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# Instrument Cluster Service Guide



| | WCC Ref. | Revision |
|---|---|---|
| **MY08 WCC Gas Cluster**<br><br>**Instrument Cluster Service Guide** | W0010338, W0010339, W0010929<br>W0011282, W0011283 | **A** |
| *© 2008 Any reproduction of this document whether total or partial without the written consent of ACTIA is forbidden.* | Page 1 | Format<br>US Letter |

| | | | |
|---|---|---|---|
| 0 | S Myers | 11.13.06 | Original Draft-based on MY07 Whirlaway function (107456) and WCC spec rev d0072. |
| 1 | S Myers | 11.20.06 | Changed source address for ABS system to 0B hex per customer table |
| | | | Added clarification to Check ABS message in PIM table. |
| | | | |
| | | | Changed cruise control lamp SPN from 595 to 596 per customer table. |
| | | | Added running light command info to 1939 message table |
| | | | Change left and right turn signal indicator data source to binary per customer spec. |
| | | | Added total vehicle distance message info to 1939 table per customer table. |
| | | | Changed all SA 11 to SA 33 or 0B depending on whether it came from the BCM or ABS system. |
| 2 | S Myers | 11.22.06 | Corrected Pinout in back to reflect PIN 20 designation for Right turn input |
| | | | Corrected cruise message name in 1939 table for clarification |
| | | | Added “click” to turn signals in indicator table. |
| 3 | S Myers | 11.24.06 | Corrected Oil Pressure message definition in 1939 table. |
| 4 | S Myers | 11.29.06 | Corrected CM1 message hexadecimal definition in 1939 table to match Whirlaway due to DA problem. |
| | | | Corrected all references of BCM addressing to reflect hexadecimal value of 21. |
| | | | Removed configuration byte definition table as the gas cluster is no longer configured for anything accept metric or English which is handled with a command, not cofig bit setting. (need to take this up with manf.) |
| | | | Removed fuel tank configuration reference because the cluster does not need to be configured for different fuel tanks as it simply receives level as a function of the databus. |
| | | | Modified Startup mode section to match previous WCC functionality as well as the customer spec. |
| | | | Modified Comm Detection section to remove gauge wag detail to match previous WCC functionality as well as the customer spec. |
| | | | Added 7/8 tick value to Engine Coolant Gauge per customer spec. |
| | | | Added PIN 9 as trigger for Battery Charge indicator |
| 5 | S Myers | 11.30.06 | Removed Alarm only messages and integrated them into the PIM section per customer retest to have all alarms associated with a lamp, display message or gauge reading. |
| | | | Removed data bus trigger for HIGH IDEL per customer request. |
| | | | Changed Low Coolant Level DM1 trigger to FMI 17 |
| | | | Changed Shift inhibit SPN from 1851 to 2900 |
| 6 | S Myers | 12.7.06 | Updated Section 3 to state that the cluster is configurable for tank size due to the need for some logic calculations that depend on fuel tank capacity (i.e. fuel range) |
| 7 | S Myers | 12.7.06 | Changed trigger for Check Transmission Temp PIM in section 11.4. Per customer request. |
| | | | Changed trigger for Turn Signal Reminder in section 11.4. Per customer request. |
| | | | Changed Data source for Seatbelt lamp in section 6.1 and updated 6.2.6 accordingly. Per customer request |
| | | | Added Stop Engine lamp function in section 6.1 and updated 6.2.7 accordingly. Also added supporting message to 1939 table. Per customer request. |
| | | | Changed Data source for Park brake lamp in section 6.1 by removing data |

| | | | |
|---|---|---|---|
| | | | message. Per customer request. |
| | | | Change data source for Daytime running light lamp in section 6.1 and updated section 6.2.20 and pinout accordingly. Per customer request. |
| 8 | S Myers | 12.11.06 | Added Auto Park reset menu option to Diagnostic Menu in section 12. |
| 9 | S Myers | 12.11.06 | Modified seatbelt logic verbage in section 6.2.6 |
| 10 | S Myers | 12.13.06 | Modified section 11.2.3 to add 4, 5 & 6th gears to the Data range as we have always supported this but accidentally removed. |
| | | | Removed Volt Meter reading from upper right corner of the last display example in section 11.2.8 because we no longer support this (Ron S.) |
| | | | Referenced CCM vs BCM for proprietary Megatech messages in section 11.4 per customer request. (BCM spec. not available) |
| | | | Corrected Battery Charge indicator binary input detail in warning lamp table and in section 6.2.3 |
| 11 | S Myers | 12.14.06 | Corrected speedo scale from 300 degrees to 200. |
| 12 | S Myers | 12.18.06 | Corrected conflicting input info for auto park in section 11.4 to say AH instead of AL. |
| 13 | S Myers | 12.20.06 | Modified section 11.2.3 to give better description concerning what gear info is displayed. The table was also updated to clarify Max gear limit. |
| | | | Added differentiation between instantaneous fuel units displayed when moving and when sitting still. This was in section 11.2 |
| 14 | S Myers | 1.2.07 | Removed Stop Engine warning lamp support as it is not sued on the Gas product…only Diesel. |
| 15 | S Myers | 1.23.07 | Adding REDUCED ENGINE POWER message for PIM. Updated 1939 table and PIM table accordingly. |
| 16 | S Myers | 1.30.07 | Added CHANGE ENGINE OIL NOW/SOON to PIM and same DM1 to 1939 table. |
| | | | Modified HIGH COOLANT TEMP data source for PIM and added same DM1 to 1939 table. |
| | | | Corrected Check Trans Temp lamp and PIM data source. This is reflected in lamp table, section 6.2.14 and 1939 table. |
| | | | Corrected SPN for ABS lamp data source. Updated this in lamp table as well as 1939 message table. This will effect Check ABS PIM as well. |
| | | | Added DM1 for ABS lamp and PIM trigger. Updated in lamp table, PIM table and 1939 message table. |
| | | | Clarified Service Engine Soon Data sources in lamp table, section 6.2.9 and 1939 table. |
| | | | Replaced binary input for HIGH IDLE with DM1 message. This is reflected in lamp table, section 6.2.10, and added in 1939 table as well as the pinout table. |
| | | | Corrected check tire lamp data source. This is reflected in lamp table and section 6.2.23. |
| | | | Replaced BCM COM FAIL message in PIM table with SPEED SIG FAIL per customer request. |
| | | | Removed all Door Ajar references as this is not supported in this product. This is reflected in Key in ignition features and pintout |
| | | | Removed all reference to AUTO PARK APPLY feature. This is reflected in lamp table, section 6, PIM table, pinout table and also the diagnostic menu. |
| 17 | S Myers | 1.31.07 | Added section 4.5.2 to add a function that keeps the cluster awake if hazard light are on. This Is not a wakup but keeps it from going to sleep. Must NOT work only on right or left but both turn signals (hazards). |
| 18 | S Myers | 2.5.07 | Added Check Tire DM1 message info to 1939 table. |
| | | | Changed sleep delay in section 4.5 from 3 sec. to 120 sec. per customer request. |

| | | | |
|---|---|---|---|
| | | | Modified sections 4.5.1 and 4.5.1 to change the way the cluster handles the Hazard feature. |
| 19 | S. Myers | 2.6.07 | Changed SA for Tire Pressure from 21 hex to 33 hex per customer request. |
| 20 | S. Myers | 2.11.07 | Added D408 LED designation for check tire in lamp table |
| 21 | S Myers | 4.17.07 | Removed Vehicle Settings option from Diag menu in section 12 per customer request. |
| 22 | S Myers | 4.19.07 | Added to section 11.2.1 outside temp data range and stated to remove if outside that range |
| 23 | S Myers | 5.3.07 | Updated Check Trans Temp PIM with correct DM1 info. To match 1939 table. |
| 24 | S Myers | 5.8.07 | Added ODO display to Hazard feature in section 4.5.2 |
| | | | Added Engine Oil Life 1939 message info in section 12.8 and 1939 table. |
| 25 | S Myers | 5.17.07 | Added Fuel Rate message to section 11.2.1 so that Instantaneous fuel can be supported if vehicle is not moving. |
| 26 | S Myers | 5.24.07 | Corrected message values for Hydraulic Fluid Pressure Message in section 6.2.12 |
| 27 | S Myers | 6.5.07 | Section 11.2.1.1—Corrected temp value in resistance table to 0C equal to 32F instead of -32F |
| 28 | S Myers | 7.13.07 | Added alarm to lamp table for Battery Charge Lamp. |
| | | | Removed seat belt alarm |
| 29 | S Myers | 7.16.07 | Modified park brake/HPB/ABS lamp activity table in section 6.2.12 per Louis Smith to add discrete wire for Low Brake Fluid. |
| | | | Removed Grade Brake per Louis Smith. |
| 30 | S Myers | 7.19.07 | Added PIN 23 as BIN AL input for ABS lamp which effected lamp table, section 6.2.16 and the Check ABS PIM per Louis Smith |
| | | | Removed Low Brake Fluid feature for PIN 23 from section 6.2.12 as it is used for ABS per Louis Smith |
| | | | Referenced Park Brake PIM to section 6.2.12 instead of lamp for better detail. |
| | | | Added ABS lamp to turn on for Hydraulic brake fluid warning PIN 25 in section 6.2.12 per Louis Smith |
| | | | Changed Hydraulic Brake fluid warning PIM to LOW BRAKE FLUID in section 6.2.12 per Louis Smith. |
| 31 | S Myers | 7.24.07 | Corrected High Beam from AL to AH in lamp table. |
| | | | Corrected Park Brake behavior scenario in section 6.2.12 for Park Brake Applied while not in Park Gear to show less than 3mph instead of greater than 3mph. |
| | | | Modified Park Brake behavior scenario in section 6.2.12 for HBS hydraulic Brake Failure Warning Circuit 1 Binary to differentiate it as Low Fluid Level. |
| | | | Corrected Change engine Oil Soon descrip in PIM table to make it different from Change Oil Now. |
| | | | Section 4.5.2—removed active ODO display from hazard function. |
| 32 | S Myers | 7.27.07 | Removed Fuel Range from CTC Per Louis Smith |
| | | | Added missing brake message 61441 to ABS lamp as trigger Per Louis Smith |
| 33 | S Myers | 8.1.05 | Added PIN 25 trigger to ABS lamp table for clarification. This was already listed in the HBS table in section 6.2.12 |
| | | | Added reference to Battery Charge Fail PIM in PIM table. |
| 34 | S Myers | 8.7.07 | Corrected High Idle trigger from DM1 to CCVS per customer |
| A | S Myers | 8.7.07 | Released to production with software 1.9548v02_00. |

# Table of Content

## 1. PURPOSE

This document is the functional design specifications for the model year 2008 instrument Cluster for Workhorse. This specification will be used to communicate the application software functional requirements for the GAS cluster. In this Specification all numeric values are considered to be a decimal number value unless specified. (Subscript $_h$ indicates a Hexadecimal value)

## 2. SCOPE

This document will only describe software/hardware functionality of the instrument system assuming it is installed in a model year 2008 GAS chassis variations of the WCC chassis line with an interface that supplies the proper inputs and communications for the operations detailed (assumed chassis modules interfacing to this system listed below). All other details for this IP can be found in the documents referenced by this specification.

| Engines | Transmissions | ABS Systems | Traction Control System | Multiplex System |
|---|---|---|---|---|
| ECM ($SA=00_h$) | Allison EVS 2500, EVS 3000, EVS 4000 ($SA=03_h$) | WABCO Hydraulic and Air Systems ($SA=0B_h$) | ATC ($SA=11_h$) | Megatech BCM ($SA=21_h$) |

## 3. CONFIGURATION

This product will be available in several programmable configurations all of which are listed below. Feature availability and some logic will be dependant on configuration of the cluster. All features will be detailed in this document but not all will be available in each configuration. Configuration is set by the manf. and stored in the EEPROM.

PRND123
This configuration selection will place a PRND123 gear selection on the display.

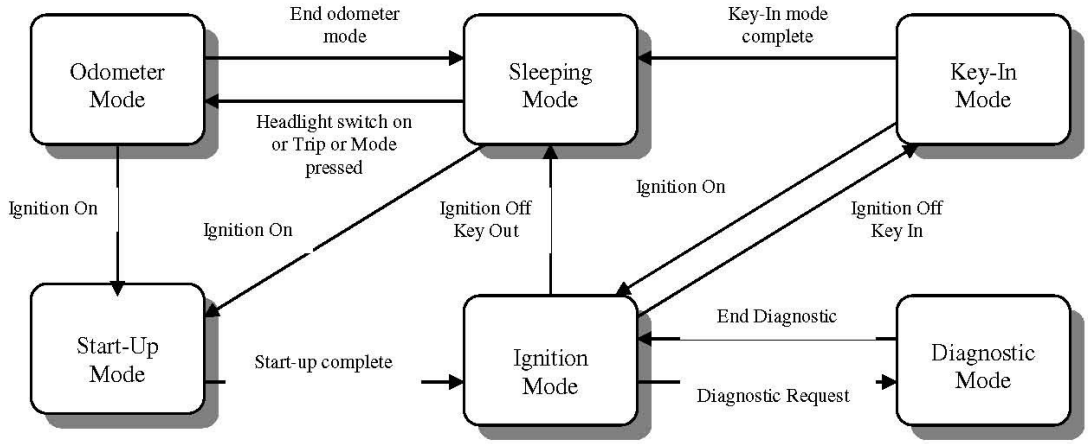
CTC
This selection is Trip Computer setting.

CTP
This selection is Power Train setting.

METRIC
The metric configuration will change standard English values to metric ones. (i.e. MPH to KMH)

Fuel Tank Capacity
The cluster uses the fuel tank capacity to calculate certain display values and needs to be configured for the tank size that will be used with it.

## 4. MODES OF OPERATION




### 4.1. Sleep Mode

If battery power is applied to the system with no other activity, it will be in sleep mode. When the system is in Sleep Mode the microprocessor is stopped.

The system exits Sleep Mode when one of the wake-up inputs becomes active. When the micro wakes up, it first begins to control the power supply by activating the power supply maintain output. It then decides, depending on which wake up input is active, what mode must be entered.

When the system goes back to sleep after the deactivation of the wakeup input, it simply deactivates the power supply maintain output.

### 4.2. Odometer Mode

The system can enter odometer mode when battery power is available, the ignition input is not active. When in odometer mode the system will backlight the display and show the last saved distance.

The inputs that can cause the system to enter this mode are pushing either the mode or trip button or by activating the headlight input with the conditions above.

The system exits this mode immediately when the ignition becomes active or after the headlight input signal is deactivated. If trip or mode was used to enter this mode the system will remain in this mode for 15 sec. The system goes back to sleep mode upon exiting this mode.

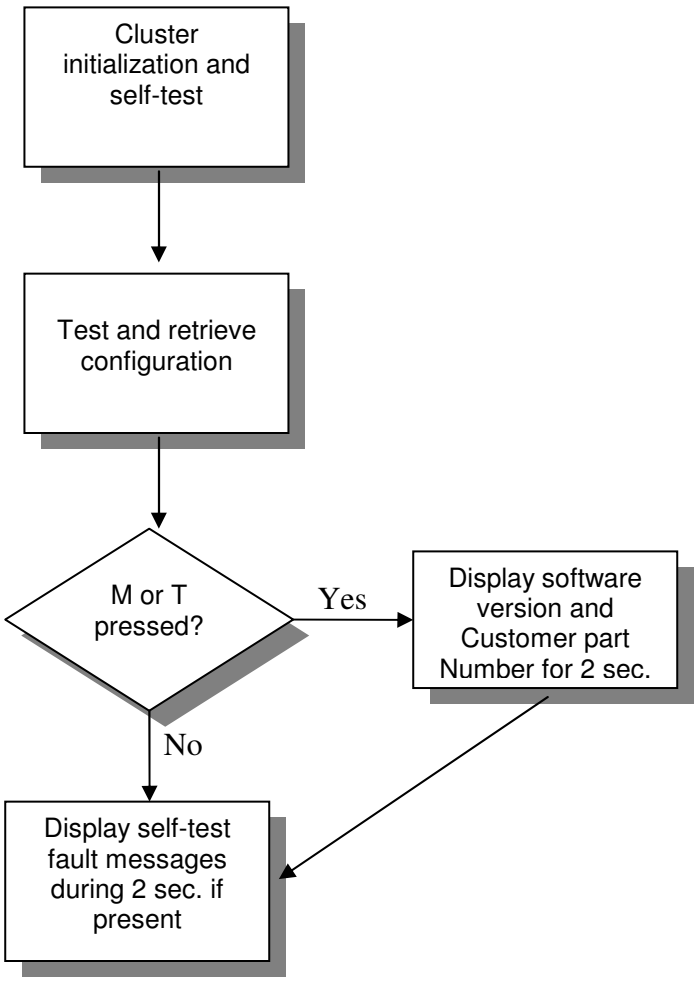
### 4.3. Key-in-Ignition Mode

If a key in ignition input is active at any point during a 60 sec. period starting at ignition off the system will sound alarm 1 (see audible alarm section). The chime will continue to sound until key is removed from the ignition and input is deactivated or the 60-second period has elapsed.

The odometer is visible in this mode also until either the key is removed from the ignition or the 60-second period has elapsed.

The system goes back to sleep mode upon exiting this mode.

### 4.4. Start-up Mode




The ignition binary input is used to sense if the key switch is on or off. The system enters start-up mode when the ignition input is active. The system will then go through the functional diagnostic tests described below.

#### 4.4.1. START-UP FUNCTIONAL DIAGNOSTIC

The start up functional diagnostic activity described in this section will have a duration no longer than 3 sec.

##### 4.4.1.1. Gauges

Gauge pointers will drive to zero position and then to the commanded position.

##### 4.4.1.2. LCD

LCD will turn all its segments on for one second, off for one second and then display any default information or active messages.

##### 4.4.1.3. Warning Lights

All warning lights will turn on for 2 seconds and then go out. Active warning lights will turn on when the gauges go to their commanded position.

#### 4.4.2. SYSTEM INITIALIZATION

If the self-test option is disabled the system will initialize in which case the gauges should index themselves and then default to actual values received by data buss messages/senders at startup. All warning lights will perform a lamp check by turning on and then go out. After lamp check, active warning lights will turn back on. Initialization duration no more than 3 sec.

#### 4.4.3. SYSTEM CONFIGURATION

Once self test/initialization is complete the cluster will retrieve the configuration information. If the cluster detects that the mode or trip button is pressed during this time the display will show the software version and part number of the system for 2 sec.

#### 4.4.4. COMM DETECTION

Next the system will determine which devices are present. Error messages will display if a device that should be present is missing. If the data bus should fail, a communications error should be displayed on the LCD.

### 4.5. Ignition Mode

The ignition mode is active as long as the ignition input is active. Ignition mode is the normal operational mode of the system and will be the mode referred to throughout this document unless otherwise stated.

#### 4.5.1. NORMAL SHUTDOWN

If the ignition line goes below 9VDC, or when the ignition switch is turned off, the following current settings of the cluster must be stored in non-volatile memory:

- Last odometer value transmitted by the CCM.
- Last Trip 1 and Trip 2 Values calculated in Cluster
- The user selection of US, or Metric units on the message display.
- The last message selection being displayed on the second line of the message display.
- The LCD contrast setting.

After storing these settings, the cluster goes to sleep mode after a delay of 120 seconds. During this delay all active warnings and backlight will be off.

#### 4.5.2. HAZARD FUNCTION

If the hazard lights (right and left turn inputs) are active during the 120 sec. sleep delay the cluster will allow these lamps to be active and the cluster will continue to delay sleep mode until the loss of these active inputs for more than 3 sec

Hazard function will NOT act as a wakeup so once cluster is in sleep mode it will require a normal wakeup input before hazards can be turned on.

## 4.6. Diagnostic Mode

The self-diagnostic mode is entered when a start diagnostic mode command is made. The start diagnostic request is sent either by a diagnostic tool through CAN or through a menu selection using the LCD to navigate. Diagnostics is only available when the Park Brake is set, and accessed by pressing and holding the MODE button for 5 seconds.

Detail specifications are found in the Diagnostic section of this document.

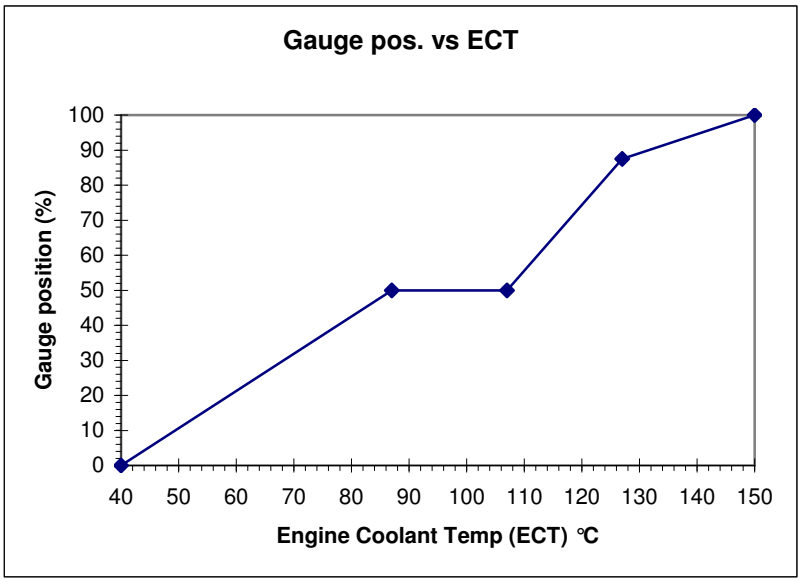
## 5. STANDARD GAUGES

These gauges will always be present in the system.

### 5.1. Engine Coolant Temperature

Engine coolant temperature is read from the BCM. Pointer remains in last active position w/ignition off, or when communication is lost.

| Data Source | Range | Movement | Scale |
|---|---|---|---|
| PGN65262_SPN110 | 140° | CW | Piecewise Linear<br>0° = 40°C (C)<br>70° = 88 to 107°C (center tick)<br>122.5°=127 °C (7/8 tick)<br>140° = 150°C (H) |




### 5.2. Fuel Level

Fuel level is read from BCM. Depending on how the system is configured the scale will have different values (see Fuel tank capacity configuration above). Pointer remains in last active position w/ignition off or when communication is lost

| Data Source | Range | Movement | 100, 75 and 60gal Scale | 40gal Scale | 30gal Scale |
|---|---|---|---|---|---|
| PGN65276_SPN96 | 140° | CW | Piecewise Linear<br>3° below E= 0% tank (no tick)<br>0° = 10% (E)<br>35° = 25% (1/4)<br>70° = 46% (1/2)<br>105° = 69% (3/4)<br>140° = 93% (F)<br>5° above F = 100% (no tick) | Piecewise Linear<br>3° below E= 0% tank (no tick)<br>0° = 11% (E)<br>35° = 25% (1/4)<br>70° = 46% (1/2)<br>105° = 69% (3/4)<br>140° = 93% (F)<br>5° above F = 100% (no tick) | Piecewise Linear<br>3° below E= 0% tank (no tick)<br>0° = 12% (E)<br>35° = 25% (1/4)<br>70° = 46% (1/2)<br>105° = 69% (3/4)<br>140° = 93% (F)<br>5° above F = 100% (no tick) |

### 5.3. Speedometer

The Speedometer will display the vehicle speed and is read from the BCM. Pointer returns to zero w/ignition off, or when communication is lost.

| Data Source | Range | Movement | Scale |
|---|---|---|---|
| PGN65265_SPN84 | 200° | CW | Linear<br>0° = 0 MPH /0 KMH<br>200° = 100 MPH /160 KMH |

### 5.4. Tachometer

The Tachometer will display the engine speed and is read from the BCM. Pointer returns to zero w/ignition off, or when communication is lost.

| Data Source | Range | Movement | Scale |
|---|---|---|---|
| PGN61444_SPN190 | 166° | CW | Linear<br>0° = 0 RPM<br>166° = 6000 RPM |

## 6. WARNING INDICATORS

### 6.1. Lamp General Detail

The lamps detailed below are either indicator lights activated to show the engagement of some chassis function or warning lights to show a fault in some chassis functions.

Some warning lights have an alarm associated with them. This alarm will be one of several preset speaker profiles. See alarm section for profile details.

Some warnings have an associated LCD Warning message that will be displayed along with the warning light. See the message display section for specifics on those messages.

All warnings with associated alarms/display messages can be “acknowledged”. If the user acknowledges the warning by pressing the ***Trip button***, the display will go back to the previous screen and the alarm will stop, but the indicator lamp will remain active. The alarm/display message will be displayed again after “Recurrence” time if the condition is still present (the user can acknowledge it again). If no reoccurrence time is listed, the warning will not reoccur until then next ignition cycle.

| Pos | Function | Color | Graphic | Data Source | Trigger Logic | Alarm/Duration |
|---|---|---|---|---|---|---|
| D405 | Left Turn | GREEN | J1362 #0084 | PIN 19, BIN AH | | 3/ once for every cycle of input |
| D406 | Right Turn | GREEN | J1362 #0084 | PIN 20, BIN AH | | 3/ once for every cycle of input |
| D401 | Battery Charge | RED | SYMBOL | PIN 9, AL BIN | Active input | 1/3sec |
| | | | | DM1_SPN167 | FMI = 1 | |
| | | | | DM1_SPN521116 | FMI= ANY | |
| D402 | Low Oil Pressure | RED | SYMBOL | DM1_SPN100 | FMI = 0 | 1/until acknowledged |
| D407 | High Beam | BLUE | J1362 #0082 | PIN 21, AH BIN | | NONE |
| D416 | Seat Belt | RED | J2402 #6..18 | PIN 26, AL BIN | See Lamp function | None |
| D412 | Stop Engine | RED | SYMBOL | NOT USED | | |
| D404 | Cruise | GREEN | SYMBOL | PGN65265_SPN595 | | NONE |
| D417 | Service Engine | YELLOW | SYMBOL | PIN 27, AL BIN<br>DM1_SPN520992<br>DM1_SPN521144<br>DM1_SPN521232<br>DM1_SPN521134<br>DM1_SPN521277 | FMI_ANY | NONE |
| D419 | High Idle | YELLOW | TEXT | PGN65265_SPN976 | value=1-17 | NONE |
| D420 | Range Inhibit | RED | SYMBOL | PGN65098_SPN2900 | | NONE |
| D410 | Auto Park | RED | TEXT | NOT USED | | NONE |
| D415 | Park Brake | RED | J2402 #6.32 | See Lamp Function | See Lamp Function | See Lamp Function |
| D403 | Check Trans | YELLOW | SYMBOL | DM1_SPN2003 | FMI_31 | 1/3sec |
| | WAIT TO START | YELLOW | TEXT | NOT USED | | |
| | WATER IN FUEL | YELLOW | TEXT | NOT USED | | |
| D414 | ABS | YELLOW | J2402 #6.47 | PIN 23 BIN AL | Active Binary | 1/3sec |
| | | | | PIN 25 BIN AL | | |
| | | | | PGN61441_SPN563 | ON=01 | |
| | | | | DM1_SPN563 | FMI_ANY | |
| | | | | PGN61441_SA 0B | Missing messages from PGN61441_SA 0B >1s | |
| | DPF | YELLOW | SYMBOL | NOT USED | | |
| | HEST | YELLOW | SYMBOL | NOT USED | | |
| D418 | Daytime Running | GREEN | SYMBOL | PIN 33, AL BIN | | NONE |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Lights | | | | | |
| D413 | Overdrive Off | YELLOW | TEXT | PIN 16, AL BIN | 4th Gear selected w/AL BIN | NONE |
| D411 | Grade Brake | GREEN | SYMBOL | Not used | Not used | Not used |
| D408 | Check Tire | YELLOW | SYMBOL | DM1_SPN929<br>DM1_SPN241 | FMI_12,31<br>FM1_1, 16, 18 | NONE |

## 6.2. Lamp Function

### 6.2.1. LEFT TURN

Lamp flashes in sequence with the binary input supplied by the chassis.

### 6.2.2. RIGHT TURN

Lamp flashes in sequence with the binary input supplied by the chassis.

### 6.2.3. BATTERY CHARGE

Lamp turns on steady with presence correct SPN and FMI combination in the DM1 message, or with binary input active. Turns off immediately when not present or deactivated input.

### 6.2.4. LOW OIL PRESSURE

Lamp turns on steady with presence correct SPN and FMI combination in the DM1 message. Lamp will flash if no information is receive in PGN65263. Turns off immediately when not present.

### 6.2.5. HIGH BEAM

Lamp turns on steady with binary input active. Turns off immediately when input is deactivated.

### 6.2.6. SEAT BELT

This light shows that the seat belt is unbuckled and is considered unbuckled when this binary is Low. When the seatbelt is buckled the circuit is broken and the input is left open allowing the gauge to pull it high.

During 60 second period after startup completion, the lamp turns on steady with binary input active for the first 20 sec. and flashes for remaining 40 seconds of the 60 second period after startup completion if the binary input is still active. Turns off immediately when input is not active.

### 6.2.7. STOP ENGINE

Not available on this product.

### 6.2.8. CRUISE

Lamp turns on steady when data bus message value on. Turns off immediately when message value is off.

### 6.2.9. SERVICE ENGINE

Lamp turns on steady with binary input active or correct DM1 message is present with any FMI. Turns off immediately when input is deactivated or DM1 messages are missing.

### 6.2.10. HIGH IDLE

Lamp turns on steady with a message value of 1-17. Turns off immediately when value is 0.

### 6.2.11. RANGE INHIBIT

Lamp turns on steady when data bus message value on. Turns off immediately when message value is off.

### 6.2.12. PARK BRAKE INDICATOR/HPB BEHAVIOR

The park brake lamp will light up, flash and be accompanied by PIM's or alarms depending on inputs or messages from the chassis and brake system. Brake system warnings take precedence over applied park brake indications or warnings.

| Function | Data Source | Trigger | Cluster Behavior |
|---|---|---|---|
| Park Brake Applied | PIN 24 , AL BIN | Active Input<br>Vehicle speed < 3mph<br>Park Gear requested | -Park Brake Indicator Lamp on Steady |
| Park Brake Applied while moving | PIN 24 , AL BIN | Active Input<br>Vehicle speed ≥ 3mph<br>Any gear but Park | -Park Brake Indicator Lamp flashing<br>-3 sec Alarm 2 (not acknowledgeable)<br>-LCD PIM: PARK BRAKE ON |
| Park Brake Applied out of Park Gear | PIN 24 , AL BIN | Active Input<br>Vehicle speed < 3mph<br>Any gear but Park | -Park Brake Indicator Lamp Steady<br>-3 sec Alarm 2 (not acknowledgeable)<br>-LCD PIM: PARK BRAKE ON |
| HBS hydraulic Brake Low Brake Fluid | PIN 25, AL BIN | IGN for >10sec<br>Active Input AND<br>RPM > 500 | -Park Brake Indicator Lamp on Steady<br>-ABS Lamp on Steady<br>-Alarm1 until acknowledged<br>-LCD PIM: LOW BRAKE FLUID |
| HBS hydraulic Brake Failure Circuit 1 | PGN64998_SPN2582 | Value = 00 | -Park Brake Indicator Lamp on Steady<br>-ABS Lamp on Steady<br>-Alarm1 until acknowledged<br>-LCD PIM: HYD BRAKE PRESS WARN |
| HBS hydraulic Brake Failure Circuit 2 | PGN64998_SPN2583 | Value = 00 | -Park Brake Indicator Lamp on Steady<br>-ABS Lamp on Steady<br>-Alarm1 until acknowledged<br>-LCD PIM: HYD BRAKE PRESS WARN |
| HBS hydraulic Brake Failure Warning Circuit 1 | PGN64998_SPN2584 | Value = 01 | -Park Brake Indicator Lamp on Steady<br>-ABS Lamp on Steady<br>-Alarm1 until acknowledged<br>-LCD PIM: HYD BRAKE PRESS WARN |
| HBS hydraulic Brake Failure Warning Circuit 2 | PGN64998_SPN2585 | Value = 01 | -Park Brake Indicator Lamp on Steady<br>-ABS Lamp on Steady<br>-Alarm1 until acknowledged<br>-LCD PIM: HYD BRAKE PRESS WARN |

*Active Low binary considered active if <2v and not active if > 4v

** The HBS hydraulic brake system failure warning takes precedence over other park brake warnings and indications.

### 6.2.13. CHECK TRANS

Lamp turns on steady with correct DM1 message present with correct FMI. Turns off immediately when DM1 message is missing or FMI is not correct.

6.2.14. WAIT TO START

Not available on this product.

6.2.15. WATER IN FUEL

Not available on this product.

6.2.16. ABS

Lamp turns on steady when data bus message value is 01 or input is active. Turns off immediately when message value is not equal to 01 or input is not active.

6.2.17. DPF-DIESEL PARTICULATE FILTER FAULT

Not used on this product.

6.2.18. HEST-HIGH EXHAUST SYSTEM TEMP

Not used on this product.

6.2.19. DAYTIME RUNNING LIGHTS

Lamp turns on steady with binary input active. Turns off immediately when input is deactivated.

6.2.20. OVERDRIVE OFF

Lamp turns on steady with binary input active and 4$^{th}$ gear is selected. Turns off immediately when input is deactivated.

6.2.21. GRADE BRAKE

NOT USED

6.2.22. CHECK TIRE

Lamp turns on steady with correct DM1 message present with correct FMI. Turns off immediately when DM1 message is missing or FMI is not correct.

## 7. TRIP AND MODE BUTTONS

The Trip Reset and Mode switch contacts are used to navigate menus, operate features of the message display and acknowledge warnings.

Both switches are also available on the cluster connector for remote operation.

### 7.1. Trip switch

- Selects and resets trip odometers

- Scrolls menu up
- Used along with "Mode switch" to select menu line and to toggle units (US/metric).
- Wake up cluster, while the ignition is off, to display the odometer.
- Available remotely through AL BIN on PIN 17

### 7.2. Mode switch

- Enters inquiry mode
- Scrolls menu down
- Used along with "Trip switch" to select menu line and to toggle units (US/metric).
- Wake up cluster, while the ignition is off, to display the odometer.
- Available remotely through AL BIN on PIN 18

## 8. UNITS SELECTION

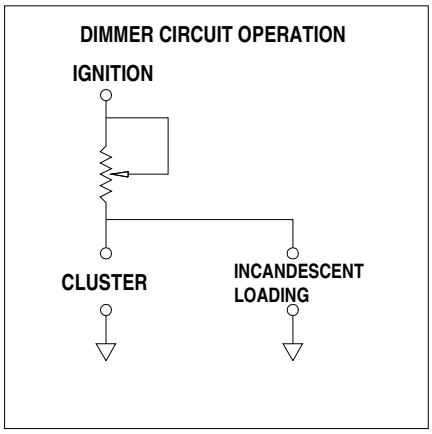
Select either US or Metric units by pressing and releasing the trip and mode switches simultaneously.

## 9. DIMMING

Gauge, pointer and display backlight intensity are controlled by a 5000 +/-5 Ω potentiometer.

When the headlights are on, all of these features dim together in accordance with the dimmer position. A selection in the diagnostic menu on the message display will allow resetting to the original factory value (this value is calculated with no load connected in parallel with the back-lighting input).

If the headlights are off, the LCD backlighting will be on full bright.

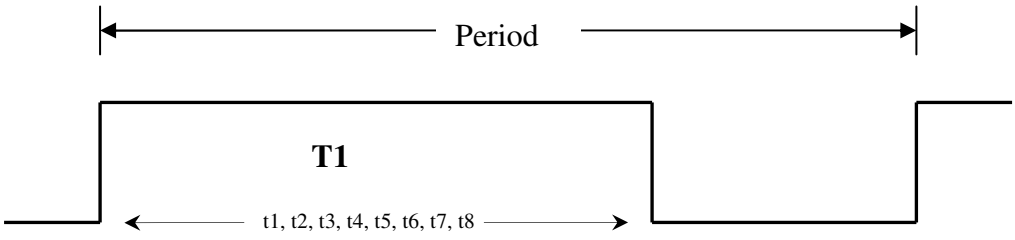


## 10. AUDIBLE ALARM

The following table lists the available alarms. These will be referred to by number throughout this document to define audible alarms for specific functions.

| Audible Alarm | Freq. | T1 | Period |
|---|---|---|---|
| 1 (Buzzer) | 2.8KHz | 120msec | Continuous |
| 2 (Chime) | 2.8KHz | 120msec | 320msec |
| 3 (Click) | See below | See below | See Below |

| Turn signal Click | | | | |
|---|---|---|---|---|
| T1 | **On** Click (Hz) | Duration (ms) | **Off** Click (Hz) | Duration (ms) |
| t1 | 10,000 | 160 | 10,000 | 160 |
| t2 | 6,200 | 80 | 2,800 | 80 |
| t3 | 2,400 | 10 | 2,400 | 10 |
| t4 | 10,000 | 160 | 10,000 | 160 |
| t5 | 6,200 | 150 | 6,200 | 80 |
| t6 | 3,600 | 80 | 2,800 | 40 |
| t7 | 920 | 40 | 10,000 | 160 |
| t8 | 6,200 | 150 | 6,200 | 80 |



### 10.1. Alarm Messages

All alarms are associated with a light, display message or gauge reading and will be detailed in the section it is associated with. See those sections for alarm details.

## 11. MESSAGE DISPLAY CENTER

The message center is a graphical, backlit, LCD that displays information to the vehicle operator. In addition to basic odometer & gear display functions, a variety of customer-defined options will be displayed. The message center can be used to navigate through menus to configure and diagnose problems. Priority messages and warning can also be displayed as they are received.

**All screen shots shown in this section are for basic graphic positioning only. Font size and style as well as symbols may differ from these references.

### 11.1. Menu Navigation Overview

- Menus have 4 lines.
- The highlighted line is shown in reverse video.
- To highlight a line, the trip switch is used to scroll up and the mode switch is used to scroll down.
- Once high-lighted, a menu item can be selected in either of two ways:
    - Depressing and then releasing the trip and the mode switches at the same time chooses the item. Or after 3 seconds of inactivity, the line shown in reverse video is automatically chosen.
    - Then, the display exits from the menu to the previous display.

### 11.2. Screen Config Overview

The default drive screen can be configured in several ways. This configuration is accessed by pushing the mode button while in the default screen. This brings up a menu of options as shown in the sections below. When selected it configures the default screen with different options.

ODO, Trip 1 or Trip 2 will always be displayed in the upper left corner of the screen.

### 11.2.1. TRIP COMPUTER FEATURES

These features are available in the display if the cluster is configured with Trip computer. When selected they will appear in the bottom center of the display as shown in the sections below. PRNDL123 will be displayed in the upper right corner.

| **Feature** | **Data Source** | **Data Range** | **Units** |
|---|---|---|---|
| Instantaneous Fuel | PGN65266_SPN184 (moving) | 0-125.5 | L/100 km (mpg) if vehicle speed is > 0 |
| | PGN65266_SPN183 (not moving) *if supported* | | L/hrs (g/hr) if vehicle speed is = 0 |
| Average Fuel Economy | PGN65266_SPN185 | 0-125.5 | L/100km (mpg) |
| Average Vehicle Speed | Logic based on time and distance traveled | since last trip reset | km/hr (mph) |
| Outside Temperature | PIN 3_ANALOG | *-30 to 70 | ℃ (℉) |

*Outside temp input data outside of range shown will be considered disconnected and will not show up in the menu.

#### 11.2.1.1. Outside Temp Details

If Outside temp range falls outside valid range it will be considered disconnected and not available in the menu.

| Outside Temperature | Temperature Sender Resistance |
|---|---|
| -30°C (-22°F) | 52595 Ω |
| -20°C (-4°F) | 28580 Ω |
| -10°C (14°F) | 16120 Ω |
| 0°C (32°F) | 9400 Ω |
| 10°C (50°F) | 5660 Ω |
| 20°C (68°F) | 3500 Ω |
| 30°C (86°F) | 2300 Ω |
| 40°C (104°F) | 1500 Ω |
| 50°C (122°F) | 1000 Ω |
| 60°C (140°F) | 670 Ω |
| 70°C (158°F) | 470 Ω |

### 11.2.2. POWER TRAIN FEATURES

These features are available in the display if the cluster is configured with Power Train computer. When selected they will appear in the bottom center of the display as shown in the sections below. PRNDL123 will be displayed in the upper right corner.

| Feature | Data Source | Data Range | Units |
|---|---|---|---|
| Battery Voltage | PIN 36_ANALOG | +VDC | Volts |
| Coolant Temp | Same as gauge | -40 to 210 | ℃ |
| Engine Speed | Same as gauge | 0 to 6000 | RPM |
| Vehicle Speed | Same as guage | 0-100 or 0-160 | mph or kmh |
| Boost Pressure | PGN65270_SPN102 | 0-500 | Kpa |
| Intake Air Temp | PGN65270_SPN105 | -40 to 210 | ℃ |

### 11.2.3. PRND123 FEATURES

The main feature available for display if the cluster is configured with PRND123 option is the Requested Range showing the operator selected gear in the bottom center as PRND123 with the requested hear highlighted in reverse video. For values of P, R, N, 1, 2 & 3 this area will highlight that value. For any gear requested over 3 (4, 5 &6) it will simply highlight the D.

This configuration will also display the Current Range in the upper right corner which is the currently engaged gear. This is simply displayed as the character for the gear.

In the bottom right corner it will show the Maximum Gear Limit which is the highest gear the automatic transmission will engage. This is read from the same message as Requested range. This is simply displayed as the character for the gear in reverse video.

| Feature | Data Source | Data Range | Units |
|---|---|---|---|
| Transmission Requested Range | PGN61445_SPN162 | P,R,N,D,1,2,3 | ASC11 32 |
| Transmission Current Range | PGN61445_SPN163 | P,R,N,1-6 | ASC11 32 |
| Maximum Gear Limit | PGN61445_SPN162 | P,R,N,1-6 | ASC11 32 |

### 11.2.4. OIL PRESSURE FEATURES

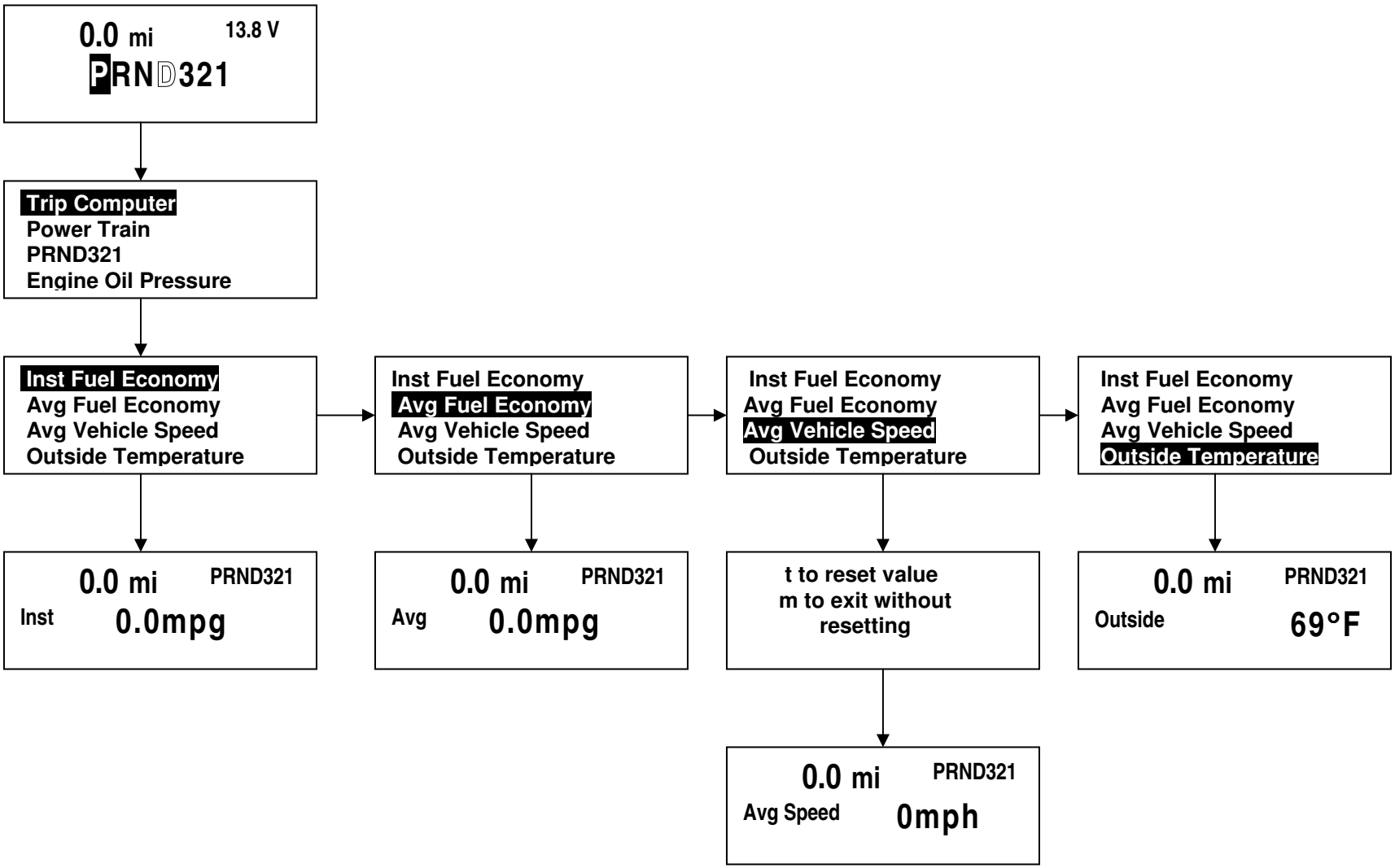
When this display option is selected the following will appear in the bottom center of the display as shown in the sections below. PRNDL123 will be displayed in the upper right corner.

| Feature | Data Source | Data Range | Units |
|---|---|---|---|
| Oil Pressure | PGN65263_SPN100 | 0-125 | kpa |

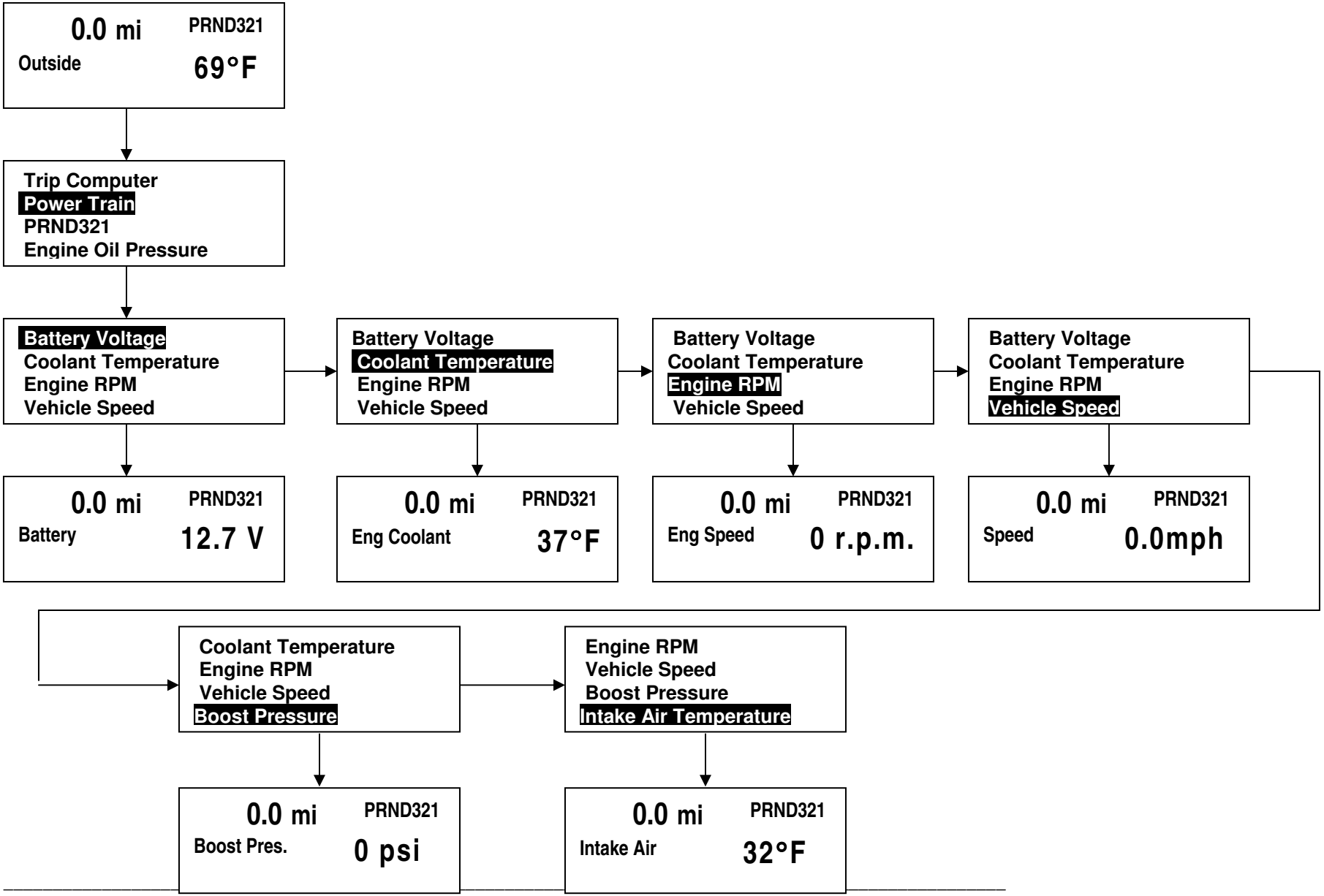
### 11.2.5. LARGE FONT FEATURES

When this display option is selected a large font PRNDL will appear in the bottom center of the display as shown in the sections below. A large font ODO can be toggled to replace this area of the display by pressing the Trip button. A large font Trip 1 and Trip 2 can also be toggled to replace this spot on the display.

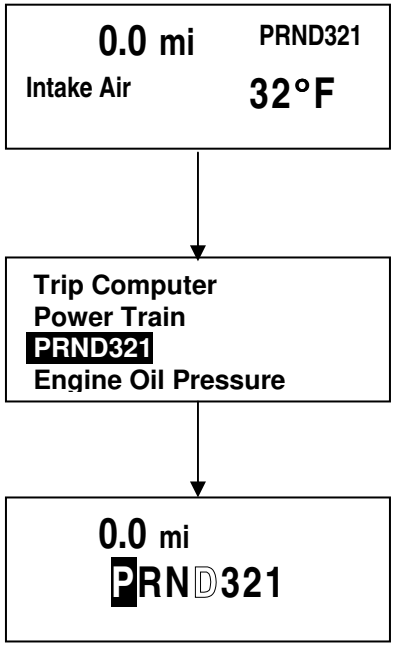
11.2.6. TRIP COMPUTER CONFIG MENU



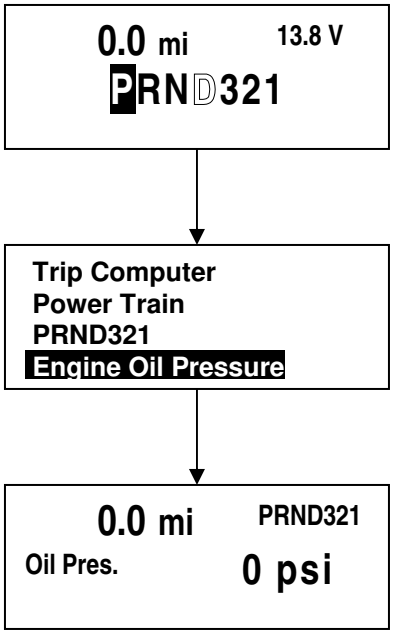
11.2.7. POWER TRAIN COMPUTER CONFIG MENU



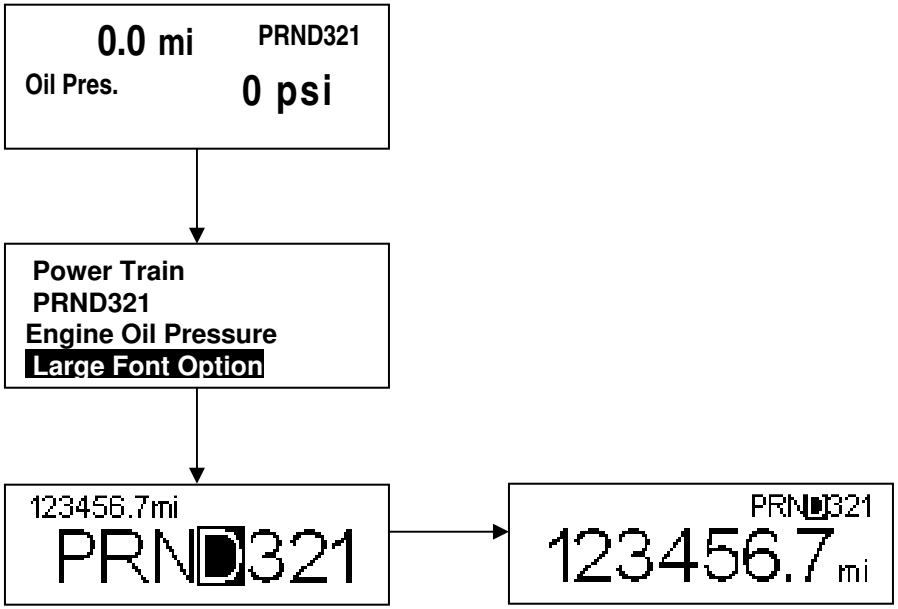
11.2.8. PRND321 CONFIG MENU



11.2.9. OIL PRESSURE CONFIG MENU



11.2.10. LARGE FONT CONFIG MENU



## 11.3. Standard Display Messages

These messages will be shown in the areas of the display shown in the sections above depending on the default screen configuration.

### 11.3.1. ODOMETER ACCUMULATED

Maximum display is 999,999.9 miles. Odometer will not roll over. Odometer mileage is incremented by reading the BCM (SA=21h) J1939 PGN 65248. During normal operation the odometer value is stored in the BCM. Last received mileage is stored in the cluster at Ignition off for viewing with wakeup inputs. This value will be overwritten when first Odometer message is received on next startup.

### 11.3.2. TRIP ODOMETER 1 AND TRIP ODOMETER 2

Two independently operating trip odometers are available. Maximum display is 9,999.9 miles. Trip odometer will then roll over. The individual trip counters are independently reset by depressing and holding "Trip" switch.

### 11.3.3. GEAR SELECTION

#### 11.3.3.1. Transmission Gear Selected

The transmission range selected is displayed on PRND321. Transmission Requested Range is defined as the gear commanded by the driver with the gear selector.
The gear selected is read from PGN 61445 (SA=03) Byte 5, Display transmission gears as "P", "R", "N", "D", "3", "2" or "1". The D will be shown as a "D" with an "O" around it. See (Appendix M: Selected Gear/Engaged Selection) for selection.

#### 11.3.3.2. Transmission Gear Engaged

Transmission Current Range is read from PGN 61445 (SA=03) Byte 7 and is displayed in the upper right corner when in PRND321 option. Gear Engaged will be displayed as: "gear 1"or,"2", "3", "4", "5" ,"6" ,"N" ,"R" ,"P".

#### 11.3.3.3. Maximum Attainable Gear

Maximum attainable gear is displayed in the lower right corner of the LCD when in PRND321 option. It will display a driver selected highest attainable gear number in reverse video. Automatic shifting can go no higher than this displayed gear.

## 11.4. Priority Interrupt Messages (PIM)

These messages will be shown in the bottom center of the display due to various inputs or data messages. If a PRNDL is present in this areas it will move to the upper right corner of the display Multiple messages will be displayed by continually cycling active messages every 3 seconds. A maximum of 10 messages can be displayed.

All messages can be acknowledged, by pressing the Trip button while being displayed, at which time the message will leave the display and the associated alarm will silence. The alarm/message will reoccur if / when the message trigger stops and reoccurs or the next key-on cycle if the trigger never stops.

**For all proprietary messages from CCM Source Address $21_h$, refer to Megatech Documentation .**

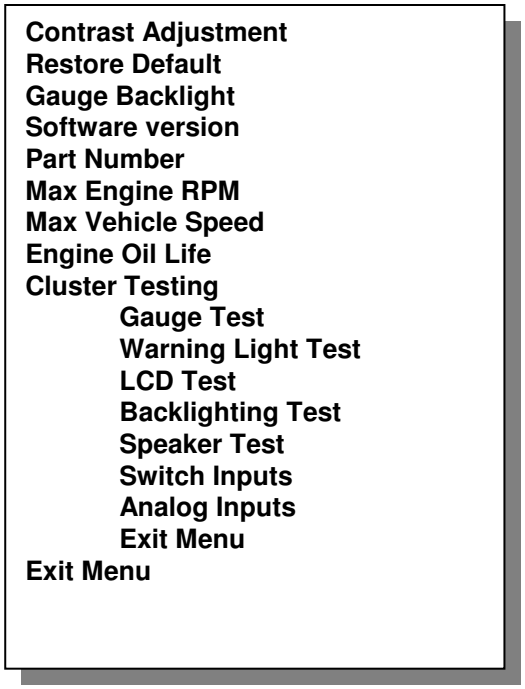
| Function | Data Source | Trigger | Exact Text | Alarm/Duration |
|---|---|---|---|---|
| Trans Comm Failure | PGN61445_SA 03 | Missing messages from PGN61445_SA 03>240ms | TRANS COMM FAIL | NONE |
| Check Transmission Temp | DM1_SPN177 | FMI 15 | CHECK TRANS TEMP | 1/3sec |
| ABS Comm Failure | PGN61441_SA 0B | Missing messages from PGN61441_SA 0B >1s | ABS COMM FAIL | 1/3sec |
| Check ABS | Same as ABS indicator | Same as ABS indicator | CHECK ABS | NONE |
| *Speed Signal Fail | PGN61444_SPN190 | Missing messages from PGN61444_SPN190>1s | SPEED SIG FAIL | 1/until acknowledged |
| Park Brake | See Section 6.2.12 | See Section 6.2.12 | PARK BRAKE ON | See Section 6.2.12 |
| Range Inhibit | Same as indicator | Same as indicator | TRANS SHIFT INHIBIT | Same as Indicator |
| Door Ajar | PIN 15, AL BIN | Active Binary | DOOR AJAR | 2/3sec |
| Low Oil Pressure | Same as indicator | Same as indicator | LOW OIL PRESS | Same as indicator |
| Check Eng Oil Level | DM1_SPN98 | FMI 1 | CHECK OIL LVL | 2/3sec |
| High Coolant Temp | PGN65262_SPN110 DM1_SPN110 | On if >125C; Off if<121C or FMI 0 or 15 | HIGH COOLNT TEMP | 1/3sec |
| **Low Coolant Level | DM1_SPN111 | FMI 17 | LOW COOLANT LVL | 1/until acknowledged |
| ***Brake Fail/Hydraulic Fluid Pressure | See Section 6.2.12 | See Section 6.2.12 | HYD BRAKE PRESS WARN | See Section 6.2.12 |
| No 1939 Activity | CAN BUS | Missing 1939 messages for >2.5s | NO 1939 ACTIVITY | 1/until acknowledged |
| Auto park Fail | PIN 34, AH BIN | REMOVED; NOT SUPPORTED | AUTO PARK FAIL | 1/until acknowledged |
| Low Fuel Level | DMI_SPN96 | FMI 17 | LOW FUEL LEVEL | 1/3sec |
| Low Voltage | PIN 36 ANALOG VAR VOLTAGE | On if <11V for more than 30s | LOW VOLTAGE | 1/until acknowledged |
| High Voltage | PIN 36 ANALOG VAR VOLTAGE | On if>16V for more than 5s | HIGH VOLTAGE | 1/until acknowledged |
| Headlight Reminder | PIN 22, AL BIN | IGN off w/input active | HEADLIGHTS ON | 2/until acknowledged |
| Turn Signal Reminder | PIN 19 PIN 20 | One of the two is active for >.75mi | TURN SIGNAL ON | 2/3sec |
| Key-in Ignition | PIN 28, AL BIN | Active input within 60sec of IGN off | KEY IN IGNITION | 2/Reference key-in-ignition mode section |
| BATTERY CHARGE FAIL | Same as Lamp | Same as Lamp | ALT FIELD FAIL | 1/3sec. or T button |
| Reduced Engine Power | DM1_SPN 521241 | FMI_11 | REDUCED ENG PWR | 2/3sec |
| Change Oil Now | DM1_SPN 521242 | FMI_16 | CHANGE ENG OIL NOW | 2/3sec |
| Change Oil Soon | DM1_SPN 521243 | FMI_15 | CHANGE ENG OIL SOON | 2/3sec |

*Reoccurrence every 10 min
**Self-canceling after 5s of no message.
***10 sec delay after ignition is required to avoid false failures.

## 12. ON BOARD DIAGNOSTIC

On-board diagnostic functions can be initiated and executed with transmission in park, the park brake is set and the Mode switch is depressed for longer than 5 seconds.

Refer to Menu Navigation section for information on how to select menu options.




### 12.1. Contrast Adjustment

This feature will allow the user to increase or decrease the contrast of the display by pressing Trip to increase or Mode to decrease. The contrast is limited to a specific visible range to prevent the user from rendering the display unusable.

### 12.2. Restore Default

The user can restore all factory defaults for any setting that can be modified by the end user (i.e. Contrast, Backlight Color, etc)

### 12.3. Gauge Backlight

Opens a menu for user selectable backlight colors. Pointers will remain Amber, and LCD backlight remains white. The color options can be scrolled through using the “trip” button. Pressing the “Mode” button exits the selection menu and automatically sets the Gauge Backlight color to the last highlighted selection. Available colors are as follows:

Blue Backlight
Yellow Backlight
Lt. Blue Backlight
White Backlight
Red Backlight
Green Backlight

### 12.4. Software Version

Display the software part number and version programmed into the micro controller.
Pressing the mode switch exits to the diagnostic menu. (The message "m to exit" appears on the screen).

### 12.5. Part Number

Display the part number programmed into the micro controller.
Pressing the mode switch exits the diagnostic menu. (The message "m to exit" appears on the screen).

### 12.6. Max Engine RPM

Displays the maximum engine RPM that was sustained for > 3 seconds. Pressing the mode switch exits the diagnostic menu. (The message “m to exit” appears on the screen).

### 12.7. Max Vehicle Speed

Display the maximum vehicle speed that was sustained for > 5 seconds. Pressing the mode switch exits the diagnostic menu. (The message “m to exit” appears on the screen).

### 12.8. Engine Oil Life Remaining

Gas Engine will display this value in % from 0 to 100% read from J1936 (PGN 61184_SPN521246)
Pressing the mode switch exits the diagnostic menu. (The message “m to exit” appears on the screen).

## 12.9. Cluster Diagnostics

Features in this menu will allow the end user or service to trouble shoot the cluster components and wiring and also set some configurations.

### 12.9.1. GAUGE TEST

One at a time, each gauge pointer will be driven through three positions, pausing at each position for ½ second. The LCD shows the position of the pointer as a percentage of full scale. At the end of the test, the gauges revert back to their original pointer position and the program returns to the Cluster Diagnostics Menu. The test can be exited at any time by pressing the Mode button.

### 12.9.2. WARNING LAMP TEST

At the start of the test, all lights are turned off. Each light is then toggled to the "on" state, and then "off". The LCD displays the name of the light being tested and its status. At the end of the test, the lights revert back to their commanded state (on or off) and the display returns to the Cluster Diagnostics Menu. The test can be exited at any time by pressing the Mode button.

### 12.9.3. LCD TEST

Uses a test pattern to make sure all pixels in the display are working properly. The pattern is a Workhorse patter that will change positive to negative 3 times and then exit to the Cluster Diagnostics menu. The test can be exited at any time by pressing the Mode button.

### 12.9.4. BACKLIGHT TEST

The backlight for the gauges, pointers and display is cycled through 0%, 50% and 100% intensity while displaying this percentage on the LCD. When finished the display returns to the Cluster Diagnostics Menu. The test can be exited at any time by pressing the Mode button.

### 12.9.5. SPEAKER TEST

This test will cycle 3 times by sounding 2 different tones each cycle. When finished the display will exit to the Cluster Diagnostics Menu. The test can be exited at any time by pressing the Mode button.

### 12.9.6. SWITCH INPUTS

This routine tells the operator the status of each Binary input. The display indicates the switch input by descriptive name and the status level (ON/OFF) at the pin. Four inputs are shown per screen page. The level status reflects the active state of the input. For example, if an input is active to ground, and the input level is 0 volts, then the status will be ON. Press Mode to exit to the Cluster Diagnostics Menu.

### 12.9.7. ANALOG INPUTS

This routine tells the operator the status of each Analog input. The display indicates status of the input by descriptive name and the status to the right. Four inputs are shown per screen page. Press Mode to exit to the Cluster Diagnostics Menu.

12.9.8. VEHICLE SETTINGS

NOT USED ON THIS PRODUCT

### 12.10. Exit

Selecting Exit will return the display to the default drive screen.

## 13. DATA LINK DIAGNOSTICS

Data link diagnostics is done through the cluster CAN channel.
It requires a PC and RS232-to-CAN interface hardware.
The capabilities are the following.

### 13.1. Diagnostic Session

Start diagnostic session
End diagnostic session

### 13.2. Reprogram Microprocessor

Flashing shall not change odometer value.

### 13.3. Current Value Monitor

Show in real time the state of the cluster inputs.

- A/D Inputs
- Logic Inputs
- Frequency Inputs

### 13.4. Set Parameters

Using proprietary software written by ACTIA, the cluster will allow the following through the data link.
Clear “maximum RPM” and “maximum vehicle speed”
Set odometer (eliminates odometer statements). This software will write any value into the odometer. A secure method will be used to set the odometer.
Calibrate gauges.
Cluster configuration.
Control the outputs of the cluster.

- LCD pixels
- Individual warning lights
- Gauge back lighting
- Individual gauges
- Speaker

## 14. J1939 TABLE OF MESSAGES

| Frame | PGN / SPN | Name | Byte | TX/ RX | English/ Metric Units | Source Address (all in hex) |
|---|---|---|---|---|---|---|
| CCVS | 65,265 (00FEF1) / 595 | Cruise Control Active | 4B 2&1 | RX | N/A | 21 |
| CCVS | 65,265 (00FEF1) / 84 | Wheel-Based Vehicle Speed | 3-2 | RX | Mph/kmh | 21 |
| CCVS | 65,265 (00FEF1) / 597 | Brake Switch | 4b 6&5 | RX | N/A | 21 |
| CCVS | 65,265 (00FEF1) / 976 | PTO State | 7b 5-1 | RX | N/A | 21 |
| EEC1 | 61,444 (00F004) / 190 | Engine speed | 4,5 | RX | RPM | 21 |
| ETC2 | 61,445 (00F005) / 523 | Transmission Current Gear | 4 | RX | PRND123 | 03 |
| ETC2 | 61,445 (00F005) / 162 | Transmission Request Range | 6-5 | RX | PRND123 | 03 |
| ETC2 | 61,445 (00F005) / 163 | Transmission Current Range | 8-7 | RX | PRND123 | 03 |
| ETC2 | 65,195 (00FEAB) / 1115 | Highest Possible Gear | 2 | RX | PRND123 | 03 |
| ETC7 | 65,098 (00FE4A) / 2900 | Transmission Shift Inhibit Indicator | 2b 8&7 | RX | N/A | 03 |
| DD | 65276 (00FEFC) / 96 | Fuel Level | 2 | RX | % | 21 |
| LC | 65089 (00FE41) / 2367 | Left Turn Signal Light Command | 2 b 8&7 | RX | N/A | 21 |
| LC | 65089 (00FE41) / 2369 | Right Turn Signal Light Command | 2 b 6&5 | RX | N/A | 21 |
| LC | 65,089 (00FE41) / 2369 | Running Light Command | 1b 2&1 | RX | | 21 |
| ET1 | 65,262 (00FEEE) / 110 | Engine coolant temp. | 1 | RX | °F / °C | 21 |
| EFL/P1 | 65,263 (00FEEF) / 100 | Engine oil pressure | 4 | RX | PSI / KPa | 21 |
| VEP1 | 65,271 (00FEF7) / 167 | Charging system potential (volts) | 4-3 | RX | V | 21 |
| CM1 | 57,344 (00E0FF) / 1865 | Seat Belt Switch | 4b 8&7 | RX | N/A | 21 |
| TRF1 | 65,272 (00FEF8) / 177 | Transmission oil temp. | 6-5 | RX | °F / °C | 03 |
| HBS | 64,998 (00FDE6) / 2584 | Hydraulic Brake Pressure Warning State Circuit 1 | 3 b 2&1 | RX | | 0B |
| HBS | 64,998 (00FDE6) / 2583 | Hydraulic Brake Pressure Supply State Circuit 2 | 3 b 8&7 | RX | | 0B |
| HBS | 64,998 (00FDE6) / 2582 | Hydraulic Brake Pressure Supply State Circuit 1 | 3 b 6&5 | RX | | 0B |
| HBS | 64,998 (00FDE6) / 2585 | Hydraulic Brake Pressure Warning State Circuit 2 | 3 b 4&3 | RX | | 0B |
| HBS | 64,998 (00FDE6) / 2931 | Hydraulic Brake Fluid Level | 4 b 4&3 | RX | | 0B |
| HBS | 64,998 (00FDE6) / 2930 | Hydraulic Brake System Audible Warning Command | 4 b 2&1 | RX | | 0B |
| B | 65,274 (FEFA) / 619 | Parking brake actuator | 4b 2&1 | RX | | 0B |
| EBC1 | 61,441 (00F001) / 563 | ABS Warning Lamp | 6b 6&5 | RX | | 0B |
| LFE | 65,266 (00FEF2) / 184 | Instantaneous fuel econ | 4-3 | RX | MPG / Km/L | 21 |
| LFE | 65,266 (00FEF2) / 185 | Average fuel economy | 6-5 | RX | MPG / Km/L | 21 |
| HOURS | 65,253 (00FEE5) / 247 | Total engine hours | 1-4 | RX | H | 21 |
| IC1 | 65,270 (00FEF6) / 102 | Eng Turbocharger Boost pressure | 2 | RX | PSI / kPa | 21 |
| IC1 | 65,270 (00FEF6) / 105 | Eng Intake Manifold 1 Temp | 3 | RX | °F / °C | 21 |
| VD | 65,248 (00FEE0) /245 | Total Vehicle Distance | 8-5 | RX | | 21 |
| PropA | 61184 (00EF00) / 521246 | Engine Oil Life | 8b 7-1 | RX | % | 21 |
| **Defined Faults** | **PGN** | **Name** | **Byte** | **SPN** | **FMI** | **SA** |
| DM1 | 65,226 (00FECA) | Low Oil Pressure | | 100 | 0 | 21 |
| DM1 | 65,226 (00FECA) | High Transmission Temp | | 177 | 15 | 03 |
| DM1 | 65,226 (00FECA) | Low Coolant Level | | 111 | 1 | 21 |
| DM1 | 65,226 (00FECA) | Check Trans | | 2003 | 31 | 03 |
| DM1 | 65,226 (00FECA) | Alternator DTC | | 167 | 1 | 21 |
| DM1 | 65,226 (00FECA) | Alternator Fail DTC | | 521116 | ANY | 21 |
| DM1 | 65,226 (00FECA) | Low Fuel | | 96 | 17 | 21 |
| DM1 | 65,226 (00FECA) | Engine Oil Level | | 98 | 1 | 21 |
| DM1 | 65,226 (00FECA) | Stop Engine | | 1111 | 1 | 21 |
| DM1 | 65,226 (00FECA) | Reduced Engine Power | | 521241 | 11 | 21 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DM1 | 65,226 (00FECA) | High Coolant Temp | | 110 | 0,15 | 21 |
| DM1 | 65,226 (00FECA) | Change engine Oil NOW | | 521242 | 16 | 21 |
| DM1 | 65,226 (00FECA) | Change engine Oil SOON | | 521243 | 15 | 21 |
| DM1 | 65,226 (00FECA) | ABS | | 563 | ANY | 0B |
| DM1 | 65,226 (00FECA) | Service Engine Soon | | 520992 | ANY | 21 |
| DM1 | 65,226 (00FECA) | Service Engine Soon | | 521144 | ANY | 21 |
| DM1 | 65,226 (00FECA) | Service Engine Soon | | 521232 | ANY | 21 |
| DM1 | 65,226 (00FECA) | Service Engine Soon | | 521134 | ANY | 21 |
| DM1 | 65,226 (00FECA) | Service Engine Soon | | 521277 | ANY | 21 |
| DM1 | 65,226 (00FECA) | High Idle | | 976 | ANY | 21 |
| DM1 | 65,226 (00FECA) | Check Tire | | 929 | 12,31 | 33 |
| DM1 | 65,226 (00FECA) | Check Tire | | 241 | 1,16,18 | 33 |

## 15. RELATED DOCUMENTS

*SAE J1455 Joint SAE/TMC Recommended Environmental Practices for Electronic Equipment Design (Heavy-Duty Trucks)*
*SAE J1211 Recommended Environmental Practices for Electronic Equipment Design*
*SAE J1113/* Electromagnetic Compatibility Measurement Procedures and Limits for Vehicle Components*
*SAE J1812 Function Performance Status Classification for EMC Immunity Testing*
*SAE J2217 Photometric Guidelines for Instrument Panel Displays that Accommodate Older Drivers*
*SAE J1226 Electric Speedometer Specification – On Road*
*SAE J1399 Electric Tachometer Specification*
*SAE J1810 Electrical Indicating System Specification*
*SAE J1048 Symbols for Motor Vehicles Controls, Indicators and Tell-Tales*
*SAE J1362 Graphical Symbols for Operator Controls and Displays on Off-Road Self-Propelled Work Machines*
*LIN Specification Package Revision 1.2*
*1037-01 117mm Gauge Specification*
*1075-01 Warning Bank with Air Specification*
*Warning Bank w/o Air Specification*
*85mm Gauge Specification*
*FMVSS 106 Federal Motor Vehicle Safety Standards, Air Brakes*
*FMVSS 101 Federal Motor Vehicle Safety Standards, Controls and Displays*
*FMVSS 121 Federal Motor Vehicle Safety Standards*
*FMVSS 302 Flammability of interior materials*
*SAE J1587 Electronic Data Exchange Between Microcomputers*
*SAE 1708 Serial Data Communications Between Microcomputers*
*SAE J1939 Recommended Practice for Serial Control and Communication Vehicle Network*
*SAE J844 NONMETALLIC Air Brake System Tub*

## 16. GLOSSARY/ABBREVIATIONS

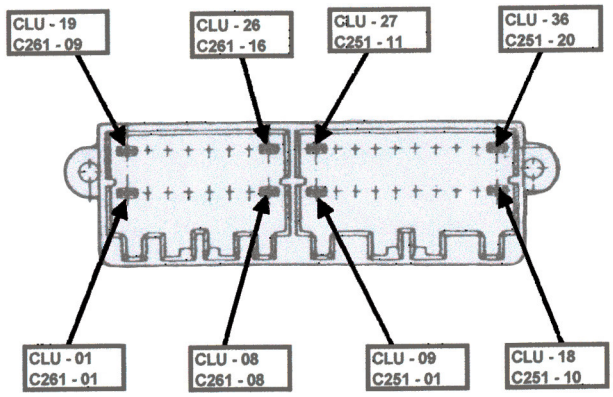
TBD – To be determined
EEPROM – Electrically Erasable Programmable Read Only Memory
SAE – Society of Automotive Engineers

PGN – Parameter Group Number (J1939)
SPN – Suspect Parameter Number (J1939)
FMI – Failure Mode Identifier (J1939)

# 17. APPENDIX A

## 17.1. Cluster Pinout

The cluster has a single, 2 bay keyed connector. The figure below show the connector pin numbering from the wire entry side with the latch on bottom. This numbering can also be found on the connector housing.



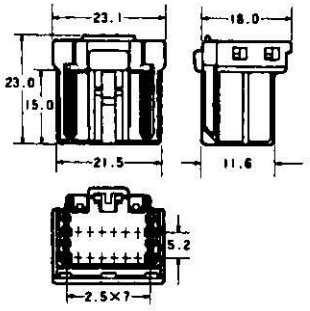

| CLU Pin | Description | CLU Pin | Description |
|---|---|---|---|
| 1 | *Not Used* | 19 | LEFT TURN |
| 2 | *Not Used* | 20 | RIGHT TURN |
| 3 | OUTSIDE TEMP | 21 | HIGH BEAM |
| 4 | DIMMER | 22 | HEADLIGHT |
| 5 | *Not Used* | 23 | *ABS* |
| 6 | IGN | 24 | PARK BRAKE |
| 7 | GND SIGNAL | 25 | BRAKE FAIL |
| 8 | *Not Used* | 26 | SEATBELT |
| 9 | BATTERY CHARGE | 27 | SERVICE ENG SOON |
| 10 | J1939 + | 28 | KEY IN IGN |
| 11 | J1939 - | 29 | GRADE BRAKE |
| 12 | *Not Used* | 30 | Not used |
| 13 | *Not Used* | 31 | *Not Used* |
| 14 | *Not Used* | 32 | *Not Used* |
| 15 | Not used | 33 | DAYTIME RUNNING LIGHTS |
| 16 | OVERDRIVE OFF | 34 | Not Used |
| 17 | REMOTE TRIP | 35 | GND CHASSIS |
| 18 | REMOTE MODE | 36 | PWR CHASSIS |

### 17.2. Mating Connectors

Mating Connectors for the cluster are TYCO mate n lock. The Mating Terminals (Sockets) used with the connector housings are Tyco P/N: 173681-1 (Actia P/N 102146)

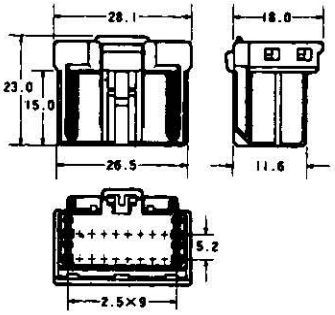
17.2.1. CONNECTOR 1

16 positions (2 X 8) (Actia P/N 102130)
Tyco US Part Number: 175966-2




17.2.2. CONNECTOR 2

20 positions (2 X 10) (Actia P/N 102131)
Tyco US Part Number: 175967-2



### 17.3. PWA Configuration

| Terminal | Designation | I/O Assignment | I/O TYPE | Wakeup | Description |
|---|---|---|---|---|---|
| 1 | | RAI FUEL- | RES ANALOG | | Used in combination with pin 2 for fuel sender input |
| 2 | AN0 | RAI FUEL+ | RES ANALOG | | Used in combination with pin 1 for fuel sender input |
| 3 | AN5 | RAI TEMP | RES ANALOG | | Used as resistive analog input for outside temperature sender |
| 4 | AN1 | VAI DIMMING | VOLT ANALOG | | Used as variable voltage analog input for backlight dimmer |
| 5 | | TOW HAUL | BIN AL | | Active Low to be used as needed |
| 6 | AN2 | VIGN | BIN AH | X | Active high for wakeup |
| 7 | GND | GND | | | Clean ground for communication |
| 8 | | | | | |
| 9 | AN3 | CHARGE | BIN AL | | Active Low to be used as needed |
| 10 | CAN+ | J1939+ | DATA | X | Data line CAN+ signal |
| 11 | CAN- | J1939- | DATA | X | Data line for CAN- signal |
| 12 | J1850 | J1850 | DATA | X | Data line for SAE J1850+ signal |
| 13 | P01 | FI TACHO | FREQ | | Frequency Input for pulsed signal |
| 14 | P00 | FI SPEED | FREQ | | Frequency Input for pulsed signal |
| 15 | | DOOR | BIN AL | | Active Low to be used as needed |
| 16 | | OVERDRIVE | BIN AL | | Active Low to be used as needed |
| 17 | P56 | TRIP | BIN AH | X | Active high for Trip Switch |
| 18 | P57 | MODE | BIN AH | X | Active high for Mode Switch |
| 19 | | LEFT | BIN AH | | Active high to be used as needed |
| 20 | | RIGHT | BIN AH | | Active high to be used as needed |
| 21 | | HIGH | BIN AH | | Active high to be used as needed |
| 22 | | LIGHTS | BIN AH | X | Active high to be used as needed |
| 23 | AN7 | ABS | BIN AL | | Active low to be used as needed |
| 24 | | PARKBRAKE | BIN AL | | Active low to be used as needed |
| 25 | AN4 | BRAKE FAIL | RES ANALOG | | Used as resistive analog input |
| 26 | | SEAT | BIN AL | | Active low to be used as needed |
| 27 | | SERVICE | BIN AL | | Active low to be used as needed |
| 28 | | KEY | BIN AL | | Active low to be used as needed |
| 29 | | SHIFT | BIN AH | | Active low to be used as needed |
| 30 | | PTO | BIN AL | | Active low to be used as needed |
| 31 | | TIRES | BIN AL | | Active low to be used as needed |
| 32 | | BUZZER EN | BIN AL | | Active low to be used as needed |
| 33 | | DAYLIGHT | BIN AL | | Active low to be used as needed |
| 34 | | AUTOPARK | BIN AH | | Active high to be used as needed |
| 35 | GND | GND | | | Chassis Ground |
| 36 | VBAT | VBAT | | | Chassis Power |