



Class 1

ISO 9001 CERTIFIED

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TECHNICAL PRODUCT DATASHEET


Total Pressure Governor *Plus* TPG+

P/N 118710




 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	1 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
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1.	REVISION LOG	3
2.	SYSTEM OVERVIEW	4
2.1.	SYSTEM PART NUMBERS	4
2.2.	HARNESS DETAIL (P/N 118453 AND P/N 117683)	4
3.	OVERVIEW OF THE TOTAL PRESSURE GOVERNOR PLUS.....	6
3.1.	INFO CENTER DISPLAY	7
3.2.	INTERLOCK STATUS INDICATORS	7
3.3.	SWITCH PANEL	7
3.3.1.	<i>IDLE</i>	7
3.3.2.	<i>MENU/SILENCE</i>	7
3.3.3.	<i>PRESET</i>	7
3.3.4.	<i>MODE</i>	7
3.3.5.	<i>INC</i>	7
3.3.6.	<i>DEC</i>	7
3.4.	MODE INDICATOR	7
3.5.	ENGINE RPM DISPLAY	7
3.6.	BATTERY VOLTAGE MONITOR	8
3.7.	COOLANT TEMPERATURE MONITOR	8
3.8.	OIL PRESSURE MONITOR	8
3.9.	PUMP INTAKE PRESSURE DISPLAY	8
3.10.	PUMP DISCHARGE PRESSURE DISPLAY	8
3.11.	STOP ENGINE AND CHECK ENGINE INDICATORS	8
4.	OPERATION	9
4.1.	INITIALIZATION	9
4.2.	OPERATING MODE SELECTION	10
4.2.1.	<i>Throttle mode</i>	10
4.2.2.	<i>Pressure mode</i>	11
4.3.	REQUIRED INTERLOCKING	12
4.4.	PRESET SWITCH OPERATION	12
4.5.	IDLE SWITCH OPERATION	12
4.6.	MENU/SILENCE SWITCH OPERATION	13
4.6.1.	<i>Viewing the engine and pump related items</i>	13
4.6.2.	<i>Silencing the alarm</i>	14
4.7.	STATUS AND WARNING MESSAGES	15
4.8.	AUTOMATIC DISPLAY BRIGHTNESS	16
5.	GOVERNOR CONTROL SETUP MENU	17
5.1.	ENGINE COMPATIBILITY	17
5.2.	ENTER THE SETUP MENU	17
5.2.1.	<i>UNITS (unit of measure configuration)</i>	20
5.2.2.	<i>PRESET RPM (throttle preset configuration)</i>	20
5.2.3.	<i>HI-IDLE (high idle configuration)</i>	20
5.2.4.	<i>PRESET PSI (pressure preset configuration)</i>	20
5.2.5.	<i>BRIGHT (display brightness)</i>	20
5.2.6.	<i>NIGHT (display brightness)</i>	20
5.2.7.	<i>DISPLAY TEST</i>	20
5.2.8.	<i>ROUND PSI</i>	20
5.2.9.	<i>ALERT TONE (configure alert tones)</i>	21
5.2.10.	<i>SENSITIVITY (pressure sensitivity configuration)</i>	21

 <p>607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473</p>	TECHNICAL DATA SHEET			PAGE	2 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

5.2.11.	SENSOR CAL (pressure sensor calibration)	21
5.2.12.	1 st MODE (first active mode configuration)	21
5.2.13.	COMM STATUS (view the CAN communication status)	21
5.2.14.	CONTROL (engine control message type)	21
5.2.15.	AUTO MODE (pressure mode automatically entered on pump engagement)	21
5.2.16.	IDLE STEPS	22
5.2.17.	IDLE RPM	22
5.2.18.	MAXIMUM RPM	22
5.2.19.	SourceID (CAN message source identification).....	22
5.2.20.	PSI TIME-OUT (pressure time out).....	22
5.2.21.	ALLOW PRESET (allow RPM preset use when pressure is detected)	22
5.2.22.	WARNINGS (data monitor warning configuration)	23
A.	WARN °F (User defined engine temperature high warning - Yellow LED).....	23
B.	CRIT °F (User defined engine temperature high critical - Red LED)	23
C.	WARN PSI (User defined oil pressure low warning - Yellow LED)	23
D.	CRIT PSI (User defined oil pressure low critical - Red LED)	23
5.2.23.	XDUCCR (discharge pressure transducer range)	23
5.2.24.	FACTORY DFLT (Set factory defaults).....	23
5.2.25.	GOV GAIN (RPM change per step)	23
5.2.26.	PRESS GAIN (PSI change per step)	23
5.2.27.	DITHER (Engine handshake).....	23
5.2.28.	LAG ΔPSI (Pressure lag)	24
5.2.29.	PUMP HOURS.....	24
5.2.30.	BCM1 VER (Body Control Message 1 version)	24
5.2.31.	SCANIA MODE? (Scania governor type)	24
6.	CONFIGURATION	25
6.1.	CONFIGURE THE UNIT OF MEASURE	25
6.2.	SELECT PRESSURE TRANSDUCER RANGE: 300 PSI (DEFAULT) OR 600 PSI	25
6.3.	ZERO CALIBRATE THE INTAKE AND DISCHARGE PRESSURE TRANSDUCERS	26
6.4.	CONFIGURE THE ENGINE CONTROL METHOD	26
6.5.	CONFIGURE THE IDLE VOLTAGE AND GAIN SETTING USING AUTO SCALE	27
7.	MOUNTING & INSTALLATION.....	28
7.1.	PANEL CUTOUT DIMENSIONS	28
8.	CONNECTOR DESCRIPTION.....	29
8.1.	TPG+ CONNECTORS	29
8.2.	PRESSURE SENSOR CONNECTOR	29
9.	TECHNICAL DETAILS	30


 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	3 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

1. Revision Log

Rev	Date	Changes
1.00	4/9/2009	Initial revision



Product specifications in this manual are subject to change without notice.

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	4 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

2. System Overview

2.1. System part numbers

Total Pressure Governor *Plus* (TPG+) system kit 119650

Kit includes

Total Pressure Governor *Plus* (TPG+) QTY-1 118710
 TPG+ main system harness QTY-1 118453
 Transducer 0-300 PSI QTY-2 113557

Optional items

TPG+ analog signal harness (analog control option) 117683
 Transducer 0-600 PSI 117179

Documentation (available from Class 1's website - www.class1.com)

TPG+ system Manual (this manual) 118711
 TPG+ OEM Quick Manual 118712
 Engine compatibility guide 117686

2.2. Harness detail (p/n 118453 and p/n 117683)

The main system harness (p/n 118453) is comprised of a pair of harnesses: the power/communication harness (depicted below in blue) and the signals harness (depicted below in green).

When the analog signal control option is desired instead of the standard CAN control option then the analog control option harness is also required (p/n 117683). This harness is actually a set of wires and sockets which must be inserted into connector C4 (depicted below with a red dashed line).

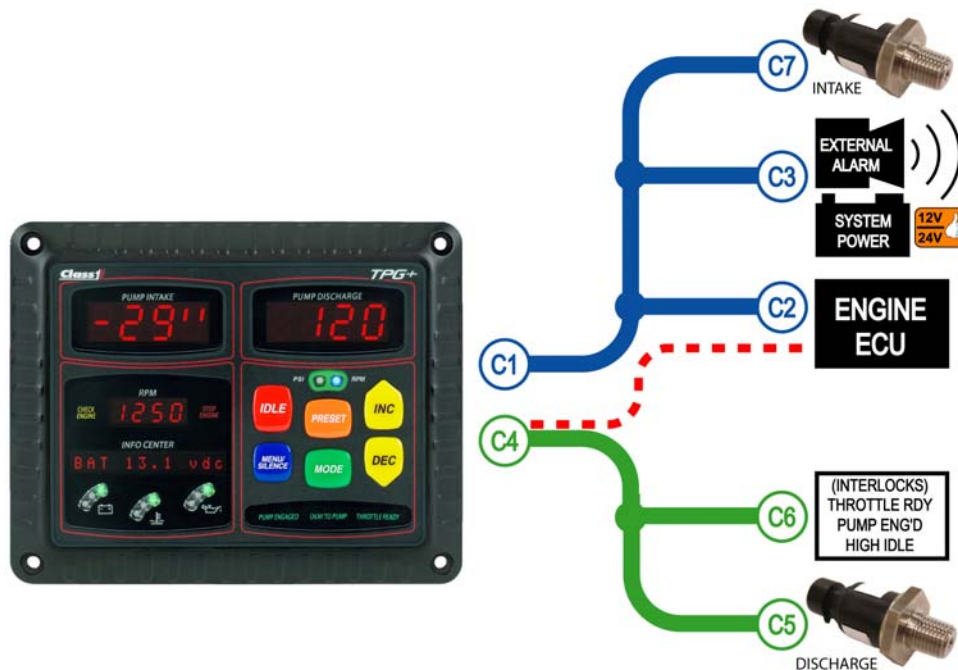



Figure 1. *Harness nomenclature.*

 <p>607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473</p>	TECHNICAL DATA SHEET			PAGE	5 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

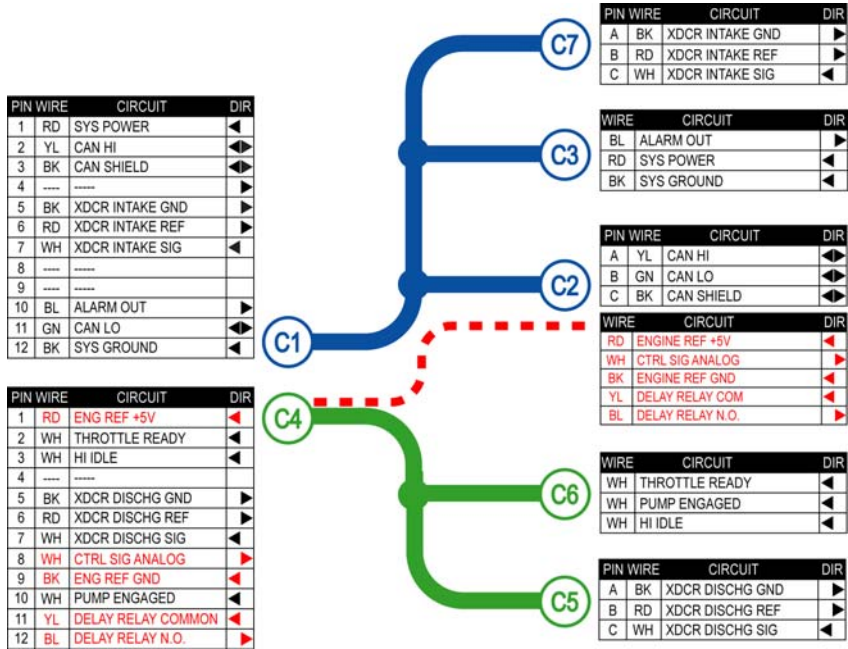



Figure 2. *Harness wiring detail - p/n 118453 with analog option harness p/n 117683 (red).*

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	6 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

3. Overview of the Total Pressure Governor Plus

The Total Pressure Governor Plus (TPG+) p/n 118710 is an SAE J1939 Controller Area Network (CAN) device that controls engine speed using data communications directly to the engine ECU or through with an analog control signal. By operating on the J1939 network, the governor is able to monitor engine RPM and other pertinent data directly from the engine ECU. Engine information is available directly so that NFPA required instrumentation is delivered through a single unit saving panel space and delivering engine specific warnings as determined by each engine manufacturer.

Control algorithms are optimized to take advantage of the J1939 CAN data to yield crisp and accurate control of engine and subsequently pump speed and pressure output.


For engines that may not support the data link control, an analog output signal is available to provide precise control of the engine speed and pressure.

The TPG+ saves pump panel space by incorporating easy to read numeric displays for Pump Intake pressure, Pump Discharge pressure, and engine RPM in accordance with NFPA standards.



Figure 3. TPG+ controls and indicators.

Pump intake pressure display	section 3.9	Pump discharge pressure display	section 3.10
Stop engine indicator	section 3.11	Mode indicator	section 3.4
Engine RPM display	section 3.5	Switch panel	section 3.3
Check engine indicator	section 3.11	Idle	section 3.3.1
Info Center display	section 3.1	Menu/Silence	section 3.3.2
Battery voltage monitor	section 3.6	Preset	section 3.3.3
Coolant temperature monitor	section 3.7	Mode	section 3.3.4
Oil pressure monitor	section 3.8	Inc	section 3.3.5
		Dec	section 3.3.6
		Interlock status indicators	section 3.2

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	7 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

3.1. Info Center display

The display shows status, warning, and information messages.

3.2. Interlock status indicators

Backlit text indicates the status of the three (3) interlocks: *pump engaged*, *okay to pump*, and *throttle ready*. *Throttle ready* and *pump engaged* are physical inputs into the gray 12-pin connector (pins 2 and 10 respectively) of the TPG+. *Okay to pump* becomes active when both the *throttle ready* and *pump engaged* interlocks are present.

3.3. Switch panel

The six (6) control switches are color coded and labeled for easy identification.

3.3.1. IDLE

The IDLE switch (red) forces the governor to **idle mode** (standby). Pressing and holding this button for **one second** while in rpm or pressure mode will cause the engine to ramp down to its idle position.

3.3.2. MENU/SILENCE

The MENU/SILENCE switch (blue) is used to silence the alarm, cycle through the display items, and enter the setup menu.

3.3.3. PRESET

The PRESET switch (orange) sets the governor to the configured preset engine RPM while in **throttle mode**, or preset pressure while in **pressure mode**.

3.3.4. MODE

The MODE switch (green) sets the governor to either **throttle mode** (RPM) or **pressure mode** (PSI). The correct interlocks must be present for the system to begin governor operation: throttle ready for RPM mode, throttle ready, pump engaged, and okay to pump for PSI mode.

3.3.5. INC

The INC [increase] switch (yellow) is used to increase the engine RPM or pressure set point.

3.3.6. DEC


The DEC [decrease] switch (yellow) is used to decrease the engine RPM or pressure set point.

3.4. Mode indicator

The mode indicator consists of two (2) LEDs to show the governor's current operating mode. The PSI LED (yellow) indicates the governor is operating in **pressure mode** and the RPM LED (blue) indicates the governor is operating in **throttle mode**. When both LEDs are OFF the governor is in **idle mode** (standby).

3.5. Engine RPM display

The engine RPM display shows the current engine RPM as reported by the Electronic Engine Controller 1 (EEC1) SAE J1939 network data message transmitted by the vehicle ECU.

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	8 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

3.6. Battery voltage monitor

The battery voltage monitor is comprised of three (3) LEDs (green, yellow, and red). The active LED color indicates the current system voltage's range as measured by the power and ground inputs pins. The alarm will activate when the voltage monitor is in condition RED.



- GREEN 12.5VDC and higher
- YELLOW 12.4VDC to 11.9VDC
- RED 11.8VDC and lower

3.7. Coolant temperature monitor

The coolant temperature monitor is comprised of three (3) LEDs (green, yellow, and red). The active LED color indicates the status of the coolant temperature as reported by the Diagnostic Message 1 (DM1) SAE J1939 network data message transmitted by the vehicle ECU. The coolant temperature status can also be set to react to user desired points (see section 5.2.22). The alarm will activate when the coolant temperature monitor is in condition RED.



- GREEN No active error reported by engine for coolant temperature
- YELLOW Coolant temperature high WARNING – SPN 110, FMI 16
- RED Coolant temperature high CRITICAL – SPN 110, FMI 0

3.8. Oil pressure monitor

The oil pressure monitor is comprised of three (3) LEDs (green, yellow, and red). The active LED color indicates the status of the oil pressure as reported by the Diagnostic Message 1 (DM1) SAE J1939 network data message transmitted by the vehicle ECU. The oil pressure status can also be set to react to user desired points (see section 5.2.22). The alarm will activate when the oil monitor is in condition RED.



- GREEN No active error reported by engine for oil pressure
- YELLOW Oil pressure low WARNING – SPN 100, FMI 18
- RED Oil pressure low CRITICAL – SPN 100, FMI 1

3.9. Pump intake pressure display


The pump intake pressure display shows the pressure as determined by the intake pressure sensor. By default, this display shows positive pressure in pounds per square inch (PSI) and negative pressure (vacuum) in inches of mercury (inHg), but it may be set up to display in metric units (see section 6.1).

3.10. Pump discharge pressure display

The pump discharge pressure display shows the pressure as determined by the discharge pressure sensor. By default, this display only shows positive pressure in pounds per square inch (PSI), but it may be set up to display in metric units (see section 6.1).

3.11. Stop engine and check engine indicators

The stop engine and check engine indicators are turned ON and OFF as directed by the Diagnostic Message 1 (DM1) SAE J1939 network data message transmitted by the vehicle ECU.

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	9 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

4. Operation

4.1. Initialization

The TPG+ has a six (6) second power initialization cycle and during this time the display will show:

First second after the power on cycle.

The TPG+ lights all indicators and shows “8.8.8.8.” in the pump intake, pump discharge, and RPM display windows.

The Info Center shows “Class 1 TPG-X”. The last letter of this display indicates the configured control method of the TPG+.

- TPG-C – CFPG control method
- TPG-P – PGN0 control method
- TPG-A – Analog control method
- TPG-S – Scania control method

(See section 6.4 for engine configuration).



Seconds 2 through 4 after the power on cycle.

The TPG+ continues to light all indicators and shows “8.8.8.8.” in the pump intake, pump discharge, and RPM display windows.

The Info Center shows the software version of the TPG+.




The final two seconds after the power on cycle.

The TPG+ turns off all of the indicators and lights only the decimals of the pump intake, pump discharge, and RPM display windows.

The Info Center shows “Initializing”.

After the initialization the TPG+ begins normal operation.



 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	10 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

4.2. Operating mode selection

The TPG+ has two operating modes: **throttle mode** (RPM) and **pressure mode** (PSI).



Press the **MODE** switch to select an operating mode. An operating mode will only be activated if the required interlock(s) are in place (see section 4.3).

There is no variation in engine RPM or pump pressure when changing between **throttle mode** and **pressure mode**.



Pressure mode is the desired operating mode because it offers protection from pressure changes that could injure personnel.

4.2.1. Throttle mode

Throttle mode (RPM) maintains a set engine RPM and will not deviate until the operator changes the RPM with the control switches on the TPG+. (*Proper interlocking is required for normal operation – refer to Required Interlocking section 4.3*)

Throttle mode is typically used when...

- *priming the pump*
- *connected to a stand pipe*
- *the water supply pressure stability is questionable*
- *acting as a relay pumper*



Press the **MODE** switch to select **throttle mode**. The display will momentarily show "GOV=THROTTLE" and the RPM mode indicator LED will illuminate blue.




Press the **INC** switch to increase or the **DEC** switch to decrease the engine RPM set point.



Press the **PRESET** switch to set the engine speed to the configured preset RPM - as long as the pump pressure is less than 10 PSI (see section 4.4). Configure the **throttle mode** preset through the Setup Menu (see section 5.2.1).



Press the **IDLE** switch at any time to set the TPG+ back to standby. The display will momentarily show "IDLE" and both mode indicator LEDs will be off (see section 4.5).

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	11 OF 30	
				DATE	4/9/2009	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	REV	1.00
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			BY	AMS

4.2.2. Pressure mode

Pressure mode (PSI) maintains a set pump pressure by monitoring the discharge pressure transducer and modifying the pump speed by adjusting the engine RPM. The operator can modify the set pump pressure with the control switches on the TPG+. (*Proper interlocking is required for normal operation – refer to Required Interlocking section 4.3*)



Pressure mode (PSI) affords the most safety to the operator by not allowing potentially hazardous pressure spikes. The TPG+ will maintain the set pump pressure even when discharge lines are actively opened and closed as long as the water supply is sufficient. The TPG+ will automatically increase engine speed when pump pressure has decreased due to discharge lines being opened. The increase in engine speed will return the pump pressure to the desired set pressure (and vice-versa when discharge lines are closed).



Press the **MODE** switch to select **pressure mode**. The display will momentarily show "GOV=PRESSURE" and the PSI mode indicator LED will illuminate yellow. It may be necessary to press the **MODE** switch twice depending on the configured first mode (see section 5.2.1).



Press the **INC** switch to increase or the **DEC** switch to decrease the pressure set point.




Press the **PRESET** switch to set the pump pressure to the configured preset. The TPG+ will adjust the engine RPM to maintain the preset pressure value (see section 4.4). Configure the **pressure mode** preset through the Setup Menu (see section 5.2.4).



Press the **IDLE** switch at any time to set the TPG+ back to standby. The display will momentarily show "IDLE" and both mode indicator LEDs will be off (see section 4.5).

There are four control properties which can be modified to improve **pressure mode** performance: pressure sensitivity, pressure time-out, pressure gain, and pressure lag.

CONTROL PROPERTY	DESCRIPTION	DEFAULT	SECTION
Pressure sensitivity	Controls how much difference between the set pressure and actual pressure that is allowed before the TPG+ actively adjusts the engine RPM to bring the pump pressure back to the set pressure.	6 PSI	5.2.10
Pressure time-out	When the pressure drops below 30 PSI for the number of seconds configured the engine RPM will be reduced to idle, the alarm will sound and the OPERATOR CMD warning will be shown in the display window (see section 4.7).	3 SEC	5.2.20
Pressure gain	The pressure change requested with each INC or DEC switch press.	3 PSI	5.2.26
Pressure lag	While the increase button is held, controls how much pressure change between the desired pressure and actual pressure can occur before the engine RPM is adjusted to maintain desired pressure.	5 PSI	5.2.28

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	12 OF 30	
				DATE	4/9/2009	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	REV	1.00
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			BY	AMS

4.3. Required interlocking

The TPG+ requires interlocks before engine control operations are permitted. The TPG+ provides two interlock inputs that allow easy separation of pumping operations and throttle/high idle operations through two inputs dedicated as system interlocks: *THROTTLE READY* (pin 2 of the gray Deutsch connector) and *PUMP ENGAGED* (pin 10 of the gray Deutsch connector). These interlock inputs are activated when system power is applied (positive polarity).



The OEM is responsible for creating safe and effective interlocking routines.

The TPG+ utilizes back lit text below the switch panel to indicate interlock status.

THROTTLE READY interlock



Apply system power to pin 2 of the gray Deutsch connector (through OEM interlocking). *THROTTLE READY* text illuminates green.

The TPG+ will operate in **throttle mode** (RPM) only.

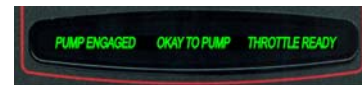
PUMP ENGAGED interlock



Apply system power to pin 10 of the gray Deutsch connector (through OEM interlocking). *PUMP ENGAGED* text illuminates green.

The TPG+ will not operate in any mode until the *THROTTLE READY* interlock is applied.

OKAY TO PUMP



When *THROTTLE READY* and *PUMP ENGAGED* interlocks are applied the *OKAY TO PUMP* text illuminates green.

The TPG+ will operate in **throttle mode** (RPM) or **pressure mode** (PSI).

4.4. PRESET switch operation



The **PRESET** switch brings the discharge pressure (or engine RPM, in throttle mode) to the configured preset point (see section 5.2.2 and 5.2.4).

Using the **PRESET** switch is a method of smoothly and expeditiously attaining water pressure and flow, but it is not intended to be the initial attack pressure. Attack pressures and flows should be determined by the actual fire status and manually achieved for best operation.

PRESET is an operational convenience and needs to be considered as a fixed point (higher or lower than the current point) that can be achieved with a single switch press.


Note: Initiating pumping operations is simplified by bringing the pump to a preset pressure with a single switch press. Consequently, securing or regaining control operations can be aided by returning to this fixed pressure point with a single switch press.

4.5. IDLE switch operation



Press and hold the **IDLE** switch for **one second** to release engine RPM control back to the engine ECU. The engine RPM will promptly go to its configured curb idle (see section 5.2.17).

Note: In view of the fact that driveline stress can be induced by quick changes in engine speed, depending on rpm and torque load, the engine speed is ramped to idle over a short duration to minimize the effect of driveline kick.

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	13 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

4.6. MENU/SILENCE switch operation

The MENU/SILENCE switch allows viewing (within the info center display) of the status of engine and pump related items (section 4.6.1) and silencing of an active alarm (section 4.6.2).

4.6.1. Viewing the engine and pump related items



Press the MENU/SILENCE switch to cycle through the engine and pump related display items (see below).

DISPLAY ITEM	FORMAT	SOURCE
Battery voltage	BAT XX.X Vdc	Input voltage at pins 1(+) and 12 (-) of the black 12-pin connector.
Engine oil pressure	OIL XX PSI	SAE J1939 CAN message – PGN 65263
Engine coolant temperature	COOLANT XXX°F	SAE J1939 CAN message – PGN 65262
Engine oil temperature	OIL TMP XXX°F	SAE J1939 CAN message – PGN 65262
Transmission oil temperature	TRANS XXX°F	SAE J1939 CAN message – PGN 65272
Engine fuel rate	FUEL X.X G/h	SAE J1939 CAN message – PGN 65266
Engine hours	ENGINE XXXXh	SAE J1939 CAN message – PGN 65253
Pump hours	PUMP XX.Xh	Internal timer based on pump engaged interlock
TPG+ alarm status	ALARM XXX	Alarm status

Battery voltage

The info center displays the battery voltage as determined by the TPG+ based upon the voltage applied to pins 1 (+) and 12 (-) of the black 12-pin connector.

Engine oil pressure


The info center displays the engine oil pressure based upon the J1939 CAN message received by the TPG+. The pressure will be displayed in PSI, kPa, or Bar dependent on the unit of measure configured in the setup menu (see section 5.2.1).

Engine coolant temperature

The info center displays the engine coolant temperature based upon the J1939 CAN message received by the TPG+. The temperature will be displayed in degrees Fahrenheit (°F) or degrees Celsius (°C) dependent on the unit of measure configured in the setup menu (see section 5.2.1).

Engine oil temperature

The info center displays the engine oil temperature based upon the J1939 CAN message received by the TPG+. The temperature will be displayed in degrees Fahrenheit (°F) or degrees Celsius (°C) dependent on the unit of measure configured in the setup menu (see section 5.2.1).

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	14 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

Transmission oil temperature

The info center displays the transmission oil temperature based upon the J1939 CAN message received by the TPG+. The temperature will be displayed in degrees Fahrenheit (°F) or degrees Celsius (°C) dependent on the unit of measure configured in the setup menu (see section 5.2.1).

Engine fuel rate

The info center displays the engine fuel rate based upon the J1939 CAN message received by the TPG+. The fuel rate will be displayed in gallons per hour (G/h) or liters per hour (L/h) dependent on the unit of measure configured in the setup menu (see section 5.2.1).

Engine hours

The info center displays the engine hours (total hours of operation) based upon the J1939 CAN message received by the TPG+.

Pump hours

The info center displays the pump hours based upon the amount of time the TPG+ has detected the pump engaged interlock has been active. The pump hours may be cleared or set to a predetermined number of hours in the setup menu (see section 5.2.29).

TPG+ alarm status

The info center displays the current alarm status of the TPG+.

- The display will show **ALARM OFF** when the alarm is not active.
- The display will show **ALARM ON** when the alarm is active.
- The display will show **ALARM SIL=XX** when the alarm is active but has been silenced by the user. The XX will be a value indicating the number of minutes until the alarm will again be allowed to sound (silenced time remaining).

4.6.2. Silencing the alarm


The active alarm can be silenced by pressing and holding the MENU/SILENCE switch for **one second**. The info center display will show **ALARM SIL=10** to indicate that the alarm has been silenced for the standard time of 10 minutes. **Continue** holding the MENU/SILENCE switch to increase the silenced time frame to 15 or 20 minutes.



Press and hold the MENU/SILENCE switch for **one second** to silence the alarm for the standard time (10 minutes).

Continue holding the MENU/SILENCE switch to increase the alarm silence time (15 or 20 minutes).

- *The alarm silenced time frame is reset to the standard 10 minutes once all alarm conditions have been cleared.*
- *The alarm will remain silenced for the selected time frame even if another alarm condition becomes active.*


 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	15 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

4.7. Status and warning messages

The table below details the status and warning messages of the TPG+.

- These codes will flash on the Info Center display while the error/warning is active.
- Multiple errors/warnings may be sequenced on the display.
- Press and hold the **MENU/SILENCE** switch for one second to silence the active alarm (see section 4.6.2).

ERROR CODE	DESCRIPTION
SENSOR FAIL	Signal voltage from the discharge pressure sensor or intake pressure sensor is less than +0.30VDC or greater than +4.90VDC.
LOW PRESSURE	Pump discharge pressure was greater than 50 PSI, but has dropped to below 30 PSI.
OPERATOR CMD	Pump intake pressure loss. Engine speed is reduced to 1100 RPM.
Δ RPM LIMIT	Engine speed change of greater than 200 RPM does not yield increase in PSI.
WATER SUPPLY	Pump discharge pressure decreased as RPM was increased (while in pressure mode).
Δ PSI LIMIT	Pump discharge pressure increased 50 PSI over set pressure point while controlling a steady RPM (while in throttle mode).
NO COMM DATA	Not receiving CAN communication data from engine ECU (while throttle interlock is active).
ANALOG FAIL	Output signal voltage differs from expected (calculated) value.
SELECT MODE?	Increase or Decrease request when no active mode (PSI/RPM) selected.
SWITCH FAIL	Switch panel reporting the INC or DEC button is active during a power on cycle.

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	16 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

4.8. Automatic display brightness

The indicators and displays on the TPG+ can be user configured for brightness in both a DAY mode and a NIGHT mode (see sections 5.2.5 and 5.2.6). The TPG+ utilizes a light sensor on its front panel to determine if it is operating in DAY or NIGHT mode. The sensitivity of the light sensor is not configurable.


- When the light sensor detects light the TPG+ is set to DAY mode.
- When the light sensor detects a low light condition the TPG+ is set to NIGHT mode.

The transition from DAY to NIGHT (or vice-versa) takes thirty (30) seconds.

Note: The TPG+ will remain in NIGHT mode if the light sensor is blocked by stickers, tape, etc.



Figure 4. TPG+ light sensor location.

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	17 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

5. Governor Control Setup Menu

5.1. Engine compatibility

The factory default settings of the TPG+ make it “out of the box” ready to operate a Cummins engine programmed with the Emergency Vehicle Calibration. Typically, for the default configuration no values will require modification, other than changing the desired engine rpm, high-idle rpm and pump pressure preset values.

The governor is capable of controlling any engine that allows J1939 PGN0 (Torque Speed Control) messages from a unique source address. These engines include various Detroit Diesel DDEC engines, Mercedes Benz (MBE) engines, Volvo, and others. The Scania engine allows control by proprietary J1939 messages and is supported by the TPG. In cases where an engine does not support data link control, the TPG+ can be configured to control the engine with an analog signal coupled to the engine remote PTO throttle input.

Contact Class 1 or visit our website (www.class1.com) for a complete engine compatibility list.

5.2. Enter the setup menu

The setup menu allows access to the configuration and calibration screens. The setup menu may be accessed anytime the TPG+ is in **idle mode** (see section 3.3.1).

There are 4 set up menus available: *menu level 1 (basic setup menu), menu level 2, menu level 3 and menu level 4 (factory menu)*. All configurations and calibrations are saved in non-volatile memory and will not be lost with power disruptions.

Standard menu level access

The standard menu level access method allows entry into menu levels 1, 2, or 3 only. Use the Direct menu level access method to enter menu level 4. Once a menu level has been selected, subsequent menu access will always enter that menu level and a system re-power is required to reset the first entry menu level.



Display shows **MENU 04 SECS** and begins counting down. Continue holding **IDLE** and **MENU** until the display shows ***SETUP MENU*** (4 seconds) and then release the switches. (If menu level 2 or menu level 3 is desired continue to hold the switches until the display shows the desired menu level then release).



Press the **MENU** switch to cycle through the available setup menu items.



Press the **INC** or **DEC** switches to modify the current menu item.



Press the **PRESET** switch to store the configured menu item. The display will show **---STORED---**.




Press the **MODE** switch to exit the setup menu. The display will show **--EXITMENU--** and then resume normal operation.

Direct menu level access




Enter a password while at idle to direct access a menu level.
 INC, DEC, DEC, INC, DEC, DEC, DEC, INC = menulevel 1
 INC, DEC, DEC, INC, DEC, DEC, INC, DEC = menulevel 2
 INC, DEC, DEC, INC, DEC, DEC, INC, INC = menulevel 3
 INC, DEC, DEC, INC, DEC, INC, DEC, DEC = menulevel 4

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	18 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

Menu items in menu levels 1, 2, 3, and 4


MENU ITEM	DESCRIPTION	DEFAULT	MENU LEVEL
UNITS	Configures units of measure	PSI / °F	1
PRESET RPM	Configures the throttle mode (RPM) preset (900 – 1400) <i>(Not available with message type ANLG)</i>	1000	1*
HI-IDLE	Configures the high idle RPM preset (900-1400) <i>(Not available with message type ANLG)</i>	1100	1*
PRESET PSI	Configures the pressure mode (PSI) preset (90 – 130)	100	1
BRIGHT	Configures the display's brightness level (1-15)	15	1
NIGHT	Configures the secondary brightness level when unit is in a dark environment (1-15)	3	1
DISPLAY TEST	Turns on all LEDs and display segments for visual inspection	N/A	1
ROUND PSI	Rounds pressure display (PSI units only) by fives	NO	1
ALERT TONE	Alert tones are indicated by a double chirp of the alarm output and do not indicate alarm conditions. Enable/disable the alert tones.	ENABLE	2
SENSITIVITY	Configures the pressure sensitivity window	+/- 6 PSI	2
-SENSOR CAL-	Calibrates the zero point of the intake/discharge pressure sensors	142 COUNTS	2
1ST MODE	Configures the first mode active when the MODE switch is pressed (interlocks permitting)	PRESSURE	2
COMM STATUS	Allows viewing of CAN messages per second and received errors	N/A	2
CONTROL	Configure control mode and message for engine	CFPG (Cummins)	3
AUTO MODE	Configures if governor automatically enters into psi mode upon pump engagement. <i>(Only available when 1st mode menu item is set to PSI)</i>	NO	3*
IDLE STEPS	Sets idle voltage for analog control signal <i>(Available only with message type ANLG)</i>	32	3*
IDLE RPM	Configure / adjust the idle rpm <i>(Not available with message type ANLG)</i>	700	3*
MAXIMUM RPM	Configure / adjust the maximum rpm commanded by governor <i>(Not available with message type ANLG or CFPG)</i>	2400	3*
SOURCE ID	Configure the CAN source ID for the TPG <i>(only available with message type PGN0 or SCAN)</i>	7	3*
PSI TIME-OUT	Configures the amount of seconds the TPG will wait after pressure has dropped below 30 PSI before dropping to IDLE mode	5	3
ALLOW PRESET	Configure enable/disable rpm preset if pump is under pressure	NO	3
WARNINGS	Configures source of the panel warning LED's (data bus or user defined)	Bus	3
WARN °F	Configure the yellow (warning) engine temp setpoint <i>(only available when WARNINGS is set to Usr)</i>	-	3*
CRIT °F	Configure the red (critical) engine temp setpoint <i>(only available when WARNINGS is set to Usr)</i>	-	3*

* Option dependent on other menu selections made

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	19 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

MENU ITEM	DESCRIPTION	DEFAULT	MENU LEVEL
WARN PSI	Configure the yellow (warning) oil pressure setpoint <i>(only available when WARNINGS is set to Ustr)</i>	-	3*
CRIT PSI	Configure the red (critical) oil pressure setpoint <i>(only available when WARNINGS is set to Ustr)</i>	-	3*
XDCR	Configures transducer type (300 or 600 psi)	300	3
FACTORY DFLT	Resets parameters to factory default settings		3
GOV GAIN	Configures the RPM change requested per INC or DEC switch press <i>(Only available with message type ANLG)</i>	15	4*
PRESS GAIN	Configures the pressure change requested per INC or DEC switch press	3 PSI	4
DITHER	Configure the engine handshake <i>(Only available with message type PGN0)</i>	NO	4*
LAG (ΔPSI)	Controls the response of the pressure increase when the INC button is held while in pressure mode. <i>(Not available with message type ANLG)</i>	5 PSI	4*
PUMP HOURS	Sets pump-engaged hours counter to a specified value	N/A	4
BCM1 VER	Configures the Scania BCM version <i>(Only available with message type SCAN)</i>	1	4*
SCANIA MODE	Configures the Scania engine control type: NORMAL or STIFF <i>(Only available with message type SCAN)</i>	NORMAL	4*

* Option dependent on other menu selections made

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	<h1>TECHNICAL DATA SHEET</h1>			PAGE	20 OF 30
				DATE	4/9/2009
PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	REV	1.00
PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			BY	AMS

5.2.1. UNITS (unit of measure configuration)

This menu item allows configuration of the display units of measure.

Use the INC and DEC keys to select the desired units of measure. The options include PSI/°F, kPa/°C, bar/°C.

Range = PSI / °F, kPa / °C, bar / °C *[default = PSI / °F]*

5.2.2. PRESET RPM (throttle preset configuration)

This menu item allows configuration of the throttle mode preset.

The display will show **PSETrpm XXXX**. Use the **INC** and **DEC** switches to adjust the RPM value desired for the throttle mode preset.

Range = 900 RPM to 1400 RPM (in 25 RPM steps). *[default = 1000 RPM]*

5.2.3. HI-IDLE (high idle configuration)

This menu item allows configuration of the high idle (fast idle) setpoint.

The display will show **Hi-Idle= XXX**. Use the **INC** and **DEC** switches to adjust the RPM value desired for the high idle setpoint.

Range = 900 RPM to 1400 RPM (in 25 RPM steps). *[default = 1100 RPM]*

5.2.4. PRESET PSI (pressure preset configuration)

This menu item allows configuration of the pressure mode preset.

The display will show **PSETpsi XXX**. Use the **INC** and **DEC** switches to adjust the PSI value desired for the pressure mode preset.

Range = 90 PSI to 130 PSI (in 5 PSI steps) *[default = 100 PSI]*

5.2.5. BRIGHT (display brightness)

This menu item allows configuration of the display's daytime brightness level.

The TPG+ senses ambient lighting conditions and switches between day/night brightness to compensate. The display will show **BRIGHT = XX**. Use the **INC** and **DEC** switches to adjust the value desired display brightness.

Range = 1 to 15 (1 is dimmest setting) *[default = 15]*

5.2.6. NIGHT (display brightness)

This menu item allows configuration the display's nighttime brightness level.

The display will show **NIGHT = XX**. Use the **INC** and **DEC** switches to adjust the value desired display brightness.

Range = 1 to 15 (1 is dimmest setting) *[default = 3]*

5.2.7. DISPLAY TEST

This menu item allows the user to test all displays and LEDs.


The display will show **DISPLAY TEST**. Press either **INC** or **DEC** to light all display segments and indicator LEDs.

5.2.8. ROUND PSI

This menu item allows displayed pressure (PSI only, kPa and Bar are not effected) to be rounded by fives.

The display will show **ROUND PSI: X**. Use the **INC** and **DEC** switches to enable (Yes) or disable (No).

Range = Y (Rounding Enabled) or N (Rounding Disabled). *[default = N]*

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	21 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

5.2.9. **ALERT TONE (configure alert tones)**

This menu item allows enabling/disabling of the alert tones. The alert tones are sounded through the external alarm output (pin 10 of the black 12-pin connector).

The display will show **ALERT TONE:X**. Use the **INC** and **DEC** switches to select **Y** (yes, enabled) or **N** (no, disabled).

Range = Y (Alert tones ON) or N (Alert tones OFF). [default = Y]

5.2.10. **SENSITIVITY (pressure sensitivity configuration)**

This menu item allows configuration of the pressure mode sensitivity window. This window dictates how much pressure difference must occur before the TPG adjusts the engine RPM to maintain the desired set pressure. The display will show **GOV ± XX PSI**. Use the **INC** and **DEC** switches to adjust the PSI value desired for the pressure mode sensitivity.

Range = ±4 PSI to ±12 PSI (in 1 PSI steps). [default = 6 PSI]

5.2.11. **SENSOR CAL (pressure sensor calibration)**

This menu item allows the zero point calibration of the intake and discharge pressure sensors.

The display will show **-SENSOR CAL-**. See section 6.3 for the calibration procedure.

5.2.12. **1st MODE (first active mode configuration)**

This menu item allows configuration of the governor mode active when the **MODE** switch is first pressed.

The display will show **1st MODE=XXX**. Use the **INC** and **DEC** switches to select the desired mode (PSI or RPM). Proper interlocks must be established for the configured 1st mode to become active during operation.

Range = RPM (throttle mode) or PSI (pressure mode). [default = PSI]

5.2.13. **COMM STATUS (view the CAN communication status)**

This menu item allows viewing of the number of CAN messages per second and received errors (255 maximum). Errors are only logged when throttle ready interlock is active.

The display will show **COMM STATUS**. Use the **INC** and **DEC** switches to toggle between message per second and received errors.

5.2.14. **CONTROL (engine control message type)**

This menu item allows configuration of the engine control type.

CFPG – **C**ummins **F**ire **P**ressure **G**overnor, uses Cummins proprietary control message via CAN to control engine speed.

PGN0 – Uses J1939, PGN0 – Torque Speed Control message to control engine speed.

SCAN – **SCAN**ia, uses the Scania Bodywork Control Message 1.

ANLG – Uses analog voltage signal to control remote throttle input on engine.


The display will show **CONTROL=XXXX**. Use the **INC** and **DEC** switches to adjust the control message type.

Range = CFPG, PGN0, SCAN, ANLG. [default = CFPG]

5.2.15. **AUTO MODE (pressure mode automatically entered on pump engagement)**

This menu item allows configuration of automatically entering pressure mode when pump engagement occurs (**AUTO MODE?:Y**). Note that this option will only be available if the 1st mode parameter (section 5.2.12) is set to pressure mode (PSI). When this parameter is enabled, the governor will be put in pressure mode when the pump is changed from a disengaged to an engaged position (interlocks permitting). Thereafter, when a user selects the IDLE (standby) mode, the governor will remain in standby mode until a new mode is selected.

Range = Y (Automode ON) or N (Automode OFF). [default = N]

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	22 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

5.2.16. IDLE STEPS

This menu item allows configuration of the analog idle offset voltage, displayed in “counts”. This option is only available with the Analog Control Type.

Note: This parameter is automatically set by the TPG+ when the Auto Scale routine is run (see section 6.5 for more information).

The display will show **IdleSteps:XX**. Use the **INC** and **DEC** switches to adjust to the desired value.

Range = 0 to 60 *[default = 32]*

5.2.17. IDLE RPM

This menu item allows configuration of the idle RPM for control via CAN.

The display will show **IDLE RPM**, and the set value will be displayed in the RPM window. Use the **INC** and **DEC** switches to adjust the RPM value desired for idle.

Note: Cannot be adjusted below curb idle speed. Option not available for Analog control (see IDLE STEPS).

Range = 650 RPM to 900 RPM (in 5 RPM steps). *[default = 700 RPM]*

5.2.18. MAXIMUM RPM

This menu item allows configuration of the maximum RPM that will be commanded when in PGN0 or SCANia mode. The display will show **MAXIMUM RPM**, and the set value will be displayed in the RPM window. Use the **INC** and **DEC** switches to adjust the maximum RPM value desired.

Note: This value cannot be adjusted above maximum governed speed.

Range = 1900 RPM to 2500 RPM (in 25 RPM steps). *[default = 2400 RPM]*

5.2.19. SourceID (CAN message source identification)

This menu item allows configuration of the CAN source message ID number.

The display will show **SourceID=X**. Use the **INC** and **DEC** switches to adjust the CAN source message ID.

Range = 0 – 255. *[default = 7]*

5.2.20. PSI TIME-OUT (pressure time out)

This menu item allows configuration of the low pressure time out. When the TPG is governing in pressure mode and the pressure falls below 30 PSI the TPG will wait the configured number of seconds to attempt to regain pressure before dropping to IDLE.

The display will show **PSI TIME-OUT**. Use the **INC** and **DEC** switches to adjust the value desired for the pressure time out.


Range = 3 seconds to 10 seconds (in 1 second steps). *[default = 5 seconds]*

5.2.21. ALLOW PRESET (allow RPM preset use when pressure is detected)

This menu item allows enabling/disabling of throttle mode preset usage when pump pressure over 10 PSI is detected.

The display will show **ALLOW PRESET**. Press the **INC** or **DEC** keys to change the display to **PRESET RPM=X**. Use the **INC** and **DEC** switches to select **Y** (yes, enabled) or **N** (no, disabled).

Range = Y (enabled) or N (disabled). *[default = N]*

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	23 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

5.2.22. WARNINGS (data monitor warning configuration)

This menu item allows configuration of the source for engine warnings. Warnings can be determined by engine diagnostic messages (DM1 messages) over the data bus (**Bus**), or at setpoints defined by the user based on J1939 oil pressure and engine temperature data (**Usr**).

The preferred and most accurate method is to use **Bus** warnings from the engine diagnostic system. Note that not all engines support this feature, contact Class1 customer support for more information.

Range = Bus (bus controlled) or Usr (user configured). [default = Bus]

When the **Usr** configuration is selected the following setpoints will be assigned next.

A. WARN°F (USER DEFINED ENGINE TEMPERATURE HIGH WARNING - YELLOW LED)

B. CRIT°F (USER DEFINED ENGINE TEMPERATURE HIGH CRITICAL - RED LED)

C. WARN PSI (USER DEFINED OIL PRESSURE LOW WARNING - YELLOW LED)

D. CRIT PSI (USER DEFINED OIL PRESSURE LOW CRITICAL - RED LED)

5.2.23. XDUCR (discharge pressure transducer range)

This menu item allows configuration of the intake/discharge pressure transducers installed as 300-PSI or 600PSI sensors.

The display will show **XDCR= XXXPSI**. Use the **INC** and **DEC** switches to select the transducer type.

Range = 300 PSI or 600 PSI. [default = 300 PSI]

5.2.24. FACTORY DFLT (Set factory defaults)

This menu item allows setting the TPG back to the factory defaults.

The display will show **FACTORY DFLT**. Press the **PRESET** switch to load the defaults.

5.2.25. GOV GAIN (RPM change per step)

This menu item allows configuration of the RPM change per step. A larger number changes the RPM more with each **INC** or **DEC** switch press.

Note: Option only available with the Analog control type. This parameter is automatically set by the TPG+ when the Auto Scale routine is run (see section 6.5 for more information).

The display will show **GOV GAIN :XX**. Use the **INC** and **DEC** switches to adjust the value.

Range = 0 to 35 [default = 15]

5.2.26. PRESS GAIN (PSI change per step)

This menu item allows configuration of the psi change per step. A larger number changes the PSI more with each **INC** or **DEC** switch press.

The display will show **PRESS GAIN**. Press the **INC** or **DEC** keys to change the display to **X PSI/STEP**. Use the **INC** and **DEC** switches to adjust the value.


Range = 1 to 5 [default = 3 PSI/STEP]

5.2.27. DITHER (Engine handshake)

This menu item allows enabling/disabling of engine handshake. Some engines require constant RPM modification in order to maintain remote RPM control. When enabled, the TPG will vary the engine speed +/- 5 RPM around the desired engine speed.

The display will show **DITHER=X**. Use the **INC** and **DEC** switches to select **Y** or **N**.

Range = Y (enabled) or N (disabled). [default = N]

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	24 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

5.2.28. LAG ΔPSI (Pressure lag)

This menu item allows configuration of the pressure lag which defines the maximum allowable difference that the actual pressure is behind the commanded set-point before a “wait” (catch-up) state is introduced while operating in pressure mode.

The display will show **LAG(ΔPSI)=X**. Use the **INC** and **DEC** switches to adjust the pressure lag value.

Range = 1 PSI to 20 PSI (in 1 PSI steps). [default = 5 PSI]

5.2.29. PUMP HOURS

This menu item allows the built-in pump-engaged hours counter to be reset to zero or to a desired value (i.e. replacing a unit).

Pump hours is only incremented when the pump engaged interlock is active.

The display will show **PUMP HOURS**. Use the **INC** and **DEC** switches to adjust the hours value.

Range = 0.0 hours to 9999.9 hours.

5.2.30. BCM1 VER (Body Control Message 1 version)

This menu item allows configuration of the message configuration version transmitted in the Scania Body Control Message 1.

The display will show **BCM1 VER: X**. Use the **INC** and **DEC** switches to adjust the value.


Range = 0 to 255. [default = 1]

5.2.31. SCANIA MODE? (Scania governor type)

This menu item allows configuration of the Scania requested governor type in the Body Control Message 1.

The display will show **MODE: XXXXXX**. Use the **INC** and **DEC** switches to adjust the value.

Range = NORMAL or STIFF. [default = NORMAL]







 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	25 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
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6. Configuration

6.1. Configure the unit of measure

The TPG+ can be configured for English (PSI, °F) or Metric (kPa or bar, °C) units of measure.








Follow the sequence below to set the unit of measure for the TPG+.


-  +  Display shows **MENU 04 SECS** and begins counting down. Continue holding IDLE and MENU until the display shows ***SETUP MENU*** (4 seconds).
-  **ONCE** The display shows the menu item: **UNITS: XXX°X.**
-  **ONCE** Press the INC switch to select the desired unit of measure: PSI/°F, kPa/°C, or bar/ °C.
-  **ONCE** Press the PRESET switch once. The display shows **---STORED---**. The unit of measure has been saved.
-  **ONCE** Press the IDLE switch once. The display shows **—EXITMENU—** and then restarts normal operation.

6.2. Select pressure transducer range: 300 PSI (default) or 600 PSI

Normally the default 300 PSI transducer is sufficient for most pump applications but if a higher pump pressure range is required the TPG+ can be programmed to use a 600 PSI transducer.

Follow the sequence below to select the desired pressure transducer range.








-  +  or  Enter menu level 3 by pressing and holding the IDLE switch while entering the following password.
INC, DEC, DEC, INC, DEC, DEC, INC, INC
-  Toggle the MENU/SILENCE switch until the display shows **XDCR= XXX.**
(XXX = 300 or 600)
-  Press the INC switch to select the desired pressure transducer range (300 or 600).
-  **ONCE** Press the PRESET switch once. The display shows **--- STORED---**. The pressure transducer range has been saved.
-  **ONCE** Press the IDLE switch once. The display shows **—EXITMENU—** and then restarts normal operation.

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	26 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

6.3. Zero calibrate the intake and discharge pressure transducers

The pressures indicated by the TPG+ may not show '0' when the pump intake or discharge pressures are actually zero due to ambient pressure and altitude at your locale.

Follow the sequence below to zero calibrate the intake and discharge pressure transducers.

-  +  Display shows **MENU 04 SECS** and begins counting down. Continue holding IDLE and MENU until the display shows ***SETUP MENU*** (4 seconds) and then **MENU LEVEL 2** (2 seconds).
-  Toggle the MENU/SILENCE switch until display shows the menu item: **-SENSOR CAL-**
-  **ONCE** Press the INC switch once. The display shows **INT:ZERO=XXX**.
-  + **HOLD** Press the INC switch and hold. The display shows **DIS:LIVE=XXX**. Verify the value is between 130 and 155. Release the INC switch. The display will show **DIS:ZERO=XXX**.
-  **ONCE** Press the PRESET switch once. The display shows **NEW ZERO=XXX**. Verify the value is between 130 and 155.
-  **ONCE** Press the IDLE switch once. The display shows **—EXITMENU—** and then restarts normal operation.

6.4. Configure the engine control method









The TPG+ has 4 engine control methods to cover several engine types and configuration.


CFPG – Cummins Fire Pressure Governor, uses Cummins proprietary control message to control engine speed.

PGN0 – Uses J1939, PGN0 – Torque Speed Control message to control engine speed.

SCAN – SCANia, uses the Scania bodywork control message 1.

ANLG – Uses analog voltage signal to control remote throttle input on engine.

-  +  or  Enter menu level 3 by pressing and holding the IDLE switch while entering the following password:
INC, DEC, DEC, INC, DEC, DEC, INC, INC
-  **ONCE** The display shows the menu item: **CONTROL=XXXX** (CFPG, PGN0, SCAN, or ANLG)
-  OR  Select the desired engine control method: CFPG, PGN0, SCAN, or ANLG
-  **ONCE** Press the PRESET switch once. The display shows **---STORED---**. The engine control method has been saved.
-  **ONCE** Press the IDLE switch once. The display shows **—EXITMENU—** and then restarts normal operation.

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	27 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

6.5. Configure the IDLE voltage and GAIN setting using Auto Scale

A TPG+ set to Analog control mode (see section 5.2.14) may use the Auto Scale configure method to automatically set the IDLE voltage (5.2.16) and GAIN setting (5.2.25).
 The engine must be running and the interlocks (as defined in section 4.3) must be enabled when running the Auto Scale mode.



The TPG+ will actively control the engine RPM during Auto Scale. Make certain that all operational precautions are observed and a trained operator is present.

Enter the Auto Scale mode by pressing and holding the IDLE switch while entering the following password.




INC, DEC, DEC, DEC, INC, DEC, DEC, DEC

The display shows: **MODE = START**



Press the MODE button to start the Auto Scale.
 The display shows: **IDLE SET = X.X** (where X.X is the current output voltage).
 The TPG+ begins ramping the output voltage until it detects a change in RPM.
 Once IDLE point is detected the display shows **FINDING GAIN**
 The TPG+ then configures the GAIN setting required and the display shows **GAIN = XX** (where XX is the GAIN setting).
 The Auto Scale mode completes by saving the IDLE and GAIN data and the display shows **STORING DATA**.

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	28 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

7. Mounting & installation

7.1. Panel cutout dimensions

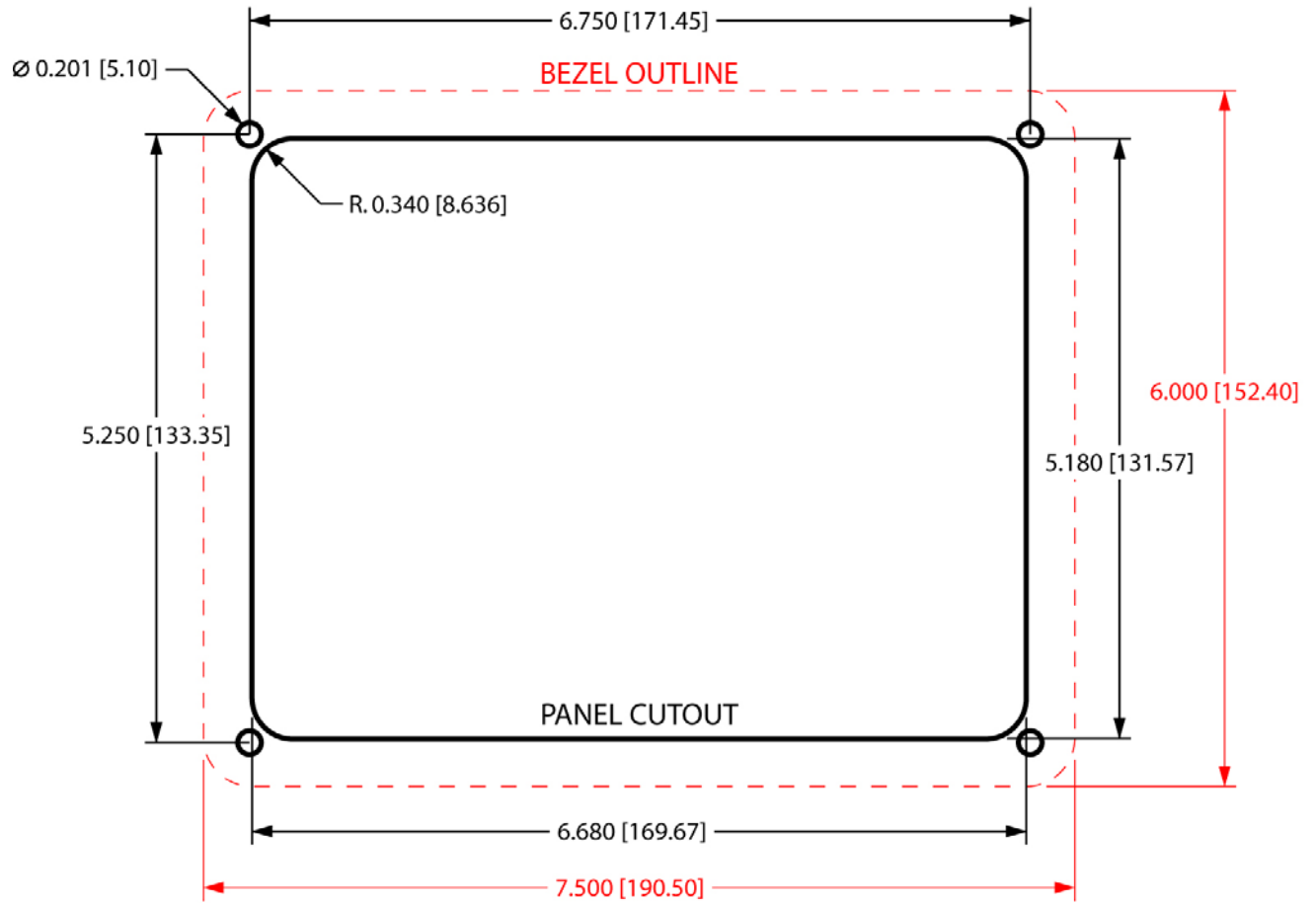



Figure 5. Installation dimensions in inches [millimeters].

 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	29 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

8. Connector Description

8.1. TPG+ connectors

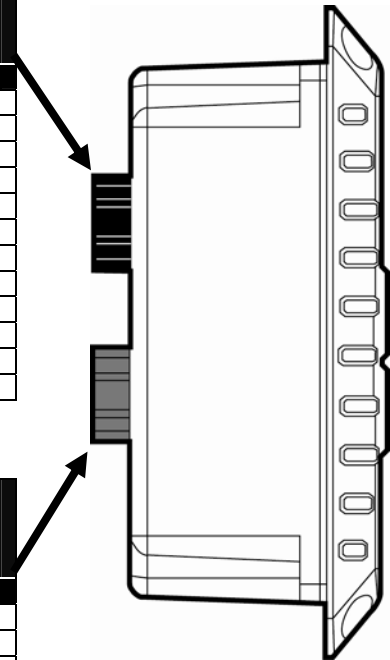
The module has two connectors and the following definitions apply:

Mating connector: Deutsch DT06-12SB BLACK		
Mating sockets: Deutsch 0462-201-16141		
Gold mating sockets: Deutsch 0462-201-1631		
Wedge lock: W12S Recommended wire gage: 16-20 AWG		
PIN	CIRCUIT	DESCRIPTION
1	SUPPLY (+)	(INPUT) – battery voltage (+9VDC...+32VDC)
2	CAN HIGH	(DATA) – SAE J1939 CAN 2.0B, 250Kbits/s *
3	CAN SHIELD	(DATA) – SAE J1939 CAN 2.0B, 250Kbits/s *
4	----	----
5	Sensor GND	(OUTPUT) – Intake pressure ground
6	Sensor REF	(OUTPUT) – Intake pressure supply (+5VDC)
7	Sensor SIGNAL	(INPUT) – Intake pressure signal (+0.5VDC to +4.5VDC)
8	----	----
9	----	----
10	ALARM (-)	(OUTPUT) – alarm active (ground polarity, 250mA)
11	CAN LOW	(DATA) – SAE J1939 CAN 2.0B, 250Kbits/s *
12	SUPPLY (-)	(INPUT) – battery ground

* Gold sockets recommended for CAN connections.

Mating connector: Deutsch DT06-12SA GRAY		
Mating sockets: Deutsch 0462-201-16141		
Wedge lock: W12S Recommended wire gage: 16-20 AWG		
PIN	CIRCUIT	DESCRIPTION
1	ENG REF (+)	(INPUT) – analog signal reference (+5VDC) *
2	THROT INTLK	(INPUT) – throttle ready interlock (positive polarity)
3	HI IDLE	(INPUT) – high idle enable (positive polarity)
4	----	----
5	Sensor GND	(OUTPUT) – Discharge pressure ground
6	Sensor REF	(OUTPUT) – Discharge pressure supply (+5VDC)
7	Sensor SIGNAL	(INPUT) – Discharge pressure signal (+0.5VDC to +4.5VDC)
8	ENG SIGNAL	(OUTPUT) – analog signal control (+0.5VDC to +4.5VDC) *
9	ENG REF (-)	(INPUT) – analog signal reference (ground) *
10	PUMP INTLK	(INPUT) – pump engaged interlock (positive polarity)
12	RELAY COM	(INPUT) – remote throttle reference (ground polarity) *
12	RELAY N.O.	(OUTPUT) – remote throttle activate (ground polarity) *

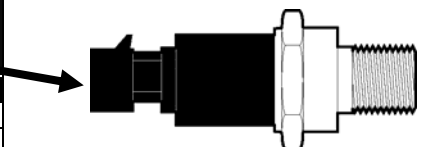
* These pins and wires are available with the analog signal harness (p/n 117683)




8.2. Pressure sensor connector

The pressure sensors (intake and discharge) have one connector and the following definitions apply:

Mating connector: Packard 12078090		
Mating sockets: Packard 12089290		
Recommended wire gage: 16-20 AWG		
PIN	CIRCUIT	DESCRIPTION
A	SUPPLY (-)	(INPUT) – pressure sensor ground
B	SUPPLY (+)	(INPUT) – pressure sensor supply (+5VDC)
C	Signal	(OUTPUT) – pressure sensor signal (+0.5VDC to +4.5VDC)



 607 NW 27th Ave Ocala, FL 34475 Ph: 352-629-5020 or 1-800-533-3569 Fax: 352-629-2902 or 1-800-520-3473	TECHNICAL DATA SHEET			PAGE	30 OF 30	
	PRODUCT GROUP	THROTTLE CONTROL	P/N	118710	DATE	4/9/2009
	PRODUCT	TOTAL PRESSURE GOVERNOR PLUS (TPG+)			REV	1.00
					BY	AMS

9. Technical Details

Product category	ES-Key network (SAE J1939 CAN)		
Voltage range	+9VDC...+32VDC		
Maximum current draw	Logic supply+ input (pin 1 of black 12-pin connector)		
@13.8VDC	400 mA		
@27.6VDC	215 mA		
Maximum output current	250mA (polythermal fuse protected to 300mA)		
Sensor (+5VDC) References	250mA (ground polarity output)		
Alarm active			
Temperature range	-40°C...+85°C		
Environmental range	IP 67		
CAN specification	SAE J1939, 250 Kbits/second		
LED	3 LEDs each (green/yellow/red) to indicate battery level, water temperature, and oil pressure status		
Electrical protection	Internal thermal fuse (2500mA on pin 1 of black 12-pin connector) CAN bus protected for heavy duty trucks (24V) Transient voltage protected to SAE J1113 specification for heavy duty trucks (24V) Load dump voltage protected to SAE J1113 specification for heavy duty trucks (24V)		
Electrical performance	Immunity to Radiated Electromagnetic Fields– Bulk Current Injection (BCI) method, Class C device	SAE J1113-4	
	Reverse voltage protection on power leads (pins 1 and 12 of black 12-pin connector), Class C device	ISO 16750-2	
	Jump start on power leads, Class C device	ISO 16750-2	
	Immunity to conducted transients on power leads, Class C device (24V)	SAE J1113-11	
	Immunity to Electrostatic Discharge – powered and unpowered modes	SAE J1113-13	
	Immunity to radiated electromagnetic fields	SAE J1113-21	
	Conducted emission on power leads (level 3 limits)	SAE J1113-41	
	Radiated emissions, absorber-lined shielded enclosure (level 2 limits)	SAE J1113-41	
	Reset behavior on voltage drop 24V, Class C device	ISO 16750-2	
	Exposure to fungus	MIL-STD-810F (method 508.5) SAE J1455 (sec 4.6)	
Thermal shock	SAE J1455 (sec 4.1.3.2)		
Exposure to humidity	MIL-STD-810F (method 507.4)		
Environmental performance	Thermal shock due to splash	Class 1 (STD-0001)	
	Steam cleaning	SAE J1455 (sec 4.4)	
	Exposure to salt spray atmosphere/fog	SAE J1455 (sec 4.3)	
	Exposure to splash due to chemicals and oils	SAE J1455 (sec 4.4)	
	Exposure to outdoor UV	ISO 4892-2 (method A)	
	Mechanical performance	Resonance dwell	SAE J1455 (sec 4.9.4.1)
Random vibration		SAE J1455 (sec 4.9.4.2)	
Mechanical shock		SAE J1455 (sec 4.10.3.4)	
Dimensions (W x H x D) in inches [millimeters]	7.500 [190.50] x 6.000 [152.40] x 2.312 [58.74]		
Weight in ounces [grams]	33.8 [958.2]		