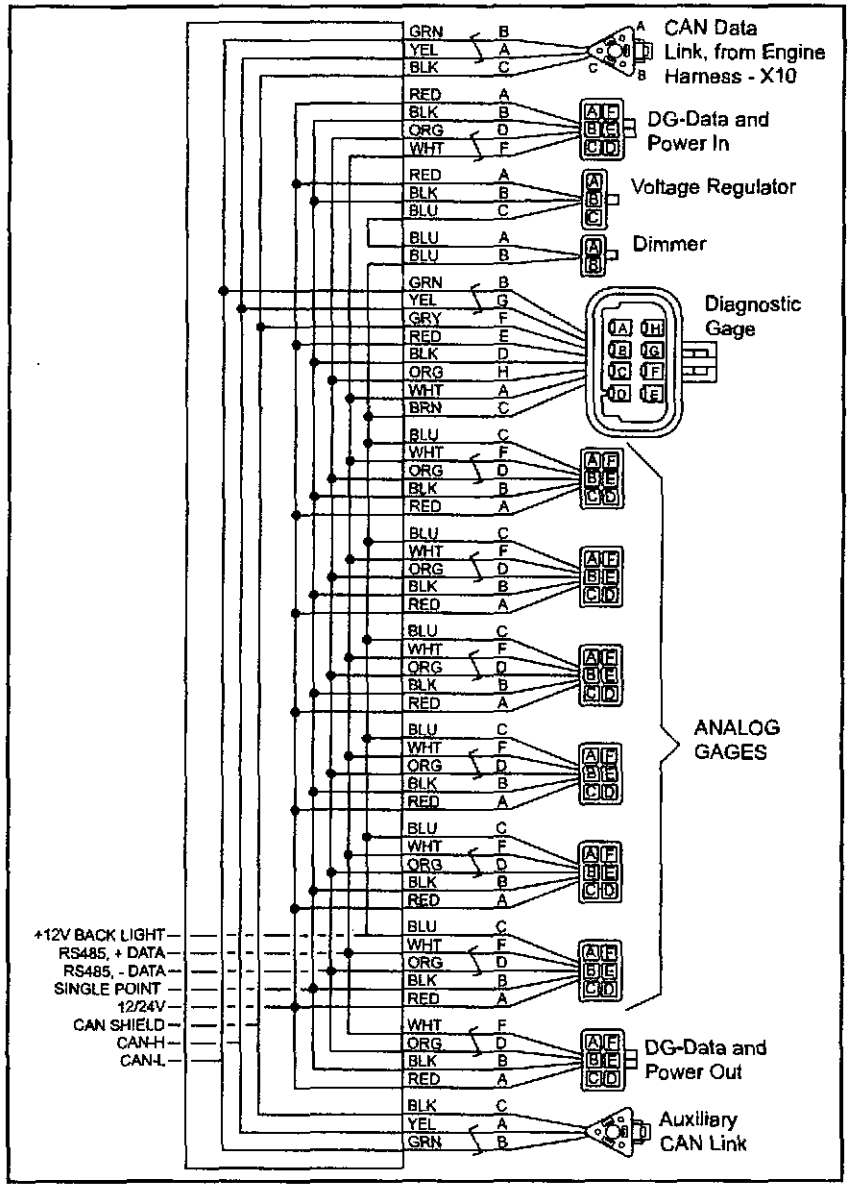


Figure AG-15 - 33a, RE162450 Databus Module Wiring Schematic

For installation of gauges and backlighting accessories, refer to the following diagram.

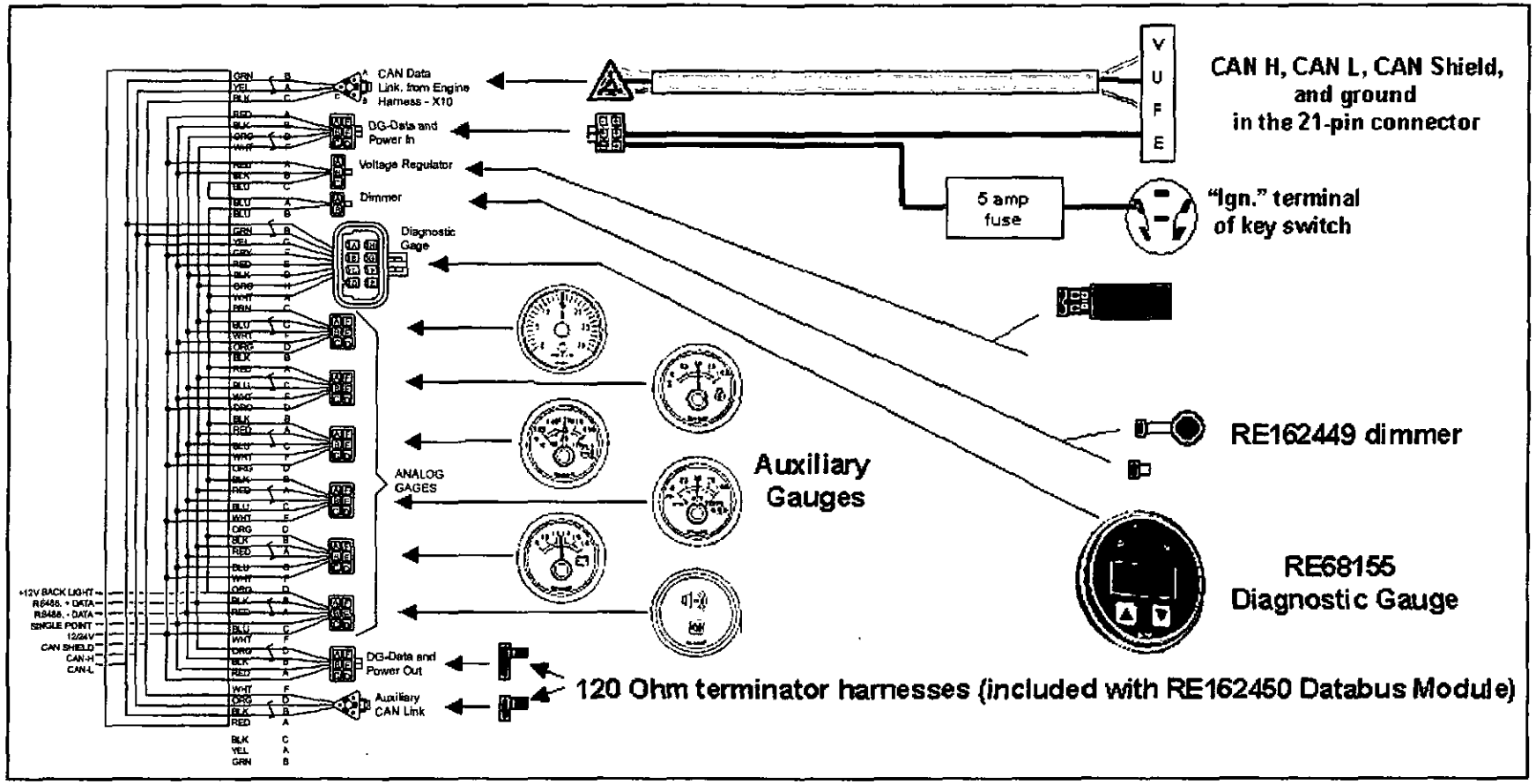


Figure AG-15 - 34, RE162450 Databus Module; Gauges and Backlighting Accessories

Refer to the following three sections for CAN Connector, Power Connector, and backlighting wiring details.

CAN CONNECTION TO RE162450 DATABUS MODULE

The CAN connection to the databus module is made through SAE J1939 compatible shielded, twisted-pair cable. The mating connector for the databus CAN connection is a Deutsch DT06-3S-E003 connector with W3S-1939 secondary locking wedge, as shown below. It plugs in to the databus as shown. The shield is attached to black wires at each end for proper termination in the connectors.

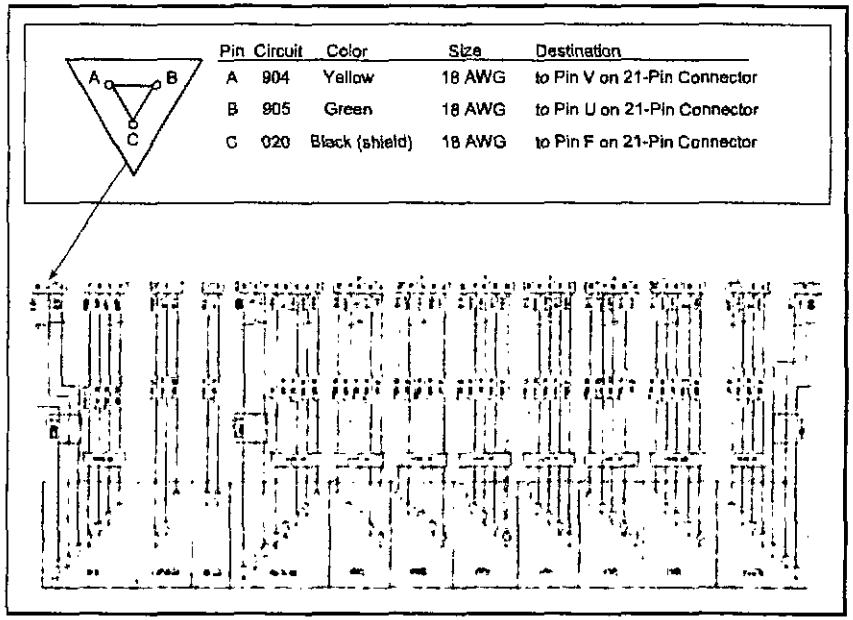


Figure AG-15 - 35, CAN Connection to the Databus Module

SAE 1939/11 shielded cable is available from various suppliers, including Champlain Cable.

POWER CONNECTION TO THE DATABUS MODULE

Power is provided to the databus module through a Packard Metri-Pack 150 Series 6-cavity male connector, #12124107, with #12045773 sealed male terminals, #12048086 cable seals, and #12052845 TPA or secondary locks on the instrument panel harness. The unused cavities are plugged with #12059168 cavity plugs. The mating connector is shown below. It plugs in to the databus as shown.

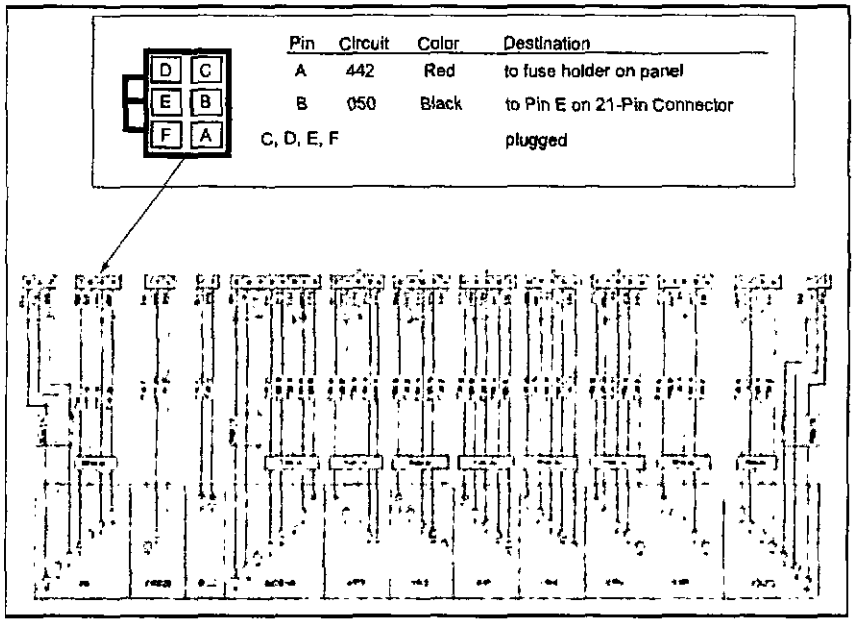


Figure AG-15 - 36, Power Connection to the Databus Module

BACKLIGHTING CONNECTIONS TO THE DATABUS MODULE

For 12-volt operation, the RE508493 12-volt backlight jumper should be installed. This provides 12-volt power directly to the backlight circuit. For 24-volt operation, an RE162448 24-volt-to-12-volt converter must be plugged into the 3-pin connector, to reduce 24-volt battery power to 12 volts.

Do not leave the RE508493 12-volt backlight jumper in place for 24-volt operation. This would provide 24 volts to the 12-volt instrumentation backlights, and result in failures of the Diagnostic Gauge, tachometer, and all other auxiliary gauges. Always order and install the RE162448 24-volt-to-12-volt converter for 24-volt backlighting. The gauges will operate on either 12 or 24 volts. RE162448 is only required if backlighting is used.

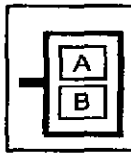
Wiring of the dimmer connector is the same for 12-volt or 24-volt operation. For "no backlighting," do not connect anything to this connector. For backlighting to be fully "on" all the time, install the RE508492 jumper wire. To turn backlighting on and off, a simple on/off toggle switch can be added to the wire between on the RE508492 jumper.

Shutdown Override Switch

The shutdown override switch is a single-pole, single-throw, normally-open, momentary switch used to temporarily override an engine shutdown.

On Engine ECU's with the Engine Protection Shutdown feature active, the engine protection shutdowns can be overridden for 30 seconds at a time. The Shutdown Override is activated when Pin P on the 21-pin connector is connected to Pin N on the 21-pin connector.

A special RE163465 push-button assembly is available from John Deere for this purpose that plugs directly into the shutdown override connector. The harness connection for the RE163465 shutdown override button assembly is a Packard Metri-Pack 150 Series two cavity male connector, #12162000 with #12045773 sealed male terminals, cable seals and a #12052634 TPA or secondary lock.



Pin	Size	Destination
A	18 AWG	to Pin "N" on 21-Pin Connector
B	18 AWG	to Pin "P" on 21-Pin Connector

Figure AG-15 - 37, Shurdown Override Switch

If you choose not to use the RE163465 push button assembly, any normally open momentary switch wired as shown below can be used.

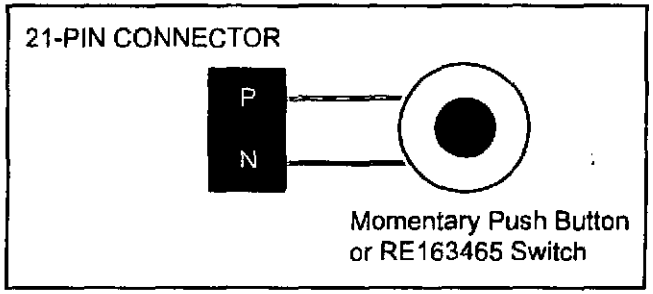


Figure AG-15 - 38, Shutdown Override Switch (RE163465)

If the circuit is open (button not pushed), the engine will shutdown 30 seconds after an automatic shutdown sequence starts. Each time the circuit is completed (button pushed), the shutdown timer is reset to a full 30 seconds and the engine runs in a derated power mode. Repeated connection of the Shutdown Override circuit each 30 seconds allows for continued engine operation.

Note: Holding the Shutdown Override continuously "ON" does not reset the 30-second timer.

Manually shutting down the engine and turning power "off" to the ECU resets the ECU. Using the Shutdown Override is not required on engine starts or restarts if the ECU power has been turned "off."

On Engine ECU's that do not have the shutdown feature active, the Shutdown Override is disabled.

Additional Features

Cruise Control

The Cruise Control feature is intended for use on mobile applications. Refer to the following diagram when wiring the Cruise Control feature.

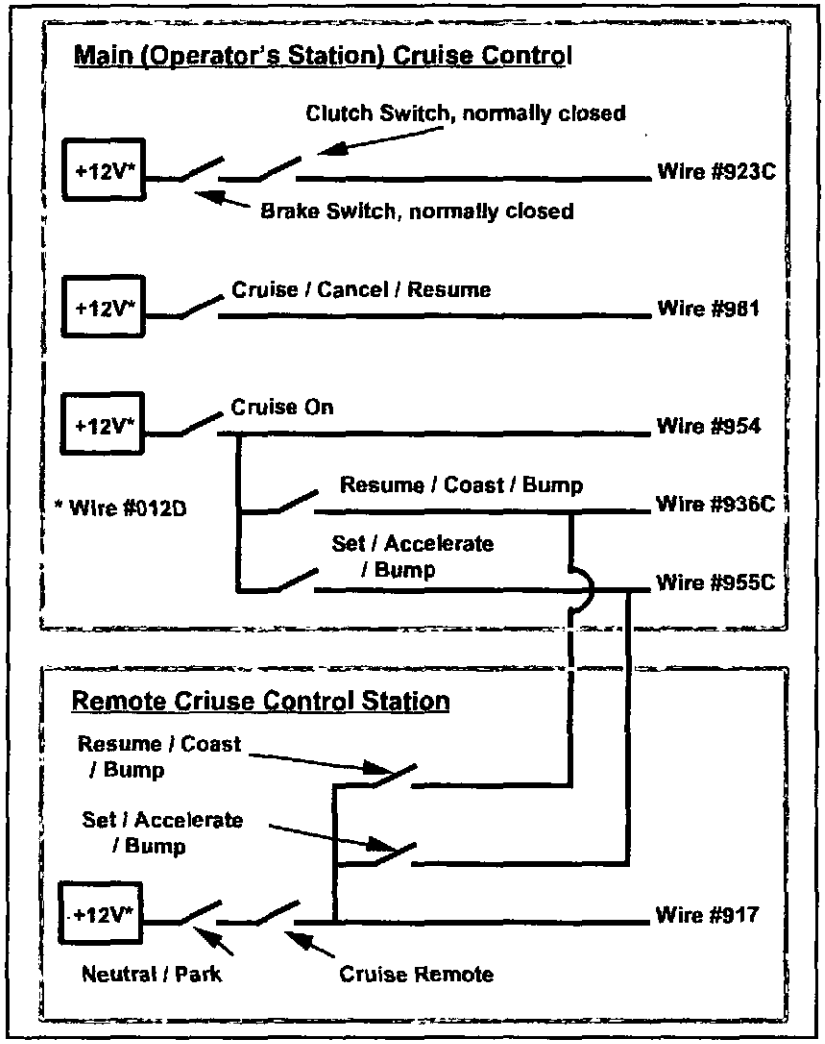
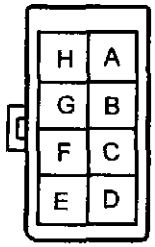


Figure AG-15 - 39, Cruise Control Wiring Diagram

The cruise control wires shown on the chart above are accessed through one Female 8-way Metri-Pack 150 connector on the Engine/ECU wiring harness.



Pin "A" - Wire #012, (red) Power (12 or 24 volts, keyed)
Pin "B" - Wire #954, (yellow) Cruise Control "ON"
Pin "C" - Wire #981, (brown) Cancel / Resume
Pin "D" - Wire #917, (purple) Remote Cruise Station "ON"
Pin "E" - Wire #935, (dark green) Brake / Clutch Switch
Pin "F" - Wire #955, (dark green) Set / Accelerate
Pin "G" - Wire #936, (light blue) Resume / Coast
Pin "H" - Wire #050J (black) Ground

Figure AG-15 - 40, Cruise Control Connector

For details of each wire and feature, refer to the following individual wire instructions:

CRUISE ON - WIRE #954 (yellow)

The Cruise Control at the operators station can be turned "ON" by supplying system voltage (+12 volts or +24 volts) to the Cruise On wire #954. Switched battery voltage can be accessed through Wire #012.

Two other conditions must exist for the main Cruise Control station to be active. The Cruise Brake/Clutch Enable - Wire #935 must also be connected to the positive system voltage lead; and the Cruise Remote - Wire #917 must be unpowered (i.e., turned "off"). The main cruise control station and the remote station cannot be active at the same time.

Power for Wire #936 and Wire #955 should come from Wire #954 as shown in the above illustration. See the following sections on the functions of Wire #936 and Wire #955.

CRUISE RESUME / COAST / BUMP SPEED DOWN -
WIRE #936C (light blue)

At the main cruise control station, a momentary contact switch should be connected from Wire #936 to Wire #954. When the cruise control is "ON," a momentary contact on this circuit returns the engine speed to it's previous set speed. When contact is maintained, the engine speed set point slowly decreases. The Cruise Resume / Coast / Bump Speed Down function has a ramped speed adjustment rate. The engine speed decreases faster, the longer the contact is held "ON."

At the remote cruise control station (if used), a momentary contact switch should be connected from Resume / Coast / Bump Down (Wire #936C) to Wire #917. (See Wire #917 instructions.)

CRUISE BRAKE ENABLE - WIRE #935 (orange)

The Cruise Brake Enable (Wire #935) should be connected to system voltage (+12 volts or +24 volts) through a normally closed switch on the vehicle brake system. 12 or 24 volts can be accessed through Wire #012. When the brakes are engaged, the circuit is broken and the cruise control is disconnected but will retain the engine set speed in memory. For a transmission with a clutch, normally closed clutch and brake switches in series should be used.

The Cruise Brake Enable circuit (Wire #935) disconnects both the main cruise controls in the operator's station and the remote cruise control station, if used.

CRUISE SET / ACCELERATE / BUMP SPEED UP -
WIRE #955 (dark green)

At the main cruise control station, a momentary contact switch should be connected from Wire #955 to Wire #954. When the cruise control is "ON", a momentary contact on this circuit sets the engine speed in memory. When contact is maintained, the engine speed set point slowly increases. The Cruise Set / Accelerate / Bump Speed Up function has a ramped speed adjustment rate. The engine speed increases faster, the longer the contact is held "ON."

At the remote cruise control station (if used), a momentary contact switch should be connected from the Set / Accelerate / Bump Up (Wire #955) to Wire #917. (See Wire #917 instructions.)

CRUISE CANCEL / RESUME - WIRE #981 (brown)

The Cruise Cancel / Resume (Wire #981) is connected to battery voltage (+12 or +24 Volts) with a momentary contact switch. A high quality switch with gold contacts should be used. 12 or 24 volts can be accessed through Wire #012.

The Cancel / Resume function can be used to temporarily interrupt a "set" cruise speed. To do so, the operator contacts the Cancel / Resume button and speed decreases toward idle. To resume the "set" cruise speed, the operator must contact the Cancel / Resume button again within one minute. (This could be used by a tractor operator at the end of each crop row.) If the second Cancel / Resume contact is not made within one minute, the engine reverts to normal cruise control and to resume "set" speed requires using the "Resume" switch.

Cruise Cancel / Resume does not resume at engine speeds below 1300 RPM.

The Cruise Cancel / Resume function does not operate when Cruise Remote (Wire #917, purple) is active. (See Wire #917 instructions.)

CRUISE REMOTE - WIRE #917 (purple)

Wire #917 is used to turn a second (remote) cruise control station on and off. This is intended for use where a remote engine speed adjustment is needed, such as at an external PTO location. When Wire #917 is connected to battery voltage, the second cruise control station is switched "on." When Wire #917 is turned "off" (no voltage, open circuit) the second cruise control station is switched off. The primary (dashboard) cruise control must be turned off for the second station to be used. If the ECU detects that both cruise control stations are "ON," the cruise control will not function.

GROUND - Wire #050J (black)

A ground is not needed for any of the primary cruise functions. This ground wire is provided for any other needs the customer might have, such as wiring a cruise indicator light at the operators station.

High Air Cleaner Restriction Switch

A 2-way Weather-Pack male connector is provided in the engine/ECU wiring harness for a customer-provided high air cleaner restriction switch.

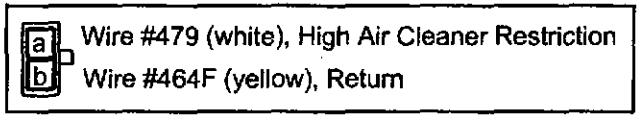


Figure AG-15 - 41, High Air Cleaner Restriction Connector

When this circuit is open (Wires #479 and #464F not connected, or nothing plugged into this connector), the engine will operate normally and no error code will be generated. When Wire #479 is connected to Wire #464F, the ECU will illuminate a fault lamp and generate a high air cleaner restriction error code. If an ECU with engine derate protection is specified, the engine will derate 2% per minute to a maximum derate of 20%. If the switch opens during the derate sequence, the power will increase at 2% per minute until normal power is reached or until the switch closes again. The current fault code will remain on until normal power is reached.

The high air cleaner restriction switch will not activate a shutdown sequence, regardless of which ECU you have specified. It is up to the operator to shut down and resolve the problem.

Low Coolant Level Switch

A female 2-way Metri-Pack 280 connector is provided in the engine/ECU wiring harness for a customer-provided low coolant level switch.

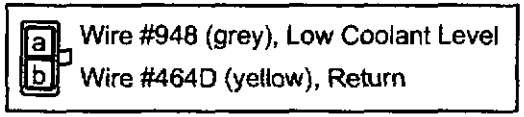


Figure AG-15 - 42, Low Coolant Level Switch Connector

When this circuit is open (Wire #948 and #464D not connected, or nothing plugged into this connector), the engine will operate normally. When Wire #948 is connected to Wire #464D, the ECU will illuminate a fault lamp and generate a low coolant level error code. It may also activate a derate/shutdown sequence, depending on which ECU you have specified:

1. For ECUs without any "Engine Protection" features enabled: The ECU will not derate the engine or shut it down. It is up to the operator to shut down and resolve the problem.
2. For ECUs with the "Engine Derate" feature enabled: The ECU will reduce engine power at 20% per minute to a maximum reduction of 40% (60% of normal power remaining), but it will not shut the engine down. It is up to the operator to shut down and resolve the problem.
3. For ECUs with the "Engine Shutdown" feature enabled: After 30 seconds, the engine will automatically shut down.

If Wire #924B returns to an open circuit condition within the 30-second delay period, the engine gradually increases back to original power, and the engine does not shut off. The fault lamp illuminates until the power returns to normal, then it shuts off.

The engine does not shut down immediately when Wire #924B is grounded, so it should not be used if an immediate shutoff is required. For an immediate shutdown, the external stop-engine input wire should be used (see instructions, below).

External Stop-Engine Input

A female 2-way Metri-Pack 150 connector is provided in the Engine/ECU wiring harness for an immediate external shutdown input. This allows the OEM to trigger an immediate shutdown from external switches, such as a loss of prime switch, or hydraulic overtemperature switch. Any number of normally open switches that close to trigger the shutdown can be added in parallel.

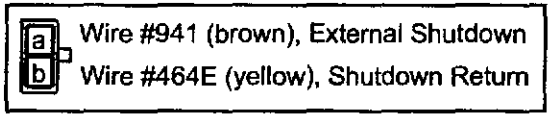


Figure AG-15 - 43, External Stop-Engine Input Connector

When the 2-wire circuit is open, the engine operates normally. When the 2-wire circuit is closed, the ECU shuts the engine off immediately and triggers a fault code. (For details, see the Operator's Manual.)

Note: The External Shutdown function is always active, even if an ECU without shutdown is specified. Also, the external shutdown function shuts down the engine immediately, with no delay period and no opportunity to override. If you do not wish to use this feature, do not connect anything to the wires.

External Derate Input

A Male 2-way Metri-Pack 150 connector is provided in the Engine/ECU wiring harness for an external derate input. This allows the OEM to trigger a 20% reduction in engine power from external switches, such as a loss of prime switch or hydraulic overtemperature switch. Any number of normally open switches that close to trigger the derate can be added in parallel.

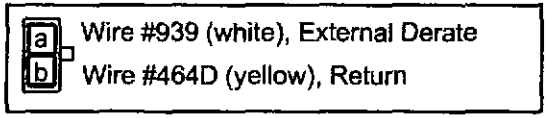


Figure AG-15 - 44, External Derate Input Connector

When the circuit between Pins A and B closes, the engine will derate at a rate of 2% per minute for a total derate of 20% in 10 minutes. A fault code and warning light will also be generated. If the circuit opens during that time, the engine will increase power at 2% per minute until reaching full power. Once the engine returns to full power the warning light will turn off.

Note: The External Derate function is always active, even if an ECU without derate is specified. If you do not wish to use this feature, do not connect anything to the wires.

Auxiliary "Warning" Lamp

A female 2-way Metri-Pack 150 connector with Wires #012E (red, Pin A) and #473 (orange, Pin B) is provided in the Engine/ECU harness to operate an auxiliary "Warning" lamp. Pin A (Wire# 012E) goes to the positive terminal of a 12- or 24-volt indicator light. Pin B (Wire #473) goes to the ground side of the bulb. Pin A is always "live" with 12 or 24 volts when the key is on. The ground (Pin B) acts as the switch.

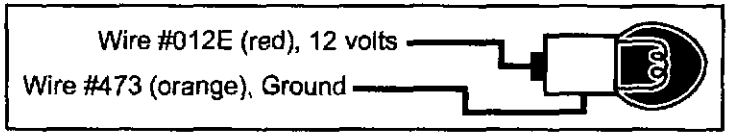


Figure AG-15 - 45, Auxiliary "Warning" Lamp Wiring

Use an amber-colored light for the warning lamp. When a "Warning" problem is detected by the ECU, the lamp blinks. "Warnings" include lower-than-normal oil pressure, higher-than-normal coolant temperatures, higher-than-normal charge air temperatures, or power derates.

This circuit supports a maximum current of 100 mA. It should not be used to drive any load larger than a 1-Watt bulb. To drive larger loads, such as audible alarms, we recommend installing the RE162427 alarm module that plugs into the databus module in the instrument panel. It includes a relay for additional loads up to 0.5 Amps at 125 volts AC, 1 Amp at 12-24 volts DC, or 62.5 VA, 30 Watts max.

Connecting this terminal is not required if you use the RE68155 diagnostic gauge. The RE68155 diagnostic gauge has amber ("Warning") and red ("Stop Engine") lamps built in.

The warning light driver also serves as the "blink light" for blink-code dagnostics.

Auxillary "Stop-Engine" Lamp

A male 2-way Metri-Pack 150 connector with series female terminals is provided in the engine/ECU harness to operate an auxiliary "Stop Engine" lamp. Pin A (Wire #012D) goes to the positive terminal of a 12- or 24-volt indicator light. Pin B (Wire #474) goes to the ground side of the bulb. Pin A is always "live" with 12 or 24 volts when the key is on. The ground (Pin B) acts as the switch.

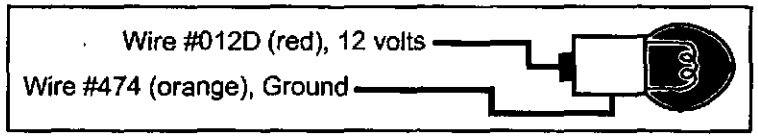


Figure AG-15 - 46, Auxillary "Stop-Engine" Lamp Wiring

Use a red-colored light for the stop-engine lamp. When a "Shutdown Engine" problem is detected by the ECU, this fault lamp blinks. "Shutdown" problems include extremely low oil pressure, and extremely high coolant temperatures. On ECU's with shutdown enabled, an "ON" lamp indicates that the engine will shutdown within 30 seconds.

This circuit supports a maximum current of 100 mA. It should not be used to drive any load larger than a 1-Watt bulb. To drive larger loads, such as audible alarms, we recommend installing the RE162427 alarm module that plugs into the databus module in the instrument panel. It includes a relay for additional loads up to 0.5 Amps at 125 volts AC, 1 Amp at 12-24 volts DC, or 62.5 VA, 30 Watts max.

Connecting this terminal is not required if you use the RE68155 diagnostic gauge. The RE68155 diagnostic gauge has amber ("Warning") and red ("Stop Engine") lamps built in.

Secondary Analog Throttle Potentiometer Connector

For installations where two analog throttles are needed, a second 3-pin male Weather-Pack throttle connector is provided on the engine wiring harness. The adjustable 2-state throttle must be set in the "low speed" position for either analog throttle to work. The "Secondary" analog throttle can be used with or without the "Primary" analog throttle installed.

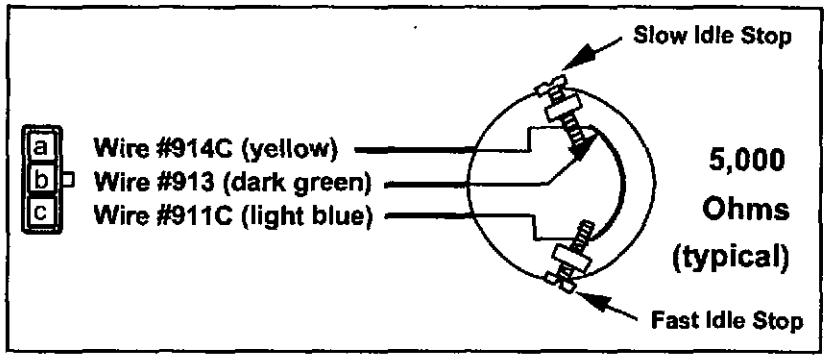


Figure AG-15 - 47, Secondary Analog Throttle Potentiometer

The second analog throttle feature is intended for use when a foot throttle and a hand throttle must both be provided. It can also be used when two throttle inputs are operated by the same lever or pedal for back-up purposes. When both analog throttles are used, the throttle signals will be additive, up to the factory preset fast idle setting or the maximum speed set with the adjustable 2-state throttle. There is no "dead band" in either throttle. When you move the foot throttle, speed immediately increases regardless of where the hand throttle is set.

The secondary analog throttle feature is not intended for use with two throttles located remotely from each other. Because the throttle signal is additive, if either throttle is at the full-speed position, the other throttle will have no control. Both throttles must be in the slow idle position for the engine to operate at slow idle.

For remote throttle applications, we suggest the use of the cruise control feature instead of the secondary throttle.

If used, the secondary analog throttle must be wired and adjusted exactly the same as the primary analog throttle. It can be used with the RE69667 potentiometer throttle or any similar unit.

Unlike the primary throttle, if the secondary throttle is not used, the special RE503681 throttle emulator is not required. To install a secondary analog throttle, unplug the dust cap provided with the wiring harness, and plug the throttle into the same connector. If a secondary throttle is not used, the dust cap should be left in place.

MAKING YOUR OWN ENGINE WIRING HARNESS

The engine wiring harness connects the ECU, all engine mounted sensors and actuators, the 21-pin instrumentation and controls connector, the alternator ignition wire, and the starter relay. To manufacture your own engine wiring harness you will need this document, a copy of the RE502338 ECU wiring diagram, and the latest manufacturing drawing of the standard John Deere wiring harness for your engine. Only the specified John Deere sensors can be used. Other sensors should not be applied.

We strongly recommend following the John Deere harness drawing as closely as possible, varying only cable lengths as needed to fit your installation. All cable lengths that connect engine-mounted components such as sensors and actuators must be exactly per the print. All connectors shown on the John Deere wiring harness drawing must be provided, including all diagnostic connectors and the CAN terminator connector. Please use the same wire colors and circuit numbers shown on the print, so service technicians will be able to trouble-shoot the system using our standard procedures and manuals. We strongly recommend that you use the same 21-pin connector used on the John Deere harness for your instrument panel connector. Not only will that facilitate service, but many of our customers find it very useful to be able to plug in one of our standard instrument panels for diagnostic and experimental purposes. Starter relay connections are included in our harness, but you can operate the starter relay separately from the engine harness if you prefer. You can also bring 12 V power to your key switch separately from the engine wiring harness if needed, to carry high accessory loads. However, the main engine power connections must be made directly to the battery (not the starter terminal) through the unterminated battery connection circuits shown on the John Deere wiring harness drawing. Other unterminated wires shown on the John Deere wiring harness drawing are optional and can be left out if not used. Please refer to the Instrumentation and Controls wiring section of this document for operating and wiring details of each circuit.

REFERENCE INFORMATION

"Metri-Pack" and "Weather Pack" connectors are products of the Packard Electronics Division of Delphi Automotive Systems.

Delphi Automotive Systems
Worldwide Headquarters, United States & Canada Headquarters
One Pontiac Plaza
Pontiac, Michigan 48340-2952
USA
Toll Free: [1] 888.255.7179
Tel: [1] 810.857.4323
Fax: [1] 810.857.4248
web: http:\\www.delphiauto.com/electric/

Delphi Automotive Systems
Asia Pacific Headquarters
1-1-110 Tsutsujigaoka
Akishima-shi, Tokyo 196
Japan
Tel: [81] 425.49.7200
Fax: [81] 425.42.3018
Delphi Automotive Systems
European Headquarters
117 Avenues des Nations, BP 60059
Zac Paris Nord II
95972 Roissy Charles de Gaulle Cedex
France
Tel: [33] 1.4990.4990
Fax: [33] 1.4990.4950

Delphi Automotive Systems
Mexico & South American Headquarters
Av. Goiás, 1820
São Caetano do Sul
São Paulo 09550-050
Brasil
Tel: [55] 11.741.9500
Fax: [55] 11.741.9599

For information on SAE J1939 CAN standards contact:

Society of Automotive Engineers (SAE)
400 Commonwealth Drive
Warrendale PA 15097-0001
USA
Tel: 412-776-4841
Fax: 412-776-5760
Email: isales@sae.org
web: http:\\www.sae.org/

Electronic Throttle Manufacturers:

Teleflex Morse Electrical Systems
(formerly Morse Controls)
6980 Professional Parkway East
Sarasota, FL 34240

Tel: 941-907-1000
Fax: 941-907-1020
web: http://www.tflx.com
Technical Support: techsupport@tflx.com

SAE 1939 Cable Manufacturer:

Champlain Cable
175 Hercules Drive
Colchester, Vermont 05446
Tel: 800-451-5162
Fax: 802-654-4224
web: http:\\www.champcable.com