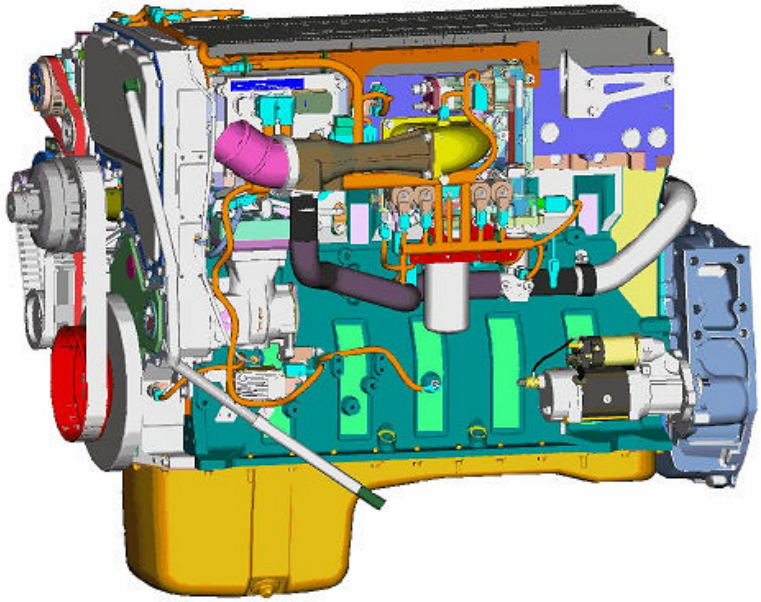
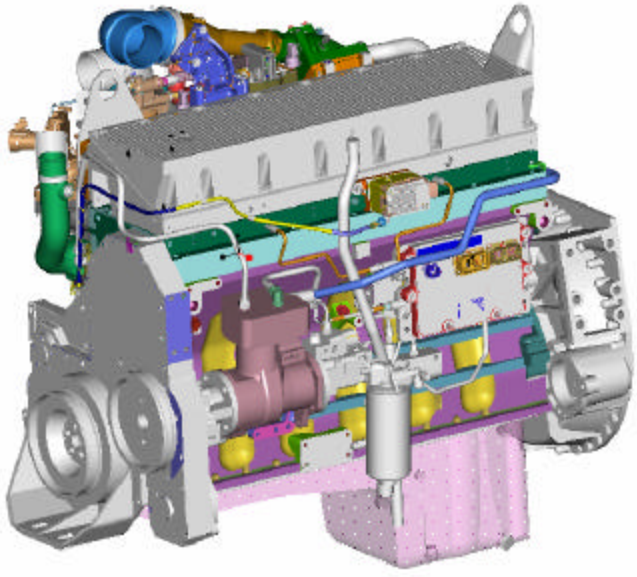
CM870 and CM875 COMMON APPROACH TO CONTROL SYSTEM DIAGNOSTICS

ISX ’04





ISM ’04

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Phase 6.4.3.x9 Software

Rev 07

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CM870 and CM875 COMMON APPROACH TO CONTROL SYSTEM DIAGNOSTICS

CM870 and CM875 Common Approach To Control System Diagnostics.doc
Full Production Version
January 23, 2004
Revision Number 00

Please Forward Suggestions For Improvement To:
Ryan E. Edgecomb

Where To Find This Document:
CTC LAN: H:\hvyduty\HD_System_Integration\Common Approach To Diagnostics\Ph6-CM870

Internet: http://www.ctg.cummins.com/hde_cpe/cpewebsite/index.htm

Overview: This document is intended to support on-site troubleshooting and diagnostics of customer complaints for **2004 Heavy-Duty engine platforms** with the **CM870 or CM875 Controls System**. This document can be used along with NGET or CalTerm for investigation, troubleshooting, and diagnosis of engine performance and electronic controls related issues.

Purpose: The information contained in this document is based in part on documented tests and procedures best suited to support in-field efforts for Cummins CM870 and CM875 heavy-duty engine platforms. Much of this information comes from legacy procedures contained in the document "***Common Approach To Diagnostics Using Calterm***" authored by Wayne Eberhard, Richard Croft, and Mark Ulrich. Because the CM870 and CM875 control system uses a new naming convention for engineering parameters, Brian Ouellette has converted legacy information over to the new naming convention. In addition, the CM870 and CM875 control system includes new control strategies for Air Handling and emissions to meet the 2004 requirements. Information on troubleshooting and diagnostics for these systems is included here. My intent for this document is to provide information and support to those in the field as well as those based in Cummins engineering facilities. With tools like NGET, CalTerm, and KESET, documentation of data within this document will provide more detailed definition of engine conditions associated with specific issues. This information, along with driver comments and concerns, will help in achieving a better responsiveness to customer needs and allow us to develop products which meet or exceed customer expectations.
Ryan E. Edgecomb

DOCUMENT CONTENTS:

- **Data Logging Using Available Engineering Tools (Calterm, NGET, and KESET)**
- **Troubleshooting And Diagnostics Parameter Guide**
- **CM870 and CM875 Engineering States**
- **CM870 and CM875 Fault Code List**
- **CM870 and CM875 Control System Diagrams**
- **Customer / Driver Survey**

THIS DOCUMENT SUPPORTS THE FOLLOWING SOFTWARE VERSION:

HD04	**ISX04**	**PHASE 6.4.3.09 SOFTWARE**	**CM870**
HD04	**ISM04**	**PHASE 6.4.3.19 SOFTWARE**	**CM875**

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DATALOGGING USING AVAILABLE ENGINEERING TOOLS (CALTERM, NGET, and KESET)

EXTERNAL/MONITOR DATA LOGGING (CALTERM and NGET)

External (MONITOR) Data Logger Helpful Hints:

When to use:	For data acquisition that does not require high speed collection Collection of Duty Cycle or Vehicle Mission data Macro-view of events or problems Normal event datalogging while monitoring Calterm or NGET monitor screen For capturing Fault Codes as well as data
Length of datalog:	Datalog length from 0.1 to 3600 seconds
File size:	20 minute datalog of 16 parameters at 1 second interval approximately 230 kbytes
Advantages of Monitor Data Logger:	Monitor data while logging Time based datalogs beyond a few minutes Able to collect data during extended trips Does not require an unsecured ECM Ability to datalog fault codes
Disadvantages of Monitor Data Logger:	Limited to 16 parameters in Calterm Cannot capture high speed events (requires IDL) Time based data collection only

INSTRUCTION FOR USING THE EXTERNAL (MONITOR) DATA LOGGER

CALTERM INSTRUCTIONS:

1. Set-up Monitor Screen with parameters to data log. Use CM870 and CM875 Common Approach to Diagnostics to determine which parameters to datalog.
2. In the Monitor Screen, hit the ALT-L keys to bring up the Monitor Log Menu.
3. Select MANUAL LOG by moving down to MANUAL LOG and hitting the Enter key. A Check mark should be made next to MANUAL LOG.
4. Select the INTERVAL TIME by moving down to INTERVAL TIME and hitting Enter.
5. For INTERVAL TIME, enter the time in which data will be collected, anywhere from 0.1 seconds to 3600 seconds.
6. DESTINATION should read DISK. If not, select DESTINATION and press the Enter key. Select DISK and press the Enter key.
7. Enter the LOG FILE NAME. Select LOG FILE NAME and press the Enter key. Manually type in the name of the datalog file you wish to save.
8. Datalog files are saved to the location shown in the UTILITY-EDIT CONFIGURATION screen next to DATA PATH. The default location is the Calterm root directory.
9. You may select to Overwrite the datalog file with a new file if OVERWRITE LOG FILE is Yes. It is suggested to keep OVERWRITE LOG FILE be set to No. This requires the user to enter a new datalog file name [7.] ever time Monitor Data Logger is invoked.
10. Select whether to log Fault Codes. Select LOG FAULTS and press the Enter key. Select ALL faults logged, ACTIVE faults logged, or NONE and press the Enter key.
11. Choose Exit to Start the Monitor Data Logger.
12. To STOP Monitor Data Logger, press the ALT-L keys.
13. To PLOT the data logged within Calterm, press the ALT-L keys to enter the Monitor Log Screen. Select PLOT and press the Enter key. Choose the file you wish to plot and press the Enter key.

INTERNAL DATA LOGGING (CALTERM)

Internal Data Logger Helpful Hints:

When to use IDL:
For high speed data acquisition or short duration events
Cranking, stumble, hiccups, idle or PTO quality, transient events
Snap throttle, quick accel,
When you need a microscope to view the problem (not a macro-view)
When you aren't sure when the event will occur (center buffer)
When you have individual events which allow time to extract the data from ECM

Length of IDL log:
Data buffer fills at rate which is function of number of parameters and rate at which data is collected, and also whether the parameter is a byte or a word (2-bytes)

	APPROXIMATE TIME TO FILL BUFFER	
CM875:	2 parameters at 20 msec = 178 secs of data	16 parameters at 20 msec = 30 secs of data
CM870:	2 parameters at 20 msec = 178 secs of data	16 parameters at 20 msec = 30 secs of data

Advantages of IDL :
Not limited to block transfer capability (sets of 3)
SPEED!!! 20 msec (CM875/CM870) capability.
Center buffer or fill buffer or stop buffer modes.
Calterm is user-friendly, doesn't require knowledge of Calterm scalars.
Monitor Parameters listed in TROUBLESHOOTING AND DIAGNOSTICS PARAMETER GUIDE section of
CM870 and CM875 Common Approach To Diagnostics is equally applicable to IDL as for Calterm external (Monitor) logs.
Can monitor activities on Monitor screen and activate IDL when necessary
Can use both Monitor datalogger and IDL simultaneously. You must stop Monitor logger before extracting data from IDL.

Disadvantages of IDL:
Requires unsecured module: security risks are increased
Manual processing time is increased for the engineer to extract each set of data
Requires renaming the file if multiple logs are required
Larger buffer (CM870) is slower to extract data (approx. 1 minute)
Very small buffer size limit the practical length of data logs
Sometimes can lock up during process, may require reboot of Calterm/PC
Less user-friendly in setup mode than for Calterm monitor

How to log faster than 20 msec:
These steps must be followed in the order presented below.
-In the Calterm Monitor screen press F7 to take Calterm from the “def” mode to “dev” mode
-Press alt-F8 to open the IDL set-up screen
-Set-up IDL screen as would usually be done
-Start data logger by pressing F7 (Do not begin filling buffer at this time)
-Escape to the Calterm monitor screen
-Enter the parameter “Collector_Multiple”
-Set Collector_Multiple to a whole number from the range of 1 through 10.
Each whole number represents the desired data collection rate in msec; eg 1 = 1 msec, 2 = 2 msec, and 10 = 10 msec
-Enter the parameter “Collector_Schedule”
-Set Collector_Schedule to “4”
-Enter “Y” to agree with the error message
-Begin filling the buffer with data by pressing F6

ECM BUFFER SIZE

Buffer size: The internal datalogger buffer is a zone of ECM memory for specific diagnostic needs. The buffer size is different size for each product:

CM870: 32 k bytes
CM875: 32 k bytes
Note: ECM must be unsecured and running from RAM prior to moving to IDL mode

For further help: Calterm 7.63 User Manual offers helpful instructions on setting up and using IDL
The CT manual is online on the Calterm web page at http://etools.ctg.cummins.com/products/calterm/

Hints:
- Right/Left arrow to adjust logging interval (.020, .040, .060,.080,.100,.120, etc. msec)
- Foreground mode = time based
- Interrupt mode = every cam EPS event
- Alt-F8 to toggle between monitor mode and IDL screen
- F6 or F5 or F4 (fill, center, stop buffer) command is available in monitor screen
- F2 (+ M) moves parameters from Calterm monitor screen to IDL screen
- Stop Broadcast - after key-on (after each key-on) may yield faster extraction

CALTERM HELPFUL HINTS

Use ALT-F1 to bring up an interface screen to enter desired parameters. F1 still functions in this screen to search for parameter names. Use ALT-C to copy a parameter name or use ALT-P to paste a variable name to a field region. When done with entering parameter names, hit ENTER to return to the monitor screen. The current screen will be updated with the new parameter list generated.

IDL parameter names can be imported into the IDL set-up screen. Save text file with parameter names to files XXXXXXXX.IDL. Use up to 16 parameter names. This is useful when running several tests and importing different parameters to datalog.

One may take a datalog from the monitor screen and take an IDL log simultaneously. To do this, set-up the IDL screen first and place in RUN DATALOGGER Mode. ESC to the monitor screen and set-up the monitor screen. Start the monitor datalogger. When an event occurs to collect IDL data, use F4, F5, or F6 to start the IDL. Once the IDL is complete, stop the monitor datalogger then upload the IDL data from the buffer in the IDL screen.

LOW SPEED DATA LOGGING (KESET)

Low Speed Data Logger Helpful Hints:

When to use:	For data acquisition that does not require high speed collection Collection of Duty Cycle or Vehicle Mission data Macro-view of events or problems For data collection of more than 16 parameters (up to 200 parameters) For data collection with fault code information
Length of datalog:	Indefinite
File size:	20 minute datalog of 16 parameters at 1 second interval approximately 230 kbytes
Advantages of Low Speed Logger:	Able to collect data during extended trips and still maintain manageable file size Does not require an unsecured ECM Able to collect more than 16 parameters Able to log fault codes in addition to data
Disadvantages of Low Speed Logger:	Cannot capture high speed events

INSTRUCTION FOR USING THE LOW SPEED DATA LOGGER (KESET)

1. Launch KESET from desktop
2. Select 'YES, I UNDERSTAND, LAUNCH KESET' after reading the J1939 disable with BAM disclaimer
3. Select' Low Speed' and hit OK
4. Select the ECM type and hit the 'Load E2M File' button
5. Select the appropriate E2M
6. Select the Run No-Sync with/without Data Logger' radio button
7. Type in parameter names using parameter 'E2M Parameter' screen in the bottom right hand corner of screen
8. Check or uncheck the' Log Fault Codes' box depending on your preference
9. Select Settings and Options from the menu bar
10. Change the sample rate to the desired rate. Review the remaining settings and adjust as necessary. Hit OK to save the settings and exit the options screen
11. Hit Start to start the monitor screen
12. Select Log to begin logging
13. Select Stop to stop logging

HIGH SPEED DATA LOGGING (KESET)

Note: There are two versions of High Speed Logging– BAM and High Speed Req/Rec

When to use High Speed Logging:	For high speed data acquisition or short duration events Cranking, stumble, hiccups, idle or PTO quality, transient events Snap throttle, quick accel, When you need a microscope to view the problem (not a macro-view) When fault code information is not necessary
Advantages of High Speed Logging:	SPEED!!! 10 msec (CM875/CM870) capability. Can monitor high speed data while recording (on monitor screen or on charts)

Disadvantages of High Speed Logging: BAM Requires unsecured module
Can not log Fault Codes
BAM disables all J1939 broadcasts (automated/automatic transmission, electronic dash, VORAD, ABS, etc.) and leaves some vehicles undriveable

INSTRUCTIONS FOR USING THE HIGH SPEED DATA LOGGER (KESET)

1. Launch KESET from desktop
2. Select 'YES, I UNDERSTAND, LAUNCH KESET' after reading the J1939 disable with BAM disclaimer
3. Select' High Speed' and hit OK
4. Select the ECM type and hit the 'Load E2M File' button
5. Select the appropriate E2M
6. Type in parameter names using parameter 'E2M Parameter' screen in the bottom right hand corner of screen
7. Select Settings and Options from the menu bar
8. Change the sample rate to the desired rate. Select BAM or Req/Rec. Review the remaining settings and adjust as necessary. Hit OK to save the settings and exit the options screen
9. Hit Start to start the monitor screen
10. Select Log to begin logging
11. Select Stop to stop logging

KESET vs CALTERM / NGET

Advantages of KESET vs Calterm/NGET
KESET can log data continuously until all hard drive space is used.
KESET can chart out as many as sixteen parameters (that are being logged) live on the screen. This live chart can be paused (while logging continues) and the user is able to zoom in on interesting data points for investigation.
Multiple instances of KESET can be run at the same time. BAM, High Speed Req/Rec, and Low Speed Req/Rec.
KESET has the ability to log non-Cummins information that may be available on the datalink (such as pressure / thermocouple output from an external data logger
KESET can log ECM data via a USB port while another tool (NGET, Calterm, Insite) is connected to the same ECM via a serial port
KESET runs on Windows XP
KESET output file is a standard *.csv file that is easily read into Excel or Matlab

Disadvantages of KESET vs Calterm/NGET
KESET can not issue user overrides
KESET can not view fault counts
KESET can not clear faults
KESET cannot collect High Speed BAM data without shutting down all other ECM J1939 broadcasts
KESET cannot collect data as quickly as Calterm IDL which is capable of short bursts at 1 msec
KESET cannot log any form of absolute time, making it difficult to tie specific files / instances within a file back to real time events
KESET cannot be 'set up' while not connected to an ECM (useful for setting up ETIF screens prior to visiting unit)
KESET requires that the user have administrative rights to their PC

For further help: The KESET User Manual offers information on how to operate KESET.

KESET HELPFUL HINTS

- Save views (parameter list and screen display) for quick screen set up by selecting the Save button in the tool bar
- In Low Speed KESET, parameter names can only be typed when the E2M Parameter screen is highlighted
- KESET High Speed BAM must have the ECM switched to Dev before issuing BAM command
- See Cherian Olikara or Kelley Stephenson for assistance in setting up KESET on a PC

2004 CM870 and CM875 CONTROL SYSTEM

Critical Parameters List:

1. Mission Data Critical Parameters List

Standard Service Investigation List:

Filtered_Engine_Speed	RPM	Road_Speed	MPH
Commanded_Throttle	%THROTTLE	Net_Engine_Torque	FT*LB
Final_Fueling	MG/STROKE	EGR_Valve_Position	%open
Fueling_Control_State	---	Alpha	---
Final_Timing	CRANK_DEG_BTDC	VGT_Duty_Cycle	%DUTY_CYCLE
Final_Timing_State	---	CHL_Derate_Is_Active	---
Boost_Pressure	IN_HG	Filtered_Turbo_Speed	KRPM
Filtered_Gear_Ratio	---	Broadcasted_Percent_Load	%

Standard Performance Duty Cycle List:

Filtered_Engine_Speed	RPM	Compressor_Inlet_Tmptr	DEG_F
Total_Fueling	MG/STROKE	EGR_Position	%open
Fueling_Control_State_Value	---	VGT_Duty_Cycle	%Duty_Cycle
Road_Speed	MPH	Filtered_Turbo_Speed	KRPM
Alpha	---	EGR_Fraction	---
CBR_Chi_Value	---	CHL_EGR_Frac_Cmd	---
Exhaust_Press	IN_HG	Charge_Flow	LB/MIN
Charge_Press	IN_HG	CHL_MCF_Cmd	LB/MIN
Commanded_Throttle	%THROTTLE	Final_Timing_State	---
TQM_Final_Torque_Cmd	FT*LB	Final_Timing	DEG_BTDC
Exhaust_Tmptr	DEG_F	Compressor_Inlet_Press	IN_HG
EGR_Orifice_Tmptr	DEG_F	Compressor_Inlet_Density	LBM/FT3
Charge_Tmptr	DEG_F	Altitude	FT
Ambient_Air_Press	IN_HG	EGR_Valve_Delta_Press	IN_HG
Ambient_Air_Tmptr	DEG_F	EGR_Orifice_Delta_Press	IN_HG
Fuel_Rail_Press	PSI	Compressor_Outlet_Tmptr	DEG_F
Fuel_Tmptr	DEG_F	Coolant_Tmptr	DEG_F
Oil_Tmptr	DEG_F	EMM_AECD_State	---
Oil_Press	PSI (gauge)	EMM_Protection_State	---

Engine Performance Parameter List:

Filtered_Engine_Speed	RPM	Ndot_Demand	RPM/SEC
Total_Fueling	MG/STROKE	Ndot_Actual	RPM/SEC
Fueling_Control_State_Value	---	Ndot_LSG	RPM/SEC
Final_Timing	CRANK_DEG	Ndot_HSG	RPM/SEC
Net_Engine_Torque	FT*LB	Ndot_RMG	RPM/SEC
Net_Machine_Torque	FT*LB	Ndot_ASG	RPM/SEC
No_Load_Torque	FT*LB	Ndot_Cruise_Control	RPM/SEC
Ndot_Error	RPM/SEC	Ndot_RSG	RPM/SEC
Ndot_ANC	RPM/SEC	Ndot_Powetrain	RPM/SEC
Final_Timing_State	---	Filtered_Turbo_Speed	KRPM
Commanded_Throttle	%THROTTLE	Coolant_Tmptr	DEG_F
Road_Speed	MPH	Charge_Tmptr	DEG_F
Filtered_Gear_Ratio	---	Charge_Press	IN_HG
Alpha	---	Ambient_Air_Tmptr	DEG_F
CBR_Chi_Value	---	Ambient_Air_Press	IN_HG
EGR_Position	%open	Compressor_Inlet_Tmptr	DEG_F
VGT_Duty_Cycle	%Duty_Cycle	Compressor_Inlet_Density	LBM/FT3

Air Handling Combustion Controls Parameter List:

Filtered_Engine_Speed	RPM	CHL_EGR_Frac_Cmd	---
FSS_Total_Fueling	MG/STROKE	EGR_Fraction	---
Fueling_Control_State_Value	---	EAC_EGR_Valve_Cmd	%
TQM_Final_Torque_Cmd	FT*LB	EGR_Position	%open
Net_Engine_Torque	FT*LB	CHS_MCF_Cmd	LB/MIN
CBR_Alpha	---	CHL_MCF_Cmd	LB/MIN
CBR_Chi_Value	---	Charge_Flow	LB/MIN
Filtered_Turbo_Speed	KRPM	TGC_VT_Cmd	%
EGR_Valve_Delta_Press	IN_HG	VGT_Duty_Cycle	%Duty_Cycle
Charge_Press	IN_HG	CSE_Xform_Error_1	---
Exhaust_Press	IN_HG	CSE_Xform_Error_2	---
Exhaust_Tmptr	DEG_F	CSE_Xform_Angle	DEG
EGR_Orifice_Tmptr	DEG_F	EGR_Delta_Press	IN_HG
Compressor_Outlet_Tmptr	DEG_F	Charge_Tmptr	DEG_F
Compressor_Inlet_Density	LBM/FT3	CBR_EGR_Frac_Ref	---
Compressor_Inlet_Tmptr	DEG_F	CBR_MCF_Ref	LB/MIN
EGA_Control_State	---	EMM_AECD_State	---
Altitude	FT	EMM_Protection_State	---

A/D Sensors:

2. Ambient Air Pressure / Compressor Inlet Pressure

(/vob/base/sys_rqmt/ad_air_pressure_sensor.doc(rev 9))

A/D Processing:		**Input to Control Algorithms:**	
Air_Pressure_Sensor	IN_HG	Ambient_Air_Press	IN_HG
Air_Pressure_Sensor_Raw	CNTS	Ambient_Air_Press_Source	---
Air_Pressure_Sensor_Global_Default	IN_HG	Air_Press_State	HEX
Air_Press_Sensor	IN_HG	Compressor_Inlet_Press	IN_HG
Air_Press_Status	---	Compressor_Inlet_Press_Source	---
Air_Pressure_Sensor_High_Error	---	Compressor_Inlet_Pressure_Drop	IN_HG
Air_Pressure_Sensor_Low_Error	---	T_AMB_Sensing_Ambient_Pressure	---

3. Charge Pressure Sensor / Boost Pressure

(/vob/base/sys_rqmt/ad_boost_pressure_absolute.doc(rev 8))

A/D Processing:		**Input to Control Algorithms:**	
Boost_Pressure_Absolute	IN_HG	Charge_Press	IN_HG
Boost_Pressure_Absolute_Raw	CNTS	Charge_Press_Source	---
Boost_Pressure_Absolute_Global_Default	IN_HG	Charge_Press_State	HEX
Charge_Press_Sensor	IN_HG	Boost_Pressure_Absolute	IN_HG
Charge_Press_Status	---		
Boost_Pressure_Absolute_High_Error	---	**Gage Boost Pressure Value:**	
Boost_Pressure_Absolute_Low_Error	---	Boost_Pressure	IN_HG
		Charge_Press_Gauge	IN_HG
		Charge_Press_Gauge_Source	---

4. Charge Temperature Sensor / Intake Manifold Temperature

(/vob/base/sys_rqmt/ad_intake_manifold_temperature.doc(rev 9))

A/D Processing:		**Input to Control Algorithms:**	
Intake_Manifold_Temperature_Sensor	DEG_F	Charge_Tmptr	DEG_F
Intake_Manifold_Temperature_Sensor_Raw	CNTS	Charge_Tmptr_Source	---
Intake_Manifold_Temperature_Sensor_Global_Default	DEG_F	Charge_Tmptr_State	HEX
Charge_Tmptr_Sensor	DEG_F	Intake_Manifold_Temperature	DEG_F
Charge_Tmptr_Status	---		
Intake_Manifold_Temperature_Sensor_High_Error	---	**IMT Lead Lag Estimation:**	
Intake_Manifold_Temperature_Sensor_Low_Error	---	TPE_IMT_Lead_Term	DEG_F
		TPE_IMT_After_Lead	DEG_F
		TPE_IMT_Lead_Time_Constant	SEC

5. Compressor Inlet Temperature / Ambient Air Temperature

(/vob/base/sys_rqmt/ad_compressor_inlet_temperature.doc(rev 8))

A/D Processing:		**Input to Control Algorithms:**	
Compressor_Inlet_Temperature	DEG_F	Compressor_Inlet_Tmptr	DEG_F
Compressor_Inlet_Temperature_Raw	CNTS	Compressor_Inlet_Tmptr_Source	---
Compressor_Inlet_Temperature_Global_Default	DEG_F	Compressor_Inlet_Tmptr_State	HEX
Compressor_Inlet_Tmptr_Sensor	DEG_F	Ambient_Air_Tmptr	DEG_F
Compressor_Inlet_Tmptr_Status	---	Ambient_Air_Tmptr_Source	---
Compressor_Inlet_Temperature_Low_Error	---	Compressor_Inlet_Tmptr_Rise	DEG_F
Compressor_Inlet_Temperature_High_Error	---		

6. Coolant Level Sensor

(/vob/base/sys_rqmt/ad_coolant_level.doc(rev 9))

A/D Processing:		**Input to Control Algorithms:**	
Coolant_Level	VOLT	Coolant_Lvl	VOLT
Coolant_Level_Raw	CNTS	Coolant_Lvl_Source	---
Coolant_Level_Global_Default	VOLT	Coolant_Lvl_State	HEX
Coolant_Lvl_Sensor	VOLT	Coolant_Level	VOLT
Coolant_Lvl_Status	---	Coolant_Level_High_Error	---
		Coolant_Level_Low_Error	---
Determining Coolant Level:			
Coolant_Tmptr	DEG_F	CLS_Safe_Threshold	---
CLS_Coolant_Level_State	---	CLS_Coolant_Level_Reading	---
CLS_Low_Coolant_Error	---	T_CLS_Algorithm_Enable	HEX

7. Coolant Temperature Sensor

(/vob/base/sys_rqmt/ad_coolant_temperature.doc(rev 7))

A/D Processing:		**Input to Control Algorithms:**	
Coolant_Temperature	DEG_F	Coolant_Tmptr	DEG_F
Coolant_Temperature_Raw	CNTS	Coolant_Tmptr_Source	---
Coolant_Temperature_Global_Default	DEG_F	Coolant_Tmptr_State	HEX
Coolant_Tmptr_Sensor	DEG_F	Coolant_Temperature	DEG_F
Coolant_Tmptr_Status	---		
Coolant_Temperature_High_Error	---		
Coolant_Temperature_Low_Error	---		

8. EGR Delta Pressure Sensor

(/vob/base/sys_rqmt/ad_egr_delta_p_sensor.doc(rev 8))

A/D Processing:		**Output from EGR ?P Autozero:**	
EGR_Delta_P_Sensor	IN_HG	EGR_Delta_Press	IN_HG
EGR_Delta_P_Sensor_Raw	CNTS	EGR_Delta_Press_Source	---
EGR_Delta_P_Sensor_Global_Default	IN_HG	EGR_Delta_Press_State	HEX
EGR_Delta_Press_Sensor	IN_HG		
EGR_Delta_Press_Status	---	EGR_Delta_Press_AP	IN_HG
EGR_Delta_P_Sensor_High_Error	---	EGR_ Delta_Pressure	IN_HG
EGR_Delta_P_Sensor_Low_Error	---	EGR_Delta_P_Autozero_Error	---

9. EGR Orifice Temperature (EGR Return Temperature)

/vob/base/sys_rqmt/ad_egr_orifice_temperature.doc(rev 7))

A/D Processing:		**Input to Control Algorithms:**	
EGR_Orifice_Temperature	DEG_F	EGR_Orifice_Temperature	DEG_F
EGR_Orifice_Temperature_Raw	CNTS	EGR_Orifice_Tmptr_Source	---
EGR_Orifice_Temperature_Global_Default	DEG_F	EGR_Orifice_Tmptr_State	HEX
EGR_Orifice_Tmptr_Sensor	DEG_F	EGR_Orifice_Tmptr	DEG_F
EGR_Orifice_Tmptr_Status	---		
EGR_Orifice_Temperature_Sensor_High_Error	---	**EGRT Lead Lag Estimation:**	
EGR_Orifice_Temperature_Sensor_Low_Error	---	INM_EGRT_Lead_Term	DEG_F
		INM_EGRT_After_Lead	DEG_F
		INM_EGRT_Lead_Time_Constant	SEC

10. EGR Valve Position Sensor

(/vob/base/sys_rqmt/ad_egr_position.doc(rev 10))

A/D Processing:		**Output from EGR Position Autozero:**	
EGR_Position_Before_Autozero	%open	EGR_Position	%open
EGR_Position_Before_Autozero_Raw	CNTS	EGR_Position_Source	---
EGR_Position_Before_Autozero_Global_Default	%open	EGR_Position_State	HEX
EGR_Position_Sensor	%open		
EGR_Position_Status	---	EGR_Valve_Position	%open
EGR_Position_Before_Autozero_High_Error	---	EGR_Valve_Is_Closed	---
EGR_Position_Before_Autozero_Low_Error	---	EGR_Valve_Autozero_Error	---

11. Exhaust Pressure Sensor

/vob/base/sys_rqmt/ad_exhaust_pressure.doc(rev10))

A/D Processing:		**Input to Control Algorithms:**	
Exhaust_Pressure_Sensor	IN_HG	Exhaust_Press	IN_HG
Exhaust_Pressure_Sensor_Raw	CNTS	Exhaust_Press_Source	---
Exhaust_Pressure_Sensor_Global_Default	IN_HG	Exhaust_Press_State	HEX
Exhaust_Press_Sensor	IN_HG	Exhaust_Pressure	IN_HG
Exhaust_Press_Status	---		
Exhaust_Pressure_Sensor_High_Error	---		
Exhaust_Pressure_Sensor_Low_Error	---		

12. Oil Pressure Sensor

(/vob/base/sys_rqmt/ad_oil_pressure_absolute.doc(rev 7))

A/D Processing:		**Input to Control Algorithms:**	
Oil_Pressure_Absolute	PSI_A	Oil_Press	PSI
Oil_Pressure_Absolute_Raw	CNTS	Oil_Press_Source	---
Oil_Pressure_Absolute_Global_Default	PSI_A	Oil_Press_State	HEX
Oil_Press_Sensor	PSI_A	Oil_Pressure	PSI
Oil_Press_Status	---		
Oil_Pressure_Absolute_High_Error	---	**Absolute Oil Pressure Value:**	
Oil_Pressure_Absolute_Low_Error	---	Oil_Press_Absolute	PSI_A

13. Oil Temperature Sensor

(/vob/base/sys_rqmt/ad_oil_temperature.doc(rev 6))

A/D Processing:		**Input to Control Algorithms:**	
Oil_Temperature	DEG_F	Oil_Tmptr	DEG_F
Oil_Temperature_Raw	CNTS	Oil_Tmptr_Source	---
Oil_Temperature_Global_Default	DEG_F	Oil_Tmptr_State	HEX
Oil_Tmptr_Sensor	DEG_F	Oil_Temperature	DEG_F
Oil_Tmptr_Status	---		
Oil_Temperature_High_Error	---		
Oil_Temperature_Low_Error	---		

14. Turbocharger Speed Processing

(/vob/base/sys_rqmt/turbospd.doc(rev 26), /vob/base/sys_rqmt/turbo_speed_processing.doc(rev 10))

A/D Processing:		**Input To Control Algorithms:**	
Ambient_Air_Press	IN_HG	Filtered_Turbo_Speed	KRPM
Boost_Pressure_Absolute	IN_HG	Turbo_Speed_Source	---
Estimated_Turbo_Speed	KRPM	Turbo_Speed_State	HEX
Raw_Turbo_Speed	HZ	VR_Turbo_Speed_Hysteresis	---
Turbo_Speed_Period	SEC	Turbo_Speed_In_Range_Error	---
Turbo_Speed_Global_Default	KRPM		
Turbo_Speed_Sensor	KRPM		
Turbo_Speed_Status	---		
Turbo_Speed_Low_Error	---		
Turbo_Speed_High_Error	---		

15. Turbocharger VG Actuator

(/vob/base/sys_rqmt/vgt_pneumatic_control_conditioning.doc(rev 11))

Input to Control Algorithm:		**Output to Control System:**	
Battery_Volt	VOLT	VGT_Duty_Cycle	%Duty_Cycle
Coolant_Tmptr	DEG_F	VGT_Dither_Amplitude	%Duty_Cycle
TGC_VT_Cmd	%	VGT_Duty_Cycle_Dithered	%Duty_Cycle
Filtered_Engine_Speed	RPM	VGT_Batt_Compensated_Duty_Cycle	%Duty_Cycle
		VGT_Cold_Compensated_Duty_Cycle	%Duty_Cycle
		VGT_Engine_On_Duty_Cycle	%Duty_Cycle

HPI-TP Fuel Systems A/D Sensors:

16. EPS (Engine Position / Engine Speed) Sensors

(/vob/fssc_proto/sys_rqmt/fssc/eps.doc(rev 8), /vob/fssc_proto/sys_rqmt/fssc/phs_dtct.doc(rev 2))

EPS_Engine_Speed	RPM	EPS_Backup_Phase	CRANK_DEG
EPS_Cam_Cycle_State	---	EPS_Cam_Half_Cycle	---
EPS_Error_Status	HEX	EPS_Crank_Tooth_At_Cam_Pulse	CNTS
EPS Main Sensor (Crank):		**EPS Backup Sensor (Cam):**	
EPS_Main_RPM	RPM	EPS_Backup_RPM	RPM
EPS_Main_Sync_State	---	EPS_Backup_Sync_State	---
EPS_Main_Intermittent_Sync	---	EPS_Backup_Intermittent_Sync	---
EPS_Main_Interrupt_Number	---	EPS_Backup_Interrupt_Number	---
EPS_Main_Period	---	EPS_Backup_Period	---
EPS_Main_Pulse_Type	---	EPS_Backup_Pulse_Type	---

17. Fuel Rail Pressure Sensor

(/vob/base/sys_rqmt/ad_fuel_rail_pressure.doc(rev 6))

A/D Processing:		**Input to Control Algorithms:**	
Fuel_Rail_Pressure	PSI	Fuel_Rail_Pressure	PSI
Fuel_Rail_Pressure_Raw	CNTS	Fuel_Rail_Press	PSI
Fuel_Rail_Pressure_Global_Default	PSI	Fuel_Rail_Press_Source	---
Fuel_Rail_Press_Sensor	PSI		
Fuel_Rail_Press_Status	---	**FSSC Parameters:**	
Fuel_Rail_Pressure_High_Error	---	FSI_lp_Gallery_v	MBAR
Fuel_Rail_Pressure_Low_Error	---		

18. Fuel Temperature Sensor

(/vob/base/sys_rqmt/ad_fuel_temperature.doc(rev 6))

A/D Processing:		**Input to Control Algorithms:**	
Fuel_Temperature	DEG_F	Fuel_Temperature	DEG_F
Fuel_Temperature_Raw	CNTS	Fuel_Tmptr	DEG_F
Fuel_Temperature_Global_Default	DEG_F	Fuel_Tmptr_Source	---
Fuel_Tmptr_Sensor	DEG_F		
Fuel_Tmptr_Status	---	**FSSC Parameters:**	
Fuel_Temperature_High_Error	---	FSI_t_fuel_v	DEG_C
Fuel_Temperature_Low_Error	---		

Parameter Estimates and Predictions:

19. Ambient Parameters Estimate

(/vob/base/sys_rqmt/ambient_parameters.doc(rev11))

Filtered_Engine_Speed	RPM		
Net_Engine_Torque	FT*LB		
Ambient Air Temperature Estimae:			
Vehicle_Speed	MPH	Ambient_Air_Tmptr	DEG_F
Fresh_Air_Flow	LB/MIN	Fresh_Air_Flow_Source	---
Compressor_Inlet_Tmptr_Rise	DEG_F	Compressor_Inlet_Tmptr_Source	---
Compressor_Inlet_Tmptr	DEG_F	Ambient_Air_Tmptr_Source	---
Altitude Estimate:			
Ambient_Air_Press	IN_HG	Ambient_Air_Press_Source	---
Altitude	FT	Altitude_Source	---
Compressor Inlet Pressure Estimate:			
Air_Press	IN_HG	Compressor_Inlet_Press	IN_HG
Fresh_Air_Flow	LB/MIN	Fresh_Air_Flow_Source	---
Compressor_Inlet_Pressure_Drop	IN_HG	Air_Press_Source	---
T_AMB_Sensing_Ambient_Pressure	---	Ambient_Air_Press_Source	---
Ambient_Air_Press	IN_HG	Compressor_Inlet_Press_Source	---
Humidity Estimation (engineering use only):			
Filtered_Engine_Speed	RPM	Ambient_Relative_Humidity	---
CBR_Fuel_Ref	MG/STROKE		

20. Charge Flow Estimate

(/vob/base/sys_rqmt/charge_flow_estimate.doc(rev12))

Filtered_Engine_Speed	RPM	Total_Fueling	MG/STROKE
Net_Engine_Torque	FT*LB	Fueling_Control_State	---
Charge Flow Estimate:			
Charge_Tmptr	DEG_F	Charge_Press_Source	---
CHP_Intake_Manifold_Tmptr_R	DEG_R	Charge_Tmptr_Source	---
CHP_Volumetric_Efficiency	---	Exhaust_Press_Source	---
Charge_Flow	LB/MIN	Charge_Flow_Source	---
Volumetric Efficiency:			
CHP_Veff_Mach	---	Exhaust_Press	IN_HG
CHP_Veff_Sqrt	---	Charge_Press	IN_HG
CHP_Flow_Area_Constant	---	Exhaust_Press_Disabled	
CHP_Veff_Mode			
Speed Density Equation:			
CHP_Volumetric_Efficiency	---	CHP_Intake_Manifold_Tmptr_R	DEG_R
Charge_Press	IN_HG	C_CHP_Engine_Displacement	IN3

21. Charge Pressure Estimate

(/vob/base/sys_rqmt/charge_pressure_estimation.doc(rev10))

Filtered_Engine_Speed	RPM		
Net_Engine_Torque	FT*LB		

Charge Pressure Estimate With Turbo Speed

Filtered_Engine_Speed	RPM	TPE_Corrected_Turbo_Speed	REV/SEC/Sqrt(K)
Compressor_Inlet_Press	IN_HG	Charge_Press_Est_Offset	IN_HG
TPE_Pressure_Ratio_Scale	---	Charge_Press_Tolerance	IN_HG
TPE_Pressure_Ratio_Estimate	---	Charge_Press_Est	IN_HG
C_TPE_Charge_Press_Est_Offset	IN_HG	Charge_Press_Est_With_TSS	IN_HG

Charge Pressure Estimate Without Turbo Speed

Filtered_Engine_Speed	RPM	TPE_CIT_Sqrt	SQRT(DEG_K)
FSS_Total_Fueling	MG/STROKE	Compressor_Inlet_Density	LBM/FT3
Charge_Tmptr	---	TPE_Corrected_Engine_Speed	RPM*sqrt(K)/R
TPE_Corrected_Fuel_Flow	mg/s*RPS/sqrt(K)	Charge_Press_Est	IN_HG
Compressor_inlet_Press	IN_HG	Charge_Press_Est_No_TSS	IN_HG
TPE_EGR_Delta_Boost	IN_HG	TPE_EGR_Delta_Boost_Scale	---
EGR_Valve_Is_Closed	---	TPE_Non_EGR_Delta_Boost_Scale	---
C_TPE_Gauge_Charge_Press_Offset	IN_HG		

Charge Pressure Estimate Status with Turbo Speed:

Turbo_Speed_Source	---	EGR_Position_Source	---
Filtered_Turbo_Speed	KRPM	EGR_Delta_Press_Source	---
Compressor_Inlet_Tmptr_Source	---	Exhaust_Press_Source	---
Charge_Tmptr_Source	---	EGR_Orifice_Tmptr_Source	---
Air_Press_Source	---	Charge_Press_Estat_With_TSS	---
T_Charge_Press_Estimate_Enable	---		

Charge Pressure Estimate Status without Turbo Speed:

T_Charge_Press_Estimate_Enable	---	Charge_Press_Estat_No_TSS	---
Charge_Tmptr_Source	---	Air_Press_Source	---
Compressor_Inlet_Tmptr_Source	---		

22. Charge Temperature Estimate

(/vob/base/sys_rqmt/charge_temperature_estimation.doc(rev6))

Compressor_Inlet_Tmptr	DEG_F	CBR_Alpha	---
Compressor_Inlet_Tmptr_Source	---	TPE_CIT_Ref	DEG_F
CBR_Chi_Value	---	CBR_Charge_Tmptr_Ref	DEG_F
CBR_Chi_Desired	---	Charge_Tmptr_Est	DEG_F
CBR_Chi_Source	---	Charge_Tmptr_EStat	---
T_Charge_Tmptr_Estimate_Enable	---		

23. Compressor Inlet Density Estimate

(/vob/base/sys_rqmt/compressor_inlet_density_estimator.doc(rev7))

Filtered_Engine_Speed	RPM	Compressor_Inlet_Density	LBM/FT3
Net_Engine_Torque	FT*LB	Compressor_Inlet_Press	IN_HG
Altitude	FT	CBR_Chi_Value	---

Compressor Inlet Density Estimate:

Compressor_Inlet_Press	IN_HG	Compressor_Inlet_Tmptr	DEG_F
		Compressor_Inlet_Density	LBM/FT3

Compressor Inlet Density Source:

Compressor_Inlet_Press_Source	---	Compressor_Inlet_Density_Source	---
Compressor_Inlet_Tmptr_Source	---		

24. Compressor Outlet Temperature Estimate

(/vob/base/sys_rqmt/compressor_outlet_temperature_estimation.doc(rev18))

Filtered_Engine_Speed	RPM	Compressor_Outlet_Tmptr	DEG_F
Net_Engine_Torque	FT*LB	Compressor_Inlet_Tmptr	DEG_F
COT Estimate:			
Compressor_Inlet_Press	IN_HG	TPE_Corrected_Air_Flow	KG*SQRT_K/S/Mpa
Compressor_Inlet_Tmptr	DEG_F	TPE_CIT_Sqrt	SQRT(DEG_K)
Fresh_Air_Flow	LB/MIN	TPE_Corrected_Turbo_Speed	REV/SEC/SQRT(K)
Filtered_Turbo_Speed	KRPM	TPE_COT_To_Inlet_Tmptr_Ratio	---
		Compressor_Outlet_Tmptr	DEG_F
COT Estimate Source:			
Compressor_Inlet_Press_Source	---	Turbo_Speed_Source	---
Compressor_Inlet_Tmptr_Source	---	T_TPE_COT_Estimation_Enable	---
Fresh_Air_Flow_Source	---	TPE_COT_Est_Enable	---
		Compressor_Outlet_Tmptr_Source	---

25. EGR Fraction Estimate

(/vob/base/sys_rqmt/egr_fraction_estimate.doc (rev17))

Filtered_Engine_Speed	RPM	Total_Fueling	MG/STROKE
Net_Engine_Torque	FT*LB	Fueling_Control_State	---
EGR Fraction Estimate:			
CHP_Volumetric_Efficiency	---	CHP_O2_Frac_EGR	---
CBP_O2_Frac_Residual_Bef_Delay	---	EGR_Flow	LB/MIN
CHP_O2_Flow_Delay	SEC	EGR_Flow_Source	---
CHP_EGR_Flow_Delay	SEC	Charge_Flow	LB/MIN
CHP_EGR_Flow_Before_Delay	LB/MIN	EGR_Fraction	---
Downstream EGR Flow Model:			
EGR_Orifice_Delta_Press	IN_HG	EGR_Position	%open
Charge_Press	IN_HG	EGR_Valve_Is_Closed	---
EGR_Orifice_Tmptr	DEG_F	C_CHP_Venturi_Vrt_Sensor_Active	---
CHP_Downstream_Pratio	---	EGR_Position_Source	---
CHP_Sqrt_Torifice_R	DEG_R	EGR_Orifice_Delta_Press_Source	---
CHP_Downstream_Corrected_Flow	LB/MIN	Charge_Press_Source	---
CHP_Downstream_EGR_Flow	LB/MIN	EGR_Tmptr_Source	---

26. Engine and EGR Valve Delta Pressure Estimate

(/vob/base/sys_rqmt/delta_pressure_estimates.doc(rev4))

Filtered_Engine_Speed	RPM	EGR_Valve_Delta_Press	IN_HG
Net_Engine_Torque	FT*LB	Engine_Delta_Press	IN_HG
Fueling_Control_State	---		
EGR Delta Pressures Estimate:			
EGR_Delta_Press	IN_HG	EGR_Orifice_Delta_Press	IN_HG
Charge_Press	IN_HG	EGR_Valve_Delta_Press	IN_HG
Exhaust_Press	IN_HG	Engine_Delta_Press	IN_HG
C_TPE_Exhaust_Pressure_Offset	IN_HG	NOTE: Engine_Delta_Press = EGR_Valve_Delta_Press * (-1)	
EGR Delta Pressures Estimate Source:			
Charge_Press_Source	---	EGR_Valve_Delta_Press_Source	---
Exhaust_Press_Source	---	Engine_Delta_Press_Source	---
EGR_Delta_Press_Source	---	EGR_Orifice_Delta_Press_Source	---

27. Exhaust Pressure Estimate

(/vob/base/sys_rqmt/exhaust_pressure_estimate.(rev9))

Filtered_Engine_Speed	RPM	Exhaust_Press	IN_HG
Net_Engine_Torque	FT*LB	Exhaust_Press_Source	---
Fueling_Control_State	---	T_TPE_Exhaust_Press_Est_Enable	---
		Exhaust_Press_Est	
Exhaust Pressure Back-up Estimate:			
Filtered_Engine_Speed	RPM	EGR_Position	%open
TGC_VT_Cmd	%	Charge_Press	IN_HG
Ambient_Air_Press	IN_HG	Exhaust_Press_Est	IN_HG
EMP Estimate Source:			
EGR_Position_Source	---	Exhaust_Press_Estat	---
Charge_Press_Source	---	T_TPE_Exhaust_Press_Est_Enable	---

28. Exhaust Temperature Estimate

(/vob/base/sys_rqmt/exhaust_temperature_estimate.doc(rev13))

Filtered_Engine_Speed	RPM	Total_Fueling	MG/STROKE
Net_Engine_Torque	FT*LB	Fueling_Control_State	---
Exhaust Temperature OPUS-Fit:			
FSS_SOI	CRANK_DEG	Filtered_Engine_Speed	RPM
Charge_Press	IN_HG	CBP_Charge_Fuel_Ratio	---
		TPE_Energy_Fraction	---
Exhaust Temperature Estimate:			
TPE_Invalid_Model	---	Exhaust_Tmptr_Source	---
TPE_Delta_Exhaust_Tmptr	DEG_F	Charge_Flow_Source	---
Exhaust_Tmptr	DEG_F	Charge_Tmptr_Source	---
Exhaust_Metal_Tmptr	DEG_F	Charge_Press_Source	---

29. Fresh Air Flow Estimation

(/vob/base/sys_rqmt/fresh_air_flow_estimate.doc(rev7))

Filtered_Engine_Speed	RPM	Total_Fueling	MG/STROKE
Net_Engine_Torque	FT*LB	Fresh_Air_Flwo	---
EGR_Flow	LB/MIN	Charge_Flow	LB/MIN
Charge_Flow_Source	---	Fresh_Air_Flow_Source	---
EGR_Flow_Source	---		

30. IMT Prediction (w/ EGR Flow) / IMT Lead-Lag Compensation

(/vob/base/sys_rqmt/imt_prediction.doc(rev5), /vob/base/sys_rqmt/charge_temperature_processing.doc(rev10))

Filtered_Engine_Speed	RPM		
Net_Engine_Torque	FT*LB		
IMT Prediction with EGR Flow:			
Ambient_Air_Tmptr	DEG_F	Coolant_Tmptr	DEG_F
CBR_Base_Chi_EGR_Frac_Cmd	---	Exhaust_Tmptr	DEG_F
EGR_Valve_Is_Closed	---	Charge_Tmptr	DEG_F
		CHP_Predicted_IMT	DEG_F
IMT Lead-Lag Compensation:			
Charge_Flow	LB/MIN	TPE_IMT_After_Lead	DEG_F
Charge_Tmptr_Sensor	DEG_F	TPE_IMT_Lead_Time_Constant	SEC
Charge_Tmptr_Status	---	TPE_IMT_Lead_Term	DEG_F
Charge Temperature Selector			
Charge_Tmptr_State	---	Charge_Tmptr	DEG_F
Charge_Tmptr_Est	DEG_F	Charge_Tmptr_Source	---
Charge_Tmptr_EStat	---	Charge_Tmptr_Status	---

31. Saturation Temperature Estimate

(/vob/base/sys_rqmt/saturation_temperature_estimates.doc(rev4))

Filtered_Engine_Speed	RPM		
Net_Engine_Torque	FT*LB		

Saturation Temperatures Estimate:

Charge_Press	IN_HG	TPE_Inlet_H2O_Mole_Fraction	---
EGR_Fraction	---	Charge_Saturation_Tmptr	DEG_F
CBR_Base_Chi_EGR_Frac_Cmd	---	Charge_H2O_PP	IN_HG
CBP_Phi	---	Exhaust_Saturation_Tmptr	DEG_F
Ambient_Air_Press	IN_HG	Exhaust_H2O_PP	IN_HG
Ambient_Air_Tmptr	DEG_F	TPE_Exhaust_H2O_Mole_Fraction	---
Ambient_Relative_Humidity	---	TPE_Charge_H2O_Mole_Fraction	---

H2O Charge Concentration:

Charge_Press	IN_HG	CBP_Phi	---
EGR_Fraction	---	TPE_Charge_H20_Mole_Fraction	---
CBR_Base_Chi_EGR_Frac_Cmd	---		

Inlet Mole Fraction of Water

TPE_Saturation_Vapor_Press	IN_HG	Ambient_Air_Tmptr	DEG_F
TPE_Vapor_Partial_Press	IN_HG	Ambient_Relative_Humidity	---
Ambient_Air_Press	IN_HG	TPE_Inlet_H20_Mole_Fraction	---

H20 Exhaust Concentration

CBP_Phi	---	TPE_Exhaust_H2O_Mole_Fraction	---
TPE_Inlet_H20_Mole_Fraction	---		

Saturation Temperature Source

Charge_Press_Source	---	Charge_Saturation_Tmptr_Source	---
Ambient_Air_Press_Source	---	Exhaust_Saturation_Tmptr_Source	---
Ambient_Air_Tmptr_Source	---		

32. Turbo Speed Estimation

(/vob/base/sys_rqmt/turbo_speed_estimation.doc(rev14))

Filtered_Engine_Speed	RPM		
Net_Engine_Torque	FT*LB		

Turbo Speed Estimate Logic:

Filtered_Engine_Speed	RPM	TPE_Turbo_Speed_Scale	---
Charge_Press	IN_HG	TPE_CIT_Sqrt	SQRT(DEG_K)
Compressor_Inlet_Press	IN_HG	Turbo_Speed_Est	KRPM
TPE_Corrected_Turbo_Speed_Est	REV/SEC/Sqrt(K)	Filtered_Turbo_Speed	KRPM

Turbo Speed Estimate Status:

Charge_Press_Source	---	Compressor_Inlet_Tmptr_Source	---
Compressor_Inlet_Press_Source	---	Turbo_Speed_EStat	---
T_Turbo_Speed_Estimation_Enable	---		

Emission Features:

33. Charge Limit Management (CHL)

(/vob/base/sys_rqmt/charge_limit_management.doc(rev30))

Filtered_Engine_Speed	RPM	CBL_EGR_Frac_Cmd	---
FSS_Total_Fueling	MG/STROKE	CHL_EGR_Frac_Cmd	---
TQM_Final_Torque_Cmd	FT*LB	CHL_COT_Drt_Active	---
Fueling_Control_State	---	CHL_COT_Drt_Offset	LB/MIN
Compressor_Inlet_Density	LBM/FT3	CHL_Delta_P_Drt_Active	---
CHL_MCF_Cmd	LB/MIN	CHL_Delta_P_Drt_Offset	LB/MIN
Filtered_Turbo_Speed	KRPM	CHL_Turbo_Speed_Drt_Active	---
CHL_Turbo_Drt_Limit	KRPM	CHL_Turbo_Speed_Drt_Offset	LB/MIN
Compressor_Outlet_Tmptr	DEG_F	CHL_EGR_Off_DP_Drt_Active	---
EGR_Valve_Delta_Press	IN_HG	CHL_EGR_Off_DP_Drt_Offset	LB/MIN

The following parameters are included in Charge Limit Management, however, this feature is calibrated off in current phase 6 software

TPE_Corrected_Air_Flow	KG*SQRT_K/S/MPa	Surge_Line_CFP	---
CHL_Surge_Drt_Active	---	CHL_Surge_Limit	---
CHL_Surge_Drt_Offset	LB/MIN		

(/vob/base/sys_rqmt/charge_limit_management.doc(rev30))

[CHL] EGR Fraction Limit Selecction:

Filtered_Engine_Speed	RPM	CBL_EGR_Frac_Cmd	---
FSS_Total_Fueling	MG/STROKE	CHL_EGR_Frac_Cmd	---
TQM_Final_Torque_Cmd	FT*LB	CHL_EGR_Frac_Cmd_With_Shutoff	---
Fueling_Control_State	---	CHL_Derate_Is_Active	---
CHL_EGR_Derate_Conditions	---	EGR_Valve_Is_Closed	---
CHL_EGR_Frac_Cmd_With_Derate	---	CHL_Surge_Drt_Offset	LB/MIN
EGR_Fraction	---	CHL_EGR_Frac_Drt_With_Shutoff	---
CHL_Keep_Valve_Closed	---	CHL_EGR_Frac_Cmd_Bef_Rate_Limit	---
CHL_EGR_Frac_Shutoff	---	EGR_Valve_Delta_Press	IN_HG

(/vob/base/sys_rqmt/charge_limit_management.doc(rev30))

[CHL] Mass Charge Flow Limit Selecction:

Filtered_Engine_Speed	RPM	Charge_Flow	LB/MIN
FSS_Total_Fueling	MG/STROKE	CHL_Turbo_Speed_Drt_Active	---
TQM_Final_Torque_Cmd	FT*LB	CHL_Turbo_Speed_Drt_Offset	LB/MIN
Fueling_Control_State	---	CHL_Delta_P_Drt_Active	---
CHL_COT_Drt_Offset	LB/MIN	CHL_Delta_P_Drt_Offset	LB/MIN
CHL_COT_Drt_Active	---	EB_Brakes_Are_On	---
CHL_EGR_Frac_Shutoff	---	CHS_MCF_Cmd	LB/MIN
CHL_EGR_Off_DP_Drt_Active	---	CHL_Derate_State	---
CHL_EGR_Off_DP_Drt_Offset	LB/MIN		

34. Charge Parameter Determination (CHP)

(/vob/base/sys_rqmt/charge_parameter_determination.doc(rev7))

Filtered_Engine_Speed	RPM	Charge_Flow	LB/MIN
TQM_Final_Torque_Cmd	FT*LB	EGR_Flow	LB/MIN
CBL_Fuel_Cmd	MG/STROKE	EGR_Fraction	---
Fueling_Control_State	---	Fresh_Air_Flow	LB/MIN
FSS_Total_Fueling	MG/STROKE	CHP_Pumping_Torque_Adj	FT*LB
Charge_Tmptr	DEG_F	CHP_Predicted_IMT	DEG_F
CBR_Base_Chi_EGR_Frac_Cmd	---		

35. Charge System Errors (CSE)

(/vob/base/sys_rqmt/charge_system_errors.doc(rev17))

Filtered_Engine_Speed	RPM	CSE_Xform_Error_1	---
TQM_Final_Torque_Cmd	FT*LB	CSE_Xform_Error_2	---
FSS_Total_Fueling	MG/STROKE	CSE_MCF_Adj_Error	LB/MIN
Fueling_Control_State	---	CSE_EGR_On_Flag	---
CHL_EGR_Frac_Cmd	---	CSE_EGR_Frac_Adj_Error	---
EGR_Fraction	---	CSE_Xform_Angle	DEG
CHL_MCF_Cmd	LB/MIN	Charge_Flow	LB/MIN

36. Combustion Limit Management (CBL)

(/vob/base/sys_rqmt/combustion_limit_management.doc(rev21))

Filtered_Engine_Speed	RPM	CBL_Fuel_Cmd	MG/STROKE
TQM_Final_Torque_Cmd	FT*LB	CBL_SOI_Cmd	CRANK_DEG
CBO_Fuel_Ref	MG/STROKE	CBL_EGR_Frac_Cmd	---
Fueling_Control_State	---	CBL_MCF_Cmd	LB/MIN
ANC_SOI	CRANK_DEG	SOI_State	---
SOI_State	---	Timing_State_Incr	---
Timing_State_Incr	---	CBL_Density_MCF_Limit	LB/MIN
CBO_SOI_Adj_Flag	---	CBL_MCF_Ref	LB/MIN
CBO_EGR_Frac_Ref	---	CBL_SOI_Min_Limit	CRANK_DEG
CBO_MCF_Ref	LB/MIN	CBL_SOI_Max_Limit	CRANK_DEG
CBR_OFC_Alpha0_Incr_Flag	---	CBL_SOI_Ref	CRANK_DEG
Compressor_Inlet_Density	LBM/FT3	CBL_User_Incr_Flag	---
EGR_Valve_Is_Closed	---	SOI_State_Before_CBL	---
OFC_EGR_Disable	---	CBL_MCF_Limit_Is_Active	---

37. Combustion Manager (CBM)

(/vob/base/sys_rqmt/combustion_manager.doc(rev14))

Filtered_Engine_Speed	RPM	Total_Fueling	MG/STROKE
TQM_Final_Torque_Cmd	FT*LB	Final_Timing	CRANK_DEG
TQM_Net_Engine_Torque_State	---	CBL_EGR_Frac_Cmd	---
Alpha	---	CBL_MCF_Cmd	LB/MIN
EMM_Protection_State	---	CBR_SOI_Alpha1	CRANK_DEG_BTDC
EMM_Cap_EL_Cmd	---	CBL_Fuel_Ref	MG/STROKE
CBO_Charge_Aggressiveness_Ref	---	CBL_SOI_Ref	CRANK_DEG

38. Combustion Parameter Determination (CBP)

(/vob/base/sys_rqmt/combustion_parameter_determination.doc(rev8))

[CBP] Combustion Parameter Determination:

Filtered_Engine_Speed	RPM	Net_Engine_Torque	FT*LB
TQM_Final_Torque_Cmd	FT*LB	OFC_Fuel_Limit	MG/STROKE
TQM_Net_Engine_Torque_State	---	Texh_Fuel_Limit	MG/STROKE
CBR_Gross_Fuel	MG/STROKE	CBP_Net_Combustion_Torque	FT*LB

(/vob/base/sys_rqmt/residual_mass_estimator.doc(rev9))

[CBP] Residual Mass Estimator:

Exhaust_Press	IN_HG	Residual_Mass	MG/STROKE
Exhaust_Tmptr	DEG_F	CBP_Residual_Mass	MG/STROKE

(/vob/base/sys_rqmt/air_fuel_and_equivalence_ratio_calculations.doc(rev9))

[CBP] Air/Fuel and Charge/Fuel Calculations:

Charge_Flow	LB/MIN	CBP_Air_Fuel_Ratio	---
Fresh_Air_Flow	LB/MIN	CBP_Charge_Fuel_Ratio	---
Fuel_Delivery_Rate_Per_Min	LB/MIN	CBP_Phi	---
EGR_Fraction	---	CBP_Intake_Charge_O2_Fraction	---

(/vob/base/sys_rqmt/in_cylinder_oxygen_estimator.doc(rev14))

[CBP] In-Cylinder Oxygen Estimator:

Filtered_Engine_Speed	RPM	CBP_Air_Mass	MG/STROKE
FSS_Total_Fueling	MG/STROKE	CBP_Charge_Mass	MG/STROKE
Charge_Flow	LB/MIN	CBP_Charge_Plus_Fuel_Mass	MG/STROKE
EGR_Flow	LB/MIN	CBP_EGR_Mass	MG/STROKE
CHP_O2_Frac_EGR	---	CBP_O2_Frac_Residual	MG/STROKE
C_CHP_Number_Of_Cylinders	---	CBP_O2_Mass_Air	MG/STROKE
CBP_O2_Frac_Residual_Bef_Delay	---	CBP_O2_Mass_Burnt	MG/STROKE
Total_O2_In_Cylinder	MG/STROKE	CBP_O2_Mass_Exhaust	MG/STROKE
		Residual_Mass	MG/STROKE

(/vob/base/sys_rqmt/ofc_fuel_limit_estimator.doc(rev13))

[CBP] OFC Fuel Limit Estimator:

Filtered_Engine_Speed	RPM	OFC_Fuel_Limit	MG/STROKE
FSS_Total_Fueling	MG/STROKE	OFC_Equiv_Ratio_Limit	---
Total_O2_In_Cylinder	MG/STROKE	Compressor_Inlet_Density	LBM/FT3
Fueling_Control_State	---		

(/vob/base/sys_rqmt/texhaust_fuel_limit_estimator.doc(rev6))

[CBP] Texhaust Fuel Limit Estimator:

Filtered_Engine_Speed	RPM	TQM_Final_Torque_Cmd	---
Charge_Flow	LB/MIN	Fueling_Control_State	---
Charge_Tmptr	DEG_F	Texh_Fuel_Limit	MG/STROKE
Exhaust_Tmptr	DEG_F	Exhaust_Metal_Tmptr	DEG_F
TPE_Energy_Fraction	DEG_F	TFC_Fuel_Flow_Limit	LB/MIN

39. Combustion Reference (CBR)

(/vob/base/sys_rqmt/combustion_reference.doc(rev27))

[CBR] Combustion Reference:

Filtered_Engine_Speed	RPM	CBR_Chi_Value	---
TQM_Final_Torque_Cmd	FT*LB	CBR_Chi_Source	---
TQM_Net_Engine_Torque_State	---	CBR_Alpha	---
OFC_Fuel_Limit	MG/STROKE	CBR_Fuel_Ref	MG/STROKE
Texh_Fuel_Limit	MG/STROKE	CBR_Gross_Fuel	MG/STROKE
TQM_Final_Torque_Cmd	FT*LB	OFC_EGR_Disable	---
Filtered_Engine_Speed	RPM	CBR_EGR_Frac_Ref	---
TQM_Net_Engine_Torque_State	---	CBR_MCF_Ref	LB/MIN
EMM_Cap_EL_Cmd	---	CBR_SOI_Ref	CRANK_DEG
EMM_Protection_State	---	CBR_SOI_Alpha1	CRANK_DEG
Alpha	---	CBR_Charge_Tmptr_Ref	DEG_F

(/vob/base/sys_rqmt/combustion_reference.doc(rev27))

[CBR] Fuel Quantity Reference with Transient Correction:

Filtered_Engine_Speed	RPM	CBR_FCLR_Ref	---
TQM_Final_Torque_Cmd	FT*LB	CBR_FCLR_On	---
TQM_Net_Engine_Torque_State	---	CBR_FCLR_Off	---
OFC_Fuel_Limit	---	OFC_EGR_Disable	---
Texh_Fuel_Limit	---	CBR_Fuel_Ref	MG/STROKE
CBR_Gross_Fuel	MG/STROKE	CBR_Fuel_Ref_State	---

(/vob/base/sys_rqmt/combustion_reference.doc(rev27))

[CBR) Gross Fuel Calculation:

Filtered_Engine_Speed	RPM	CBR_Gross_Fuel_Before_Adj	MG/STROKE
TQM_Final_Torque_Cmd	FT*LB	CBR_SOI_Adj_Fuel_Active	---
TQM_Net_Engine_Torque_State	---	SOI_Torque_To_Fuel_Adj	MG/STROKE
Compressor_Inlet_Density	LBM/FT3	CBR_Density_Max_Fuel	MG/STROKE
FSS_Fueling_Derate_Request	MG/STROKE	CBR_Max_Chi_Fuel	MG/STROKE
CBR_Gross_Fuel	MG/STROKE	CBR_Max_Fuel_Limit	MG/STROKE
CBR_Fuel_Ref	MG/STROKE	CBR_Fuel_Ref_State	---

(/vob/base/sys_rqmt/combustion_reference.doc(rev27))

[CBR] Chi Determination:

Filtered_Engine_Speed	RPM	CBR_Chi_Value	---
TQM_Final_Torque_Cmd	FT*LB	CBR_Chi_Desired	---
TQM_Net_Engine_Torque_State	---	CBR_Chi_Source	---
Compressor_Inlet_Density	LBM/FT3	CBR_Chi_High	---
Coolant_Tmptr	DEG_F	CBR_Chi_Low	---
Alpha	LBM/FT3	CBR_Alpha	---
EMM_Cap_EL_Cmd	---	CBR_EGR_Off	---
EMM_Protection_State	---	CBR_Protection_Chi_Flag	---

(/vob/base/sys_rqmt/combustion_reference.doc(rev27))

[CBR] EGR Fraction Reference with Transient Correction:

Filtered_Engine_Speed	RPM	CBR_EGR_Frac_Alpha0	---
CBR_Gross_Fuel	MG/STROKE	CBR_EGR_Frac_Alpha1	---
CBR_Alpha	---	CBR_EGR_Frac_Chi2	---
CBR_Chi_Value	---	CBR_EGR_Frac_Chi3	---
CBR_Base_Chi	---	CBR_EGR_Frac_Chi4	---
CBR_EGR_Off	---	CBR_EGR_Frac_Ref	---
OFC_EGR_Disable	---	CBR_Base_Chi_EGR_Frac_Cmd	---

(/vob/base/sys_rqmt/combustion_reference.doc(rev27))

[CBR] Mass Charge Flow (MCF) Reference:

Filtered_Engine_Speed	RPM	CBR_MCF_Alpha0	LB/MIN
CBR_Gross_Fuel	MG/STROKE	CBR_MCF_Alpha1	LB/MIN
CBR_Alpha	---	CBR_MCF_Chi2	LB/MIN
CBR_Chi_Value	---	CBR_MCF_Chi3	LB/MIN
CBR_MCF_Ref	LB/MIN	CBR_MCF_Chi4	LB/MIN

(/vob/base/sys_rqmt/combustion_reference.doc(rev27))

[CBR] SOI Reference with Transient Correction:

Filtered_Engine_Speed	RPM	CBR_SOI_Alpha0	CRANK_DEG
CBR_Fuel_Ref	MG/STROKE	CBR_SOI_Alpha1	CRANK_DEG
CBR_Fuel_Ref_State	---	CBR_SOI_Chi2	CRANK_DEG
CBR_Alpha	---	CBR_SOI_Chi3	CRANK_DEG
CBR_Chi_Value	---	CBR_SOI_Chi4	CRANK_DEG
CBR_Base_Chi	---	CBR_SOI_Ref	CRANK_DEG
OFC_EGR_Disable	---	CBR_OFC_Alpha0_Incr_Flag	---
CBR_OFC_Limit_SOI_Alpha0	CRANK_DEG	CBR_Base_Chi_SOI_Cmd	CRANK_DEG

(/vob/base/sys_rqmt/combustion_reference.doc(rev27))

[CBR] Charge Temperature Reference:

Filtered_Engine_Speed	RPM	CBR_Charge_Tmptr_Alpha0	DEG_F
CBR_Fuel_Ref	MG/STROKE	CBR_Charge_Tmptr_Alpha1	DEG_F
CBR_Fuel_Ref_State	---	CBR_Charge_Tmptr_Chi2	DEG_F
CBR_Alpha	---	CBR_Charge_Tmptr_Chi3	DEG_F
CBR_Chi_Value	---	CBR_Charge_Tmptr_Chi4	DEG_F
Charge_Tmptr	DEG_F	CBR_Charge_Tmptr_Ref	DEG_F

(/vob/base/sys_rqmt/combustion_reference.doc(rev27))

[CBR] Chi Max Fuel Limit:

Filtered_Engine_Speed	RPM	CBR_Max_Fuel_Alpha0	MG/STROKE
TQM_Final_Torque_Cmd	FT*LB	CBR_Max_Fuel_Alpha1	MG/STROKE
TQM_Net_Engine_Torque_State	---	CBR_Max_Fuel_Chi2	MG/STROKE
CBR_Gross_Fuel_Before_Adj	MG/STROKE	CBR_Max_Fuel_Chi3	MG/STROKE
CBR_Alpha	---	CBR_Max_Fuel_Chi4	MG/STROKE
CBR_Chi_Value	---	CBR_Max_Chi_Fuel	MG/STROKE
CBR_Gross_Fuel	MG/STROKE	CBR_Fuel_Ref_State	---

40. Compensate For Off-Nominal Combustion Conditions (CBO)

(/vob/base/sys_rqmt/compensate_for_off_nominal_combustion_conditions.doc(rev17))

Filtered_Engine_Speed	RPM	CBO_EGR_Frac_Ref	---
TQM_Final_Torque_Cmd	FT*LB	CBO_MCF_Ref	LB/MIN
Fueling_Control_State	---	CBO_SOI_Ref	CRANK_DEG
CBR_EGR_Frac_Ref	---	CBO_Charge_Aggressiveness_Ref	---
CBR_MCF_Ref	LB/MIN	CBO_SOI_Ref_Adj	CRANK_DEG
CBR_SOI_Ref	CRANK_DEG	CBO_EGR_Frac_Adj	---
CBR_Charge_Tmptr_Ref	DEG_F	CBR_FCLR_Ref	CRANK_DEG
CBR_Fuel_Ref	MG/STROKE		

(/vob/base/sys_rqmt/compensate_for_off_nominal_combustion_conditions.doc(rev17))

[CBO] Intake O2 Fraction Adjustment:

Filtered_Engine_Speed	RPM	CBO_FSNOx_Ratio_Actual	---
TQM_Final_Torque_Cmd	FT*LB	CBO_Air_Fuel_Ratio_Ref	---
CBR_Fuel_Ref	MG/STROKE	CBO_Intake_Charge_O2_Frac_Ref	---
Fueling_Control_State	---	CBO_FSNOx_Ratio_Ref	---
CBR_EGR_Frac_Ref	---	CBO_O2_Frac_Adj	---
CBR_MCF_Ref	LB/MIN		

(/vob/base/sys_rqmt/compensate_for_off_nominal_combustion_conditions.doc(rev17))

[CBO] Charge Temperature Adjustment:

Charge_Tmptr	DEG_F	CBO_Delta_Charge_Tmptr	DEG_F
CBR_Charge_Tmptr_Ref	DEG_F	CBO_Charge_Tmptr_Adj	---

(/vob/base/sys_rqmt/compensate_for_off_nominal_combustion_conditions.doc(rev17))

[CBO] SOI Off-Nominal Compensation:

CBR_SOI_Ref	CRANK_DEG	CHH_CBO_Off	---
CBO_Composite_Adj	---	CBR_EGR_Off	---
CBR_Alpha	---	CBR_Chi_Value	---
C_EMO_Air_AECD_Level_3_Cap_EL	G/HP*HR	CBO_SOI_Ref_Adj	CRANK_DEG
CBO_SOI_Adjust_Flag	---	CBO_Off	--
CBO_SOI_Ref	CRANK_DEG		

41. Compensate For Off-Nominal Emission Conditions (EMO)

(/vob/base/sys_rqmt/compensate_for_off_nominal_emission_conditions.doc(rev7))

Filtered_Engine_Speed	RPM	EMO_Air_Handling_Cap_EL	---
Filtered_Turbo_Speed	KRPM	EMO_Air_Handling_AECD_Active	---
Net_Machine_Torque	FT*LB	EMO_Extreme_Amb_Cap_EL	---
Ambient_Air_Tmptr	DEG_F	EMO_Extreme_Amb_AECD_Active	---
Altitude	FT	EMO_Condensation_Cap_EL	---
Compressor_Outlet_Tmptr	DEG_F	EMO_Condensation_AECD_Active	---
Exhaust_Metal_Tmptr	DEG_F	EMO_White_Smoke_Cap_EL	---
Coolant_Tmptr	DEG_F	EMO_White_Smoke_AECD_State	---
Charge_Tmptr	DEG_F	EMO_Extended_Idle_Cap_EL	---
Charge_Flow	LB/MIN	EMO_Extended_Idle_AECD_Active	---
Charge_H2O_PP	IN_HG	EMO_Engine_Start_Cap_EL	---
Exhaust_H2O_PP	IN_HG	EMO_Engine_Start_AECD_Active	---
CHP_Predicted_IMT	DEG_F	EMO_Gen_Protect_Cap_EL	---
Engine_Is_Active	---	EMO_Gen_Protect_AECD_State	---
Engine_Is_Starting	---	EMO_Modulation_AECD_Active	---
EMR_Cap_EL_Ref	---	EMM_AECD_State	---
EMM_Cap_EL_Cmd	---	EMM_Protection_State	---

42. EGR Valve Position Command

(/vob/base/sys_rqmt/egr_valve_assist_throttle_controller.doc((rev23))

Filtered_Engine_Speed	RPM	EAC_EGR_Valve_Cmd	%open
TQM_Final_Torque_Cmd	FT*LB	EGR_ Position	%open
Total_Fueling	MG/STROKE	EAC_Adjusted_I_Gain	---
Fueling_Control_State	---	EAC_Adjusted_P_Gain	---
CHL_EGR_Frac_Cmd	---	EAC_EGR_Valve_High	%
CSE_Xform_Error_1	---	EAC_EGR_Valve_Low	%
EGR_Valve_Delta_Press	IN_HG	EAC_Feedforward_Term	%
EAC_Asst_Throt_Cmd	%	EAC_Integral_Term	%
T_EGA_Cycle_Counter	CNTS	EAC_Proportional_Term	%
EAC_Modified_Error	---	EAC_Preset	%
EAC_Preset_Active	---		

43. Emission Manager (EMM)

(/vob/base/sys_rqmt/emission_manager.doc(rev10))

Filtered_Engine_Speed	RPM	EMR_NTE_Flag	---
TQM_Final_Torque_Cmd	FT*LB	EMR_Cap_EL_Ref	---
Net_Engine_Torque	FT*LB	EMM_AECD_State	---
Alpha	---	EMM_Cap_EL_Cmd	---
Ambient_Air_Tmptr	DEG_F	EMM_Protection_State	---
Altitude	FT	EMM_Protection_Active	---

44. Emission Reference (EMR)

(/vob/base/sys_rqmt/emission_reference.doc(rev2))

Filtered_Engine_Speed	RPM	Ambient_Air_Tmptr	DEG_F
TQM_Final_Torque_Cmd	FT*LB	Altitude	FT
Fueling_Control_State	---	EMR_NTE_Flag	---
Net_Engine_Torque	FT*LB	EMR_Cap_EL_Ref	---

45. Net Torque Determination

(/vob/base/sys_rqmt/torque_parameter_determination.doc(rev8), /vob/base/sys_rqmt/combustion_torque_estimation.doc(rev2), /vob/base/sys_rqmt/engine_brake_parameter_determination.doc(rev3))

TQM_Final_Torque_Cmd	FT*LB	TQM_Net_Engine_Torque_State	---
Fueling_Control_State	---		

Combustion Torque Determination:

Filtered_Engine_Speed	RPM	CBP_Adj_Total_Fueling	MG/STROKE
FSS_Total_Fueling	MG/STROKE	Coolant_Torque_Adjustment	FT*LB
CBP_SOI_Torque_Adj_Gain	MG/STROKE	CHP_Pumping_Torque_Adj	FT*LB
FSS_SOI	CRANK_DEG	CBP_Combustion_Torque	FT*LB
CBR_SOI_Alpha1	CRANK_DEG	CBP_Net_Combustion_Torque	FT*LB
SOI_Torque_To_Fuel_Adj	mg/strk/degBTDC		

Net Torque Determination:

CBP_Net_Combustion_Torque	FT*LB	AC_Torque	FT*LB
EBP_EB_Torque	FT*LB	Fan_Torque	FT*LB
EB_Brakes_Are_On	---	Net_Engine_Torque	FT*LB
Filtered_Net_Machine_Torque	FT*LB	Net_Machine_Torque	FT*LB

Engine Brake Torque Determination:

Filtered_Engine_Speed	RPM	EBP_Adj_Charge_Flow	LB/MIN
Charge_Flow	LB/MIN	EBP_EB_Torque	FT*LB
EB_Active_Driver_Fraction	---	Jcomm_Ind_Retarder_Torque	FT*LB
CHP_Pumping_Torque_Adj	FT*LB		

No Load Torque Determination:

Filtered_Engine_Speed	RPM	Coolant_Torque_Adjustment	FT*LB
Zero_Fuel_Torque	FT*LB	Friction_Torque	FT*LB
Coolant_Tmptr	DEG_F	CHP_Pumping_Torque_Adj	FT*LB
		No_Load_Torque	FT*LB

46. Pumping Torque Estimation

(/vob/base/sys_rqmt/pumping_torque_estimate.doc(rev11))

Filtered_Engine_Speed	RPM	Engine_Delta_Press	IN_HG
FSS_Total_Fueling	MG/STROKE	CHP_Pumping_Torque_No_Offset	FT*LB
CHP_Nominal_Engine_Delta_P	IN_HG	CHP_Pumping_Torque_Adj	FT*LB
C_CHP_Engine_Displacement		C_CHP_Pump_Torque_Offset	FT*LB

47. Torque Manager (TQM)

(/vob/base/sys_rqmt/torque_manager.doc(rev15))

[TQM] Torque Manager:

Filtered_Engine_Speed	RPM	Engine_Protection_Derate_Torque	FT*LB
Ndot_Net_Torque_Cmd	FT*LB	TQM_Final_Torque_Cmd	FT*LB
Ndot_Net_Torque_Cmd_State	---	TQM_Net_Engine_Torque_State	---
Throttle_100_Torque	FT*LB	TQM_Net_Machine_Torque_Cmd	FT*LB
Fan_Torque	FT*LB	TQM_Net_Machine_Torque_State	---
AC_Torque	FT*LB	Coolant_Torque_Adjustment	FT*LB
Altitude_Derate_Torque	FT*LB	TQM_Engine_Torque_Limit	FT*LB
WP_Startup_Torque_Limit	FT*LB	TQM_Engine_Torque_Limit_State	---
CHP_Pumping_Torque_Adj	FT*LB	TQM_Machine_Torque_Limit	FT*LB
TQM_Net_Engine_Torque_Rqst	FT*LB	TQM_Machine_Torque_Limit_State	---
TQM_Net_Engine_Torque_Cmd	FT*LB		

(/vob/base/sys_rqmt/torque_manager.doc(rev15))

[TQM] Max Machine Torque:

Filtered_Engine_Speed	RPM	Torque_Derate_Override_Enable	---
Throttle_100_Torque	FT*LB	C_TQM_No_Derate_Torque	FT*LB
Out_Of_Gear_Torque	FT*LB	Jcomm_Trans_Torque_Derate	FT*LB
PTO_Derate_Torque	FT*LB	TQM_Machine_Torque_Limit	FT*LB
PTP_Torque_Output	FT*LB	TQM_Machine_Torque_Limit_State	---
Fan_Torque	FT*LB	Coolant_Torque_Adjustment	FT*LB
AC_Torque	FT*LB		

(/vob/base/sys_rqmt/torque_manager.doc(rev15))

[TQM] Machine Torque Limiting:

Filtered_Engine_Speed	RPM	TQM_Machine_Torque_Limit	FT*LB
Ndot_Net_Torque_Cmd	FT*LB	TQM_Machine_Torque_Limit_State	---
Ndot_Net_Torque_Cmd_State	---	TQM_Net_Machine_Torque_Cmd	FT*LB
MS_Control_Flag	---	TQM_Net_Machine_Torque_State	---
MS_Override_Enable	HEX	Torque_Derate_Override_Enable	---
MS_Final_Override_Torque	FT*LB		

(/vob/base/sys_rqmt/torque_manager.doc(rev15))

[TQM] Max Engine Torque:

Filtered_Engine_Speed	RPM	Torque_Derate_Override_Enable	---
CHH_Charge_Mgr_Derate_Torque	FT*LB	C_TQM_No_Derate_Torque	FT*LB
Altitude_Derate_Torque	FT*LB	TQM_Engine_Torque_Limit	FT*LB
Engine_Protection_Derate_Torque	FT*LB	TQM_Engine_Torque_Limit_State	---
WP_Startup_Torque_Limit	FT*LB		

(/vob/base/sys_rqmt/torque_manager.doc(rev15))

[TQM] Engine Torque Limiting:

Filtered_Engine_Speed	RPM	TQM_Final_Torque_Cmd	FT*LB
Ndot_Net_Torque_Rqst	FT*LB	TQM_Net_Engine_Torque_State	---
Ndot_Net_Machine_Torque_State	---	TQM_Net_Engine_Torque_Rqst	FT*LB
TQM_Engine_Torque_Limit	FT*LB	TQM_Net_Machine_Torque_State	---
TQM_Engine_Torque_Limit_State	---	Coolant_Torque_Adjustment	FT*LB
CHP_Pumping_Torque_Adj	FT*LB		

48. Torque Parameter Determination (TQP)

(/vob/base/sys_rqmt/torque_parameter_determination.doc(rev8))

Filtered_Engine_Speed	RPM	Coolant_Torque_Adjustment	FT*LB
TQM_Final_Torque_Cmd	FT*LB	Friction_Torque	FT*LB
Total_Fueling	MG/STROKE	Net_Machine_Torque	FT*LB
AC_Torque	FT*LB	No_Load_Torque	FT*LB
Fan_Torque	FT*LB	Zero_Fuel_Torque	FT*LB
CHP_Pumping_Torque_Adj	FT*LB	Net_Engine_Torque	FT*LB
CBP_Net_Combustion_Torque	FT*LB	Filtered_Net_Machine_Torque	FT*LB
Coolant_Tmptr	DEG_F		

49. VG Turbocharger Duty Cycle Command

(/vob/base/sys_rqmt/turbine_geometry_controller.doc(rev13))

Filtered_Engine_Speed	RPM	TGC_VT_Cmd	%
TQM_Final_Torque_Cmd	FT*LB	VGT_Duty_Cycle	%Duty_Cycle
Total_Fueling	MG/STROKE	TGC_Adjusted_I_Gain	---
Fueling_Control_State	---	TGC_Adjusted_P_Gain	---
CSE_Xform_Error_2	---	TGC_Feedforward_Term	%
EGR_Valve_Delta_Press	IN_HG	TGC_Integral_Term	%
EB_Brakes_Are_On	---	TGC_Proportional_Term	%

Emission Controls AECDs:

50. Air Handling System Protection AECD

(/vob/base/sys_rqmt/air_handling_system_protection_aecd.doc(rev6))

Filtered_Engine_Speed	RPM	EMO_Air_AECD_Level_1	---
Total_Fueling	MG/STROKE	EMO_Air_AECD_Level_2	---
Filtered_Turbo_Speed	KRPM	EMO_Air_AECD_Level_2_Allowed	---
Net_Machine_Torque	FT*LB	EMO_Air_AECD_Level_3	---
Ambient_Air_Tmptr	DEG_F	EMO_Air_AECD_Level_3_Allowed	---
Altitude	FT	EMO_Air_Handling_COT_Limit	DEG_F
Compressor_Outlet_Tmptr	DEG_F	EMO_Air_Handling_Near_Limit	---
Exhaust_Metal_Tmptr	DEG_F	EMO_Air_Handling_Speed_Limit	KRPM
EMO_Air_Handling_Cap_EL	---	EMO_Air_Handling_Texh_Limit	DEG_F
EMO_Air_Handling_AECD_Active	---	EMO_High_Load	---
CHL_EGR_Derate_Is_Active	---	EMM_AECD_State	---
EMO_Near_COT_Limit	---	EMM_Protection_State	---
EMO_Near_Speed_Limit	---		
EMO_Near_Texh_Limit	---		

51. Charge System Engine Protection

(/vob/base/sys_rqmt/charge_system_engine_protection_determination.doc(rev4))

Filtered_Engine_Speed	RPM	Turbo_Speed_Disabled	---
Total_Fueling	MG/STROKE	CHH_VGT_System_Failure	---
Net_Engine_Torque	FT*LB	CHH_EGR_System_Failure	---
Fueling_Control_State	---	TQM_Final_Torque_Cmd	FT*LB
Air_Press_Source	---	TQM_Current_Max_Derate_Torque	FT*LB
Exhaust_Press_Source	---	TQM_Current_No_Derate_Torque	FT*LB
Charge_Press_Source	---	CHH_Sensor_Fault_Derate_Index	---
Charge_Tmptr_Source	---	CHH_Charge_Mgr_Derate_Torque	FT*LB
Compressor_Inlet_Tmptr_Source	---	CHH_Major_Engine_Protection	---
Turbo_Speed_Source	---	CHH_Minor_Engine_Protection	---

52. Condensation Protection AECD

(/vob/base/sys_rqmt/condensation_protection_aecd.doc(rev9))

Filtered_Engine_Speed	RPM	EMO_Condensation_Cap_EL	---
Total_Fueling	MG/STROKE	EMO_Condensation_AECD_Active	---
Fueling_Control_State	---	EMO_Cond_AECD_Timer_Active	---
Charge_Flow	LB/MIN	EMO_Intake_Cond_Delta_T	DEG_F
Charge_H2O_PP	IN_HG	EMO_Intake_Cond_Adj_Off_Gain	---
CHP_Predicted_IMT	DEG_F	EMO_Intake_Cond_Adj_On_Gain	---
Engine_Is_Active	---	EMO_Intake_Cond_AECD_Active	---
Charge_Saturation_Tmptr	DEG_F	EMO_Intake_Cond_AECD_Possible	---
Charge_Tmptr	DEG_F	EMM_AECD_State	---
EMO_Intake_Cond_Count	CNTS	EMM_Protection_State	---
EMO_Intake_Cond_Delta_PP	IN_HG		

53. EGR System Monitor (CHH)

(/vob/base/sys_rqmt/egr_system_monitor.doc(rev12))

Filtered_Engine_Speed	RPM	EGR_Flow	LB/MIN
FSS_Total_Fueling	MG/STROKE	EGR_Orifice_Tmptr	DEG_F
Fueling_Control_State	---	EGR_Orifice_Tmptr_Source	---
Charge_Press	IN_HG	EGA_Over_Temperature	---
Charge_Press_Source	---	EGA_Driver_OC_Fault	---
Charge_Tmptr_Source	---	EGA_Electrical_Fault	---
Exhaust_Press_Source	---	CHH_EGR_System_Failure	---
EGR_Position_Source	---	CHH_CBO_Off	---
EGR_Delta_Press_Source	---	CHH_EGRT_Over_Temperature	---
Coolant_Tmptr	DEG_F	CHH_EGR_Cooler_Fouled	---
Exhaust_Tmptr	DEG_F		

(/vob/base/sys_rqmt/egr_system_monitor.doc(rev12))

[CHH] EGR Return Overtemperature Monitor:

Filtered_Engine_Speed	RPM	EGR_Orifice_Tmptr	DEG_F
Total_Fueling	MG/STROKE	EGR_Orifice_Tmptr_Source	---
Fueling_Control_State	---	CHH_EGRT_Over_Temperature	---

(/vob/base/sys_rqmt/egr_system_monitor.doc(rev12))

[CHH] EGR Cooler Fouling Monitor:

Filtered_Engine_Speed	RPM	Coolant_Tmptr_Source	---
Total_Fueling	MG/STROKE	Exhaust_Tmptr_Source	---
Fueling_Control_State	---	EGR_Orifice_Tmptr_Source	---
Coolant_Tmptr	DEG_F	EGR_Flow_Source	---
Exhaust_Tmptr	DEG_F	EGR_Cooler_Fouling_Precondition	---
EGR_Orifice_Tmptr	DEG_F	EGR_Cooler_Eff	%
EGR_Flow	LB/MIN	EGR_Cooler_Eff_Thd	%
CHH_EGR_Cooler_Fouled	---	EGR_Cooler_Fouling_Fault_Count	SEC

54. Engine Starting / Warm-Up AECD

(/vob/base/sys_rqmt/engine_starting_and_warmup_protection_aecd.doc(rev4))

Filtered_Engine_Speed	RPM	EMO_Engine_Start_Cap_EL	---
Fueling_Control_State	---	EMO_Engine_Start_AECD_Active	---
Engine_Is_Starting	---	EMM_AECD_State	---
FSS_Total_Fueling	MG/STROKE	Exhaust_Saturation_Tmptr	
Engine_Is_Active	---	EMO_Cooler_Cond_Incrt	CNTS
Charge_Flow	LB/MIN	EMM_Protection_State	---
EMO_Cooler_Cond_Delta_T	DEG_F	EMO_Cooler_Cond_Adj_Off_Gain	---
EMO_Cooler_Cond_Count	CNTS	EMO_Cooler_Cond_Adj_On_Gain	---
Coolant_Tmptr	DEG_F	EMO_Cooler_Cond_AECD_Active	---
Exhaust_H2O_PP	IN_HG	EMO_Cooler_Cond_AECD_Possible	---
PIF_Temp_Adj_Status	---	SOI_State	---
PIT_Temp_Adj_Status	---	EMO_Cooler_Cond_Delta_PP	IN_HG
PRS_Temp_Adj_Status	---	EMO_Cooler_Cond_Delta_T	DEG_F

55. Extended Idle / PTO AECD

(/vob/base/sys_rqmt/extended_idle_and_pto_protection_aecd.doc(rev2))

Filtered_Engine_Speed	RPM	EMO_Extended_Idle_Cap_EL	---
Engine_Is_Active	---	EMO_Extended_Idle_AECD_Active	---
Ndot_Net_Torque_Cmd_State	---	EMM_AECD_State	---
Ndot_Net_Torque_Cmd	FT*LB	EMM_Protection_State	---

56. Extreme Ambient Overheat AECD

(/vob/base/sys_rqmt/extreme_ambient_overheat_protection.doc(rev5))

Filtered_Engine_Speed	RPM	EMO_Extreme_Amb_Cap_EL	---
TQM_Final_Torque_Cmd	FT*LB	EMO_Extreme_Amb_AECD_Active	---
Total_Fueling	MG/STROKE	EMM_AECD_State	---
Fueling_Control_State	---	EMM_Protection_State	---
Coolant_Tmptr	DEG_F	MME_Vehicle_Mass	

57. General Engine Protection AECD

(/vob/base/sys_rqmt/general_engine_protection_aecd.doc(rev4))

Filtered_Engine_Speed	RPM	CLS_Low_Coolant_Error	---
Fueling_Control_State	---	Turboconveyor_Is_Active	---
CHH_EGR_System_Failure	---	EMO_Gen_Protect_AECD_State	---
CHH_VGT_System_Failure	---	EMO_Gen_Protect_Cap_EL	---
CHH_Major_Engine_Protection	---	EMM_AECD_State	---
CHH_Minor_Engine_Protection	---	EMM_Protection_State	---

58. White Smoke / Misfire AECD

(/vob/base/sys_rqmt/white_smoke_and_misfire_protection_aecd.doc(rev5))

Filtered_Engine_Speed	RPM	Coolant_SOI_Advance	CRANK_DEG
TQM_Final_Torque_Cmd	FT*LB	IMT_SOI_Advance	CRANK_DEG
FSS_Total_Fueling	MG/STROKE	CBR_Base_Chi_SOI_Cmd	CRANK_DEG
Fueling_Control_State	---	EMO_White_Smoke_Cap_EL	---
Final_Timing	CRANK_DEG	EMO_White_Smoke_AECD_State	---
Final_Timing_State	---	EMM_AECD_State	---
Coolant_Tmptr	DEG_F	EMM_Protection_State	---
Charge_Tmptr	DEG_F	PIF_Temp_Adj_Status	---
SOI_State	---	PIT_Temp_Adj_Status	---
		PRS_Temp_Adj_Status	---

Performance Diagnostics:

59. Alpha Determination

(/vob/base/sys_rqmt/xalpha.doc(rev40))

Filtered_Engine_Speed	RPM	Alpha	---
Total_Fueling	MG/STROKE	ESP_Tau	---
Fueling_Control_State	---	Alpha_State	---
TQM_Final_Torque_Cmd	FT*LB	Engine_State	---
Road_Speed	MPH	Ambient_Air_Press	IN_HG
Filtered_Fuel_Delivery_Rate	LB/HR	Alpha_AFC_Timer	SEC
Fuel_Delivery_Rate	LB/HR	Alpha_LSG_Timer	SEC
Alpha_Fuel_Rate	LB/HR	Cruise_Control_Status	---
Fueling_AFC_State_Detected	---	EPF_Torque_Limit_Status	---
Fueling_LSG_State_Detected	---	LSG_Adjusted_Reference_Speed	RPM

60. Altitude Performance

(/vob/base/sys_rqmt/air_handling_system_protection_aecd.doc(rev6), /vob/base/sys_rqmt/alt_der.doc(rev15))

Filtered_Engine_Speed	RPM	CHL_MCF_Cmd	LB/MIN
Total_Fueling	MG/STROKE	Charge_Flow	LB/MIN
Fueling_Control_State_Value	---	CHL_EGR_Frac_Cmd	---
Final_Timing	CRANK_DEG	EGR_Fraction	---
Ambient_Air_Press	IN_HG	EGR_Position	%open
Ambient_Air_Tmptr	IN_HG	VGT_Duty_Cycle	%Duty_Cycle
Compressor_Inlet_Density	LBM/FT3	Compressor_Outlet_Tmptr	DEG_F
CBR_Chi_Value	---	Compressor_Inlet_Tmptr	DEG_F
Altitude	FT	Compressor_Inlet_Press	IN_HG
EGR_Valve_Delta_Press	IN_HG	Charge_Press	IN_HG
Exhaust_Tmptr	DEG_F	Charge_Tmptr	DEG_F
Exhaust_Metal_Tmptr	DEG_F	Exhaust_Press	IN_HG
Ndot_Net_Torque_Cmd	FT*LB	Filtered_Turbo_Speed	KRPM
Altitude_Derate_Torque	FT*LB	EMM_AECD_State	---
CBR_Density_Max_Fuel	MG/STROKE	EMM_Protection_State	---

61. Charge Flow Derate [Charge Limit Manager (CHL)]

(/vob/base/sys_rqmt/charge_limit_management.doc(rev30))

Filtered_Engine_Speed	RPM	Charge_Flow	LB/MIN
FSS_Total_Fueling	MG/STROKE	CHL_MCF_Cmd	LB/MIN
TQM_Final_Torque_Cmd	FT*LB	CHL_EGR_Frac_Cmd	---
Fueling_Control_State	---	CHL_COT_Drt_Active	---
CHS_MCF_Cmd	LB/MIN	CHL_Delta_P_Drt_Active	---
CBL_EGR_Frac_Cmd	---	CHL_Turbo_Speed_Drt_Active	---
CHL_Derate_Status	---	CHL_EGR_Off_DP_Drt_Active	---

(/vob/base/sys_rqmt/charge_limit_management.doc(rev30))

[CHL] Surge Limit Function (Calibrated off in current phase 6 software):

Surge_Line_CFP	---	C_CHL_Surge_Drt_On_Ratio	---
Surge_Margin_Source	---	C_CHL_Surge_Drt_Off_Ratio	---
CHL_Surge_Limit	---	CHL_Surge_Drt_Offset	---
TPE_Corrected_Air_Flow	KG*SQRT_K/SMPa	CHL_Surge_Drt_Active	---
CHL_Derate_Is_Active	---	C_CHL_Surge_Drt_Limit	%
CHL_MCF_Cmd	LB/MIN	Charge_Flow	LB/MIN
		CHS_MCF_Cmd	LB/MIN

(/vob/base/sys_rqmt/charge_limit_management.doc(rev30))

[CHL] EGR Off Delta-P Derate Function:

EGR_Valve_Delta_Press	IN_HG	C_CHL_EGR_Off_DP_Drt_On_Ratio	---
C_CHL_EGR_Off_DP_Drt_Limit	IN_HG	C_CHL_EGR_Off_DP_Drt_Off_Ratio	---
Charge_Flow	LB/MIN	CHL_EGR_Off_DP_Drt_Active	---
CHS_MCF_Cmd	LB/MIN	CHL_EGR_Off_DP_Drt_Offset	LB/MIN
CHL_Derate_Is_Active	---	CHL_MCF_Cmd	LB/MIN

(/vob/base/sys_rqmt/charge_limit_management.doc(rev30))

[CHL] Delta-P Derate Function:

EGR_Valve_Delta_Press	IN_HG	C_CHL_Delta_P_Drt_On_Ratio	---
C_CHL_Delta_P_Drt_Limit	IN_HG	C_CHL_Delta_P_Drt_Off_Ratio	---
Charge_Flow	LB/MIN	CHL_Delta_P_Drt_Active	---
CHS_MCF_Cmd	LB/MIN	CHL_Delta_P_Drt_Offset	LB/MIN
CHL_Derate_Is_Active	---	CHL_MCF_Cmd	LB/MIN

(/vob/base/sys_rqmt/charge_limit_management.doc(rev30))

[CHL] COT Derate Function:

Compressor_Outlet_Tmptr	DEG_F	C_CHL_COT_Drt_On_Ratio	---
C_CHL_COT_Drt_Limit	DEG_F	C_CHL_COT_Drt_Off_Ratio	---
Charge_Flow	LB/MIN	CHL_COT_Drt_Active	---
CHS_MCF_Cmd	LB/MIN	CHL_COT_Drt_Offset	LB/MIN
CHL_Derate_Is_Active	---	CHL_MCF_Cmd	LB/MIN
Ambient_Air_Tmptr	DEG_F	Compressor_Inlet_Tmptr	DEG_F
VGT_Duty_Cycle	%DUTY_CYCLE	Boost_Pressure	IN_HG
Intake_Manifold_Temperature	DEG_F	EGR_Valve_Position	%open

(/vob/base/sys_rqmt/charge_limit_management.doc(rev30))

[CHL] Turbo Speed Derate Function:

Compressor_Inlet_Density	LBM/FT3	C_CHL_Turbo_Drt_On_Ratio	---
Filtered_Turbo_Speed	KRPM	C_CHL_Turbo_Drt_Off_Ratio	---
CHL_Turbo_Drt_Limit	KRPM	CHL_Turbo_Speed_Drt_Active	---
Charge_Flow	LB/MIN	CHL_Turbo_Speed_Drt_Offset	LB/MIN
CHS_MCF_Cmd	LB/MIN	CHL_MCF_Cmd	LB/MIN
Turbo_Speed_Source	---	AH_Fuel_Derate_Latch	---
CHL_Derate_Is_Active	---		

62. Chi Determination

(/vob/base/sys_rqmt/combustion_reference.doc(rev27))

Filtered_Engine_Speed	RPM	CBR_Chi_Value	---
TQM_Final_Torque_Cmd	FT*LB	CBR_Chi_Desired	---
Total_Fueling	MG/STROKE	CBR_Chi_Source	---
Fueling_Control_State_Value	---	CBR_Alpha	---
Compressor_Inlet_Density	LBM/FT3	CBR_Protection_Chi_Flag	---
Coolant_Tmptr	DEG_F	T_CBR_Chi_Selective_Override	---
Alpha	---	T_CBR_Chi_User_Override	---
EMM_Cap_EL_Cmd	---	C_CBR_Chi_Override_Value	---
EMM_Protection_State	---	C_CBR_Chi_Override_EL	G/HP*HR
Charge_Tmptr	DEG_F	CBR_EGR_Off	---

63. EGR Motor Diagnostics

(/vob/base/sys_rqmt/egr_valve_controller.doc(rev17), /vob/base/sys_rqmt/egr_motor_temperature_protection.doc(rev14), /vob/base/sys_rqmt/egr_valve_control_diagnostics.doc(rev11))

Filtered_Engine_Speed	RPM	EGA_Control_Error	---
TQM_Final_Torque_Cmd	FT*LB	EGA_Electrical_Fault	---
Total_Fueling	MG/SSTROKE	EGA_Over_Temperature	---
Fueling_Control_State_Value	---	EGA_Driver_Over_Current	---
EGR_Position	%open	EGA_Motor_OK	---
EAC_EGR_Valve_Cmd	%open	EGA_Zero_Hold_Status	---
EGA_Position_Cmd_Final	%open	EGR_Valve_Autozero_Error	---
EGA_Control_State	---	EGA_PWM_Enable	---
EGR_Valve_Delta_Press	IN_HG	EGA_PWM_Diagnostic_Override	---
EGR_Orifice_Delta_Press	IN_HG	EGA_PWM_Limited	%DUTY_CYCLE
EGR_Fraction	---	EGR_Motor_Current	AMP
CHL_EGR_Frac_Cmd	---	EGA_Temperature	DEG_F
T_EGA_Cycle_Counter	CNTS		

64. EGR Off Conditions

Filtered_Engine_Speed	RPM	EGR_Position	%open
TQM_Final_Torque_Cmd	FT*LB	EGA_Control_State	---
Total_Fueling	MG/STROKE	EGR_Valve_Delta_Press	IN_HG
Fueling_Control_State_Value	---	EGR_Orifice_Delta_Press	IN_HG
CBR_Chi_Value	---	EGR_Valve_Is_Closed	---
CBR_Chi_Source	---	CHL_EGR_Frac_Cmd	---
CBR_Alpha	---	EMM_AECD_State	---
CBR_EGR_Off	---	EMM_Protection_State	---
EGR_Orifice_Tmptr	DEG_F	CHH_EGRT_Over_Temperature	---

65. EGR On Conditions

Filtered_Engine_Speed	RPM	Compressor_Outlet_Tmptr	DEG_F
TQM_Final_Torque_Cmd	FT*LB	Filtered_Turbo_Speed	KRPM
Total_Fueling	MG/STROKE	EGR_Position	%open
Fueling_Control_State_Value	---	EGA_Control_State	---
CBR_Chi_Value	---	EGR_Valve_Delta_Press	IN_HG
CBR_Chi_Source	---	EGR_Orifice_Delta_Press	IN_HG
CBR_Alpha	---	CHL_EGR_Frac_Cmd	---
Charge_Press	IN_HG	EGR_Fraction	---
Charge_Tmptr	DEG_F	CHL_MCF_Cmd	LB/MIN
Coolant_Tmptr	DEG_F	Charge_Flow	LB/MIN
EMM_AECD_State	---	EMM_Protection_State	---
EGR_Orifice_Tmptr	DEG_F		

66. EGR Valve Controller

(/vob/base/sys_rqmt/egr_valve_assist_throttle_controller.doc(rev23))

Filtered_Engine_Speed	RPM	CHL_MCF_Cmd	LB/MIN
Total_Fueling	MG/STROKE	Charge_Flow	LB/MIN
Fueling_Control_State_Value	---	CSE_Xform_Error_1	---
EGR_Position	%open	CSE_Xform_Angle	DEG
EAC_EGR_Valve_Cmd	%open	EGR_Valve_Is_Closed	---
EGA_Control_State	---	EGR_Valve_Delta_Press	IN_HG
CHL_EGR_Frac_Cmd	---	Charge_Tmptr	DEG_F
EGR_Fraction	---	T_EGA_Cycle_Counter	CNTS
EGA_Position_Cmd_Final	%open	EGR_Motor_Current	AMP
CBL_Fuel_Cmd	MG/STROKE	CSE_EGR_On_Flag	---
CBR_Alpha	---	EAC_EGR_Valve_Low	%
Compressor_Inlet_Density	LBM/FT3	EAC_EGR_Valve_High	%

67. EGR Valve Preferred Position

(/vob/base/sys_rqmt/egr_valve_assist_throttle_controller.doc(rev23))

Filtered_Engine_Speed	RPM	EAC_Pref_Position	%
Total_Fueling	MG/STROKE	EAC_Pref_Pos_Error	---
Fueling_Control_State_Value	---	EAC_Pref_Pos_Error_Modifier	---
EGR_Position	%open	CSE_Xform_Error_1	---
CBL_Fuel_Cmd	MG/STROKE	CBR_Alpha	---
Compressor_Inlet_Density	LBM/FT3	EAC_Modified_Error	---
		EAC_EGR_Valve_Cmd	%

68. Exhaust Temperature (Texh) Fuel Limit

(/vob/base/sys_rqmt/texhaust_fuel_limit_estimator.doc(rev6))

Filtered_Engine_Speed	RPM	Texh_Fuel_Limit	MG/STROKE
TQM_Final_Torque_Cmd	FT*LB	Exhaust_Metal_Tmptr	DEG_F
Total_Fueling	MG/STROKE	Charge_Flow	LB/MIN
Fueling_Control_State_Value	---	TPE_Energy_Fraction	DEG_F
Charge_Tmptr	DEG_F	TFC_Fuel_Flow_Limit	LB/MIN

69. Oxygen / Fuel Control (OFC) Fuel Limit

(/vob/base/sys_rqmt/ofc_fuel_limit_estimator.doc(rev13))

Filtered_Engine_Speed	RPM	CBR_Fuel_Ref	MG/STROKE
TQM_Final_Torque_Cmd	FT*LB	Compressor_Inlet_Density	LBM/FT3
FSS_Total_Fueling	MG/STROKE	OFC_EGR_Disable	---
Fueling_Control_State_Value	---	C_CBP_Stoic_OF_Ratio	---
OFC_Fuel_Limit	MG/STROKE	Total_O2_In_Cylinder	MG/STROKE
CBR_Gross_Fuel	MG/STROKE		

70. Torque Manager Derates

(/vob/base/sys_rqmt/torque_manager.doc(rev15))

Filtered_Engine_Speed	RPM	TQM_Engine_Torque_Limit_State	---
TQM_Final_Torque_Cmd	FT*LB	TQM_Engine_Torque_Limit	FT*LB
Net_Engine_Torque	FT*LB	TQM_Net_Machine_Torque_Cmd	FT*LB
Total_Fueling	MG/STROKE	TQM_Net_Engine_Torque_Rqst	FT*LB
Fueling_Control_State_Value	---	TQM_Engine_Torque_Limit	FT*LB
T_TQM_Trq_Drt_Override_Enable	---	C_TQM_No_Derate_Torque	FT*LB
CHH_Charge_Mgr_Derate_Torque	FT*LB	Altitude_Derate_Torque	FT*LB
WP_Startup_Torque_Limit	FT*LB	Engine_Protection_Derate_Torque	FT*LB
Ndot_Net_Torque_Cmd	FT*LB		

71. VGT Pneumatic Controller

(/vob/base/sys_rqmt/turbine_geometry_controller.doc(rev13))

Filtered_Engine_Speed	RPM	CHL_EGR_Frac_Cmd	---
Total_Fueling	MG/STROKE	EGR_Fraction	---
Fueling_Control_State_Value	---	CHL_MCF_Cmd	LB/MIN
VGT_Duty_Cycle	%Duty_Cycle	Charge_Flow	LB/MIN
TGC_VT_Cmd	%	CSE_Xform_Error_2	---
Charge_Press	IN_HG	CSE_Xform_Angle	DEG
Filtered_Turbo_Speed	KRPM	EGR_Valve_Delta_Press	IN_HG
EB_Brakes_Are_On	---		

ETIF Performance Evaluation:

72. Clutch Engagement Performance

Level Ground / Grade:

Filtered_Engine_Speed	RPM	Ndot_Proportional_Gain	LBF/RPM/SEC
Ndot_Net_Torque_Cmd	FT*LB	Ndot_Integral_Gain	---
TQM_Final_Torque_Cmd	FT*LB	LSG_Reference_Speed	RPM
Total_Fueling	MG/STROKE	HSG_Active_Breakpoint	RPM
Fueling_Control_State_Value	---	CHL_EGR_Frac_Cmd	---
Commanded_Throttle	%THROTTLE	EGR_Fraction	---
Effective_Gear_Ratio	---	CHL_MCF_Cmd	LB/MIN
Filtered_Gear_Ratio	---	Charge_Flow	LB/MIN
Road_Speed	MPH	EGR_Valve_Position	%open
Ndot_LSG	RPM/SEC	VGT_Duty_Cycle	%Duty_Cycle
Ndot_HSG	RPM/SEC	System_Switch_Status	---
Ndot_Demand	RPM/SEC	System_Switch_Status_2	---

73. Coupled Controller Performance During Gear Shifts

Filtered_Engine_Speed	RPM	Alpha	---
Total_Fueling	MG/STROKE	CBR_Chi_Value	---
Fueling_Control_State_Value	---	CBL_EGR_Frac_Cmd	---
Commanded_Throttle	%THROTTLE	CHL_EGR_Frac_Cmd	---
Filtered_Gear_Ratio	---	EGR_Fraction	---
Road_Speed	MPH	CHS_MCF_Cmd	LB/MIN
Charge_Press	IN_HG	CHL_MCF_Cmd	LB/MIN
EGR_Valve_Delta_Press	IN_HG	Charge_Flow	LB/MIN
OFC_Fuel_Limit	MG/STROKE	CSE_Xform_Angle	DEG
Ambient_Air_Press	IN_HG	CSE_Xform_Error_1	---
Compressor_Inlet_Tmptr	DEG_F	CSE_Xform_Error_2	---
Compressor_Inlet_Density	LBM/FT3	EGR_Position	%open
Compressor_Outlet_Tmptr	DEG_F	VGT_Duty_Cycle	%Duty_Cycle
Net_Machine_Torque	FT*LB	Filtered_Turbo_Speed	KRPM
TQM_Final_Torque_Cmd	FT*LB		

74. Cruise Control Auto Resume

(/vob/automotive/ccar.doc(rev12) – NOTE: This SDR rev does not depict phase 6 software, however, there is not a current rev that is in the system that defines this feature. The actual code can be reviewed at /vob/core0/automotive/sw/base/cc_mode.c if help is needed understanding this feature)

Filtered_Engine_Speed	RPM	System_Switch_Status	---
Fueling_Control_State_Value	---	Cruise_Control_Status	---
Adjusted_User_Fueling_State	---	Cruise_Max_Road_Speed	MPH
Cruise_Control_Reference_Speed	MPH	GD_Gear_Down_High_Load_Speed	MPH
Road_Speed	MPH	Cruise_Control_AR_Clutch_Time_Limit	MPH
Cruise_Control_AR_Flag	---	Cruise_OOG_ES_Inactivated	HEX
Clutch_Switch	HEX	Gear_Ratio	---
Cruise_Valid_Resume_Speed_Flag	---	Cruise_Control_AR_Gear_Ratio	---
Cruise_Control_AR_Enable	---	Net_Engine_Torque	FT*LB

75. Cruise Control Base Functionality

Filtered_Engine_Speed	RPM	CHL_MCF_Cmd	LB/MIN
Total_Fueling	MG/STROKE	Charge_Flow	LB/MIN
Fueling_Control_State_Value	---	EGR_Position	%open
Adjusted_User_Fueling_State	---	VGT_Duty_Cycle	%Duty_Cycle
Cruise_Control_Reference_Speed	MPH	Filtered_Turbo_Speed	KRPM
Road_Speed	MPH	Charge_Press	IN_HG
System_Switch_Status	---	Cruise_Max_Road_Speed_Trim	MPH
Cruise_Command_Mode	---	Cruise_Max_Road_Speed	MPH
CHL_EGR_Frac_Cmd	---	Cruise_Top_Droop_Width	MPH
EGR_Fraction	---	Cruise_Bottom_Droop_Width	MPH
Effective_Gear_Ratio	---	CC_Proportional_Gain	1/SEC

76. Cruise Control Overshoot

Filtered_Engine_Speed	RPM	Road_Speed	MPH
Total_Fueling	MG/STROKE	System_Switch_Status	---
Fueling_Control_State_Value	---	Cruise_Command_Mode	---
Adjusted_User_Fueling_State	---	Cruise_Control_Status	---
CC_Error	MPH	Ndot_Demand	RPM/SEC
Cruise_Droop	MPH	Ndot_Cruise_Control	RPM/SEC
Cruise_Control_Reference_Speed	MPH		

77. Cruise Control with Engine Brakes

Filtered_Engine_Speed	RPM	EB_Charge_Flow_Command	LB/MIN
FSS_Total_Fueling	MG/STROKE	CHL_MCF_Cmd	LB/MIN
Fueling_Control_State_Value	---	Charge_Flow	LB/MIN
Cruise_Control_Reference_Speed	MPH	EB_Driver_Level	%
Road_Speed	MPH	EB_Active_Driver_Fraction	---
TQM_Final_Torque_Cmd	FT*LB	EB_Allowed_State	---
Net_Engine_Torque	FT*LB	EB_Brakes_Are_On	---
Cruise_Control_EB_Torque	FT*LB	EB_Cruise_Braking_Inhibit	---
EB_Adj_Torque_Cmd	FT*LB	VGT_Duty_Cycle	%Duty_Cycle

78. Dyno Performance Monitor

Filtered_Engine_Speed	RPM	Commanded_Throttle	%THROTTLE
FSS_Total_Fueling	MG/STROKE	Alpha	---
Net_Engine_Torque	FT*LB	CBR_Chi_Value	---
No_Load_Torque	FT*LB	Coolant_Tmptr	DEG_F
Fueling_Control_State_Value	---	Compressor_Inlet_Tmptr	DEG_F
Final_Timing	CRANK_DEG	Charge_Tmptr	DEG_F
EGR_Position	%open	Charge_Press	IN_HG
VGT_Duty_Cycle	%Duty_Cycle	Exhaust_Press	IN_HG
Filtered_Turbo_Speed	KRPM	Compressor_Outlet_Tmptr	DEG_F
EGR_Fraction	---	Compressor_Inlet_Density	LBM/FT3
CHL_EGR_Frac_Cmd	---	Exhaust_Tmptr	DEG_F
Charge_Flow	LB/MIN	Ambient_Air_Press	IN_HG
CHL_MCF_Cmd	LB/MIN	Ambient_Air_Tmptr	DEG_F
EGR_Valve_Delta_Press	IN_HG	Fuel_Rail_Press	PSI
EGR_Delta_Press	IN_HG	EMM_AECD_State	---
EGR_Orifice_Tmptr	DEG_F	EMM_Protection_State	---
Fresh_Air_Flow	LB/MIN	Fuel_Tmptr	DEG_F
CBO_bsNOx	G/HP*HR	ESP_Tau	---
System_Switch_Status	HEX	Oil_Press	PSI
System_Switch_Status_2	HEX	Oil_Tmptr	DEG_F

79. EGR Valve and VGT Behavior

Filtered_Engine_Speed	RPM	Filtered_Turbo_Speed	KRPM
Total_Fueling	MG/STROKE	Charge_Press	IN_HG
Net_Engine_Torque	FT*LB	Exhaust_Press	IN_HG
Fueling_Control_State_Value	---	EGR_Delta_Press	IN_HG
Road_Speed	MPH	EGR_Valve_Delta_Press	IN_HG
CHL_EGR_Frac_Cmd	---	OFC_Fuel_Limit	MG/STROKE
EGR_Fraction	---	CBR_FCLR_Off	---
CHL_MCF_Cmd	LB/MIN	CBR_FCLR_On	---
Charge_Flow	LB/MIN	Alpha	---
EGR_Position	%open	CBR_Chi_Value	---
VGT_Duty_Cycle	%Duty_Cycle	CSE_Xform_Angle	DEG
Compressor_Inlet_Density	LBM/FT3	Ambient_Air_Press	IN_HG
T_EGA_Cycle_Counter	CNTS		

80. Engine Brake Performance

Filtered_Engine_Speed	RPM	EB_Active_Driver_Fraction	---
Filtered_Turbo_Speed	MG/STROKE	E_Brake_Command_Source	---
Commanded_Throttle	%THROTTLE	EB_Charge_Flow_Command	LB/MIN
Road_Speed	MPH	CHL_MCF_Cmd	LB/MIN
EB_Switch_Command	---	Charge_Flow	LB/MIN
EB_Switch_Torque	FT*LB	Charge_Press	IN_HG
EB_Adj_Torque_Command	FT*LB	Exhaust_Press	IN_HG
EB_Driver_Level	%	Ambient_Air_Press	IN_HG
Engine_Brake_Driver_1	---	Compressor_Inlet_Density	LBM/FT3
Engine_Brake_Driver_2	---	EGR_Position	%open
Engine_Brake_Driver_3	---	VGT_Duty_Cycle	%Duty_Cycle

81. Engine Lug Up / Lug Down

Filtered_Engine_Speed	RPM	Charge_Press	IN_HG
Total_Fueling	MG/STROKE	Charge_Tmptr	DEG_F
TQM_Final_Torque_Cmd	FT*LB	Ambient_Air_Press	IN_HG
Fueling_Control_State_Value	---	EGR_Valve_Delta_Press	IN_HG
Commanded_Throttle	%THROTTLE	EGR_Delta_Press	IN_HG
Road_Speed	MPH	OFC_Fuel_Limit	MG/STROKE
CHL_EGR_Frac_Cmd	---	Alpha	---
EGR_Fraction	---	CBR_Chi_Value	---
CHL_MCF_Cmd	LB/MIN	CBR_FCLR_Off	---
CHS_MCF_Cmd	LB/MIN	CBR_FCLR_On	---
Charge_Flow	LB/MIN	CBR_FCLR_Ref	---
EGR_Position	%open	CHL_Delta_P_Drt_Active	---
VGT_Duty_Cycle	%Duty_Cycle	CHL_COT_Drt_Active	---
Filtered_Turbo_Speed	KRPM	CHL_Turbo_Speed_Drt_Active	---

82. Engine Start-Up

Cold Engine Start Up:		**Warm Engine Start Up:**	
Filtered_Engine_Speed	RPM	Filtered_Engine_Speed	RPM
Total_Fueling	MG/STROKE	Total_Fueling	MG/STROKE
Fueling_Control_State_Value	---	Fueling_Control_State	---
Final_Timing	CRANK_DEG	Final_Timing	CRANK_DEG
Final_Timing_State	---	Final_Timing_State	---
EPS_Main_Sync_State	---	Crank_Jumpstart_Timer	SEC
EPS_Backup_Sync_State	---	Fuel_Rail_Pressure	PSI_A
Fuel_Rail_Pressure	PSI_A	Charge_Tmptr	DEG_F
Battery_Volt	VOLT	Oil_Tmptr	DEG_F
Charge_Tmptr	DEG_F	Oil_Press	PSI
Oil_Tmptr	DEG_F	Coolant_Tmptr	DEG_F
Oil_Press	PSI	Ambient_Air_Press	IN_HG
Coolant_Tmptr	DEG_F	Ambient_Air_Tmptr	DEG_F
Ambient_Air_Press	IN_HG	LSG_Reference_Speed	RPM
Compressor_Inlet_Tmptr	DEG_F	Crank_Exit_Speed	RPM
LSG_Reference_Speed	RPM	Crank_Exit_Fuel	MG/STROKE
Crank_Exit_Speed	RPM	T_EGR_Delta_P_Autozero_Offset	IN_HG
Crank_Exit_Fuel	MG/STROKE	EGR_Fraction	---
T_EGR_Delta_P_Autozero_Offset	IN_HG	CHL_EGR_Frac_Cmd	---
		Charge_Flow	LB/MIN
		CHL_MCF_Cmd	LB/MIN
		EGR_Position	%open
		VGT_Duty_Cycle	%Duty_Cycle

83. Gear Ratio Validation

Filtered_Engine_Speed	RPM	Filtered_Gear_Ratio	---
Road_Speed	MPH	Effective_Gear_Ratio	---
User_Filtered_Gear_Ratio	---	RSC_Sensor_Type	---

84. High Idle Stability, Loaded Trailer

Filtered_Engine_Speed	RPM	HSG_Proportional_Gain	%FUEL
Total_Fueling	MG/STROKE	Ndot_HSG	RPM/SEC
Fueling_Control_State_Value	---	Ndot_Net_Torque_Cmd	FT*LB
HSG_Reference_Speed	RPM	TQM_Final_Torque_Cmd	FT*LB
HSG_Ref_Speed_State	---	CHL_EGR_Frac_Cmd	---
Road_Speed	MPH	EGR_Fraction	---
Ndot_Feedforward_Torque	FT*LB	CHL_MCF_Cmd	LB/MIN
Ndot_Integral_Torque	FT*LB	Charge_Flow	LB/MIN
Effective_Gear_Ratio	---	HSG_Compensated_Engine_Speed	RPM

85. Idle In Gear, Bobtail

Filtered_Engine_Speed	RPM	CHL_EGR_Frac_Cmd	---
Total_Fueling	MG/STROKE	EGR_Fraction	---
Road_Speed	MPH	CHL_MCF_Cmd	LB/MIN
Effective_Gear_Ratio	---	Charge_Flow	LB/MIN
LSG_Proportional_Gain	1/SEC	EGR_ Position	%open
Ndot_LSG	RPM/SEC	VGT_Duty_Cycle	%Duty_Cycle
TQM_Net_Engine_Torque_Rqst	FT*LB	Ndot_Net_Torque_Cmd	FT*LB

86. Idle In Gear, Loaded Trailer

Filtered_Engine_Speed	RPM	Fuel_Rail_Pressure	PSI_A
Total_Fueling	MG/STROKE	Ndot_Net_Torque_Cmd	FT*LB
Road_Speed	MPH	TQM_Net_Engine_Torque_Rqst	FT*LB
Effective_Gear_Ratio	---	CHL_EGR_Frac_Cmd	---
LSG_Proportional_Gain	1/SEC	EGR_Fraction	---
Ndot_LSG	RPM/SEC	CHL_MCF_Cmd	LB/MIN
Ndot_Demand	RPM/SEC	Charge_Flow	LB/MIN
FTT_ti_BaseFlTTL_v	MSEC	EGR_Position	%open
FTT_ti_BaseTmTTL_v	MSEC	VGT_Duty_Cycle	%Duty_Cycle

87. Low Idle Stability, Stationary

Filtered_Engine_Speed	RPM	CHL_EGR_Frac_Cmd	---
Total_Fueling	MG/STROKE	EGR_Fraction	---
Fueling_Control_State_Value	---	CHL_MCF_Cmd	LB/MIN
FTT_ti_BaseFlTTL_v	MSEC	Charge_Flow	LB/MIN
LSG_Proportional_Gain	1/SEC	EGR_Position	%open
Ndot_LSG	RPM/SEC	VGT_Duty_Cycle	%Duty_Cycle
TQM_Net_Engine_Torque_Rqst	FT*LB	Alpha	---
Charge_Tmptr	DEG_F	T_EGR_Delta_P_Autozero_Offset	IN_HG
Coolant_Tmptr	DEG_F		

88. OFC Fuel Limit

(/vob/base/sys_rqmt/ofc_fuel_limit_estimator.doc(rev13))

Filtered_Engine_Speed	RPM	CBR_FCLR_On	---
FSS_Total_Fueling	MG/STROKE	CBR_FCLR_Off	---
Fueling_Control_State_Value	---	CBR_FCLR_Ref	---
OFC_Fuel_Limit	MG/STROKE	OFC_EGR_Disabled	---
CBR_Fuel_Ref	MG/STROKE	Compressor_Inlet_Density	LBM/FT3
CBR_Fuel_Ref_State	---	C_CBP_Stoic_OF_Ratio	---
Exhaust_Metal_Tmptr	DEG_F	OFC_Equiv_Ratio_Limit	---
Total_O2_In_Cylinder	MG/STROKE	OFC_Fuel_Llim	MG/STROKE

89. PTO Pump-Off

Filtered_Engine_Speed	RPM	PTO_State	---
Total_Fueling	MG/STROKE	PTO_Status	---
Fueling_Control_State_Value	---	Charge_Tmptr	DEG_F
FTT_ti_BaseFlTTL_V	MSEC	Coolant_Tmptr	DEG_F
PTO_Requested_Speed	---	Oil_Tmptr	DEG_F
HSG_Active_Breakpoint	RPM		

90. PTO Response

Cold Engine / Warm Engine:

Filtered_Engine_Speed	RPM	CHL_EGR_Frac_Cmd	---
Total_Fueling	MG/STROKE	EGR_Fraction	---
Fueling_Control_State_Value	---	CHL_MCF_Cmd	LB/MIN
FTT_ti_BaseFITTL_v	MSEC	Charge_Flow	LB/MIN
PTO_Requested_Speed	RPM	EGR_Position	%open
PTO_State	---	VGT_Duty_Cycle	%Duty_Cycle
PTO_Status	---	Boost_Pressure	IN_HG
HSG_Active_Breakpoint	RPM	System_Switch_Status	---
LSG_Reference_Speed	RPM	Charge_Tmptr	DEG_F
PTO_Maximum_Reference_Speed	RPM	Coolant_Tmptr	DEG_F
		Oil_Tmptr	DEG_F

91. Reverse ESP / Take-Off ESP

(/vob/base/sys_rqmt/esp_auto.doc(rev23), /vob/base/sys_rqmt/esp_base.doc(rev16))

Filtered_Engine_Speed	RPM	Reverse_ESP_Transition_Flag	---
Total_Fueling	MG/STROKE	Reverse_ESP_Min_Gear_Ratio	---
Fueling_Control_State_Value	---	Road_Speed	MPH
ESP_Tau	---	User_Filtered_Gear_Ratio	---
ESP_Tau_State	---	Commanded_Throttle	%THROTTLE
Reverse_ESP_Tau	---	System_Switch_Status	---

92. Road Speed Governor Base Functionality

Filtered_Engine_Speed	RPM	CHL_MCF_Cmd	LB/MIN
Total_Fueling	MG/STROKE	Charge_Flow	LB/MIN
Fueling_Control_State_Value	---	VGT_Duty_Cycle	%Duty_Cycle
Adjusted_User_Fueling_State	---	Filtered_Turbo_Speed	KRPM
Commanded_Throttle	%THROTTLE	Charge_Press	IN_HG
RSG_Error	MPH	Max_Road_Speed_Trim	MPH
RSG_Droop	MPH	Max_Road_Speed	MPH
RSG_Reference_Speed	MPH	RSG_Top_Droop_Width	MPH
Road_Speed	MPH	RSG_Bottom_Droop_Width	MPH
CHL_EGR_Frac_Cmd	---	Top_Gear_Ratio	---
EGR_Fraction	---	Gear_Down_Gear_Ratio	---
Effective_Gear_Ratio	---	Gear_Down_Active	---
RSG_Proportional_Gain	1/SEC		

93. Road Speed Governor Overshoot

Filtered_Engine_Speed	RPM	RSG_Error	MPH
Total_Fueling	MG/STROKE	RSG_Droop	MPH
Fueling_Control_State_Value	---	Road_Speed	MPH
Adjusted_User_Fueling_State	---	RSG_Reference_Speed	MPH
Commanded_Throttle	%THROTTLE	Ndot_Demand	RPM/SEC
Effective_Gear_Ratio	---	Ndot_RSG	RPM/SEC
RSG_Proportional_Gain	1/SEC		

94. Sensor Characterization

Filtered_Engine_Speed	RPM		
Coolant_Temperature_Raw	CNTS	Coolant_Tmptr	DEG_F
Oil_Temperature_Raw	CNTS	Oil_Tmptr	DEG_F
Oil_Pressure_Absolute_Raw	CNTS	Oil_Press_Absolute	PSI_A
Air_Pressure_Sensor_Raw	CNTS	Ambient_Air_Press	IN_HG
Compressor_Inlet_Temperature_Raw	CNTS	Compressor_Inlet_Tmptr	DEG_F
Boost_Pressure_Absolute_Raw	CNTS	Charge_Press	IN_HG
Intake_Manifold_Temperature_Sensor_Raw	CNTS	Charge_Tmptr	IN_HG
Exhaust_Pressure_Sensor_Raw	CNTS	Exhaust_Press	IN_HG
Battery_Voltage_Raw	CNTS	Battery_Volt	VOLT
Sampled_Throttle_Raw	CNTS	Sampled_Throttle	%
EGR_Delta_P_Sensor_Raw	CNTS	EGR_Delta_Press	IN_HG
EGR_Position_Before_Autozero_Raw	CNTS	EGR_Position	%open
EGR_Orifice_Temperature_Raw	CNTS	EGR_Orifice_Tmptr	DEG_F
Raw_Turbo_Speed	CNTS	Filtered_Turbo_Speed	KRPM
Fuel_Temperature_Raw	CNTS	Fuel_Tmptr	DEG_F
Fuel_Rail_Pressure_Raw	CNTS	Fuel_Rail_Press	PSI
Coolant_Level_Raw	CNTS	Coolant_Level	VOLT

95. Snap Throttle Response (HSG, Bobtail)

Filtered_Engine_Speed	RPM	CHL_EGR_Frac_Cmd	---
Total_Fueling	MG/STROKE	EGR_Fraction	---
Fueling_Control_State_Value	---	CHL_MCF_Cmd	LB/MIN
Final_Timing	CRANK_DEG	Charge_Flow	LB/MIN
Final_Timing_State	---	EGR_Position	%open
Commanded_Throttle	%THROTTLE	VGT_Duty_Cycle	%Duty_Cycle
Road_Speed	MPH	Filtered_Turbo_Speed	KRPM
HSG_Active_Breakpoint	RPM	Boost_Pressure	IN_HG
HSG_Reference_Speed	RPM	User_Selected_Throttle_Control	---
HSG_Breakpoint_Speed	RPM	Selected_Throttle_Control	---

96. Snap Throttle Response (HSG/LSG Stationary)

Filtered_Engine_Speed	RPM	Boost_Pressure	IN_HG
Total_Fueling	MG/STROKE	OFC_Fuel_Limit	MG/STROKE
Fueling_Control_State_Value	---	EGR_Valve_Delta_Press	IN_HG
Commanded_Throttle	%THROTTLE	CSE_Xform_Angle	DEG
Sampled_Throttle_Raw	CNTS	User_Selected_Throttle_Control	---
HSG_Active_Breakpoint	RPM	Selected_Throttle_Control	---
CHL_EGR_Frac_Cmd	---	Oil_Tmptr	DEG_F
EGR_Fraction	---	Charge_Tmptr	DEG_F
CHL_MCF_Cmd	LB/MIN	Ambient_Air_Press	IN_HG
Charge_Flow	LB/MIN	CBR_FCLR_Off	---
EGR_Position	%open	CBR_FCLR_On	---
VGT_Duty_Cycle	%Duty_Cycle	T_EGR_Delta_P_Autozero_Offset	IN_HG

97. SOI Advance Control

(/vob/base/sys_rqmt/soi_adv.doc(rev12))

Filtered_Engine_Speed	RPM	CBO_Fuel_Ref	MG/STROKE
Total_Fueling	MG/STROKE	Fueling_Control_State_Value	---
Final_Timing	CRANK_DEG_BTDC	Final_Timing_State	---
CBR_SOI_Ref	CRANK_DEG_BTDC		

CoolantTemperature SOI Advance

Coolant_Tmptr	DEG_F	Charge_Tmptr	DEG_F
Coolant_Undertemperature_SOI_Advance	CRANK_DEG_BTDC	IMT_Advance_NTE_Correction	---
Coolant_Temperature_Advance	CRANK_DEG_BTDC	IMT_Advance_Correction	---
Coolant_Advance_Correction	---	EMR_NTE_Flag	---
Coolant_SOI_Advance_Enable	---	C_IMT_SOI_Advance_NTE_Enable	---
Coolant_SOI_Advance	CRANK_DEG_BTDC	Intake_Temperature_Advance	CRANK_DEG_BTDC
		IMT_SOI_Advance_Enable	---
Ambient Air Pressure SOI Advance		IMT_SOI_Advance	CRANK_DEG_BTDC
Ambient_Air_Press	IN_HG		
Ambient_Pressure_Advance_Correcton	---		
Ambient_Pressure_Advance	CRANK_DEG_BTDC		
Ambient_Pressure_SOI_Advance_Enable	---		
Ambient_Pressure_SOI_Advance	CRANK_DEG_BTDC		

98. Surge Characterization

Air Handling Controller Induced Surge:

Filtered_Engine_Speed	RPM	CHS_MCF_Cmd	LB/MIN
FSS_Total_Fueling	MG/STROKE	CHL_MCF_Cmd	LB/MIN
Fueling_Control_State_Value	---	Charge_Flow	LB/MIN
Filtered_Turbo_Speed	KRPM	CBL_EGR_Frac_Cmd	---
Compressor_Inlet_Tmptr	DEG_F	CHL_EGR_Frac_Cmd	---
Compressor_Outlet_Tmptr	DEG_F	EGR_Fraction	---
Charge_Tmptr	DEG_F	VGT_Duty_Cycle	%Duty_Cycle
Exhaust_Tmptr	DEG_F	TGC_VT_Cmd	%
Charge_Press	IN_HG	EGR_Position	%open
Compressor_Inlet_Press	IN_HG	EAC_EGR_Valve_Cmd	%open
Compressor_Inlet_Density	LBM/FT3	Fresh_Air_Flow	LB/MIN

Engine Surge:

Filtered_Engine_Speed	RPM	Effective_Gear_Ratio	---
FSS_Total_Fueling	MG/STROKE	Ndot_LSG	RPM/SEC
Fueling_Control_State_Value	---	Ndot_HSG	RPM/SEC
TQM_Final_Torque_Cmd	FT*LB	Ndot_Cruise_Control	RPM/SEC
Ndot_Net_Torque_Cmd	FT*LB	Ndot_RSG	RPM/SEC
No_Load_Torque	FT*LB	Ndot_ASG	RPM/SEC
Ndot_Demand	RPM/SEC	Ndot_PTO	RPM/SEC
Ndot_Actual	RPM/SEC		

Quasi-Steady State Compressor Surge:

Filtered_Engine_Speed	RPM	Compressor_Outlet_Tmptr	DEG_F
FSS_Total_Fueling	MG/STROKE	Compressor_Inlet_Density	LBM/FT3
Fueling_Control_State_Value	---	CBR_Chi_Value	---
Filtered_Turbo_Speed	KRPM	CBP_Air_Fuel_Ratio	---
Compressor_Inlet_Tmptr	DEG_F	CHP_Volumetric_Efficiency	---
Charge_Tmptr	DEG_F	EGR_Position	%open
CHL_EGR_Frac_Cmd	---	VGT_Duty_Cycle	%Duty_Cycle
EGR_Fraction	---		

Transient Compressor Surge:

Filtered_Engine_Speed	RPM	Boost_Pressure	IN_HG
FSS_Total_Fueling	MG/STROKE	Filtered_Turbo_Speed	KRPM
Fueling_Control_State_Value	---	Altitude	FT
Charge_Press	IN_HG	Charge_Flow	LB/MIN
Charge_Tmptr	DEG_F	CHS_MCF_Cmd	LB/MIN
Compressor_Inlet_Tmptr	DEG_F	CHL_MCF_Cmd	LB/MIN
Compressor_Inlet_Density	LBM/FT3	EGR_Position	%open
Compressor_Outlet_Tmptr	DEG_F	VGT_Duty_Cycle	%Duty_Cycle

99. Texh Fuel Limit

(/vob/base/sys_rqmt/texhaust/fuel_limit_estiamtor.doc(rev6))

Filtered_Engine_Speed	RPM	Exhaust_Metal_Tmptr	DEG_F
FSS_Total_Fueling	MG/STROKE	Charge_Flow	LB/MIN
Fueling_Control_State_Value	---	TPE_Energy_Fraction	DEG_F
Texh_Fuel_Limit	MG/STROKE	Charge_Tmptr	DEG_F
CBR_Fuel_Ref	MG/STROKE	TFC_Fuel_Flow_Limit	MG/STROKE
CBR_Fuel_Ref_State	---		

100. Throttle Control / Stability, Bobtail

Filtered_Engine_Speed	RPM	EGR_Position	%open
Total_Fueling	MG/STROKE	VGT_Duty_Cycle	%DUTY_CYCLE
Commanded_Throttle	%THROTTLE	Boost_Pressure	IN_HG
Sampled_Throttle_Raw	CNTS	OFC_Fuel_Limit	MG/STROKE
Road_Speed	MPH	EGR_Valve_Delta_Press	IN_HG
Filtered_Gear_Ratio	---	CSE_Xform_Angle	DEG
CHL_EGR_Frac_Cmd	---	CBR_FCLR_Off	---
EGR_Fraction	---	CBR_FCLR_On	---
CHL_MCF_Cmd	LB/MIN	User_Selected_Throttle_Control	---
Charge_Flow	LB/MIN	Selected_Throttle_Control	---

101. Throttle Control / Stability, Loaded Trailer

Filtered_Engine_Speed	RPM	EGR_Position	%open
Total_Fueling	MG/STROKE	VGT_Duty_Cycle	%Duty_Cycle
Commanded_Throttle	%THROTTLE	Charge_Press	IN_HG
Sampled_Throttle_Raw	CNTS	OFC_Fuel_Limit	MG/STROKE
Road_Speed	MPH	EGR_Valve_Delta_Press	IN_HG
Filtered_Gear_Ratio	---	CSE_Xform_Angle	DEG
CHL_EGR_Frac_Cmd	---	CHL_Delta_P_Drt_Active	---
EGR_Fraction	---	CHL_COT_Drt_Active	---
CHL_MCF_Cmd	LB/MIN	CHL_Turbo_Speed_Drt_Active	---
CHS_MCF_Cmd	LB/MIN	User_Selected_Throttle_Control	---
Charge_Flow	LB/MIN	Selected_Throttle_Control	---

102. Throttle Characterization

Filtered_Engine_Speed	RPM	Auto_Zero	%THROTTLE
Commanded_Throttle	%THROTTLE	Throttle_Deadband	%THROTTLE
Sampled_Throttle_Raw	CNTS	FTT_ti_BaseFlTTL_v	MSEC
Throttle_Status	---	CHL_EGR_Frac_Cmd	---
Total_Fueling	MG/STROKE	EGR_Fraction	---
Fueling_Control_State_Value	---	CHL_MCF_Cmd	LB/MIN
Sampled_Throttle	%	Charge_Flow	LB/MIN
Throttle_Min	%THROTTLE	EGR_Position	%open
User_ Selected_Throttle_Control	---	VGT_Duty_Cycle	%Duty_Cycle
Selected_Throttle_Control	---	Boost_Pressure	IN_HG

103. Torque Response

Filtered_Engine_Speed	RPM	Road_Speed	MPH
TQM_Final_Torque_Cmd	FT*LB	Charge_Press	IN_HG
TQM_Net_Machine_Torque_Cmd	FT*LB	Filtered_Turbo_Speed	KRPM
Total_Fueling	MG/STROKE	VGT_Duty_Cycle	%Duty_Cycle
CBR_Gross_Fuel	MG/STROKE	Charge_Flow	LB/MIN
Fueling_Control_State_Value	---	CHL_MCF_Cmd	LB/MIN
Commanded_Throttle	%THROTTLE	Compressor_Outlet_Tmptr	DEG_F
Alpha	---	EGR _Position	%open
CBR_Chi_Value	---	EGR_Valve_Delta_Press	IN_HG
Ambient_Air_Press	IN_HG	EGR_Delta_Press	IN_HG

Application Features:

104. ANC Timing Limit

(/vob/base/sys_rqmt/anc_time.doc(rev16))

Engine_Speed	RPM	CBO_SOI_Ref	CRANK_DEG_BTDC
AS_ANC_Enable_Flag	---	ANC_Timing_Algorithm_Enable	---
Coolant_Tmptr	DEG_F	ANC_Timing	CRANK_DEG_BTDC
Filtered_Engine_Acceleration	RPM/SEC	ANC_Timing_Limit_Inhibit	---
Engine_Acceleration	RPM/SEC	ANC_Coolant_Temp_Limit	DEG_F
ANC_Timing_Trigger_Filtered_Accel_Limit	RPM/SEC	AS_ANC_Override	---
ANC_Timing_Trigger_Accel_Limit	RPM/SEC	ANC_Timing_Limit_Status	---

105. CORS Centinel

(/vob/base/sys_rqmt/cors.doc(rev22))

Filtered_Engine_Speed	RPM	CORS_Remote_Oil_Level_Switch	---
		CORS_Fuel_Used	GAL
Total_Fueling	MG/STROKE	CORS_Makeup_Fuel_Used	GAL
Fueling_Control_State	---	CORS_Missed_Pulse_Count	---
TQM_Final_Torque_Cmd	FT*LB	CORS_Burn_Valve_Command	---
Road_Speed	MPH	CORS_Remote_Oil_Level_Low	---
Engine_State	---	CORS_Remote_Oil_Counter	SEC
FSS_Total_Fuel_Delivered	GAL	T_CORS_Remote_Oil_Level_Enable	---
Oil_Pressure	PSI	CORS_Oil_Blend_Fuel_Limit	GAL
Oil_Temperature	DEG_F	Oil_Pressure_High_Postprocessed_Error	---
Oil_Temperature_High_Error	---	Oil_Pressure_Absolute_Low_Error	---
Oil_Temperature_Low_Error	---	CORS_Remote_Oil_Level_Low_Error	---
CORS_Burn_Valve_Driver_PWM_High_Control_Error	---	CORS_Enable	---
CORS_Burn_Valve_Driver_PWM_Low_Control_Error	---		

106. Engine Brake Command Level Determination

(/vob/automotive/sys_rqmt/engine_brake_command_level_determination.doc(rev13))

Filtered_Engine_Speed	RPM	Cruise_Control_EB_Torque	FT*LB
Total_Fueling	MG/STROKE	Clutch_Switch	---
Fueling_Control_State	---	EB_Allowed_State	---
TQM_Final_Torque_Cmd	FT*LB	EB_Jcomm_Non_Override_Torque	FT*LB
EB_Jcomm_Torque_Source	---	EB_Switch_Torque	FT*LB
EB_Switch_Torque_Source	---	EB_Override_Torque	FT*LB
EB_Override_Torque_Source	---	Effective_Gear_Ratio	---
EGA_Control_Error	---	EGR_Valve_Position	%open
EGR_Position_Source	---	PTP_Torque_Output	FT*LB
E_Brake_Command_Source	---	EB_Non_Override_Torque	FT*LB
EB_Torque_Command	FT*LB	C_EB_Max_Trq_GR_Thd	---

107. Engine Brake Manager

Filtered_Engine_Speed	RPM	EB_Cruise_Engine_Brake_Active	---
Total_Fueling	MG/STROKE	EB_CC_Brake_Torque_Only	---
Fueling_Control_State	---	Cruise_Control_EB_Torque	FT*LB
TQM_Final_Torque_Cmd	FT*LB	EB_Switch_Torque	FT*LB
Charge_Flow	LB/MIN	EB_Override_Torque	FT*LB
CHL_MCF_Cmd	LB/MIN	EB_Jcomm_Non_Override_Torque	FT*LB
Exhaust_Press	IN_HG	EB_Torque_Command	FT*LB
Charge_Press	IN_HG	EB_Charge_Flow_Command	LB/MIN
E_Brake_Status	---		
Engine_Brake_Inhibit	---	Engine_Brake_Driver_1	---
EB_Allowed_State	---	Engine_Brake_Driver_2	---
EB_Immediate_Brake	---	Engine_Brake_Driver_3	---

108. Engine Start-Up / Cranking

Filtered_Engine_Speed	RPM	EPS_Main_Sync_State	---
Total_Fueling	MG/STROKE	EPS_Backup_Sync_State	---
Fueling_Control_State	---	Crank_Exit_Speed	RPM
TQM_Final_Torque_Cmd	FT*LB	Crank_Fuel	MG/STROKE
No_Load_Torque	FT*LB	Crank_Exit_Fuel_Adjustment	MG/STROKE
Coolant_Tmptr	DEG_F	Crank_Advance	CRANK_DEG
Ambient_Air_Tmptr	DEG_F	Crank_Exit_Timer	SEC
Charge_Tmptr	DEG_F	Crank_Reentry_Speed	RPM
		Crank_Jumpstart_Timer	SEC

109. Ether Start Injection

(/vob/base/sys_rqmt/ether_start.doc(rev9))

Filtered_Engine_Speed	RPM	Ether_Injection_Driver_PWM_Duty_Cycle	%
FSS_Total_Fueling	MG/STROKE	Ether_Injection_Driver_PWM_Period	USEC
Fueling_Control_State_Value	---	Ether_Injection_Delay_Timer	SEC
Coolant_Tmptr	DEG_F	Ether_Injection_Cranking_Timer	SEC
EGR_Valve_Is_Closed	---	Ether_Injection_Preload_Timer	SEC
Engine_State	---	Ether_Injection_Pulse_Off_Time	SEC
EPS_Status	---	Ether_Request_Flag	---
Ether_Injection_Driver_PWM_Low_Control_Error	---	Ether_Solenoid_Command	---
Ether_Injection_Driver_PWM_High_Control_Error	---	EGR_Position_Source	---
Coolant_Tmptr_Source	---	Ether_Injection_Pulse_Timer	SEC
Ether_Preload_Limit_Reached	---	Ether_Preload_Conditions_Met	---
Ether_Measured_Shot_Command	---	Ether_Starting_Conditions_Met	---
Ether_Start_Preconditions_Met	---	Ether_Requested_Off	---

110. Fan Control

(/vob/base/sys_rqmt/fan_clutch.doc(rev41))

Filtered_Engine_Speed	RPM	Fan_Torque	FT*LB
Engine_State	---	Fan_Clutch_1_PWM_Duty_Cycle	%
Total_Fueling	MG/STROKE	Fan_Clutch_1_PWM_Period	USEC
TQM_Final_Torque_Cmd	FT*LB	Fan_Air_Conditioner_Request	%
Fueling_Control_State	---	Fan_Coolant_Temp_Request	%
Coolant_Tmptr	DEG_F	Fan_Datalink_Request	%
Intake_Manifold_Temperature	DEG_F	Fan_Engine_Brake_Request	%
Air_Conditioner_Pressure_Switch	---	Fan_Intake_Manifold_Temp_Request	%
Manual_Fan_Input	---	Fan_Manual_Input_Request	%
Fan_Request	%	Fan_Tool_Request	%
Fan_Drive_State	---	Manual_Fan_Level	%
EB_Driver_Fraction_Raw	---	Fan_Clutch_Logic	---
Vehicle_Speed	MPH	LSG_Adjusted_Reference_Speed	RPM
Fan_AC_Pressure_Enable	---	Jcomm_Estimated_Percent_Fan_Speed	%
Fan_Clutch1_Type	---	Fan_AC_Vehicle_Speed_Interaction_Enable	---
Fan_Clutch_Tool_Request_Level	%	Fan_Clutch_Enable	---
Fan_EB_Enable	---	Fan_Clutch_Min_On_Time	SEC
Fan_Manual_Input_Enable	---	Fan_Coolant_Temp_Enable	---
Manual_Fan_Level_User_Value	%	Fan_IMT_Enable	---

111. Gear Down Protection

(/vob/automotive/sys_rqmt/rsgrefgd.doc(46))

Filtered_Engine_Speed	RPM	GD_Filtered_Percent_Load	%
Total_Fueling	MG/STROKE	GD_State	---
Fueling_Control_State	---	Max_Road_Speed	MPH
TQM_Final_Torque_Cmd	FT*LB	Cruise_Max_Road_Speed	MPH
Road_Speed	MPH	GD_Low_Limit_Speed	MPH
Cruise_Control_Reference_Speed	MPH	GD_High_Limit_Speed	MPH
Cruise_Control_Status	---	RSG_Desired_Reference_Speed	MPH
SR_Reference_Speed	MPH	RSG_Reference_Speed	MPH
DR_RSG_CC_Delta	MPH	SR_Reference_Speed	MPH
Filtered_Gear_Ratio	---	DR_Max_Offset	MPH
Gear_Down_Active	---	Jcomm_Progressive_Shift_Disable	---
Rear_Axle_Ratio_Switch	---	Gear_Down_Active	---
Percent_Load	%	Gear_Ratio	---
Cruise_Max_Road_Speed_Trim	MPH	DR_CC_RSG_Both_Option	---
DR_Enable	---	Gear_Down_Protection_Enable	---
GD_Gear_Down_High_Load_Speed	MPH	GD_Gear_Down_Light_Load_Speed	MPH
GD_Next_Gear_Down_High_Load_Delta	MPH	GD_Next_Gear_Down_Light_Load_Delta	MPH
Global__Road_Speed_Maximum	MPH	Max_Road_Speed_Trim	MPH
SR_Enable	---	Top_Gear_Ratio	---

112. Idle Shutdown

(/vob/base/sys_rqmt/is_base.doc(20))

Filtered_Engine_Speed	RPM	Brake_Switch	---
Total_Fueling	MG/STROKE	Clutch_Switch	---
TQM_Final_Torque_Cmd	FT*LB	VSS_Signal_Lost_ Error	---
Fueling_Control_State	---	PTO_Status	---
Engine_State	---	Idle_Shutdown_State	---
OEM_Ambient_Air_Tmptr	DEG_F	Idle_Shutdown_Override_Flag	HEX
Commanded_Throttle	%THROTTLE	Idle_Shutdown_Reset_Flag	HEX
Road_Speed	MPH	Idle_Shutdown_Reset_From_Warning_Flag	HEX
Parking_Brake_Switch	---	Idle_Shutdown_Reset_From_Override_Flag	HEX
OEM_Ambient_Air_Temperature_High_Error	---	Percent_Load	%
Tool_IS_Minimum_Ambient_Temperature_LL	DEG_F	OEM_Ambient_Air_Tmptr_Source	---
Idle_Shutdown_Temperature_Enable	---	OEM_Ambient_Air_Temperature_Low_Error	---
IS_Loading_Threshold	%	Tool_IS_No_Override_High_Threshold_UL	DEG_F

113. J1587 Percent Load (VSS_Transmission = 1)

(20 msec datalogs)

Automatic Transmissions:

Filtered_Engine_Speed	RPM	Throttle_100_Torque	FT*LB
Fueling_Control_State_Value	---	J1587_Percent_Load	%
Total_Fueling	MB/STROKE	Friction_Torque	FT*LB
HSG_Active_Slope	RPM/FTLB	Jcomm_Ind_Percent_Load	%
HSG_Before_Droop_Speed	RPM	Jcomm_Pumping_Torque	FT*LB
HSG_Droop_Flag	---	Fan_Torque	FT*LB
Net_Engine_Torque	FT*LB	Effective_Gear_Ratio	---
Throttle_100_Torque_At_HSG_Bef_Droop_Speed	FT*LB		

114. J1939 ABS/ASR

(20 msec datalogs)

Commanded_Throttle	%THROTTLE	Jcomm_Engine_Speed_Limit_RPM	RPM
Effective_Gear_Ratio	---	Jcomm_Torque_Converter_Lockup_Disengaged	HEX
Filtered_Engine_Speed	RPM	Jcomm_Derate_Torque	FT*LB
Fueling_Control_State	---	Jcomm_Retarder_Control_Mode	---
Net_Engine_Torque	FT*LB	Jcomm_Retarder_Torque_Command	FT*LB
Total_Fueling	MG/STROKE	Jcomm_Engine_Brake_Limit	FT*LB
Jcomm_Engine_Control_Byte	HEX	E_Brake_Status	---
Jcomm_Engine_Torque_Command	%	E_Brake_Command_Source	---

115. J1939 Automated Manual Transmissions (VSS_Transmission = 2, 3, or 4)

(20 msec datalogs)

Autoshift / Ultrashift / Freedom / Lightning Transmissions:

Commanded_Throttle	%THROTTLE	Jcomm_Reference_RPM	RPM
Effective_Gear_Ratio	---	Jcomm_Engine_Speed_Limit_RPM	RPM
Filtered_Engine_Speed	RPM	Jcomm_Engine_Torque_Command	%
Fueling_Control_State	---	Jcomm_Derate_Torque	FT*LB
Net_Engine_Torque	FT*LB	Jcomm_Retarder_Torque_Command	FT*LB
Total_Fueling	MG/STROKE	Jcomm_Engine_Control_Device_Indicator	---
Ndot_Powertrain	RPM/SEC	Powertrain_Proportional_Gain	1/SEC
Jcomm_Engine_Control_Byte	HEX	Road_Speed	MPH

116. J1939 Roadspeed (RSC_Sensor_Type = Datalink_Tailshaft)

(20 msec datalogs)

Commanded_Throttle	%THROTTLE	J1939_Tailshaft_Speed	RPM
Effective_Gear_Ratio	---	VSS_Signal_Lost_Error	---
Filtered_Engine_Speed	RPM	VSS_Transmission	---
Fueling_Control_State	---	RSC_Sensor_Type	---
Net_Engine_Torque	FT*LB	J1939_Last_ETC1_SA_Table	---
Total_Fueling	MG/STROKE		

117. J1939 Torque Accuracy

(20 msec datalogs)

Cruise_Command_Mode	---	Jcomm_Fric_Trq_Adj	FT*LB
Filtered_Engine_Speed	RPM	Jcomm_Ind_Friction_Torque	%
Fueling_Control_State	---	Cruise_Control_Status	---
Net_Engine_Torque	FT*LB	Ndot_Drivers_Demand	RPM/SEC
Jcomm_Pumping_Torque	FT*LB	Ndot_Drivers_Demand_From_Torque	RPM/SEC
Friction_Torque	FT*LB	Ndot_Feedforward_Gain	---
Jcomm_Actual_Engine_Ind_Torque	%	Ndot_Integral_Torque	FT*LB
Fan_Torque	FT*LB	Drivers_Demand_Torque	FT*LB

118. J1939 Vorad

(20 msec datalogs)

Cruise_Command_Mode	---	Jcomm_Engine_Speed_Limit_RPM	RPM
Effective_Gear_Ratio	---	Jcomm_Retarder_Torque_Command	FT*LB
Filtered_Engine_Speed	RPM	Cruise_Control_Reference_Speed_Old	MPH
Fueling_Control_State	---	Cruise_Control_Reference_Speed	MPH
Net_Engine_Torque	FT*LB	Road_Speed	MPH
Adaptive_Cruise_Control_State	---	Out_Of_Gear	---
Adaptive_Cruise_Control_Mode	---	Ndot_RSG	RPM/SEC
Jcomm_Engine_Control_Byte	HEX	Ndot_Cruise_Control	RPM/SEC

119. Limp Home Mode

(/vob/base/sys_rqmt/limphome.doc(rev22)

Engine_Speed	RPM	Ndot_Demand	RPM/SEC
Total_Fueling	MG/STROKE	Ndot_Error	RPM/SEC
Fueling_Control_State	---	Limp_Home_Filtered_Engine_Speed	RPM
TQM_Final_Torque_Cmd	FT*LB	Limp_Home_Max_Net_Torque	FT*LB
Net_Machine_Torque	FT*LB	Limp_Home_Net_Torque	FT*LB
Ndot_Integral_Torque	FT*LB	Limp_Home_Net_Torque_Limit	FT*LB
Ndot_Feedforward_Gain	---	Limp_Home_Torque_Error	FT*LB
Commanded_Throttle	%THROTTLE	Limp_Home_Active_Flag	---
Throttle_Status	---	J1939_Mux_APS_Data_Error	HEX
Road_Speed	MPH	J1939_Mux_APS_PGN_Timeout_Error	HEX
Limp_Home_Algorithm_Enable	---	Remote_Throttle_Switch	---
Remote_Throttle_Enable	---	Sampled_Throt_Source	---
		Limp_Home_Enable_Conditions_Met	---

120. Load Based Speed Control (LBSC)

(/vob/base/sys_rqmt/machine_mass_estimator(rev11))

[SM] Shift Manager:

Filtered_Engine_Speed	RPM	Filtered_Gear_Ratio	---
FSS_Total_Fueling	MG/STROKE	Gear_Down_Gear_Ratio	---
Fueling_Control_State_Value	---	SM_Engine_Torque	FT*LB
TQM_Final_Torque_Cmd	FT*LB	SM_Torque_Threshold	FT*LB
HSG_Active_Isochronous_Speed	RPM	SM_Downshifft_Active	---
HSG_Active_Isochronous_Speed_State	---	SM_Reference_Speed	RPM
HSG_Active_Breakpoint	RPM	SM_Ref_Speed_Adjust	RPM
HSG_Reference_Speed	RPM	SM_Ref_Mode	---
Commanded_Throttle	%THROTTLE	Net_Machine_Torque	FT*LB
Road_Speed	MPH	Throttle_100_Torque	FT*LB
Top_Gear_Ratio	---	SM_Flag	---
Rear_Axle_Ratio	---	SM_Downshift_Active	---
Jcomm_Progressive_Shift_Disable	---	SM_High_Load	---
Out_Of_Gear	---	SM_Low_Load	---
PTO_Status	---	SM_Save_Last_Ref_Speed	RPM
VSS_Signal_Lost_Error	---	SM_Target_Speed	RPM

Vehicle Trims:

T_Shift_Manager_Enable	HEX	RSC_Sensor_Type	---
T_SM_High_RPM_Breakpoint	RPM	VSS_Transmission	---
T_SM_Low_RPM_Breakpoint	RPM	Gear_Down_Gear_Ratio	---

[SM] Determine Shift Manager Status:

Filtered_Engine_Speed	RPM	SM_Low_Load	---
Filtered_Gear_Ratio	---	SM_High_Load	---
Out_Of_Gear	---	SM_Downshift_Active	---
SM_Engine_Torque	FT*LB	SM_Flag	---
SM_Torque_Threshold	FT*LB	Brake_Switch	---

[SM] Determine Shift Manager Torque Thresholds:

Filtered_Engine_Speed	RPM	SM_Torque_Accel	FT*LB
Net_Machine_Torque	FT*LB	MME_Torque_Aero	FT*LB
MME_Vehicle_Mass	LBM	MME_Torque_Rolling	FT*LB
MME_Tire_Radius	FT	MME_Torque_Grade	FT*LB
Filtered_Gear_Ratio	---	MME_Torque_Transmission	FT*LB
Rear_Axle_Ratio	---	MME_Torque_Axle	FT*LB
Fan_Torque	FT*LB	SM_Torque_Threshold	FT*LB
Road_Speed	MPH	MME_Engine_Inertia_At_Wheels	LBF*FT*SEC^2
SM_Vehicle_Acceleration	FT/SEC^2	Out_Of_Gear	---

[SM] Shift Manager Reference Mode:

Filtered_Engine_Speed	RPM	PTO_Status	---
Filtered_Gear_Ratio	---	SM_Ref_Mode	---
Out_Of_Gear	---	HSG_Active_Breakpoint	RPM
SM_Ref_Speed_Adjust	RPM	Jcomm_Progressive_Shift_Disable	---
SM_Flag	---	Gear_Down_Gear_Ratio	---

[SM] Shift Manager Reference Speed:

Filtered_Engine_Speed	RPM	HSG_Active_Isochronous_Speed	RPM
Filtered_Gear_Ratio	---	SM_Ref_Speed_Adjust	RPM
Out_Of_Gear	---	SM_Ref_Mode	---
SM_Saved_Reference_Speed	RPM	SM_Reference_Speed	RPM
Net_Machine_Torque	FT*LB	SM_Target_Speed	RPM
Throttle_100_Torque	FT*LB	SM_Save_Last_Ref_Speed	---

[MME] Machine Mass Estimator:

Filtered_Engine_Speed	RPM	MME_Tire_Radius	FT
FSS_Total_Fueling	MG/STROKE	MME_Estimated_Vehicle_Mass	LBM
Fueling_Control_State_Value	---	MME_Engine_Inertia_At_Wheels	LBF*FT*SEC^2
Net_Machine_Torque	FT*LB	MME_Road_Grade_Detected	---
Filtered_Gear_Ratio	---	MME_Vehicle_Acceleration	FT/SEC^2
Road_Speed	MPH	MME_Vehicle_Mass	LBM
Rear_Axle_Ratio	---	Brake_Switch	---
Fan_Torque	FT*LB		

[MME] Estimated Torque For Acceleration:

Filtered_Engine_Speed	RPM	MME_Torque_Aero	FT*LB
Road_Speed	MPH	MME_Torque_Axle	FT*LB
MME_Tire_Radius	FT	MME_Torque_Rolling	FT*LB
Filtered_Gear_Ratio	---	MME_Torque_Transmission	FT*LB
Rear_Axle_Ratio	---	MME_Machine_Torque_At_Wheels	FT*LB
Net_Machine_Torque	FT*LB	MME_Excess_Machine_Torque	FT*LB
MME_Machine_Torque	FT*LB	MME_Min_Torque_Timer	SEC
MME_Estimated_Vehicle_Mass	LBM		

[MME] Monitor Vehicle Data For Changes In Engine Conditions:

Filtered_Engine_Speed	RPM	MME_Start_Data_Processing	---
Net_Machine_Torque	FT*LB	MME_Data_Processing_Complete	---
MME_Vehicle_Mass	LBM	MME_Major_Chage_Confirmed	---
MME_Estimated_GCVW	LBM	MME_Mass_Increase_Confirmed	---
Filtered_Gear_Ratio	---	MME_Total_Samples	---
Out_of_Gear	---	MME_Average_GCVW	LBM
MME_Collect_Data	---	MME_Major_Change_Flag	---
MME_Road_Grade_Detected	---	MME_Major_Mass_Increase_Flag	---
Road_Speed	MPH	MME_Machine_Torque	FT*LB
MME_Instantaneous_Average_GCVW	LBM	MME_Max_Torque_Threshold	FT*LB
MME_Vehicle_Acceleration	FT/SEC^2		

[MME] Optimal Torque Range:

Filtered_Engine_Speed	RPM	MME_Torque_Aero	FT*LB
Filtered_Gear_Ratio	---	MME_Torque_Axle	FT*LB
Rear_Axle_Ratio	---	MME_Torque_Rolling	FT*LB
Out_of_Gear	---	MME_Torque_Transmission	FT*LB
MME_Tire_Radius	FT	MME_Torque_Grade	FT*LB
MME_Vehicle_Mass	LBM	MME_Torque_Accel	FT*LB
MME_Vehicle_Acceleration	FT/SEC^2	MME_Max_Torque_Threshold	FT*LB
Fan_Torque	FT*LB	C_MME_Min_Torque_Threshold	FT*LB
Net_Machine_Torque	FT*LB	C_MME_Min_Transient_Torque_Thd	FT*LB
MME_Estimated_Vehicle_Mass	LBM	MME_Engine_Inertia_At_Wheels	LBF*FT*SEC^2

[MME] Vehicle Mass Estimation:

Filtered_Engine_Speed	RPM	MME_Engine_Inertia_At_Wheels	LBF*FT*SEC^2
Filtered_Gear_Ratio	---	MME_Estimated_GCVW	LBM
Rear_Axle_Ratio	---	MME_Average_GCVW	LBM
MME_Tire_Radius	FT	MME_Adjusted_Avg_GCVW	LBM
Road_Speed	MPH	MME_Vehicle_Acceleration	FT/SEC^2
Net_Machine_Torque	FT*LB	MME_Vehicle_Mass	LBM
MME_Excess_Machine_Torque	FT*LB	T_MME_Vehicle_Weight	LBM

121. NDOT Governor

Filtered_Engine_Speed	RPM	Commanded_Throttle	%THROTTLE
Ndot_Net_Torque_Cmd	FT*LB	Road_Speed	MPH
Ndot_Net_Torque_Cmd_State	---	Effective_Gear_Ratio	---
Ndot_Integral_Torque	FT*LB	Ndot_Demand	RPM/SEC
Ndot_Proportional_Torque	FT*LB	Ndot_Actual	RPM/SEC
Ndot_Feedforward_Torque	FT*LB	Ndot_Error	RPM/SEC
Ndot_Excess_Machine_Torque	FT*LB	Torque_Derived_Ndot	---
Ndot_Excess_Torque_Adj	FT*LB	Ndot_Integral_Gain	---
No_Load_Torque	FT*LB	Ndot_Proportional_Gain	---
Net_Machine_Torque	FT*LB	Ndot_Feedforward_Gain	---
Ndot_Powertrain	RPM/SEC	Cruise_Control_Priority	---
Ndot_Cruise	RPM/SEC	RSG_Priority	---
Ndot_RSG	RPM/SEC	ASG_Priority	---
Ndot_ASG	RPM/SEC	LSG_Priority	---
Ndot_LSG	RPM/SEC	ANC_Priority	---
Ndot_ANC	RPM/SEC	HSG_Priority	---
Ndot_HSG	RPM/SEC	User_Override_Priority	---
Ndot_User_Override	RPM/SEC		

(/vob/base/sys_rqmt/anc_ndot(rev4) NOTE: Data should be taken at 20 msec intervals for proper analysis)

Acceleration Noise Control (ANC)

Engine_Speed	RPM	Filtered_Engine_Speed	RPM
Total_Fueling	MG/STROKE	User_Selected_Throttle_Control	---
Fueling_Control_State	---	ANC_Timing_Limit_Status	---
TQM_Final_Torque_Cmd	FT*LB	ANC_Timing_Limit_Inhibit	---
Effective_Gear_Ratio	---	ANC_Timing	CRANK_DEG
Road_Speed	MPH	Filtered_Engine_Acceleration	RPM/SEC
Coolant_Tmptr	DEG_F	Engine_Acceleration	RPM/SEC
SM_Ref_Mode	---	Ndot_ANC	RPM/SEC
ANC_Timing_Algorithm_Enable	---		

(/vob/base/sys_rqmt/asg_gain(rev10), /vob/base/sys_rqmt/asg_ndot(rev4) NOTE: Data should be taken at 20 msec intervals for proper analysis)

All Speed Governor (ASG)

Filtered_Engine_Speed	RPM	Ndot_User_Command	RPM/SEC
Total_Fueling	MG/STROKE	Ndot_ASG	RPM/SEC
Fueling_Control_State	---	Ndot_Demand	RPM/SEC
Commanded_Throttle	%THROTTLE	ASG_Error	RPM
Road_Speed	MPH	Net_Engine_Torque	FT*LB
Effective_Gear_Ratio	---	Ndot_Net_Torque_Cmd	FT*LB
ASG_Reference_Speed	RPM	Ndot_Net_Torque_Cmd_State	---
Torque_Derived_Ndot	---	Ndot_Integral_Torque	FT*LB
ASG_Proportional_Gain	1/SEC		

(/vob/base/sys_rqmt/cc_gain(rev7), /vob/base/sys_rqmt/cc_ndot(rev3) NOTE: Data should be taken at least at 40 msec intervals for proper analysis)

Cruise Control Governor (CC)

Filtered_Engine_Speed	RPM	Road_Speed	MPH
Total_Fueling	MG/STROKE	Cruise_Max_Road_Speed	MPH
Fueling_Control_State	---	Cruise_Control_Reference_Speed	MPH
Net_Engine_Torque	FT*LB	Ndot_Cruise_Control	RPM/SEC
Ndot_Net_Torque_Cmd	FT*LB	Ndot_Demand	RPM/SEC
Ndot_Net_Torque_Cmd_State	---	CC_Error	RPM
Ndot_Integral_Torque	FT*LB	Cruise_Control_Status	---
Effective_Gear_Ratio	---	System_Switch_Status	---
Commanded_Throttle	%THROTTLE	CC_Proportional_Gain	1/SEC

(/vob/base/sys_rqmt/hsg_gain(rev11), /vob/base/sys_rqmt/hsg_ndot(rev5) NOTE: Data should be taken at 20 msec intervals for proper analysis)

High Idle Governor (HSG)

Filtered_Engine_Speed	RPM	HSG_Reference_Speed	RPM
Total_Fueling	MG/STROKE	Ndot_HSG	RPM/SEC
Fueling_Control_State	---	Ndot_Demand	RPM/SEC
Net_Engine_Torque	FT*LB	HSG_Error	RPM
Ndot_Net_Torque_Cmd	FT*LB	Commanded_Throttle	%THROTTLE
Ndot_Net_Torque_Cmd_State	---	Road_Speed	MPH
Ndot_Integral_Torque	FT*LB	Effective_Gear_Ratio	---
HSG_Proportional_Gain	%FUEL/RPM		

(/vob/base/sys_rqmt/lsg_gain(rev16), /vob/base/sys_rqmt/lsg_ndot(rev5) NOTE: Data should be taken at 20 msec intervals for proper analysis)

Low Idle Governor (LSG)

Filtered_Engine_Speed	RPM	LSG_Reference_Speed	RPM
Total_Fueling	MG/STROKE	Ndot_LSG	RPM/SEC
Fueling_Control_State	---	Ndot_Demand	RPM/SEC
Net_Engine_Torque	FT*LB	Ndot_Error	RPM/SEC
Ndot_Net_Torque_Cmd	FT*LB	Commanded_Throttle	%THROTTLE
Ndot_Net_Torque_Cmd_State	---	Road_Speed	MPH
Ndot_Integral_Torque	FT*LB	Effective_Gear_Ratio	---

(/vob/base/sys_rqmt/pto _gain(rev8), /vob/base/sys_rqmt/pto_ndot(rev3) NOTE: Data should be taken at 20 msec intervals for proper analysis)

Power Take-Off Governor (PTO)

Filtered_Engine_Speed	RPM	PTO_Reference_Speed	RPM
Total_Fueling	MG/STROKE	Ndot_PTO	RPM/SEC
Fueling_Control_State	---	Ndot_Demand	RPM/SEC
Net_Engine_Torque	FT*LB	PTO_Error	RPM
Ndot_Net_Torque_Cmd	FT*LB	Ndot_User_Command	RPM/SEC
Ndot_Net_Torque_Cmd_State	---	System_Switch_Status	HEX
Ndot_Integral_Torque	FT*LB	System_Switch_Status_2	HEX
PTO_Status	---	PTO_Proportional_Gain	%FUEL/RPM

(/vob/base/sys_rqmt/rsg_gain(rev7), /vob/base/sys_rqmt/rsg_ndot(rev3) NOTE: Data should be taken at least at 40 msec intervals for proper analysis)

Road Speed Governor (RSG)

Filtered_Engine_Speed	RPM	Road_Speed	MPH
Total_Fueling	MG/STROKE	RSG_Proportional_Gain	1/SEC
Fueling_Control_State	---	RSG_Reference_Speed	MPH
Net_Engine_Torque	FT*LB	Ndot_RSG	RPM/SEC
Ndot_Net_Torque_Cmd	FT*LB	Ndot_Demand	RPM/SEC
Ndot_Net_Torque_Cmd_State	---	RSG_Error	RPM
Ndot_Integral_Torque	FT*LB	Commanded_Throttle	%THROTTLE
Effective_Gear_Ratio	---	System_Switch_Status	HEX
Max_Road_Speed	MPH		

122. Out Of Gear Protection

(/vob/automotive/sys_rqmt/outofgr.doc(rev9))

Filtered_Engine_Speed	RPM	Out_Of_Gear_Desired_Torque	FT*LB
Total_Fueling	MG/STROKE	Out_Of_Gear_Protection_State	---
Fueling_Control_State	---	Out_Of_Gear_Torque	FT*LB
TQM_Final_Torque_Cmd	FT*LB	Net_Machine_Torque	FT*LB
Coolant_Torque_Adjustment	FT*LB	Desired_User_Fueling_State	---
Coolant_Tmptr	DEG_F	VSS_Transmission	---
Filtered_Gear_Ratio	---	Road_Speed_Governor_Enable	---
Out_Of_Gear	---	Road_Speed	MPH
		RSG_Desired_Reference_Speed	MPH

123. Powertrain Protection

(/vob/automotive/sys_rqmt/ptp.doc(rev21)

Filtered_Engine_Speed	RPM	PTP_Switched_Input	---
Total_Fueling	MG/STROKE	PTP_Torque_Output	FT*LB
Fueling_Control_State	---	PTP_Lugback_State	---
TQM_Final_Torque_Cmd	FT*LB	PTP_P_Load	%LOAD
Net_Machine_Torque	FT*LB	PTP_TC_Limit	FT*LB
TQM_Machine_Torque_Limit	FT*LB	Vehicle_Deceleration	MPH/SEC
TQM_Machine_Torque_Limit_State	---	Brake_Switch	---
Road_Speed	MPH	Filtered_Gear_Ratio	---
VSS_Signal_Lost_Error	---	VSS_Tampering_Error	---
RSC_Sensor_Type	---	PTP_Enable	---
T_PTP_Torque_Enable	---	PTP_Lugback_Enable	---
PTP_Axle_Torque_Limit	FT*LB	PTP_Switched_Input_Torque_Limit	FL*LB

124. Remote PTO Control

(/vob/base/sys_rqmt/pto_ref.doc(rev12))

Remote_PTO_Switch	---	Ndot_Net_Torque_Cmd	FT*LB
Alternate_Throttle_Selection_State	---	Net_Machine_Torque	FT*LB
Filtered_Engine_Speed	RPM	PTO_Reference_Speed	RPM
PTO_Status	---	PTO_Speed_Selected	RPM
PTO_State	---	PTO_Remote_Throttle_Inhibit	---
User_Fueling_State	---	PTO_Remote_PTO_Inhibit	---
Total_Fueling	MG/STROKE	PTO_Derate_Torque	FT*LB
Brake_Switch	---	Clutch_Switch	---
Commanded_Throttle	%THROTTLE	Engine_State	---
FIW_State	---	Percent_Load	%
Parking_Brake_Switch	---	Road_Speed	MPH
PTO_Remote_Switch_Timeout	SEC	Ignore_VSS_In_PTO	---
PTO_Remote_Speed	RPM	PTO_Remote_Speed_2	RPM
PTO_Remote_Speed_3	RPM	PTO_Remote_Speed_4	RPM
PTO_Remote_Speed_5	RPM	PTO_Remote_Throttle_Interaction_Enable	---

125. Remote Throttle Control

(/vob/base/sys_rqmt/remthrot.doc(10))

Calculated_Commanded_Throttle	%THROTTLE	Alternate_Throttle	%THROTTLE
Remote_Throttle	%	Remote_Throttle_Diagnostics_Enable_Flag	---
Remote_Throttle_Raw	CNTS	RT_High_Error	---
Remote_Throttle_High_Error	---	RT_Low_Error	---
Remote_Throttle_Low_Error	---	Throttle_Selection	DEC
Remote_Throttle_Switch	---	J1939_Mux_APS_PGN_Timeout_Error	HEX
Remote_Throttle_Enable	---	J1939_Mux_Remote_Throttle_Data_Error	---
Remote_Throttle_Override	---		

126. Smart Torque (ST Rating)

(/vob/base/sys_rqmt/esp_base.doc(rev16))

Filtered_Engine_Speed	RPM	ESP_Tau	---
Total_Fueling	MG/STROKE	ESP_Tau_State	---
Fueling_Control_State	---	Smart_Torque_Gear_Ratio	---
TQM_Final_Torque_Cmd	FT*LB	ESP_Smart_Torque_Enable	ENABLE/DISABLE
Filtered_Gear_Ratio	---	Four_D_Torque	FT*LB
Coolant_Tmptr	DEG_F	ESP_Filtered_Engine_Decel_Rate	RPM/SEC
Ndot_Integral_Torque	FT*LB	Steady_State_Torque_Min	FT*LB
Net_Machine_Torque	FT*LB	Steady_State_Torque_Max	FT*LB
Throttle_100_Torque	FT*LB	Transient_Torque_Min	FT*LB
ESP_Steep_Grade_Transition_Flag	---	Transient_Torque_Max	FT*LB
Reverse_ESP_Transition_Flag	---	Alpha	---
Brake_Switch	---	Road_Speed	MPH
Intake_Manifold_Temperature	DEG_F	Commanded_Throttle	%THROTTLE
		ESP_Decel_Rate_Threshold	RPM/SEC

127. SOI Timing Selection

(/vob/base/sys_rqmt/timesel.doc(rev25))

Filtered_Engine_Speed	RPM	CBL_SOI_Cmd	CRANK_DEG_BTDC
Total_Fueling	MG/STROKE	EB_Timing	CRANK_DEG_BTDC
Fueling_Control_State	---	CBM_SOI	CRANK_DEG_BTDC
Final_Timing	CRANK_DEG_BTDC	SOI_State	---
Final_Timing_State	---	Final_Timing_Incr_State	HEX
CBR_SOI_Ref	CRANK_DEG_BTDC	Overspeed_Timing	CRANK_DEG_BTDC
Crank_Advance	CRANK_DEG_BTDC	Stop_Timing	CRANK_DEG_BTDC
Timing_State_Incr	HEX	Shutdown_Timing	CRANK_DEG_BTDC
E_Brake_Timing	CRANK_DEG_BTDC		

128. Starter Lockout

(/vob/automotive/sys_rqmt/stlckout.doc(rev13))

Engine_State	---	Starter_Lockout_Driver	---
Filtered_Engine_Speed	RPM	Starter_Lockout_Driver_PWM_Duty_Cycle	%
Keyswitch	---	SL_Started	---
SL_Enable	RPM	Starter_Lockout_Request	---
SL_Engine_Speed_Inhibit_Threshold	---	Starter_Inhibit	HEX

129. Throttle Governor (Min/Max)

Filtered_Engine_Speed	RPM	Torque_Derived_Ndot	---
Total_Fueling	MG/STROKE	Ndot_Demand	RPM/SEC
Fueling_Control_State	---	Ndot_Error	RPM/SEC
Net_Engine_Torque	FT*LB	Four_D_Torque	FT*LB
Ndot_Net_Torque_Cmd	FT*LB	Alpha	---
Ndot_Net_Torque_Cmd_State	---	Road_Speed	MPH
Commanded_Throttle	%THROTTLE	Effective_Gear_Ratio	---
Ndot_Integral_Torque	FT*LB		

130. Turboconveyor

(/vob/base/sys_rqmt/engstate.doc(rev33))

Filtered_Engine_Speed	RPM	Turbine_Pressure_Ratio	---
FSS_Total_Fueling	MG/STROKE	C_Turboconveyor_Pratio_Thd	---
Fueling_Control_State_Value	---	C_Turboconveyor_Turbo_Speed_Thd	KRPM
Exhaust_Press	IN_HG	C_Turboconveyor_Enable_Time	SEC
Ambient_Air_Press	IN_HG	Turboconveyor_Is_Active	---
Filtered_Turbo_Speed	KRPM	EMO_Gen_Protect_AECD_State	---
PTO_Status	---	EMM_AECD_State	---
Exhaust_Tmptr	DEG_F	EMM_Protection_State	---
CBR_Chi_Value	---	EGR_Valve_Is_Closed	---
Exhaust_Press_Source	---	Ambient_Air_Press_Source	---
Turbo_Speed_Source	---	EMO_Gen_Protect_Cap_EL	---

Engineering Features:

131. ECM Parameters

Calibration_Version_Number	HEX	ECM_Internal_Tmptr	DEG_F
Boot_Loader_Phase_Designation	HEX	ECM_Internal_Tmptr_Source	---
Reset_Count	---	ECM_Internal_Tmptr_Status	---
ECM_STAT	HEX	Max_ECM_Tmptr	DEG_F
ECM_Status	HEX	Throughput_Percent_Busy	%
RUN_TIME	SEC	Throughput_Percent_Idle	%
SEC_KEY	HEX	Throughput_Time	MSEC
Battery_Voltage	VOLT	FTM_p_throughput_v	%

132. EGR Position In-Range:

(/vob/base/sys_rqmt/egr_position_processing.doc(rev10))

EGR_Position_Default	%open	EGR_Position_Before_Autozero_Low_Error	---
EGR_Position_Rate	%	EGR_Position_Before_Autozero_High_Error	---
EGA_Control_Error	---	EGR_Valve_Is_Closed	---
EGR_Position_AP	%open	EGA_Zero_Hold_Status	---
EGR_Position	%open	EGR_Position_Source	---
EGR_Position_State	---		

133. EGR Valve Position Autozero

(/vob/base/sys_rqmt/egr_position_processing.doc(rev10))

EGR_Position_Sensor	%open		
EGR_Position_Status	---		

EGR Valve Position AZ Enabler:

T_EGR_Pos_AZ_Logic_Enable	---	EGA_PWM_Diagnostic_Override	---
EGA_Autozero_Enable	---	EGR_Valve_Autozero_Enabled	---
EGA_Zero_Hold_Status	---		

EGR Position AZ Logic:

C_EGR_Position_AZ_Tolerance	%open	EGR_Valve_Position_Offset	%open
C_EGR_Position_AZ_Enable_Time	SEC	EGR_Position_AP	%open
C_EGR_Position_AZ_Fault_Time	SEC	EGR_Position	%open
T_EGR_Clr_Autozero_Error_Count	---	EGR_Position_State	---
EGR_Valve_Autozero_Error	---	EGR_Position_Source	---

134. Engine Protection (EPF)

(/vob/base/sys_rqmt/epftmpl.doc(rev13))

Filtered_Engine_Speed	RPM	Compressor_Outlet_Temperature	DEG_F
Total_Fueling	MG/STROKE	Coolant_Level_Status	VOLT
TQM_Final_Torque_Cmd	FT*LB	Coolant_Temperature	DEG_F
Fueling_Control_State	---	EGR_Orifice_Temperature	DEG_F
Throttle_100_Torque	FT*LB	Exhaust_Metal_Temperature	DEG_F
Engine_Protection_Derate_Torque	FT*LB	Intake_Manifold_Temperature_Sensor	DEG_F
EPF_Torque_Limit_Status	---	Oil_Pressure	PSI
EPF_Max_Torque_Limit_Index	---	Oil_Temperature	DEG_F
Engine_Protection_Enable	---	CLS_Low_Coolant_Error	

[EPF] Compressor Outlet Temperature Engine Protection:

Compressor_Outlet_Temperature	DEG_F	**Engine Protection Limits:**	
COT_Torque_Index	---	COT_RPM_Lower_Limit	DEG_F
COT_Torque_Error	---	COT_RPM_Shutdown_Severity_Thres	DEG_F
COT_RPM_Index	---	COT_Torque_Max_Threshold	DEG_F
COT_RPM_Error	---	COT_Torque_Min_Threshold	DEG_F
		COT_Torque_Shutdown_Severity_Thres	DEG_F
COT_Torque_Duration	SEC	COT_Torque_Derate_Start_Duration	SEC
COT_RPM_Duration	SEC	COT_Torque_Shutdown_Duration_Thres	SEC
		COT_RPM_Derate_Start_Duration	SEC
		COT_RPM_Shutdown_Duration_Thres	SEC

[EPF] Coolant Level Engine Protection:

Coolant_Level	VOLT	**Engine Protection Limits:**	
Coolant_Level_Torque_Index	---	Coolant_Level_RPM_Lower_Limit	VOLT
Coolant_Level_Torque_Error	---	Coolant_Level_RPM_Shutdown_Severity_Thres	VOLT
Coolant_Level_RPM_Index	---	Coolant_Level_Torque_Max_Threshold	VOLT
Coolant_Level_RPM_Error	---	Coolant_Level_Torque_Min_Threshold	VOLT
		Coolant_Level_Torque_Shutdown_Severity_Thres	VOLT
Coolant_Level_Torque_Duration	SEC	Coolant_Level_Torque_Derate_Start_Duration	SEC
Coolant_Level_RPM_Duration	SEC	Coolant_Level_Torque_Shutdown_Duration_Thres	SEC
		Coolant_Level_RPM_Derate_Start_Duration	SEC
		Coolant_Level_RPM_Shutdown_Duration_Thres	SEC

[EPF] Coolant Temperature Engine Protection:

Coolant_Temperature	DEG_F	**Engine Protection Limits:**	
Coolant_Tmptr	DEG_F	Coolant_Temperature_RPM_Lower_Limit	DEG_F
Coolant_Temperature_Torque_Index	---	Coolant_Temperature_RPM_Shutdown_Severity_Thres	DEG_F
Coolant_Temperature_Torque_Error	---	Coolant_Temperature_Torque_Max_Threshold	DEG_F
Coolant_Temperature_RPM_Index	---	Coolant_Temperature_Torque_Min_Threshold	DEG_F
Coolant_Temperature_RPM_Error	---	Coolant_Temperature_Torque_Shutdown_Severity_Thres	DEG_F
		Coolant_Temperature_Torque_Derate_Start_Duration	SEC
Coolant_Temperature_Torque_Duration	SEC	Coolant_Temperature_Torque_Shutdown_Duration_Thres	SEC
Coolant_Temperature_RPM_Duration	SEC	Coolant_Temperature_RPM_Derate_Start_Duration	SEC
		Coolant_Temperature_RPM_Shutdown_Duration_Thres	SEC

[EPF] Coolant Temp2 Engine Protection:

Coolant_Temperature	DEG_F	**Engine Protection Limits:**	
Coolant_Tmptr	DEG_F	Coolant_Temp2_RPM_Lower_Limit	DEG_F
Coolant_Temp2_Torque_Index	---	Coolant_Temp2_RPM_Shutdown_Severity_Thres	DEG_F
Coolant_Temp2_Torque_Error	---	Coolant_Temp2_Torque_Max_Threshold	DEG_F
Coolant_Temp2_RPM_Index	---	Coolant_Temp2_Torque_Min_Threshold	DEG_F
Coolant_Temp2_RPM_Error	---	Coolant_Temp2_Torque_Shutdown_Severity_Thres	DEG_F
		Coolant_Temp2_Torque_Derate_Start_Duration	SEC
Coolant_Temp2_Torque_Duration	SEC	Coolant_Temp2_Torque_Shutdown_Duration_Thres	SEC
Coolant_Temp2_RPM_Duration	SEC	Coolant_Temp2_RPM_Derate_Start_Duration	SEC
		Coolant_Temp2_RPM_Shutdown_Duration_Thres	SEC

[EPF] EGR Orifice Temperature Engine Protection:

EGR_Orifice_Temperature	DEG_F	**Engine Protection Limits:**	
EGR_Orifice_Tmptr_Torque_Index	---	EGR_Orifice_Tmptr_Temperature_RPM_Lower_Limit	DEG_F
EGR_Orifice_Tmptr_Torque_Error	---	EGR_Orifice_Tmptr_RPM_Shutdown_Severity_Thres	DEG_F
EGR_Orifice_Tmptr_RPM_Index	---	EGR_Orifice_Tmptr_Torque_Max_Threshold	DEG_F
EGR_Orifice_Tmptr_RPM_Error	---	EGR_Orifice_Tmptr_Torque_Min_Threshold	DEG_F
		EGR_Orifice_Tmptr_Torque_Shutdown_Severity_Thres	DEG_F
EGR_Orifice_Tmptr_Torque_Duration	SEC	EGR_Orifice_Tmptr_Torque_Derate_Start_Duration	SEC
EGR_Orifice_Tmptr_RPM_Duration	SEC	EGR_Orifice_Tmptr_Torque_Shutdown_Duration_Thres	SEC
		EGR_Orifice_Tmptr_RPM_Derate_Start_Duration	SEC
		EGR_Orifice_Tmptr_RPM_Shutdown_Duration_Thres	SEC

[EPF] EGR Orifice Temp2 Engine Protection:

EGR_Orifice_Temperature	DEG_F	**Engine Protection Limits:**	
EGR_Orifice_Temp2_Torque_Index	---	EGR_Orifice_Temp2_RPM_Lower_Limit	DEG_F
EGR_Orifice_Temp2_Torque_Error	---	EGR_Orifice_Temp2_RPM_Shutdown_Severity_Thres	DEG_F
EGR_Orifice_Temp2_RPM_Index	---	EGR_Orifice_Temp2_Torque_Max_Threshold	DEG_F
EGR_Orifice_Temp2_RPM_Error	---	EGR_Orifice_Temp2_Torque_Min_Threshold	DEG_F
		EGR_Orifice_Temp2_Torque_Shutdown_Severity_Thres	DEG_F
EGR_Orifice_Temp2_Torque_Duration	SEC	EGR_Orifice_Temp2_Torque_Derate_Start_Duration	SEC
EGR_Orifice_Temp2_RPM_Duration	SEC	EGR_Orifice_Temp2_Torque_Shutdown_Duration_Thres	SEC
		EGR_Orifice_Temp2_RPM_Derate_Start_Duration	SEC
		EGR_Orifice_Temp2_RPM_Shutdown_Duration_Thres	SEC

[EPF] Exhaust Temperature Engine Protection:

Exhaust_Tmptr	DEG_F	**Engine Protection Limits:**	
Exhaust_Metal_Temperature	DEG_F	Exhaust_Metal_Tmptr_RPM_Lower_Limit	DEG_F
Exhaust_Metal_Tmptr_Torque_Index	---	Exhaust_Metal_Tmptr_RPM_Shutdown_Severity_Thres	DEG_F
Exhaust_Metal_Tmptr_Torque_Error	---	Exhaust_Metal_Tmptr_Torque_Max_Threshold	DEG_F
Exhaust_Metal_Tmptr_RPM_Index	---	Exhaust_Metal_Tmptr_Torque_Min_Threshold	DEG_F
Exhaust_Metal_Tmptr_RPM_Error	---	Exhaust_Metal_Tmptr_Torque_Shutdown_Severity_Thres	DEG_F
		Exhaust_Metal_Tmptr_Torque_Derate_Start_Duration	SEC
Exhaust_Metal_Tmptr_Torque_Duration	SEC	Exhaust_Metal_Tmptr_Torque_Shutdown_Duration_Thres	SEC
Exhaust_Metal_Tmptr_RPM_Duration	SEC	Exhaust_Metal_Tmptr_RPM_Derate_Start_Duration	SEC
		Exhaust_Metal_Tmptr_RPM_Shutdown_Duration_Thres	SEC

[EPF] Intake Manifold Temperature Sensor Engine Protection:

Intake_Manifold_Temperature_Sensor	DEG_F	**Engine Protection Limits:**	
Charge_Tmptr	DEG_F	IMT_RPM_Lower_Limit	DEG_F
IMT_Torque_Index	---	IMT_RPM_Shutdown_Severity_Thres	DEG_F
IMT_Torque_Error	---	IMT_Torque_Max_Threshold	DEG_F
IMT_RPM_Index	---	IMT_Torque_Min_Threshold	DEG_F
IMT_RPM_Error	---	IMT_Torque_Shutdown_Severity_Thres	DEG_F
		IMT_Torque_Derate_Start_Duration	SEC
IMT_Torque_Duration	SEC	IMT_Torque_Shutdown_Duration_Thres	SEC
IMT_RPM_Duration	SEC	IMT_RPM_Derate_Start_Duration	SEC
		IMT_RPM_Shutdown_Duration_Thres	SEC

[EPF] Oil Pressure Engine Protection:

Oil_Pressure	PSI	**Engine Protection Limits:**	
Oil_Press	PSI	Oil_Pressure_RPM_Lower_Limit	PSI
Oil_Pressure_Torque_Index	---	Oil_Pressure_RPM_Shutdown_Severity_Thres	PSI
Oil_Pressure_Torque_Error	---	Oil_Pressure_Torque_Max_Threshold	PSI
Oil_Pressure_RPM_Index	---	Oil_Pressure_Torque_Min_Threshold	PSI
Oil_Pressure_RPM_Error	---	Oil_Pressure_Torque_Shutdown_Severity_Thres	PSI
		Oil_Pressure_Torque_Derate_Start_Duration	SEC
Oil_Pressure_Torque_Duration	SEC	Oil_Pressure_Torque_Shutdown_Duration_Thres	SEC
Oil_Pressure_RPM_Duration	SEC	Oil_Pressure_RPM_Derate_Start_Duration	SEC
		Oil_Pressure_RPM_Shutdown_Duration_Thres	SEC

[EPF] Oil Temperature Engine Protection:

Oil_Temperature	DEG_F	**Engine Protection Limits:**	
Oil_Tmptr	DEG_F	Oil_Temperature_RPM_Lower_Limit	DEG_F
Oil_Temperature_Torque_Index	---	Oil_Temperature_RPM_Shutdown_Severity_Thres	DEG_F
Oil_Temperature_Torque_Error	---	Oil_Temperature_Torque_Max_Threshold	DEG_F
Oil_Temperature_RPM_Index	---	Oil_Temperature_Torque_Min_Threshold	DEG_F
Oil_Temperature_RPM_Error	---	Oil_Temperature_Torque_Shutdown_Severity_Thres	DEG_F
		Oil_Temperature_Torque_Derate_Start_Duration	SEC
Oil_Temperature_Torque_Duration	SEC	Oil_Temperature_Torque_Shutdown_Duration_Thres	SEC
Oil_Temperature_RPM_Duration	SEC	Oil_Temperature_RPM_Derate_Start_Duration	SEC
		Oil_Temperature_RPM_Shutdown_Duration_Thres	SEC

135. In-Range Diagnostics

(/vob/base/sys_rqmt/charge_pressure_processing(rev9))

Charge Pressure In-Range Diagnostics:

Filtered_Engine_Speed	RPM	Charge_Press_Tolerance	IN_HG
FSS_Total_Fueling	MG/STROKE	Charge_Press_Default	IN_HG
Fueling_Control_State_Value	---	Charge_Press_Keyon_Error	---
Charge_Press_Sensor	IN_HG	Charge_Press_Source	---
Charge_Press_Est	IN_HG	Charge_Press_State	---
Charge_Press_Status	---	Charge_Press_IR_Enable	---
Charge_Press_Estat	---	Charge_Press_IR_Cond	---
Charge_Press_Est_Offset	IN_HG	Charge_Press_IR_Error	---
		Charge_Press_IR_Fault_Cnt	CNTS
T_Charge_Press_IR_Enable	---		

(/vob/base/sys_rqmt/egr_delta_pressure_processing.doc(rev12))

EGR Delta Pressure Autozero and In-Range:

EGR_Delta_Press_Sensor	IN_HG	EGR_Delta_P_Autozero_Enable	---
EGR_Delta_Press_Status	---	EGR_Delta_P_AZ_Bypass	---
		EGR_Delta_P_AZ_Precondition	---
EGR Delta P Autozero Enabler:			
Coolant_Tmptr_Source	---	Coolant_Tmptr	DEG_F
EGR_Delta_Press_Status	---	Charge_Tmptr	DEG_F
EGR_Position_Source	---	Charge_Tmptr_Source	---
EGR_Delta_Press_Status	---	EGR_DP_IR_Error	---
EGA_Driver_Over_Current	---	EGA_Over_Temperature	---
EGA_Electrical_Fault	---	Filtered_Engine_Speed	RPM
EGR_Orifice_Tmptr	DEG_F	EGR_Orifice_Tmptr_Source	---
EGR_Delta_P_AZ_Precondition	---	EGR_Delta_P_Autozero_Enable	---
EGR_Delta_P_Sensor_Warm	---	EGR_Valve_Is_Closed	---
EGR_Flow	LB/MIN	Filtered_Turbo_Speed	KRPM
		Keyswitch	---
EGR Delta P Autozero Logic:			
C_EGR_Delta_P_AZ_Tolerance	%open	T_EGR_Delta_P_Autozero_Offset	IN_HG
C_EGR_Delta_P_AZ_Enable_Time	SEC	EGR_Delta_Press_AP	IN_HG
C_EGR_Delta_P_AZ_Fault_Time	SEC	EGR_Delta_Press_Sensor	IN_HG
EGR_Delta_P_Autozero_Error	---	EGR_Delta_Press_State	---
EGR_Delta_P_Autozero_Complete	---	EGR_Delta_Press_Source	---
		EGR_Delta_P_Sensor_Warm	---
EGR Delta P Valve Open Diagnostic:			
T_EGR_DP_IR_Enable	---	Net_Engine_Torque	FT*LB
Engine_Delta_Press_Source	---	EGR_Delta_Press_AP	IN_HG
EGR_Position_Source	---	EGR_DP_IR_Open_Enable_Cond	---
Engine_Delta_Press	IN_HG	EGR_DP_IR_Open_Fault_Cond	---
EGR_Position	%open	Filtered_Engine_Speed	RPM
C_EGR_DP_IR_Open_Eng_DP_Thd	IN_HG	C_EGR_DP_IR_Open_Eng_Trq_Thd	FT*LB
C_EGR_DP_IR_Open_EGR_Pos_Thd	%open	C_EGR_DP_IR_Open_Thd	IN_HG
		C_EGR_DP_IR_Open_Eng_Spd_Thd	RPM
EGR Delta P Valve Closed Diagnostic:			
T_EGR_DP_IR_Enable	---	Net_Engine_Torque	FT*LB
EGR_Position_Source	---	EGR_Delta_Press_AP	IN_HG
EGR_Position	%open	EGR_DP_IR_Closed_Enable_Cond	---
Filtered_Engine_Speed	RPM	EGR_DP_IR_Closed_Fault_Cond	---
C_EGR_DP_IR_Closed_EGR_Pos_Thd	%open	C_EGR_DP_IR_Closed_Eng_Trq_Thd	FT*LB
C_EGR_DP_IR_Closed_Eng_Spd_Thd	RPM	C_EGR_DP_IR_Closed_ Thd	IN_HG

(/vob/base/sys_rqmt/exhaust_pressure_processing(rev8))

Exhaust Pressure In-Range Low Diagnostics:

Filtered_Engine_Speed	RPM	Exhaust_Pressure_Keyon_Error	---
Net_Engine_Torque	FT*LB	Exhaust_Press_State	---
Charge_Press	IN_HG	Exhaust_Press_Status	---
Exhaust_Press_Sensor	IN_HG	Exhaust_Press_IR_Low_Fault_Cnt	CNTS
Exhaust_Press_IR_Low_Error	---	Exhaust_Press_Disabled	---
Exhaust_Press_IR_Low_Cond	---	Exhaust_Press_Default	IN_HG
Exhaust_Press_Est	IN_HG	Exhaust_Press_Source	---
Exhaust_Press	IN_HG		
		T_Exhaust_Press_IR_Low_Enable	---

(/vob/base/sys_rqmt/turbo_speed_processing.doc(rev10))

Turbo Speed In-Range Diagnostics:

Filtered_Engine_Speed	RPM	Turbo_Speed_Source	---
FSS_Total_Fueling	MG/STROKE	Turbo_Speed_Disabled	---
Fueling_Control_State_Value	---	Turbo_Speed_State	---
Filtered_Turbo_Speed	KRPM	Turbo_Speed_IR_State	---
Turbo_Speed_Sensor	KRPM	Turbo_Speed_IR_Enable	---
Turbo_Speed_Est	KRPM	Turbo_Speed_IR_Cond	---
Turbo_Speed_Status	---	Turbo_Speed_In_Range_Error	---
Turbo_Speed_Estat	---	Turbo_Speed_IR_Fault_Count	CNTS
Turbo_Speed_Comparison_Value	KRPM		
		T_Turbo_Speed_IR_Enable	HEX

136. Keyon Pressure Check Diagnostics

(/vob/base/sys_rqmt/prinrnge.doc(rev16))

Air_Pressure_Sensor	IN_HG	Pressure_Check_Enable	---
Boost_Pressure_Absolute	IN_HG	Pressure_Check_Cold_Oil_Temperature	DEG_F
EGR_Delta_Press_Sensor	IN_HG	Pressure_Check_Delay_Time	SEC
Exhaust_Pressure_Sensor	IN_HG	Pressure_Check_Timer	SEC
Oil_Pressure_Absolute	PSI_A	EGR_Position	%open
Air_Pressure_Keyon_Error	---	Engine_State	---
Charge_Pressure_Keyon_Error	---	Oil_Temperature	DEG_F
Exhaust_Pressure_Keyon_Error	---	Ambient_Air_Press_Sensor_Tolerence	IN_HG
Oil_Pressure_Keyon_Error	---	Charge_Press_Sensor_Tolerence	IN_HG
EGR_Delta_Press_Keyon_Error	---	Exhaust_Press_Sensor_Tolerence	IN_HG
Pressure_Check_Executed_Count	---	Oil_Press_Sensor_Tolerence	PSI_A
C_EGR_DP_IR_Startup_Press_Thd	IN_HG	C_EGR_DP_IR_Startup_Pos_Thd	%open

137. Torque To Fuel Conversion

Inputs to Fuel System Controls (Command):		**Output from Fuel System Controls (Feedback):**	
Filtered_Engine_Speed	RPM	FSI_q_totalFueling_v	MG/STROKE
Total_Fueling	MG/STROKE	FSS_Total_Fueling	MG/STROKE
Fueling_Control_State	---	CBP_Adj_Total_Fueling	MG/STROKE
Ndot_Net_Torque_Cmd	FT*LB	Charge_Flow	LB/MIN
Ndot_Integral_Torque	FT*LB	EBP_Adj_Charge_Flow	LB/MIN
TQM_Final_Torque_Cmd	FT*LB	CBP_Combustion_Torque	FT*LB
TQM_Engine_Torque_Limit	FT*LB	CBP_EB_Torque	FT*LB
TQM_Machine_Torque_Limit	FT*LB	Net_Engine_Torque	FT*LB
CBR_Gross_Fuel	MG/STROKE	Net_Machine_Torque	FT*LB
CBR_Fuel_Ref	MG/STROKE	No_Load_Torque	FT*LB

138. User Overrides

User Override Enable:	**Overrides:**	**User Override Value:**	
User_Override_Fueling_Enable	Total_Fueling	User_Override_Fueling	MG/STROKE
T_CBR_Fuel_Ref_User_Override	CBR_Fuel_Ref	C_CBR_Fuel_Ref_Override_Value	MG/STROKE
T_CBL_Fuel_User_Override	CBL_Fuel_Cmd	C_CBL_Fuel_Override_Value	MG/STROKE
T_OFC_Fuel_Limit_User_Override	OFC_Fuel_Limit	C_OFC_Fuel_Limit_Override_Value	MG/STROKE
User_Override_Timing_Enable	Final_Timing	User_Override_Timing	CRANK_DEG
T_CBL_SOI_User_Override	CBL_SOI_Cmd	C_CBL_SOI_Override_Value	CRANK_DEG
T_CBL_SOI_Increment_Enable	CBL_SOI_Ref	C_CBL_SOI_Increment	CRANK_DEG
User_Commanded_Torque_Enable	Ndot_Net_Torque_Cmd	User_Commanded_Torque	FT*LB
Alpha_User_Override_Enable	Alpha	User_Override_Alpha	---
T_CBR_Alpha_User_Override	CBR_Alpha	C_CBR_Alpha_Override_Value	---
T_CBR_Chi_User_Override	CBR_Chi_Value	C_CBR_Chi_Override_Value	---
T_CBR_Chi_Selective_Override	CBR_Chi_Value	C_CBR_Chi_Override_Value	---
T_CBL_EGR_Frac_User_Override	CBL_EGR_Frac_Cmd	C_CBL_EGR_Frac_Override_Value	---
T_CBL_MCF_User_Override	CBL_MCF_Cmd	C_CBL_MCF_Override_Value	LB/MIN
T_CSE_Xform_User_Override	CSE_Xform_Angle	C_CSE_Xform_Override_Value	DEG
T_EGA_Cmd_User_Override	EGA_Position_Cmd_Final	C_EGA_Cmd_Override_Value	%open
T_EGA_PWM_User_Override	EGA_PWM_Limited	C_EGA_PWM_Override_Value	%Duty_Cycle
VGT_Duty_Cycle_Override_Enable	VGT_Duty_Cycle	VGT_Duty_Cycle_Override	%Duty_Cycle

HPI-TP Fuel System:

139. Boost Pressure Compensation (BPC)

(/vob/tp02/sys_rqmt/bpc.doc)

EPS_Engine_Speed	RPM	BPC_q_FuelComp_v	MG/STROKE
FSS_Total_Fueling	MG/STROKE	FTT_ti_BaseFITTL_v	MSEC
Net_Engine_Torque	FT*LB	FTT_q_CompFlCmd_v	MG/STROKE
Fueling_Control_State	---	BPC_lp_BoostErr_v	MBAR
Boost_Pressure_Absolute	IN_HG	BPC_lp_NomBoost_v	MBAR
FSI_lp_Boost_v	MBAR	BPC_s_Enable_c	---
FSI_q_totalFueling_v	MG/STROKE		

140. CBD / EPS Based Unintended Fueling Diagnostics (CUFD)

(no CM870 specific SDR available – can reference /vob/hpi_tp/sys_rqmt/cufd_fss.doc for CM570 SDR, however parameter names have changed slightly)

Filtered_Engine_Speed	RPM	CUFD_s_AlgorithmEnable_c		---
FSS_Total_Fueling	MG/STROKE	CUFD_s_Enable_v		---
Fueling_Control_State	---	CUFD_s_State_v		---
EPS_Cam_Half_Cycle	---		CUFD_s_State_v = 0	Normal State
Fuel_Rail_Pressure	PSI		CUFD_s_State_v = 1	Diag. State
Final_Fueling	MG/STROKE		CUFD_s_State_v = 2	Low Power State
LSG_Adjusted_Reference_Speed	RPM		CUFD_s_State_v = 3	Limphome State
E_Brake_Status	---			
CTS_x_UserFlMask_c	HEX	CUFD_s_FSOEnable_v		---
FDH_x_CylinderMask_v	HEX	CUFD_x_CylinderMask_v		HEX
FSI_x_ExtCylMask_v	HEX	CUFD_x_AugDeltaAccel_v		---
Engine_State	---	CUFD_x_DeltaAccelThreshold_v		---
EPS_Cam_Cycle_State	---	CUFD_x_BankFailed_v		---
EPS_Main_Period	---			
EPS_Main_Sync_State	---			
EPS_Pulse_Number	CNTS			

141. Cylinder Balancing Diagnostics (CBD)

(/vob/fssc_proto/sys_rqmt/fssc/cbd.doc)

Filtered_Engine_Speed	RPM	CBD_s_compensation_c	---
FSI_ca_mainSOI_v	CRANK_DEG	Fueling_Control_State	---
FSI_q_totalFueling_v	MG/STROKE		

CBD Fueling Adjustments:

Large Positive Adjustment = Weak Cylinder
Large Negative Adjustment = Strong Cylinder

Cyl #1:	FSI_q_cbdTotalAdj_v[0]	MSEC
Cyl #2:	FSI_q_cbdTotalAdj_v[1]	MSEC
Cyl #3:	FSI_q_cbdTotalAdj_v[2]	MSEC
Cyl #4:	FSI_q_cbdTotalAdj_v[3]	MSEC
Cyl #5:	FSI_q_cbdTotalAdj_v[4]	MSEC
Cyl #6:	FSI_q_cbdTotalAdj_v[5]	MSEC

142. Cylinder Cut-Out Diagnostics (CTS)

(/vob/tp02/sys_rqmt /cts.doc)

Filtered_Engine_Speed	RPM	CTS_x_UserTmMask_c	HEX
FSI_q_totalFueling_v	MG/STROKE		
FSI_ca_mainSOI_v	CRANK_DEG	**Fuel Actuator Addition Time-On Trims:**	
Fueling_Control_State	---	Cyl #1: CTS_ti_FlTrim_c[0]	MSEC
		Cyl #2: CTS_ti_FlTrim_c[1]	MSEC
CTS_x_ActiveFlMask_v	HEX	Cyl #3: CTS_ti_FlTrim_c[2]	MSEC
FSI_x_ExtCylMask_c	HEX	Cyl #4: CTS_ti_FlTrim_c[3]	MSEC
CTS_x_UserFlMask_c (003F = all cylinders active)	HEX	Cyl #5: CTS_ti_FlTrim_c[4]	MSEC
FSI_x_ExtCylMask_c / CTS_x_UserFlMask_c = 003E	Disables Cyl 1	Cyl #6: CTS_ti_FlTrim_c[5]	MSEC
FSI_x_ExtCylMask_c / CTS_x_UserFlMask_c = 003D	Disables Cyl 2		
FSI_x_ExtCylMask_c / CTS_x_UserFlMask_c = 003B	Disables Cyl 3	**Timing Actuator Additional Time-On Trims:**	
FSI_x_ExtCylMask_c / CTS_x_UserFlMask_c = 0037	Disables Cyl 4	Cyl #1: CTS_ti_TmTrim_c[0]	MSEC
FSI_x_ExtCylMask_c / CTS_x_UserFlMask_c = 002F	Disables Cyl 5	Cyl #2: CTS_ti_TmTrim_c[1]	MSEC
FSI_x_ExtCylMask_c / CTS_x_UserFlMask_c = 001F	Disables Cyl 6	Cyl #3: CTS_ti_TmTrim_c[2]	MSEC
FSI_x_ExtCylMask_c / CTS_x_UserFlMask_c = 0038	Disables Cyl 1-3	Cyl #4: CTS_ti_TmTrim_c[3]	MSEC
FSI_x_ExtCylMask_c / CTS_x_UserFlMask_c = 0007	Disables Cyl 4-6	Cyl #5: CTS_ti_TmTrim_c[4]	MSEC
		Cyl #6: CTS_ti_TmTrim_c[5]	MSEC

143. Engine Speed Processing (EPS)

(/vob/fssc_proto/sys_rqmt/fssc/eps.doc)

Filtered_Engine_Speed	RPM	Fueling_Control_State	---
EPS_Engine_Speed	RPM		
EPS_Status	---	EPS_Crank_Start_Type	---
EPS_Main_Sync_State	---	EPS_Cam_Cycle_State	---
EPS_Backup_Sync_State	---		

144. Estimated Valve Delay (EVD)

(/vob/tp02/sys_rqmt/evd.doc)

Filtered_Engine_Speed	RPM	EVD_ti_EstFlEVD_v	MSEC
FSI_q_totalFueling_v	MG/STROKE	EVD_ti_EstTmEVD_v	MSEC
Net_Engine_Torque	FT*LB	EVD_v_FiltBatt_v	
Fueling_Control_State	---	EVD_s_Enable_c	---
FSI_v_batt_v	VOLT	EVD_ti_UserFlEVD_c	MSEC
FSI_lp_Gallery_v	MBAR	EVD_ti_UserTmEVD_c	MSEC
Fuel_Rail_Pressure	PSI		

145. Flow-To-Time Conversion (FTT)

(/vob/tp02/sys_rqmt/ftt.doc)

Inputs For Determining FTT Conversion:		**Output From FTT Conversion Algorithm:**	
SFH_qt_TimingFlow_v	MM3/STROKE	FTT_q_CompFlCmd_v	MG/STROKE
EVD_ti_EstFlEVD_v	MSEC	FTT_qt_CompTmCmd_v	MM3/STROKE
EVD_ti_EstTmEVD_v	MSEC	FTT_ti_BaseFlTTL_v	MSEC
PCC_q_FuelComp_v	MG/STROKE	FTT_ti_BaseTmTTL_v	MSEC
PCC_qt_TimingComp_v	MM3/STROKE		
BPC_q_FuelComp_v	MG/STROKE	**Engineering Addition to Fueling Pulse Time-On:**	
TTC_qt_tFlowComp_v	MM3/STROKE	FTT_ti_FlAdust_c	MSEC
FTC_q_fuelingComp_v	MG/STROKE	FTT_ti_TmAdust_c	MSEC
FSI_q_totalFueling_v	MG/STROKE		
EPS_Engine_Speed	RPM		

146. Fuel Pressure Compensation (PCC)

(/vob/tp02/sys_rqmt/pcc.doc)

Inputs For Determining Fuel Pressure Comp		**Output From Fuel Pressure Comp**	
EPS_Engine_Speed	RPM	PCC_lp_ModelPressure_v	MBAR
FSI_lp_Gallery_v	MBAR	PCC_lp_PressureError_v	MBAR
FSI_q_totalFueling_v	MG/STROKE	PCC_q_FuelComp_v	MG/STROKE
SFH_qt_TimingFlow_v	MM3/STROKE	PCC_qt_TimingComp_v	MM3/STROKE
SFH_ht_FuelColumn_v	MM		
SFH_ar_LowerPlunger_c	---		
PCC_s_Enable_c	---		

147. Fuel Pressure Monitor (FPM)

(/vob/tp02/sys_rqmt/fpm.doc)

EPS_Engine_Speed	RPM	FPM_lp_LowPressureErr_v	MBAR
FSS_Total_Fueling	MG/STROKE	FPM_lp_LowThreshold_c	MBAR
Fueling_Control_State	---	FPM_ct_LowMBarSec_p	---
FSI_q_totalFueling_v	MG/STROKE	Fuel_Supply_Pressure_Low_Error	---
FSI_s_BaseControlState_v	---	PCC_lp_PressureError_v	MBAR
FDH_s_GalleryPSensorErr_v	---	FSI_lp_Gallery_v	MBAR
FSO_p_PWMDutyCycle_v	%DC		
FSI_lp_Gallery_v	MBAR	FPM_lp_HighPressureErr_v	MBAR
PCC_lp_PressureError_v	MBAR	FPM_lp_HighThreshold_c	MBAR
FPM_s_Enable_c	---	FPM_ct_HighMBarSec_p	---
		Fuel_Supply_Pressure_High_Error	---
		PCC_lp_PressureError_v	MBAR
		FPM_ct_FilterMBarSec_p	---
		Prs_Fuel_Filter_Clogged_Error	---

148. Fuel Shut Off (FSO) Controls

(/vob/tp02/sys_rqmt/fso.doc)

Filtered_Engine_Speed	RPM	FSO_Command	---
FSS_Total_Fueling	MG/STROKE	FSO_p_PWMDutyCycle_v	%DC
Fueling_Control_State	---	FSO_s_PWMState_v	---
Fuel_Rail_Pressure	PSI	FSO_ct_PWMTimer_v	SEC
FSI_v_batt_v	Volt	CUFD_s_FSOEnable_v	---
FSI_s_enableFuel_v	---	FSO_v_BattVoltageX_c	VOLT
FSO_ct_PWMTime_c	SEC	FSO_p_PWMDutyCycleY_c	%DC

149. Fuel Shut Off (FSO) Mechanically Stuck Open Diagnostics (FSOD)

(/vob/tp02/sys_rqmt/fsod.doc)

EPS_Engine_Speed	RPM	FDH_s_GalleryPSensorErr_v	---
FSS_Total_Fueling	MG/STROKE	FDG_s_FSOControlErr_v	---
Fueling_Control_State	---	FSI_s_BaseControlState_v	---
Fuel_Rail_Pressure	PSI	FSI_lp_Gallery_v	MBAR
FSO_s_KeyOffShutdown_v	---	FSO_s_DiagState_v	---
FSO_ct_Timer_v	SEC	FSO_Stuck_Open_Error	---
FSO_ct_InternFaultCounter_v	---	FSO_s_DiagEnable_c	---
FSS_Key_Off_Shutdown	---		

150. Fuel System Fault Derate Handler (FDH)

(/vob/tp02/sys_rqmt/fdh.doc)

Filtered_Engine_Speed	RPM	**Fault Derate Handler Reaction Calibrations:**	
FSI_q_totalFueling_v	MG/STROKE	FDH_x_CBDTrimLimReact_c	HEX
FSI_ca_mainSOI_v	CRANK_DEG	FDH_x_CylCutoutReact_c	HEX
Fueling_Control_State	---	FDH_x_EPSBackupIntrSyncReact_c	HEX
Fuel_Rail_Pressure	PSI	FDH_x_EPSBackupReact_c	HEX
Fuel_Temperature	DEG_F	FDH_x_EPSMainIntrSyncReact_c	HEX
EPS_Main_Sync_State	---	FDH_x_EPSMainReact_c	HEX
EPS_Backup_Sync_State	---	FDH_x_EPSPhaseReact_c	HEX
CTS_x_ActiveFlMask_v	HEX	FDH_x_FSOHighElectReact_c	HEX
Battery_Voltage	VOLT	FDH_x_FSOLowElectReact_c	HEX
Coolant_Temperature	DEG_F	FDH_x_FSOMechStuckReact_c	HEX
		FDH_x_FlPrsSenInRangeReact_c	HEX
FSSC Fault Derate Handler Parameters:		FDH_x_FrontFlActImpReact_c	HEX
FDH_x_ActiveReaction_v	HEX	FDH_x_FrontFlActSevReact_c	HEX
FDH_q_megaDerate_c	MG/STROKE	FDH_x_FrontTmActImpReact_c	HEX
FDH_q_miniDerate_c	MG/STROKE	FDH_x_FrontTmActSevReact_c	HEX
FDH_q_normalDerate_c	MG/STROKE	FDH_x_RearFlActImpReact_c	HEX
FDH_ca_SOIDerate_c	CRANK_DEG	FDH_x_RearFlActSevReact_c	HEX
FDH_n_MinSpeedLimit_c	RPM	FDH_x_RearTmActImpReact_c	HEX
FDH_n_MaxSpeedLimit_c	RPM	FDH_x_RearTmActSevReact_c	HEX
FDH_n_DerateRate_c	RPM	FDH_x_GalleryPOORReact_c	HEX
		FDH_x_HiFlSupplyPReact_c	HEX
		FDH_x_LowFlSupplyPReact_c	HEX
		FDH_x_PrsFlFiltCloggReact_c	HEX
		FDH_x_VBattOORReact_c	HEX

Derate Reaction	*Bit*
Mini Fueling Derate	0
Normal Fueling Derate	1
Mega Fueling Derate	2
Maximum SOI Advance Derate	3
Fueling to Front Bank Cylinders Cut Off	4
Fueling to Rear Bank Cylinders Cut Off	5
All Fueling Stopped	6
CBD Trims Frozen	7
Speed Derate	8

151. Fuel Systems Interface (FSI)

(/vob/fssc_proto/sys_rqmt/caps2/Fsi.doc)

Filtered_Engine_Speed	RPM			
Fueling_Control_State	---			
Fuel System Output Parameters:		**Base Control System Parameters:**		
FSI_q_totalFueling_v	MG/STROKE	Total_Fueling (after derate)	MG/STROKE	
FSI_ca_mainSOI_v	CRANK_DEG	Final_Timing	CRANK_DEG	
FSI_lp_Gallery_v	MBAR	Fuel_Rail_Pressure	PSI	
FSI_v_batt_v	VOLT	Battery_Voltage	VOLT	
FSI_t_fuel_v	---	Fuel_Temperature	DEG_F	
FSI_t_coolant_v	---	Coolant_Temperature	DEG_F	
FSI_lp_Boost_v	MBAR	Boost_Pressure_Absolute	IN_HG	
FSI_s_stopFuel_c	1 = OVERRIDE	← Overrides FSI_q_totalFueling_c and FSI_ca_mainSoi_v		
FSI_s_stopOutputs_c	1 = OVERRIDE	← Suspends calculation of FSSC to Base Control System		

152. Fuel Temperature Compensation (FTC/TTC)

(/vob/tp02/sys_rqmt/ftc.doc, /vob/tp02/sys_rqmt/ttc.doc)

Inputs For Determining Fuel Temp Comp		Output From Fuel Temp Comp	
PCC_q_FuelComp_v	MG/STROKE	FTT_q_CompFlCmd_v	MG/STROKE
FSI_q_totalFueling_v	MG/STROKE	FTT_ti_BaseFlTTL_v	MSEC
FTC_q_fuelingComp_v	MG/STROKE	FTT_qt_CompTmCmd_v	MM3/STROKE
BPC_q_FuelComp_v	MG/STROKE	FTT_ti_BaseTmTTL_v	MSEC
EPS_Engine_Speed	RPM	TTC_n_filtEngRPM_v	RPM
EVD_ti_EstFlEVD_v	MSEC	TTC_qt_filtTFlow_v	MM3/STROKE
PCC_qt_TimingComp_v	MM3/STROKE	TTC_qt_tFlowComp_v	MM3/STROKE
SFH_qt_TimingFlow_v	MM3/STROKE	TTC_qt_unshapedComp_v	MM3/STROKE
TTC_qt_tFlowComp_v	MM3/STROKE	TTC_t_filtInjInlet_v	---
EVD_ti_EstTmEVD_v	MSEC	TTC_t_head_v	---
FDH_s_coolTSensorErr_v	---	TTC_t_ssInjInlet_v	---
FDH_s_fuelTSensorErr_v	---	TTC_t_ssRefInjInlet_v	---
FSI_t_coolant_v	---	TTC_tc_warmupTime_v	---
FSI_t_fuel_v	---	TTC_tc_reset_v	---
FTT_q_CompFlCmd_v	MG/STROKE		
SFH_qt_TimingFlow_v	MM3/STROKE		
		Engineering Addition to Fueling Pulse Time-On:	
Engineering Enable		FTT_ti_FlAdjust_c	MSEC
TTC_s_enable_c	---	FTT_ti_TmAdust_c	MSEC

153. Solid Fuel Height Determination (SFH)

(/vob/tp02/sys_rqmt/sfh.doc)

Filtered_Engine_Speed	RPM	SFH_ca_EOI_v	CRANK_DEG
FSI_q_totalFueling_v	MG/STROKE	SFH_ca_TimingCommand_v	CRANK_DEG
Net_Engine_Torque	FT*LB	SFH_ht_FuelColumn_v	MM
Fueling_Control_State	---	SFH_qt_TimingFlow_v	MM3/STROKE
FSI_ca_mainSOI_v	CRANK_DEG	FTT_ti_BaseTmTTL_v	MSEC
FDH_ca_SOIDerate_v	CRANK_DEG	FTT_qt_CompTmCmd_v	MM3/STROKE
SFH_ca_SOIOffset_c	CRANK_DEG_BTDC		
		SFH_ca_MaxSOILimit_c	CRANK_DEG
		SFH_ca_MinSOILimit_c	CRANK_DEG

Legacy Information

154. Acceleration Noise Control

Record Coolant_Temperature during testing.

Time:	0.3 sec	Filtered_Engine_Speed	Road_Speed
Monitor		Total_Fueling	ANC_Fuel_Limit_Status
		Commanded_Throttle	ANC_Timing_Limit_Status
		Fueling_Control_State_Value	Ndot_ANC
Time:	0.4 sec	Filtered_Engine_Speed	Road_Speed
Monitor		Total_Fueling	ANC_Fuel_Limit_Status
		Commanded_Throttle	ANC_Timing_Limit_Status
		Fueling_Control_State_Value	Ndot_ANC
		Final_Timing	Ndot_Demand
		Effective_Gear_Ratio	OFC_Fuel_Limit

155. Ambient Air Pressure Sensor – Poor Engine Performance

Time:	0.3 sec	Filtered_Engine_Speed	Ambient_Air_Press
Monitor		Total_Fueling	Boost_Pressure
		Fueling_Control_State_Value	Charge_Tmptr
		Air_Pressure_Sensor	
		Air_Pressure_Sensor_Raw	

156. Anti-Theft

Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Engine_State	
		Anti_Theft_State	

157. Cab Switchable Governor

Time:	0.2 sec	Commanded_Throttle	No_Load_Torque
Monitor		Total_Fueling	Selected_Throttle_Control
		Ndot_Net_Torque_Cmd	Filtered_Engine_Speed
Time:	0.3 sec	Filtered_Engine_Speed	No_Load_Torque
Monitor		Total_Fueling	Commanded_Throttle
		Fueling_Control_State_Value	Ndot_ASG
		Selected_Throttle_Control	STCG_ASG_Droop_Select
		Ndot_Net_Torque_Cmd	Ndot_Demand

158. Clutch Engagement / Idle Overshoot

Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Total_Fueling	
		Road_Speed	
Time:	0.2 sec	Filtered_Engine_Speed	Fueling_Control_State_Value
Monitor		Road_Speed	FTT_ti_BaseFlTTL_v
		Total_Fueling	Commanded_Throttle
Time:	0.4 sec	Filtered_Engine_Speed	Commanded_Throttle
Monitor		Road_Speed	Fueling_Control_State_Value
		Total_Fueling	OFC_Fuel_Limit
		Ndot_LSG	Sampled_Throttle_Raw
		FTT_ti_BaseFlTTL_v	System_Switch_Status

159. Cold Starting

Time:	0.5 sec	Filtered_Engine_Speed	Fuel_Rail_Press
Monitor		Total_Fueling	Battery_Volt
		Fueling_Control_State_Value	Charge_Tmptr
		Final_Timing	Coolant_Tmptr
		Final_Timing_State	FTT_ti_BaseFlTTL_v
		EPS_Main_Sync_State	FTT_ti_BaseTmTTL_v
		EPS_Backup_Sync_State	Reset_Count

160. Cold Temperature Stumble / IMT SOI Advance Control (White Smoke)

Rapid accelerations under free-engine conditions may lead to white smoke and/or poor acceleration. A combination of data Is recommended. The first set of data serves as the baseline to engine conditions at idle prior to the second data set. The second set of data captures various engine conditions and temperatures as the engine warms up. Record DATA 1 prior to DATA 2, then record DATA 1 again to document engine conditions as engine conditions change.

Time:	0.3 sec	Filtered_Engine_Speed	Oil_Tmptr
Monitor	DATA 1	Ambient_Air_Press	Charge_Tmptr
		Coolant_Tmptr	Boost_Pressure
		Final_Timing	EGR_Fraction
Time:	0.3 sec	Filtered_Engine_Speed	Final_Timing
Monitor	DATA 2	Total_Fueling	Final_Timing_State
		Fueling_Control_State_Value	Boost_Pressure
		EGR_Fraction	

161. Cruise Control / Road Speed / Geardown Governor Behavior

Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Total_Fueling	
		Road_Speed	
Time:	0.2 sec	Filtered_Engine_Speed	Road_Speed
Monitor		Fueling_Control_State_Value	Ndot_Demand
		Adjusted_User_Fueling_State	Net_Engine_Torque
		Total_Fueling	CC_Error
Time:	0.5 sec	Filtered_Engine_Speed	Fueling_Control_State_Value
Monitor		CC_Error	Ndot_Net_Torque_Cmd_State
		Ndot_Cruise_Control	Commanded_Throttle
		Ndot_Demand	Road_Speed
		Net_Engine_Torque	Boost_Pressure
		Total_Fueling	Cruise_Max_Road_Speed
		System_Switch_Status	Cruise_Control_Reference_Speed

162. Cruise Control Setting Switch Diagnostics

Time:	0.2 sec	Filtered_Engine_Speed	Total_Fueling
Monitor		Fueling_Control_State_Value	System_Switch_Status
		Cruise_Control_Reference_Speed	Road_Speed

163. Cruise Control With AutoResume

Time:	0.2 sec	Filtered_Engine_Speed	Road_Speed
Monitor		Total_Fueling	Cruise_Control_Status
		Fueling_Control_State_Value	CC_Error
Time:	0.4 sec	Ndot_Net_Torque_Cmd_State	Cruise_Control_Reference_Speed
Monitor		Cruise_Droop	CC_Error
		Total_Fueling	System_Switch_Status
		Fueling_Control_State_Value	Cruise_Control_Status
		Road_Speed	Cruise_Command_Mode
		Net_Engine_Torque	

164. Cruise Control With Engine Brakes

Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Total_Fueling	
		Road_Speed	
Time:	0.2 sec	Filtered_Engine_Speed	Road_Speed
Monitor		Fueling_Control_State_Value	Ndot_Demand
		Adjusted_User_Fueling_State	Net_Engine_Torque
		Total_Fueling	CC_Error
Time:	0.5 sec	Filtered_Engine_Speed	Fueling_Control_State_Value
Monitor		CC_Error	Ndot_Net_Torque_Cmd_State
		Charge_Press	Commanded_Throttle
		Exhaust_Press	Road_Speed
		Net_Engine_Torque	Charge_Flow
		Total_Fueling	Cruise_Max_Road_Speed
		System_Switch_Status	Cruise_Control_Reference_Speed

165. Driver Reward

Time:	0.1 sec	Trip_Average_Fuel_Economy	
Monitor		DR_RSG_CC_Delta	
		DR_ESP_Delta	
Time:	0.2 sec	Trip_Average_Fuel_Economy	Max_Road_Speed
Monitor		DR_RSG_CC_Delta	Cruise_Max_Road_Speed
		DR_ESP_Delta	ESP_Tau_State
Time:	0.3 sec	Trip_Average_Fuel_Economy	ESP_Tau_State
Monitor		DR_RSG_CC_Delta	Trip_Idle_Time
		DR_ESP_Delta	Trip_Short_Stop_Idle_Time
		Max_Road_Speed	Trip_PTO_Time
		Cruise_Max_Road_Speed	
Time:	0.4 sec	Trip_Average_Fuel_Economy	Trip_Idle_Time
Monitor		DR_RSG_CC_Delta	Trip_Short_Stop_Idle_Time
		DR_ESP_Delta	Trip_PTO_Time
		Max_Road_Speed	Trip_Time
		Cruise_Max_Road_Speed	Driver_Reward_State
		ESP_Tau_State	Road_Speed
		NOTE THE FOLLOWING VALUES:	
		DR_ESP_Reward1	DR_RSG_CC_Reward1
		DR_ESP_Reward2	DR_RSG_CC_Reward2
		DR_ESP_Reward3	DR_RSG_CC_Reward3
		DR_ESP_Reward4	DR_RSG_CC_Reward4
		DR_MPG_Threshold1	DR_ZVS_Percent1
		DR_MPG_Threshold2	DR_ZVS_Percent2
		DR_MPG_Threshold3	DR_ZVS_Percent3
		DR_CC_RSG_Both_Option	Cruise_Max_Road_Speed_Trim
			Max_Road_Speed_Trim

166. Duty Cycle Logging of Route

Time:	0.3 sec	Filtered_Engine_Speed	Net_Engine_Torque
Monitor		Road_Speed	Final_Timing
		Boost_Pressure	Total_Distance
		Total_Fueling	
		Fueling_Control_State_Value	
		Commanded_Throttle	
Time:	0.5 sec	Filtered_Engine_Speed	CBR_Chi_Value
Monitor		Total_Fueling	Oil_Tmptr –OR- Coolant_Tmptr
		Fueling_Control_State_Value	EB_Driver_Level
		Final_Timing	EGR_Valve_Delta_Press
		Net_Engine_Torque	Charge_Press
		Road_Speed	Charge_Tmptr
		Commanded_Throttle	EGR_Position
		Total_Distance	VGT_Duty_Cycle

167. ECM Trip Information / Fuel Economy Accuracy

Record Odometer and Hubometer Miles at start and end of trip. Top-Off fuel tank at start and end of trip
For comparison of fill gallons / miles against data-logged ECM data at start and end of trip.
Calculate ECM MPG accuracy based on actual (fill/odom/hubo) versus ECM.
Log data at state line crossings or freeway mile markers for reference to Trip_Distance.
Confidence in results increases with long trips. If possible, trips of sufficient length to require multiple Fuel fills between start and end.

Time:	1.0 sec	Trip_Distance	Trip_PTO_Fuel_Used
Monitor		Trip_CC_Distance	Trip_Drive_Fuel_Used
		Trip_GD_Distance	Trip_Time
		Trip_TG_Distance	Trip_Idle_Time
		Trip_ESP_Distance	Trip_PTO_Time
		Trip_RSG_Distance	Total_Distance
		Trip_Fuel_Used	Total_Fuel_Usage
		Trip_Idle_Fuel_Used	Trip_Average_Load

168. Engine Braking

Time:	0.2 sec	Filtered_Engine_Speed	Commanded_Throttle
Monitor		E_Brake_Status	Road_Speed
		Boost_Pressure	Total_Fueling
		Net_Engine_Torque	
Time:	0.4 sec	Filtered_Engine_Speed	Commanded_Throttle
Monitor		E_Brake_Status	Fueling_Control_State_Value
		EB_Driver_Level	Boost_Pressure
		Total_Fueling	Road_Speed
		Net_Engine_Torque	Ambient_Air_Press
Time:	0.5 sec	Filtered_Engine_Speed	Road_Speed
Monitor		E_Brake_Status	Charge_Tmptr
		EB_Driver_Level	System_Switch_Status
		Total_Fueling	Ambient_Air_Press
		Net_Engine_Torque	Coolant_Tmptr
		Commanded_Throttle	Oil_Press
		Fueling_Control_State_Value	Exhaust_Press
		Boost_Pressure	Charge_Flow

169. ESP Performance (Hill Climbing)

Time:	0.4 sec	Filtered_Engine_Speed	Road_Speed
Monitor		Boost_Pressure	User_Filtered_Gear_Ratio
		Commanded_Throttle	ESP_Tau
		Total_Fueling	ESP_Tau_State
		System_Switch_Status	ESP_Cruise_Timer
		Fueling_Control_State_Value	ESP_Throttle_Timer_1
		ESP_Learned_Speed	

170. Fan Control

Time:	0.5 sec	Filtered_Engine_Speed	Coolant_Tmptr
Monitor		Total_Fueling	Charge_Tmptr
		Fueling_Control_State_Value	Fan_Air_Conditioner_Request
		Fan_Drive_State	Fan_Coolant_Temp_Request
		System_Switch_Status	Fan_Intake_Manifold_Temp_Request
		System_Switch_Status_2	Fan_EB_Request
		Fan_Clutch_Status_1	Fan_Manual_Input_Request

171. Fan Drive Activation

Time:	0.3 sec	Filtered_Engine_Speed	Coolant_Tmptr
Monitor		Total_Fueling	Charge_Tmptr
		Fan_Drive_State	System_Switch_Status
			System_Switch_Status_2
Time:	0.5 sec	Filtered_Engine_Speed	Fan_Manual_Input_Request
Monitor		Total_Fueling	Fan_Air_Conditioner_Request
		Fueling_Control_State_Value	Fan_Coolant_Temp_Request
		Fan_Drive_State	Fan_Intake_Manifold_Temp_Request
		Air_Conditioner_Pressure_Switch	Fan_Clutch_Status_1
		Manual_Fan_Input	Fan_Request
		Coolant_Tmptr	
		Charge_Tmptr	

172. FSSC: Cylinder Cut-Out

Cylinder Trim Selection (CTS) determines the final actuator pulse times and crank angle placement.
CTS algorithm applies single cylinder on-time trims and reconciles cylinder cut-outs. CTS algorithm also
Contains important engineering overrides. CTS can be used to disable cylinders for troubleshooting.

Time:	0.2 sec	Filtered_Engine_Speed	
Monitor		Total_Fueling	
		Fueling_Control_State_Value	
		CTS_x_ActiveFlMask_v	
		FTT_ti_BaseFlTTL_v	
		FTT_ti_BaseTmTTL_v	
		Override Cylinder On Times:	
		CTS_x_UserFlMask_c	Disable #1 Cyl – set value to 003E hex
			Disable #2 Cyl – set value to 003D hex
			Disable #3 Cyl – set value to 003B hex
			Disable #4 Cyl – set value to 0037 hex
			Disable #5 Cyl – set value to 002F hex
			Disable #6 Cyl – set value to 001F hex
			Disable Front Bank – set value to 0038 hex
			Disable Rear Bank – set value to 0007 hex
		CTS_ti_FlTrim_c[0-5]	CTS_ti_FlTrim_c[0] = 0.5 msec – add 0.5 msec on-time to #1 Cyl
			CTS_ti_FlTrim_c[5] = -0.5 msec – remove 0.5 msec on-time to #6 Cyl
		NOTE:	
		CTS_x_ActiveFlMask_v	Hex value which indicates active cylinders. Bits 0-5 correspond to Cylinders 1-6. Bit value of 1 indicates cylinder is enabled.
			CTS_x_ActiveFlMask_c = 003F – all 6 cylinders enabled

173. Hard Starting / Startup and Overshoot

Time:	0.1 sec	Filtered_Engine_Speed	EPS_Main_Sync_State
Monitor		Total_Fueling	EPS_Backup_Sync_State
		Oil_Pressure	Fuel_Rail_Pressure
Time:	0.2 sec	Filtered_Engine_Speed	FTT_ti_BaseFlTTL_v
Monitor		Total_Fueling	Final_Timing
		Engine_State	EPS_Main_Sync_State
		Fueling_Control_State_Value	EPS_Backup_Sync_State

174. High Speed Governor Stability

These parameters can be used for logging most HSG issues, Transient and Steady State.

Time:	0.02 sec	Filtered_Engine_Speed	FTT_ti_BaseFlTTL_v
Monitor		Total_Fueling	HSG_Proportional_Gain
		Fueling_Control_State_Value	Ndot_Demand
		Adjusted_User_Fueling	Ndot_HSG
		Adjusted_User_Fueling_State	Ndot_Error
		HSG_Reference_Speed	Ndot_Net_Torque_Cmd
		HSG_Ref_Speed_State	Net_Engine_Torque
		HSG_Droop_Speed	HSG_Compensated_Engine_Speed
Time:	0.3 sec	Filtered_Engine_Speed	HSG_Reference_Speed
Monitor		Total_Fueling	Ndot_HSG
		Fueling_Control_State_Value	Ndot_Demand
		HSG_Ref_Speed_State	Ndot_Error
		HSG_Droop_Speed	Zero_Vss_Derate_RPM

175. Highway Cruise Strategy Data Collection

Also record:
Estimate of Gross Vehicle Combined weight
Route start location
Ambient conditions: Ambient_Air_Tmptr, Ambient_Air_Press, Relative Humidity
Note odometer and hubometer at start and end of datalog
Note route description during test, note any major events during test

Time:	1.0 sec	Filtered_Engine_Speed	Alpha_Fuel_Rate
Monitor		Road_Speed	Alpha_AFC_Timer
		Commanded_Throttle	Alpha_LSG_Timer
		Total_Fueling	Alpha_Governor
		Fueling_Control_State_Value	Current_Torque_Output
		Delta_Fuel_Trip	Net_Engine_Torque
		Alpha	J1587_Percent_Load
		Final_Timing	System_Switch_Status
		Final_Timing_State	

176. Integrated Centinel (CORS)

Time:	0.3 sec	CORS_Burn_Valve_Command	Trip_Average_Fuel_Rate
Monitor		Trip_Average_Load	J1587_Fuel_Rate
		Trip_Drive_Distance	Filtered_Engine_Speed
		Trip_Fuel_Used	Total_Fueling

177. Low Idle Stability / Rough Idle

Record Oil_Temperature, Coolant_Temperature, Intake_Manifold_Temperature

Time:	0.02 sec	Filtered_Engine_Speed	LSG_Breakpoint_Speed
Monitor		Total_Fueling	CBD_s_adjusting_v
		Final_Timing	CBD_s_error_v
		FTT_ti_BaseFlTTL_v	LSG_Error
		FTT_ti_BaseTmTTL_v	Ndot_LSG
		EPS_Engine_Speed	Ndot_Demand
		Fuel_Rail_Press	Ndot_Error
		PCC_Ip_PressureError_v	Fueling_Control_State
		LSG_Proportional_Gain	
Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Total_Fueling	
		Final_Timing	
Time:	0.2 sec	Filtered_Engine_Speed	FTT_ti_BaseFlTTL_v
Monitor		Total_Fueling	Fueling_Control_State_Value
		Final_Timing	Final_Timing_State

178. Low Power – Boost Response Test

Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Boost_Pressure	
		Commanded_Throttle	
Time:	0.2 sec	Filtered_Engine_Speed	Net_Engine_Torque
Monitor		Sampled_Throttle_Raw	Commanded_Throttle
		Boost_Pressure	Road_Speed
		Total_Fueling	VGT_Duty_Cycle
Time:	0.3 sec	Filtered_Engine_Speed	Final_Timing
Monitor		Fueling_Control_State_Value	Commanded_Throttle
		Total_Fueling	Road_Speed
		Alpha	Boost_Pressure
		Final_Timing_State	VGT_Duty_Cycle
			Net_Engine_Torque
Time:	0.5 sec	Filtered_Engine_Speed	Boost_Pressure
Monitor		Fueling_Control_State_Value	Ambient_Air_Press
		Total_Fueling	EGR_Position
		Alpha	VGT_Duty_Cycle
		Final_Timing_State	Filtered_Turbo_Speed
		Final_Timing	OFC_Fuel_Limit
		Commanded_Throttle	Fuel_Rail_Press
		Road_Speed	PCC_lp_PressureError_v

179. Low Power – Geardown Protection

Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Total_Fueling	
		Road_Speed	
Time:	0.2 sec	Filtered_Engine_Speed	Total_Fueling
Monitor		RSG_Reference_Speed	Commanded_Throttle
		Boost_Pressure	Road_Speed
		Gear_Down_Active	
Time:	0.4 sec	Filtered_Engine_Speed	Commanded_Throttle
Monitor		Total_Fueling	Filtered_Gear_Ratio
		Fueling_Control_State_Value	User_Filtered_Gear_Ratio
		Ndot_Net_Torque_Cmd_State	Gear_Down_Gear_Ratio
			Gear_Down_Active

180. Low Power – Road Speed Governor

Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Total_Fueling	
		Road_Speed	
Time:	0.2 sec	Filtered_Engine_Speed	Total_Fueling
Monitor		Ndot_Net_Torque_Cmd_State	Commanded_Throttle
		Boost_Pressure	Road_Speed
Time:	0.4 sec	Filtered_Engine_Speed	Ndot_RSG
Monitor		Throttle_100_Torque	OFC_Fuel_Limit
		Fueling_Control_State_Value	OFC_EGR_Disable
		Total_Fueling	Road_Speed
		Commanded_Throttle	Boost_Pressure
		Ndot_Demand	

181. No Load Friction / Light Load Throttle Control

Take two sets of data: One with bare engine and one with fan control locked ON (optional).
Gently activate throttle to slowly ramp engine speed from low idle to high idle (30 second ramp).

Time:	0.2 sec	Filtered_Engine_Speed	Total_Fueling
Monitor		Sampled_Throttle_Raw	Commanded_Throttle
		Fueling_Control_State_Value	Final_Timing
		Boost_Pressure	
Time:	0.3 sec	Filtered_Engine_Speed	Oil_Tmptr
Monitor		Sampled_Throttle_Raw	No_Load_Torque
		Fueling_Control_State_Value	Net_Engine_Torque
		Total_Fueling	Final_Timing
		Commanded_Throttle	Boost_Pressure
			FTT_ti_BaseFlTTL_v

182. Powertrain Protection

Time:	0.1 sec	PTP_Torque_Output	
Monitor		Net_Engine_Torque	
		Fueling_Control_State_Value	
Time:	0.2 sec	PTP_Torque_Output	Adjusted_User_Fueling_State
Monitor		Net_Engine_Torque	Total_Fueling
		Fueling_Control_State	
Time:	0.4 sec	PTP_Torque_Output	Total_Fueling
Monitor		Net_Engine_Torque	PTP_Switched_Input
		Throttle_100_Torque	Ndot_Demand
		Fueling_Control_State_Value	Ndot_Powertrain
		Filtered_Gear_Ratio	Ndot_Error
		Ndot_Net_Torque_Cmd	

183. PTO Response / Stability

Record Oil_Temperature, Coolant_Temperature, Intake_Manifold_Temperature
Ramp engine speed from idle to PTO speed via SET or RESUME switch.

Time:	0.02 sec	Filtered_Engine_Speed	Ndot_PTO
Monitor		Total_Fueling	Ndot_Demand
		PTO_State	Fueling_Control_State_Value
		PTO_Status	PTO_Error
			System_Switch_Status
Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Total_Fueling	
		Final_Timing	

184. Road Speed Governor / Cruise Control Hiccup / Miss

Try to log these different combinations of parameters. Logging at any slower rate with more parameters significantly reduces the likelihood of capturing the event. If necessary, utilize Internal Data Logger with parameters listed. Deeper analysis may require all 5 parameters at 40 msec.

Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Out_Of_Gear	
		Road_Speed	
Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Total_Fueling	
		Fueling_Control_State_Value	
Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Fueling_Control_State_Value	
		Road_Speed	

185. Smart Road Speed Governor

Time:	0.2 sec	Filtered_Engine_Speed	Max_Road_Speed
Monitor		Total_Fueling	System_Switch_Status
		Fueling_Control_State	SR_Reference_Speed
Time:	0.4 sec	Filtered_Engine_Speed	System_Switch_Status
Monitor		Total_Fueling	Cruise_Control_Accel_Switch
		Fueling_Control_State_Value	Cruise_Control_Coast_Switch
		SR_Reference_Speed	Cruise_Control_On_Switch
		Max_Road_Speed	
		Road_Speed	

186. Starter Lockout

Time:	0.2 sec	Filtered_Engine_Speed	Commanded_Throttle
Monitor		Total_Fueling	Engine_State
		Fueling_Control_State_Value	Starter_Lockout_Driver

187. Stationary Test – Brake Activation Delay

Use with manual throttle event. Cycle throttle pedal. Engine speed snap throttles from High idle to low idle with Engine Brake switch ON. Collect data at cold oil temperature And at every 20 deg F as engine warms up.

Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Commanded_Throttle	
		Fueling_Control_State_Value	
Time:	0.2 sec	Filtered_Engine_Speed	Total_Fueling
Monitor		Commanded_Throttle	EB_Driver_Level
		Fueling_Control_State_Value	Oil_Tmptr

188. Stumble During Rapid Accel

OFC (Oxygen-Fuel Control) related stumble or poor acceleration.

Time:	0.02 sec	Filtered_Engine_Speed	Charge_Flow
Monitor		Total_Fueling	Total_O2_in_Cylinder
		OFC_Fuel_Limit	Final_Timing
		OFC_Limited	Final_Timing_State
		OFC_Equiv_Ratio_Limit	Alpha
		CBR_Chi_Value	
Time:	0.1 sec	Filtered_Engine_Speed	
Monitor		Total_Fueling	
		OFC_Fuel_Limit	

189. Throttle Characterization / Idle Validation Switches

Make note of throttle pedal make and model.
Slowly ramp throttle from fully released to fully depressed to fully released – especially near 0 and 100 % throttle.
Engine speed data is useful in evaluating throttle deadband (EM00168).

Time:	0.4 sec	Filtered_Engine_Speed	Sampled_Throttle_Raw
Monitor		Auto_Zero	Throttle_Status
		Throttle_Min	Total_Fueling
		Sampled_Throttle	Fueling_Control_State
		Commanded_Throttle	System_Switch_Status
		FTT_ti_BaseFlTTL_v	System_Switch_Status_2

190. Throttle Control – All Speed (VS) Governor

Make note of any tendency towards seat movement/chassis vibration, pedal events, etc. Is seat locked? Location of driver's foot. How is driver's foot touching the throttle pedal?

Time:	0.1 sec	Filtered_Engine_Speed	ASG_Throttle_Reference_RPM
Monitor		Sampled_Throttle_Raw	ASG_Reference_Speed
		Ndot_ASG	
Time:	0.2 sec	Filtered_Engine_Speed	Ndot_ASG
Monitor		Fueling_Control_State_Value	Ndot_Demand
		Sampled_Throttle_Raw	Road_Speed
		Commanded_Throttle	Commanded_Throttle
Time:	0.4 sec	Filtered_Engine_Speed	Boost_Pressure
Monitor		Sampled_Throttle_Raw	Fueling_Control_State_Value
		Ndot_ASG	FTT_ti_BaseFlTTL_v
		Total_Fueling	Ndot_Demand
		Commanded_Throttle	TQM_Final_Torque_Cmd
		Road_Speed	

191. Throttle Control – Min / Max (Automotive Governor)

Make note of any tendency towards seat movement/chassis vibration, pedal events, etc. Is seat locked? Location of driver's foot. How is driver's foot touching the throttle pedal? Is the driver's heel firmly on the pedal or is it above pedal? Does the driver's heel slide along the cab floor?

Time:	0.1 sec	Filtered_Engine_Speed	Sampled_Throttle_Raw
Monitor		Commanded_Throttle	
		Total_Fueling	
Time:	0.2 sec	Filtered_Engine_Speed	Commanded_Throttle
Monitor		Sampled_Throttle_Raw	Boost_Pressure
		Total_Fueling	Road_Speed
		Fueling_Control_State_Value	
		Filtered_Gear_Ratio	
Time:	0.4 sec	Filtered_Engine_Speed	FTT_ti_BaseFlTTL_v
Monitor		Sampled_Throttle_Raw	Throttle_Range
		Total_Fueling	Auto_Zero
		Fueling_Control_State_Value	Ndot_Demand
		Commanded_Throttle	TQM_Final_Torque_Cmd
		Road_Speed	

192. Turbo Surge Conditions

Time:	0.1 sec	Filtered_Engine_Speed	Commanded_Throttle
Monitor		Boost_Pressure	VGT_Duty_Cycle
Time:	0.2 sec	Filtered_Engine_Speed	Total_Fueling
Monitor		Boost_Pressure	System_Switch_Status
		Commanded_Throttle	Ambient_Air_Press
			VGT_Duty_Cycle
Time:	0.5 sec	Filtered_Engine_Speed	VGT_Duty_Cycle
		Boost_Pressure	Charge_Flow
		Commanded_Throttle	CHL_MCF_Cmd
		Total_Fueling	EGR_Fraction
		System_Switch_Status	CHL_EGR_Frac_Cmd
		Ambient_Air_Press	EGR_Position
		Charge_Tmptr	EGR_Delta_Press
		Road_Speed	Filtered_Turbo_Speed

193. VSS Anti-Tampering

Make note of Calibration_Version_Number (Application Software Phase)

Time:	0.3 sec	Filtered_Engine_Speed	Throttle_Status
Monitor	F/C 241	Road_Speed	System_Switch_Status
		Total_Fueling	VSS_Tamper_State
		Fueling_Control_State_Value	
Time:	0.4 sec	Filtered_Engine_Speed	User_Filtered_Gear_Ratio
Monitor	F/C 242	J1587_Percent_Load	VSS_Tamper_State
		Total_Fueling	VSS_Tampering_Error
		Fueling_Control_State	

CM870 ENGINEERING STATES

BINARY DEFINITION:

1 = ACTIVE							
0 = NOT ACTIVE							
0000 = 0	0001 = 1	0010 = 2	0011 = 3	0100 = 4	0101 = 5	0110 = 6	0111 = 7
1000 = 8	1001 = 9	1010 = 10	1011 = 11	1100 = 12	1101 = 13	1110 = 14	1111 = 15

Converting DECIMAL to BINARY:
Divide the DECIMAL value by 2, and keep dividing the remainder by 2 until you reach a value of 1. Integer values are only used, so 1 divided by 2 becomes 0 with a remainder of 1. The combined remainders become the BINARY equivalent. Example:

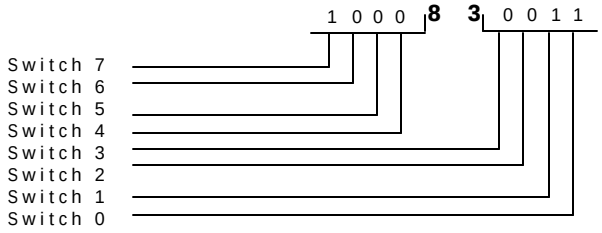
512/2 = 256	remainder	0	BIT 0	87/2 = 43	remainder	1	BIT 0
256/2 = 128	remainder	0	BIT 1	43/2 = 21	remainder	1	BIT 1
128/2 = 64	remainder	0	BIT 2	21/2 = 10	remainder	1	BIT 2
64/2 = 32	remainder	0	BIT 3	10/2 = 5	remainder	0	BIT 3
32/2 = 16	remainder	0	BIT 4	5/2 = 2	remainder	1	BIT 4
16/2 = 8	remainder	0	BIT 5	2/2 = 1	remainder	0	BIT 5
8/2 = 4	remainder	0	BIT 6	1/2 = 0	remainder	1	BIT 6
4/2 = 2	remainder	0	BIT 7				
2/2 = 1	remainder	0	BIT 8				
1/2 = 0	remainder	1	BIT 9				

The BINARY equivalent of 512 is 0010 0000 0000

The BINARY equivalent of 87 is 0101 0111

HEXADECIMAL DEFINITION:

1 = ACTIVE							
0 = NOT ACTIVE							
0000 = 0	0001 = 1	0010 = 2	0011 = 3	0100 = 4	0101 = 5	0110 = 6	0111 = 7
1000 = 8	1001 = 9	1010 = A	1011 = B	1100 = C	1101 = D	1110 = E	1111 = F



A/D SENSOR SOURCE INFORMATION:

Air_Press_Source	**ECM_Internal_Tmptr_Source**	**Oil_Press_Absolute_Source**
Battery_Volt_Source	**EGR_Delta_Press_Source**	**Oil_Press_Source**
Charge_Press_Source	**EGR_Orifice_Tmptr_Source**	**Oil_Tmptr_Source**
Charge_Press_Gauge_Source	**EGR_Position_Source**	**Remote_Throt_Source**
Charge_Tmptr_Source	**Exhaust_Press_Source**	**Sampled_Throt_Source**
Compressor_Inlet_Tmptr_Source	**Fuel_Rail_Press_Source**	**Turbo_Speed_Source**
Coolant_Lvl_Source	**Fuel_Tmptr_Source**	**WIF_Source**
Coolant_Tmptr_Source	**OEM_Ambient_Air_Tmptr_Source**	

State	Alpha Value	Decimal Value	Bit Mask
SENSOR_PRIMARY	PRIMARY	0	0
SENSOR_BACKUP	BACKUP	1	1
SENSOR_DEFAULT	DEFAULT	2	2

A/D SENSOR STATE INFORMATION:

Air_Press_State	**EGR_Delta_Press_State**	**Oil_Tmptr_State**
Battery_Volt_State	**EGR_Orifice_Tmptr_State**	**Remote_Throt_State**
Charge_Press_State	**EGR_Position_State**	**Sampled_Throt_State**
Charge_Tmptr_State	**Exhaust_Press_State**	**Turbo_Speed_State**
Compressor_Inlet_Tmptr_State	**Fuel_Rail_Press_State**	**WIF_State**
Coolant_Lvl_State	**Fuel_Tmptr_State**	
Coolant_Tmptr_State	**OEM_Ambient_Air_Tmptr_State**	
ECM_Internal_Tmptr_State	**Oil_Press_State**	

State	Alpha Value	Decimal Value	Bit Mask
GOOD	GOOD	0	0
OOR_SUSPECT	OS	1	1
OOR_FAILED	OF	2	2
AP_SUSPECT	AS	4	3
AP_FAILED	AF	8	4
IR_SUSPECT	IS	16	5
IR_FAILED	IF	32	6
EST_SUSPECT	ES	64	7
EST_FAILED	EF	128	8

A/D SENSOR STATUS INFORMATION:

Air_Press_Status	**EGR_Delta_Press_Status**	**Oil_Tmptr_Status**
Battery_Volt_Status	**EGR_Orifice_Tmptr_Status**	**Remote_Throt_Status**
Charge_Press_Status	**EGR_Position_Status**	**Sampled_Throt_Status**
Charge_Tmptr_Status	**Exhaust_Press_Status**	**Supply_1_Volt_Status**
Compressor_Inlet_Tmptr_Status	**Fuel_Rail_Press_Status**	**Supply_2_Volt_Status**
Coolant_Lvl_Status	**Fuel_Tmptr_Status**	**Turbo_Speed_Status**
Coolant_Tmptr_Status	**OEM_Ambient_Air_Tmptr_Status**	**WIF_Status**
ECM_Internal_Tmptr_Status	**Oil_Press_Status**	

State	Alpha Value	Decimal Value	Bit Mask
GOOD	GOOD	0	0
OOR_SUSPECT	OS	1	1
OOR_FAILED	OF	2	2
AP_SUSPECT	AS	4	3
AP_FAILED	AF	8	4
IR_SUSPECT	IS	16	5
IR_FAILED	IF	32	6
EST_SUSPECT	ES	64	7
EST_FAILED	EF	128	8

ACCELERATOR PEDAL STATES:

Accelerator_Pedal_State		
State	**Alpha Value**	**Enumeration**
Fully_Released	RELEASE	0
Partially_Depressed	PART_DEP	1
Fully_Depressed	FULL_DEP	2

ANTI-THEFT STATES:

Anti_Theft_State		
State	**Alpha Value**	**Enumeration**
Unlocked_While_Stopped	STOP_UNLOCK	0
Locked_While_Running	RUN_LOCK	1
Unlocked_While_Running	RUN_UNLOCK	2
Tampered_With_Vehicle	TAMPER	3
Locked_While_Stoppped	STOP_LOCK	4

AT_Password_State		
State	**Alpha Value**	**Enumeration**
No_Entry	NO_ENTRY	0
Good_Entry	GOOD_ENTRY	1
Bad_Entry	BAD_ENTRY	2

AT_Engine_Lock_State **AT_Engine_Lock_State_Request**		
State	**Alpha Value**	**Enumeration**
Unlocked	FALSE	0
Locked	TRUE	1

ANTI-THEFT STATES (JCOMM):

Jcomm_AT_Command_State		
State	**Alpha Value**	**Enumeration**
Add_Password	ADD_PASSWD	0
Delete_Password	DEL_PASSWD	1
Change_Password	CHG_PASSWD	2
Lock_Or_Unlock	LOCK_UNLOCK	3
Check_Status	CHECK	4
Login	LOGIN	5
Idle_State	IDLE	6
IBZ_Idle_State	IBZ_IDLE	7

Jcomm_AT_Component_Status		
State	**Alpha Value**	**Enumeration**
Unlocked	UNLOCK	0
Locked	LOCK	1
Blocked	BLOCK	2

Jcomm_AT_Desired_Exit_Mode		
State	**Alpha Value**	**Enumeration**
Lock_Upon_Operator_Request	LOCK_RQST	0
Lock_When_Key_Off	LOCK_KEYOFF	1
Not_Available	NOT_AVAIL	2

Jcomm_AT_Encryption_Indicator		
State	**Alpha Value**	**Enumeration**
Encryption_Seed_Request	REQUEST	0
Encryption_Password_Present	PRESENT	1
Indicator_Not_Available	NOT_AVAIL	2

CHARGE FLOW STATES:

CHL_Derate_State		
State	**Alpha Value**	**Decimal Value**
CHL_No_Derate_State	NO_DRT	0
CHL_COT_Derate_State	COT_DRT	1
CHL_Turbo_Speed_Derate_State	TURB_DRT	2
CHL_Delta_P_Derate_State	DLTP_DRT	4
CHL_EGR_Off_DP_Derate_State	DPOFFDRT	8

Charge_Flow_Command_State	
State	**Decimal Value**
Normal Operation	0
COT Derate	1
Turbo Speed Derate	2
Delta P Derate	4
EGR Off Delta P Derate	8
Density Based MCF Limit	16
CBL MCF Command Override	32
Engine Brakes	64
CBL MCF Command Increment	128

Charge_Flow_Derate_Active_State	
State	**Decimal Value**
All Derates Inactive	0
COT Near Limit	1
Turbo Speed Near Limit	2
Delta P Near Limit	4
Delta P Near EGR Off Limit	8

EGR_Fraction_Command_State	
State	**Decimal Value**
Normal Operation	0
EMM Protection	1
CBR EGR Override	2
OFC EGR Disabled	4
CBL EGR Override	8
Low EGR Command	16
Prevent Opening Against High Delta P	32
CHL Surge Derate	64
CBL EGR Command Increment	128

CRUISE CONTROL STATES:

Cruise_Command_Mode		
State	**Alpha Value**	**Enumeration**
CC_Off	OFF	0
Set	SET	1
Resume	RESUME	2
Coast	COAST	3
Accel	ACCEL	4
Bump_Down	BUMPDWN	5
Bump_Up	BUMPUP	6
CC_Hold	HOLD	7
Cancel	CANCEL	8
VORAD Headway	HEADWAY	9

J1939_Cruise_Command_Mode		
State	**Alpha Value**	**Enumeration**
Cruise Off	OFF	0
Cruise Hold	HOLD	1
Cruise Accelerate	ACCEL	2
Cruise Decelerate	DECEL	3
Cruise Resume	RESUME	4
Cruise Set	SET	5
Cruise Accel Override	ACOVRRIDE	6
Cruise Not Available	NOT_AVAIL	7

Cruise_Control_AR_Flag		
State	**Alpha Value**	**Enumeration**
AR_Inactive	INACTIVE	0
AR_Active	ACTIVE	1
AR_Pre_Active	PRE_ACTIVE	2
AR_Resume	RESUME	3
AR_After_Test	AFTER_TEST	4

Adaptive_Cruise_Control_Mode		
State	**Alpha Value**	**Enumeration**
No Cruise Control	NO_CRUISE	0
Normal Cruise Control	NORMAL_CRUISE	1
VORAD Headway Cruise	HEADWAY_CRUISE	2

DRIVER REWARD STATES:

DR_CC_RSG_Both_Option		
State	**Alpha Value**	**Enumeration**
DR_Type_RSG	RSG	0
DR_Type_CC	CRUISE	1
DR_Type_Both	BOTH	2

DR_Reward_State		
State	**Alpha Value**	**Enumeration**
DR_State_None	NONE	0
DR_State_1	DR_STAT1	1
DR_State_2	DR_STAT2	2
DR_State_3	DR_STAT3	3
DR_State_4	DR_STAT4	4

EGR VALVE CONTROLLER STATES:

EGA_Control_State		
State	**Alpha Value**	**Enumeration**
Closed_Loop	CLOSLOOP	0
Zero_Hold	ZEROHOLD	1
User_Override	USEROVER	2
Diagnostic_PWM_Override	DIAGOVER	3
PWM_Disabled	PWMDISAB	4

EMISSION MANAGER AECD STATES:

EMM_AECD_State		
State	**Decimal Value**	**Bit Mask**
Emission Protection	0	None
Air Handling System Protection	1	Bit 0
Extreme Ambient Overheat Protection	2	Bit 1
Condensation Protection	4	Bit 2
White Smoke / Misfire Protection	8	Bit 3
Extended Idle & PTO Protection	16	Bit 4
Engine Starting & Warmup Protection	32	Bit 5
Engine Protection	64	Bit 6
Diagnostic Procedures	128	Bit 7

EMISSION MANAGER PROTECTION STATES:

EMM_Protection_State		
State	**Decimal Value**	**Bit Mask**
Normal Operation	0	None
Cranking	1	Bit 0
Normal Shutdown	2	Bit 1
Minor Engine Protection	4	Bit 2
Major Engine Protection	8	Bit 3
Emergency Shutdown	16	Bit 4
Wet Stack Protection	32	Bit 5
Coolant Advance	64	Bit 6
EGR Off Allowed	128	Bit 7
EGR System Failure	256	Bit 8
Cylinder Pressure Limit	512	Bit 9

ENGINE BRAKES STATES:

E_Brake_Command_Source		
State	**Alpha Value**	**Enumeration**
Not_Commanded	NONE	0
JCOMM_Over_Ride	JCOMMOVD	1
Cruise_Control	CRUISE	2
Switch_Input	SWITCH	3
JCOMM_Limit	JCOMMLMT	4
Source_Not_Set	NOT_SET	5
No_Override	NOOVERDE	6
Hydraulic_Retarder_Cmd	HYD_RTDR	7
Powertrain_Protection	PTP	8
EGR_Protection	EGR_PROT	9

EB_Allowed_State		
State	**Alpha Value**	**Enumeration**
No_Ebrakes	NONE	0
Override_Only	OVERRIDE	1
Override_Or_Non_Override	OVER_OR_NON	2

Engine_Brake_Jcomm_Device_Indicator **Jcomm_Retarder_Control_Device_Indicator**		
State	**Alpha Value**	**Enumeration**
No_Device	NODEVICE	0
Transmission_Control	TRANSMIS	1
ABS_Control	ABS	2
ASR_Control	ASR	3
Unknown_Control	UNKNOWN	4
PTO_Control	PTO	5
VORAD Headway_Control	HEADWAY	6

ENGINE BRAKES STATES / JCOMM RETARDER:

Jcomm_Retarder_Control_Mode		
State	**Alpha Value**	**Enumeration**
Retarder_Override_Disabled	DISABLE	0
Retarder_Torque_Control	TORQUE	2
Limit_Retarder	LIMIT	3

Jcomm_Retarder_Control_Mode_Test_Point		
State	**Alpha Value**	**Enumeration**
Retarder_Override_Disable_Test	OVR_DSBL	0
No_Retarder_Test	NO_TEST	1
Retarder_Torque_Control_Test	TRQ_CNTL	2
Limit_Retarder_Test	LIM_RTRD	3

ENGINE BRAKE SWITCH STATES:

Valid_Brake_Switch		
State	**Alpha Value**	**Enumeration**
Brake_Inactive	OFF	0
Brake_Active	ON	1
Brake_Invalid_Inactive	STUCK_OFF	2
Brake_Invalid_Active	STUCK_ON	3

ENGINE DATA FILES:

EDF_Coolant_Temp_Abuse_Type **EDF_Engine_Ovrspd_Abuse_Type** **EDF_IMT_Abuse_Type** **EDF_Oil_Pres_Abuse_Type**	**EDF_Oil_Temp_Abuse_Type** **EDF_Coolant_Pres_Abuse_Type** **EDF_Coolant_Lvl_Abuse_Type** **EDF_Blowby_Pres_Abuse_Type**	
State	**Alpha Value**	**Enumeration**
EDF_No_Source	NONE	0
EDF_Discrete_Source	DISCRETE	1
EDF_Analog_Source	ANALOG	2
EDF_Error_Source	ERROR	3

EDF_Coolant_Temp_Abuse_Min_Or_Max **EDF_Engine_Ovrspd_Abuse_Min_Or_Max** **EDF_IMT_Abuse_Min_Or_Max** **EDF_Oil_Pres_Abuse_Min_Or_Max**	**EDF_Oil_Temp_Abuse_Min_Or_Max** **EDF_Coolant_Pres_Abuse_Min_Or_Max** **EDF_Coolant_Lvl_Abuse_Min_Or_Max** **EDF_Blowby_Pres_Abuse_Min_Or_Max**	
State	**Alpha Value**	**Enumeration**
EDF_Max	MAX	0
EDF_Min	MIN	1

ENGINE OPERATING CONDITION (ALPHA/CHI) STATES:

Engine_State		
State	**Alpha Value**	**Enumeration**
Engine_Stop_State	STOP	1
Engine_Crank_State	CRANK	2
Engine_Run_State	RUN	3
Engine_Brake_State	ENGBRAKE	4
Engine_Overspeed_State	OVERSPED	5
Engine_Jumpstart_State	JUMPSTRT	6
Engine_Crank_Reentry_State	REENTRY	7
Engine_Shutdown_State	SHUTDOWN	8

Alpha **CBR_Alpha**		
State	**Alpha Value**	**Enumeration**
Urban Mode / Transient	URBAN	0
On-Highway / Steady State	OPEN_ROAD	1

Alpha_State		
State	**Alpha Value**	**Enumeration**
Base	BASE	0
User	USER	1
Altitude_Derate	ALTITUDE	2
Engine_Protection	EPF	3
Slave	SLAVE	4
ESP	ESP	5

CBR_Chi_Value		
State	**Alpha Value**	**Enumeration**
Chi 1: Steady State	CHI 1	1
Chi 2: AECD Region II	CHI 2	2
Chi 3: AECD Region III	CHI 3	3
Chi 4: EGR Off	CHI 4	4

CBR_Chi_Source		
State	**Alpha Value**	**Enumeration**
CBR_DENSITY_CHI	DENS_CHI	1
CBR_EXHAUST_CHI	EXH_CHI	2
CBR_COOLANT_CHI	COOL_CHI	3
CBR_EGR_OFF_CHI	EGR_OFF_CHI	10
USER_OVERRIDE_SOURCE	OVERRIDE	11
CBR_FULL_USER_OVERRIDE_CHI	FULL_OD	12
CBR_SINGLE_USER_OVERRIDE_CHI	SINGLE_OD	13
CBR_PROTECTION_CHI	PROTECT_CHI	14

ESP_Tau_State

State	**Alpha Value**	**Enumeration**
Normal	NORMAL	0
Reverse	REVERSE	1
Steep Grade	STEEP_GRADE	2

ENGINE SOI TIMING COMMAND ENGINEERING STATES:

Final_Timing_State **SOI_State** **CBA_SOI_State**		
State	**Alpha Value**	**Enumeration**
Four_D_Timing_State	FOUR_D	0
Wet_Stack_Timing	WETSTACK	1
User_Commanded_Timing	USERCOMD	2
ANC_Timing	ANC	3
Max_Timing	MAX	4
Crank_Advance	CRANK	5
E_Brake_Timing	ENGBRAKE	6
User_Override_Timing	USEROVRD	7
Stopped_Timing	STOP	8
Overspeed_Timing	OVERSPED	9
Shutdown_Timing	SHUTDOWN	10
Misfire_Timing_Limit	MISFIRE	11
MS_Override_Timing	MSOVRIDE	12
Wet_Stack_Coolant_Timing	WTSTCOOL	13
Coolant_SOI_Advance_State	COOL_SOI	14
IMT_SOI_Advance_State	IMT_SOI	15
Ambient_Air_Pressure_SOI_Advance_State	AMB_SOI	16
CBR_SOI_Ref_State	CBR_SOI	17
E_Brake_Timing_State	EBRAKETM	18
Max_Timing_State	MAXTMST	19
Min_Timing_State	MINTMST	20

Final_Timing_Incr_State		
State	**Alpha Value**	**Enumeration**
Timing_Incr_4_D	[NOT USED]	0
Timing_Incr_Coolant_Adv	[NOT USED]	1
AFC Timing Incr	AFC_INCR	2
Timing_Incr_Cylinder_Press	CYL_INCR	3
User Incr Mask	USER_INCR	4
CBO_Adjust	CBO_ADJ	5
OFC_Alpha0_Incr	OFC_INCR	6
Timing Incr Coolant Timing	COOL_INCR	7

ENGINE SPEED PROCESSING (EPS) STATES:

EPS_Sensor_Select		
State	**Alpha Value**	**Enumeration**
Main_EPS	MAIN	0
Backup_EPS	BACKUP	1

EPS_Main_Synch_State **EPS_Backup_Synch_State**		
State	**Alpha Value**	**Enumeration**
EPS_No_Pulse	NO_PULSE	0
EPS_Have_Sync	HAVE	1
EPS_No_Sync	NO_SYNC	2
EPS_Start_Sync	START	3

EPS_Status		
State	**Alpha Value**	**Enumeration**
EPS_Stopped	STOPPED	0
EPS_Degraded	DEGRADED	1
EPS_Healthy	HEALTHY	2
EPS_Failed	FAILED	3

EPS_Cam_Cycle_State		
State	**Alpha Value**	**Enumeration**
Unknown	UNKNOWN	0
No_Cam	NO_CAM	1
Known	KNOWN	2

ENGINE START STATES:

ES_State		
State	**Alpha Value**	**Enumeration**
Aborted	ABORT	0
Begin	BEGIN	1
Proceed	PROCEED	2
OK_To_Autostart	AUTO_OK	3
Started	STARTED	4
ES_Wait	ES_WAIT	5
Key_Switch_Off	KEYSWOFF	6
OK_To_Manual_Start	MANUAL_OK	7
Alarm_Delay	ALARM	8

ENGINE TORQUE / FUEL COMMAND ENGINEERING STATES:

** NOTE: Fueling_Control_State represents the Alpha Value while Fueling_Control_State_Value represents the Enumeration **

Fueling_Control_State	**Desired_User_Fueling_State**
Fueling_Control_State_Value	**Adjusted_User_Fueling_State**
TQM_Net_Engine_Torque_State	**Ndot_Net_Torque_Cmd_State**
TQM_Machine_Torque_Limit_State	**CBR_Fuel_Ref_State**
TQM_Engine_Torque_Limit_State	**User_Fueling_State**

State	Alpha Value	Enumeration
NOT_SET	NOT_SET	0
FUELING_JCOMM_TORQUE_STATE	JCOMTORQ	1
FUELING_JCOMM_SPEED_STATE	JCOMSPED	2
FUELING_PROGRESSIVE_SHIFT_SPEED_STATE	PSSPEED	3
FUELING_PTO_STATE	PTO	4
FUELING_USER_COMMAND_STATE	USERCOMD	5
FUELING_LIMP_HOME_STATE	LIMPHOME	6
FUELING_ASG_THROTTLE_STATE	ASGTHROT	7
FUELING_FOUR_DIMENSION_STATE	FOUR_D	8
FUELING_CRUISE_CONTROL_STATE	CRUISE	9
FUELING_RSG_STATE	RSG	10
FUELING_LSG_STATE	LSG	11
FUELING_HSG_STATE	HSG	12
FUELING_TORQUE_DERATE_OVERRIDE_STATE	TRQDROVR	13
FUELING_LOW_GEAR_STATE	LOWGEAR	14
FUELING_ALTITUDE_DERATE_STATE	ALTDERAT	15
FUELING_OFC_DERATE_STATE	OFCDERAT	16
FUELING_ANC_DERATE_STATE	ANCDERAT	17
FUELING_ENGINE_PROTECT_STATE	EPF	18
FUELING_MAXIMUM_THROTTLE_STATE	MAXTHROT	19
FUELING_JCOMM_TORQUE_DERATE_STATE	JCTRQDER	20
FUELING_OUT_OF_GEAR_STATE	OUTOGEAR	21
FUELING_CRANK_STATE	CRANK	22
FUELING_OVERRIDE_STATE	OVERRIDE	23
FUELING_ENGINE_BRAKE_STATE	ENGBRAKE	24
FUELING_OVERSPEED_STATE	OVERSPED	25
FUELING_STOP_STATE	STOP	26
FUELING_SHUTDOWN_STATE	SHUTDOWN	27
FUELING_FSS_DERATE_STATE	FSSDERAT	28
FUELING_EPF_DERATE_STATE	EPFDERAT	29
FUELING_ASG_APPLICATION_STATE	ASG_APPL	30
FUELING_ALTERNATE_TORQUE_STATE	ALT_TORQ	31
FUELING_MS_OVERRIDE_STATE	MSOVRIDE	32
FUELING_ENGINE_STARTUP_OIL_LIMIT	ESUOILLM	33
FUELING_PTO_DERATE_STATE	PTODERAT	34
FUELING_TORQUE_CONTROL_STATE	TORQCTRL	35
FUELING_PTP_DERATE_STATE	PTPDERAT	36
FUELING_T2_SPEED_STATE	T2SPD	37
FUELING_T2_TORQUE_STATE	T2TORQ	38
FUELING_T2_DERATE_STATE	T2DERAT	39
FUELING_NO_DERATE_STATE	NODERAT	40
FUELING_ANTI_THEFT_DERATE_STATE	ATDERAT	41
FUELING_PARTIAL_THROTTLE_LIMIT_STATE	PTTHLM	42
SS_AMBIENT_DERATE_STATE	SSAMBTDR	43
TRANSIENT_COOLANT_DERATE_STATE	TSCOOLDR	44
FUELING_RMG_STATE	RMG	45
FUELING_AIR_DENSITY_LIMIT_STATE	AIRDENLM	46
FUELING_CHI_FUEL_LIMIT_STATE	CHIFULLM	47
FUELING_TFC_DERATE_STATE	TFCDERAT	48
FUELING_CBR_GROSS_FUEL_OVERRIDE_STATE	GROSSOVR	49
FUELING_CHM_DERATE_STATE	CHMDERAT	50
FUELING_JCOMM_PTP_DERATE_STATE	JCPTPDER	51
FUELING_AUX_NDOT_STATE	AUXNDOT	52

FAN CONTROL STATES:

Fan_Drive_State		
State	**Alpha Value**	**Enumeration**
Fan_Drive_Off	OFF	0
Fan_Drive_General_Engine	ENGINE	1
Fan_Drive_IMT_Cooling	IMT_COOL	2
Fan_Drive_OT_Cooling	OT_COOL	3
Fan_Drive_CT_Cooling	CT_COOL	4
Undefined	UNUSE5	5
Undefined	UNUSE6	6
Undefined	UNUSE7	7
Undefined	UNUSE8	8
Fan_Drive_Manual_Switch	MANUAL	9
Undefined	NOCODE	10
Fan_Drive_AC_Switch	AC_SWITCH	11
Fan_Drive_IMT_Timer	IMT_TIME	12
Fan_Drive_Loading	LOADING	13
Fan_Drive_Other	OTHER	14
Fan_Drive_J1939_Not_Available	JNOT_AVL	15
Fan_Drive_Misc	MISC	16
Fan_Drive_Tool	TOOL	17
Fan_Drive_Datalink	DATALINK	18
Fan_Drive_OEM_Pressure	OEMPRES	19
Fan_Drive_OEM_Temperature	OEMTEMP	20
Fan_Drive_Fuel_Temperature	FUELTEMP	21

Fan_Drive_State 22 = TFC Derate Control

It is based on a percentage, CBR_Gross_Fuel / Texh_Fuel_Limit * 100%. It currently set to 90% for fan on (as start of derate approaches) and 85% for fan off. The minimum fan on time is based on the A/C pressure timer.

Fan_Clutch_1_Type		
State	**Alpha Value**	**Enumeration**
On_Off	ON_OFF	0
Active High / Low	HIGH_LOW_OFF	1
Variable	VARIABLE	2

Fan_Clutch_Logic		
State	**Alpha Value**	**Enumeration**
Active_High (12V FAN ON)	FALSE	0
Active_Low (12V FAN OFF)	TRUE	1

Fan_Clutch_Status		
State	**Alpha Value**	**Enumeration**
Fan_Clutch_Off	FC_OFF	0
Fan_Clutch_On	FC_ON	1
Fan_Clutch_Active_Low	FC_LOW	2
Fan_Clutch_Active_High	FC_HIGH	3

GEAR DOWN / OUT OF GEAR PROTECTION STATES:

GD_State		
State	**Alpha Value**	**Enumeration**
GD_Reset_State	RESET	1
GD_High_Load_State	HI_LOAD	2
GD_Wait_For_Filter_State	WAIT	3
GD_Preset_Ramp_State	PRESET	4
GD_Low_Load_State	LOW_LOAD	5
GD_Top_Gear_State	TOP_GEAR	6
GD_Decel_State	DECEL	7

Gear_Down_Active		
State	**Alpha Value**	**Enumeration**
GDA_Top_Gear	TOP_GEAR	0
GDA_Gear_Down	GEAR_DWN	1
GDA_In_A_Low_Gear	LOW_GEAR	2

Out_Of_Gear_Protection		
State	**Alpha Value**	**Enumeration**
OOG_Steady_State_Inactive	SS_INACTIVE	0
OOG_Steady_State_Active	SS_ACTIVE	1
OOG_Ramping_Up	RAMP_UP	2
OOG_Ramping_Down	RAMP_DOWN	3

HSG REFERENCE SPEED STATES:

HSG_Ref_Speed_State		
State	**Alpha Value**	**Enumeration**
HSG_Injector_Fault_State	INJ_FAULT	1
HSG_Zero_VSS_State	ZERO_VSS	2
HSG_ANC_Derate_State	ANC_DER	3
HSG_VSS_Tamper_State	VSS_TAMP	4
HSG_Engine_Protection_State	ENG_PROT	5
HSG_Breakpoint_State	BREAKPOINT	6
HSG_FSS_Derate_State	FSS_DER	7
HSG_Jcomm_Override_State	JCOMM_OVR	8
HSG_Jcomm_Limit_State	JCOMM_LIM	9
HSG_TSG_Default_Engine_Speed_State	TSG_DEF	10
HSG_PTO_Throttle_Override_State	PTO_THROT	11
HSG_Alt_Breakpoint_State	ALT_BREAKPT	12

HSG_Active_Isochronous_Speed_State **HSG_Indicated_Isochronous_Speed_State**		
State	**Alpha Value**	**Enumeration**
HSG_Iso_State	ISOCHRONOUS	0
HSG_Iso_Switched_Max_Op_Speed	SWITCHED_ISO	1
HSG_Iso_Zero_VSS	ZERO_VSS	2
HSG_Iso_SM_State	SHIFT_MNGR	3

IDLE SHUTDOWN STATES:

Idle_Shutdown_State		
State	**Alpha Value**	**Enumeration**
Reset	RESET	0
Count	COUNT	1
Warning	WARNING	2
Delay	DELAY	3
Overridden	OVERRIDE	4
Shutdown	SHUTDOWN	5

POWER TAKE-OFF (PTO) STATES:

PTO_State		
State	**Alpha Value**	**Enumeration**
Remote_Count	REMOTE_COUNT	0
Remote_Run	REMOTE_RUN	1
Wait	WAIT	2
Normal_PTO	NORMAL	3

J1939_PTO_State		
State	**Alpha Value**	**Enumeration**
Off	OFF	0
Hold	HOLD	1
Remote_Hold	REM_HOLD	2
Decelerate	DECEL	6
Accelerate	ACCEL	8
Accelerate_Override	ACCEL_OV	9
Preprogrammed_Set_Speed_1	PROGSPD1	10
Preprogrammed_Set_Speed_2	PROGSPD2	11
Preprogrammed_Set_Speed_3	PROGSPD3	12
Preprogrammed_Set_Speed_4	PROGSPD4	13
Preprogrammed_Set_Speed_5	PROGSPD5	14
Preprogrammed_Set_Speed_6	PROGSPD6	15
Preprogrammed_Set_Speed_7	PROGSPD7	16
Preprogrammed_Set_Speed_8	PROGSPD8	17

POWERTRAIN STATES:

Powertrain_State		
State	**Alpha Value**	**Enumeration**
Not_Set	NOT_SET	0
Fueling_Jcomm_Torque_State	JCOMTORQ	1
Fueling_Jcomm_Speed_State	JCOMSPED	2
Fueling_Jcomm_Torque_Derate_State	JCTRQDER	3

SENSOR ESTIMATION STATUS INFORMATION:

Charge_Press_EStat Charge_Tmptr_EStat	Exhaust_Press_Estat Turbo_Speed_EStat		
State	**Alpha Value**	**Decimal Value**	**Bit Mask**
GOOD	GOOD	0	0
OOR_SUSPECT	OS	1	1
OOR_FAILED	OF	2	2
AP_SUSPECT	AS	4	3
AP_FAILED	AF	8	4
IR_SUSPECT	IS	16	5
IR_FAILED	IF	32	6
EST_SUSPECT	ES	64	7
EST_FAILED	EF	128	8

SYSTEM SWITCH STATUS:

System_Switch_Status [SSSWSS01]	
Switch	**BIT #**
Keyswitch	0
Test_Switch	1
Increment_Switch	2
Decrement_Switch	3
Cruise_Control_On_Switch	4
Cruise_Control_Set_Switch	5
Cruise_Control_Resume_Switch	6
PTO_On_Switch	7
PTO_Set_Switch	8
PTO_Resume_Switch	9
Brake_Switch	10
Clutch_Switch	11
Engine_Brake_Select_1	12
Engine_Brake_Select_2	13
Engine_Brake_Select_3	14
Manual_Fan_Input	15

System_Switch_Status_2 [SSSWSS02]	
Switch	**BIT #**
Air_Conditioner_Pressure_Switch	0
Idle_Switch	1
Not_Idle_Switch	2
Remote_Throttle_Switch	3
Remote_PTO_Switch	4
PTP_Switched_Input	5
Accelerator_Interlock_Switch	6
EPF_Shutdown_Override_Switch	7
STCG_ASG_Droop_Switch	8
Remote_Oil_Switch	9
Sensor_Supply_Monitor_A	10
Rear_Axle_Ratio_Switch	11
HSG_Droop_Select_Switch	12
Unused	13
Unused	14
Unused	15

TRIP INFORMATION STATES:

Trip_Info_State		
State	**Alpha Value**	**Enumeration**
TI_EPF_Derate	EPF_DER	0
TI_Air_Compressor	AIR_COMP	1
TI_Battery_Auto_Start	BATT_AS	2
TI_Block_Auto_Start	BLOCK_AS	3
TI_Bunk_Auto_Start	BUNK_AS	4
TI_Engine_ESP	ENG_ESP	5
TI_Driver_Reward_1	DR_1	6
TI_Driver_Reward_2	DR_2	7
TI_Driver_Reward_3	DR_3	8
TI_Vehicle_ESP	VEH_ESP	9
TI_Fan_Due_To_Ext	FAN_EXT	10
TI_Fan_Due_To_AC	FAN_AC	11
TI_Fan_Due_To_Engine	FAN_ENG	12
TI_Fan_1_With_MPH	FAN_1_MPH	13
TI_Fan_1_Without_MPH	FAN_1_NOMPH	14
TI_Vehicle_Out_Of_Gear	VEH_OOG	15
TI_Engine_Drive	ENG_DRIVE	16
TI_Engine_Idle	ENG_IDLE	17
TI_Fast_Engine_Idle	FAST_ENG_IDLE	18
TI_Engine_PTO	ENG_PTO	19
TI_Hot_Shutdown	HOT_SD	20
TI_Warmup_Violation	WARM_VIOL	21
TI_Idle_Shutdown	IDLE_SD	22
TI_Idle_Shutdown_Override	IDLE_SD_OVR	23
TI_Engine_Revving	ENG_REV	24
TI_Engine_Overrev	ENG_OVERREV	25
TI_Vehicle_Drive	VEH_DRIVE	26
TI_Vehicle_PTO	VEH_PTO	27
TI_Cruise	CRUISE	28
TI_RSG	RSG	29
TI_Vehicle_Coast	VEH_COAST	30
TI_Vehicle_Above_Sweet_Spot	ABV_SWSP	31
TI_Vehicle_Below_Sweet_Spot	BEL_SWSP	32
TI_Vehicle_Brake	VEH_BRAKE	33
TI_Top_Gear	TOP_GEAR	34
TI_Gear_Down	GEAR_DWN	35
TI_Engine_Brakes	E_BRAKE	36
TI_Vehicle_Overspeed_1	VEH_OS_1	37
TI_Vehicle_Overspeed_2	VEH_OS_2	38
TI_Vehicle_Deceleration	VEH_DEC	39
TI_ECM	ECM	40
TI_Fan_2_On	FAN_2_ON	41
TI_Engine_On	ENG_ON	42
TI_Vehicle_PTO_Loaded_And_Not_Moving	PTO_NO_VSS	43
TI_Vehicle_PTO_Loaded_And_Moving	PTO_VSS	44
TI_Auto_Start	AUTO_STRT	45
TI_Engine_Sleep_Idle	ENG_SLEP_IDLE	46
Unused	UNUSED	47

VEHICLE SPEED SENSOR STATES:

RSC_Sensor_Type		
State	**Alpha Value**	**Enumeration**
None	NONE	0
Inductive	INDUCTIVE	1
Mini_Gen	MINIGEN	2
Tachograph	TACH	3
Datalink_Tailshaft_Speed	DL_W_GR OOG	4
Unused	UNUSED	5
J1939 Tachometer	1939TACH	6

VSS_Transmission		
State	**Alpha Value**	**Enumeration**
Manual_Transmission	MANUAL	0
Automatic_Transmission	AUTOMATIC	1
Fully_Automated_Manual_Transmission	FULL_AMT	2
Partially_Automated_Manual_Transmission	PARTIAL_AMT	3
Automated_Transmission_No_Clutch	AMT_NO_CLUTCH	4

VSS_Tamper_State		
State	**Alpha Value**	**Enumeration**
VSS_No_Tampering	NO_TAMPR	0
VSS_Disconnected_Stop	DISCON_STP	1
VSS_Disconnected_Moving	DISCON_MOV	2
VSS_Const_Signal_State	CONSTANT	3
VSS_Noise_Signal_State	NOISE	4
VSS_Scaled_Signal_State	SCALED	5
VSS_Idle_Shutdown_State	IDLE_SD	6

VIRTUAL SENSOR SOURCE INFORMATION:

Altitude_Source **Ambient_Air_Press_Source** **Ambient_Air_Tmptr_Source** **Charge_Flow_Source** **Charge_Saturation_Tmptr_Source**	**Compressor_Inlet_Density_Source** **Compressor_Inlet_Press_Source** **Compressor_Outlet_Tmptr_Source** **EGR_Flow_Source**	**EGR_Valve_Delta_Press_Source** **Engine_Delta_Press_Source** **Exhaust_Saturation_Tmptr_Source** **Fresh_Air_Flow_Source**

State	**Alpha Value**	**Decimal Value**	**Bit Mask**
SENSOR_PRIMARY	PRIMARY	0	0
SENSOR_BACKUP	BACKUP	1	1
SENSOR_DEFAULT	DEFAULT	2	2

CM870 and CM875 FAULT CODE LIST

FAULT CODE	DESCRIPTION OF FAULT	SYSTEM ERROR PARAMETER NAME	CAUSED BY: LIMIT OR FAULT CONDITION
111	Engine Control Module - critical internal failure	Powerdown_EEPROM_Checksum_Error OR RAM_Image_Word_Error	Write Error to Flash / EEPROM Data Difference between RAM versus Flash/EEPROM
111	ISM04: Engine Control Module - critical internal failure	Boost_Voltage_Supply_Error	Injector Solenoid Boost Voltage Issue
122	Boost Pressure Sensor Circuit - shorted high.	Boost_Pressure_Absolute_High_Error	Boost_Pressure_Absolute_High_Limit
123	Boost Pressure Sensor Circuit - shorted low.	Boost_Pressure_Absolute_Low_Error	Boost_Pressure_Absolute_Low_Limit
131	Accelerator Pedal Position Sensor Circuit - shorted high.	Sampled_Throttle_High_Error	Sampled_Throttle_High_Limit
132	Accelerator Pedal Position Sensor Circuit - shorted low.	Sampled_Throttle_Low_Error	Sampled_Throttle_Low_Limit
133	Remote Throttle Pedal Position Sensor Circuit - shorted high.	RT_High_Error	Remote_Throttle_High_Error
134	Remote Throttle Pedal Position Sensor Circuit - shorted low.	RT_Low_Error	Remote_Throttle_Low_Error
135	Oil Pressure Sensor Circuit - shorted high.	Oil_Pressure_High_Postprocessed_Error	Oil_Pressure_Absolute_High_Limit
141	Oil Pressure Sensor Circuit - shorted low.	Oil_Pressure_Absoute_Low_Error	Oil_Pressure_Absolute_Low_Limit
143	Oil Pressure - data below normal range.	Oil_Pressure_Torque_Error	Oil Pressure Engine Protection
144	Coolant Temperature Sensor Circuit – shorted high.	Coolant_Temperature_High_Error	Coolant_Temperature_High_Limit
145	Coolant Temperature Sensor Circuit – shorted low.	Coolant_Temperature_Low_Error	Coolant_Temperature_Low_Limit
151	Coolant Temperature - data above normal range.	Coolant_Temperature_RPM_Error	Coolant Temperature Engine Protection
153	Intake Manifold Temperature Sensor Circuit - shorted high.	Intake_Manifold_Temperature_Sensor_High_Error	Intake_Manifold_Temperature_Sensor_High_Limit
154	Intake Manifold Temperature Sensor Circuit - shorted low.	Intake_Manifold_Temperature_Sensor_Low_Error	Intake_Manifold_Temperature_Sensor_Low_Limit
155	Intake Manifold Temperature - data above normal range. Critical.	IMT_RPM_Error	IMT Engine Protection
187	Sensor Supply 2 Voltage Circuit - shorted low.	Sensor_Supply_2_Voltage_Low_Error	Sensor_Supply_2_Voltage_Low_Limit
195	Coolant Level Sensor Circuit - shorted high.	T_Coolant_Level_High_Error	Coolant_Level_High_Limit
196	Coolant Level Sensor Circuit - shorted low.	T_Coolant_Level_Low_Error	Coolant_Level_Low_Limit
197	Coolant Level Low – warning.	CLS_Low_Coolant_Error	Coolant Level Engine Protection
212	Oil Temperature Sensor Circuit - shorted high.	Oil_Temperature_High_Error	Oil_Temperature_High_Limit
213	Oil Temperature Sensor Circuit - shorted low.	Oil_Temperature_Low_Error	Oil_Temperature_Low_Limit
214	Oil Temperature - data above normal range.	Oil_Temperature_Torque_Error OR Oil_Temperature_RPM_Error	Oil Temperature Engine Protection
219	CORS Oil Level Low - Warning	CORS_Remote_Oil_Level_Low_Error	CORS_Remote_Oil_Counter > C_CORS_Remote_Oil_Counter_Max
221	Ambient Air Pressure Sensor Circuit – shorted high.	Air_Pressure_Sensor_High_Error	Air_Pressure_Sensor_High_Limit
222	Ambient Air Pressure Sensor Circuit – shorted low.	Air_Pressure_Sensor_Low_Error	Air_Pressure_Sensor_Low_Limit
223	Oil Burn Valve Solenoid – shorted high	T_CORS_Burn_Valve_Driver_PWM_Low_Control_Error	CORS PWM Output Driver Shorted HIGH

FAULT CODE	DESCRIPTION OF FAULT	SYSTEM ERROR PARAMETER NAME	CAUSED BY: LIMIT OR FAULT CONDITION
224	Oil Burn Valve Solenoid – shorted low	T_CORS_Burn_Valve_Driver_PWM_High_Control_Error	CORS PWM Output Driver Shorted LOW
227	Sensor Supply 2 Voltage Circuit - shorted low.	Sensor_Supply_2_Voltage_High_Error	Sensor_Supply_2_Voltage_High_Limit
234	ISX '04: Engine Speed - data above normal range.	ES_Overspeed_Error	Engine_Overspeed_Limit = 2650 RPM
241	Vehicle Speed Sensor Circuit - data incorrect.	VSS_Signal_Lost_Error	J1939 Tailshaft Speed Lost
242	Vehicle Speed Sensor Circuit - tampering detected.	VSS_Tampering_Error	VSS_IS_Tamper_Time
245	Fan Clutch Circuit - shorted low.	T_Fan_Clutch_1_PWM_High_Control_Error	Fan Clutch PWM Output Driver Shorted LOW
249	Ambient Air Temperature Sensor Circuit – shorted high.	T_OEM_Ambient_Air_Temperature_High_Error	Ambient_Air_Temperature_High_Limit
254	Fuel Shutoff Valve Circuit – shorted low.	FSO_PWM_High_Control_Error	Electrical Failure of FSO actuator / actuator driver
255	Fuel Shutoff Valve Circuit – shorted high.	FSO_PWM_Low_Control_Error	Electrical Failure of FSO actuator / actuator driver
256	Ambient Air Temperature Sensor Circuit – shorted low.	T_OEM_Ambient_Air_Temperature_Low_Error	Ambient_Air_Temperature_Low_Limit
259	ISX '04: Fuel Shutoff Valve – stuck open.	FSO_Stuck_Open_Error	FSOV - Fuel Pressure does not drop in gallery
259	ISM '04: Fuel Shutoff Valve – stuck open.	FSO_Stuck_Open_Error	FSOV stuck mechanically open
263	ISX '04: Fuel Temperature Sensor Circuit – shorted high	Fuel_Temperature_High_Error	Fuel_Temperature_High_Limit
265	ISX '04: Fuel Temperature Sensor Circuit – shorted low	Fuel_Temperature_Low_Error	Fuel_Temperature_Low_Limit
284	ISX '04: Engine Speed Sensor Supply Voltage – data below normal range.	Engine_Speed_Sensor_SV_Low_Error	Sensor_Supply_Monitor_A = OFF
285	SAE J1939 Multiplexing – PGN timeout error.	J1939_Mux_PGN_Timeout_Error	J1939 MUX Time-Out / Loss Of Communications
286	SAE J1939 Multiplexing – configuration error.	J1939_Mux_Configuration_Error	J1939 MUX Configuration
287	SAE J1939 Multiplexing – accelerator pedal sensor system (APS) system error	J1939_Mux_APS_System_Error	J1939 MUX Accel Throttle Pedal Sensor Error
288	SAE J1939 Multiplexing – remote throttle data error.	J1939_Mux_Remote_Throttle_Data_Error	J1939 MUX Remote Throttle Error
295	Ambient Air Pressure – data incorrect.	Air_Pressure_Keyon_Error	Key-On Pressure In-Range Check
311	ISM '04: Injector Solenoid Valve Cyl #1 Circuit – Grounded Circuit	Act1_FF_Shorted_HS_To_LS_Error	Injector Solenoid Valve Cyl #1 Shorted High Side to Low Side
312	ISM '04: Injector Solenoid Valve Cyl #5 Circuit – Grounded Circuit	Act5_FF_Shorted_HS_To_LS_Error	Injector Solenoid Valve Cyl #5 Shorted High Side to Low Side
313	ISM '04: Injector Solenoid Valve Cyl #3 Circuit – Grounded Circuit	Act3_FF_Shorted_HS_To_LS_Error	Injector Solenoid Valve Cyl #3 Shorted High Side to Low Side
314	ISM '04: Injector Solenoid Valve Cyl #6 Circuit – Grounded Circuit	Act6_FF_Shorted_HS_To_LS_Error	Injector Solenoid Valve Cyl #6 Shorted High Side to Low Side
315	ISM '04: Injector Solenoid Valve Cyl #2 Circuit – Grounded Circuit	Act2_FF_Shorted_HS_To_LS_Error	Injector Solenoid Valve Cyl #2 Shorted High Side to Low Side
319	Real Time Clock - power interrupt.	RTC_Power_Interrupt_Error	RTC_Power_Interrupt_Error_Inhibit = FALSE
321	ISM '04: Injector Solenoid Valve Cyl #4 Circuit – Grounded Circuit	Act4_FF_Shorted_HS_To_LS_Error	Injector Solenoid Valve Cyl #4 Shorted High Side to Low Side

FAULT CODE	DESCRIPTION OF FAULT	SYSTEM ERROR PARAMETER NAME	CAUSED BY: LIMIT OR FAULT CONDITION
322	ISM '04: Injector Solenoid Valve Cyl #1 Circuit – Open Circuit	Act1_FF_Circuit_Open_Error OR Act1_FF_Shorted_HS_To_Ground_Error OR Act1_FF_Loss_of_Boost_Voltage_Error OR Act1_FF_Fault_Catch_All_Error OR Act1_FF_HW_Command_Stuck_On_Error OR Act1_FF_HW_Command_Stuck_Off_Error OR Act1_FF_SW_Command_Stuck_Error OR Act1_FF_Mode_Error	Injector Solenoid Valve Cyl#1 Open Circuit
323	ISM '04: Injector Solenoid Valve Cyl #5 Circuit – Open Circuit	Act5_FF_Circuit_Open_Error OR Act5_FF_Shorted_HS_To_Ground_Error OR Act5_FF_Loss_of_Boost_Voltage_Error OR Act5_FF_Fault_Catch_All_Error OR Act5_FF_HW_Command_Stuck_On_Error OR Act5_FF_HW_Command_Stuck_Off_Error OR Act5_FF_SW_Command_Stuck_Error OR Act5_FF_Mode_Error	Injector Solenoid Valve Cyl#5 Open Circuit
324	ISM '04: Injector Solenoid Valve Cyl #3 Circuit – Open Circuit	Act3_FF_Circuit_Open_Error OR Act3_FF_Shorted_HS_To_Ground_Error OR Act3_FF_Loss_of_Boost_Voltage_Error OR Act3_FF_Fault_Catch_All_Error OR Act3_FF_HW_Command_Stuck_On_Error OR Act3_FF_HW_Command_Stuck_Off_Error OR Act3_FF_SW_Command_Stuck_Error OR Act3_FF_Mode_Error	Injector Solenoid Valve Cyl#3 Open Circuit
325	ISM '04: Injector Solenoid Valve Cyl #6 Circuit – Open Circuit	Act6_FF_Circuit_Open_Error OR Act6_FF_Shorted_HS_To_Ground_Error OR Act6_FF_Loss_of_Boost_Voltage_Error OR Act6_FF_Fault_Catch_All_Error OR Act6_FF_HW_Command_Stuck_On_Error OR Act6_FF_HW_Command_Stuck_Off_Error OR Act6_FF_SW_Command_Stuck_Error OR Act6_FF_Mode_Error	Injector Solenoid Valve Cyl#6 Open Circuit
331	ISM '04: Injector Solenoid Valve Cyl #2 Circuit – Open Circuit	Act2_FF_Circuit_Open_Error OR Act2_FF_Shorted_HS_To_Ground_Error OR Act2_FF_Loss_of_Boost_Voltage_Error OR Act2_FF_Fault_Catch_All_Error OR Act2_FF_HW_Command_Stuck_On_Error OR Act2_FF_HW_Command_Stuck_Off_Error OR Act2_FF_SW_Command_Stuck_Error OR Act2_FF_Mode_Error	Injector Solenoid Valve Cyl#2 Open Circuit

FAULT CODE	DESCRIPTION OF FAULT	SYSTEM ERROR PARAMETER NAME	CAUSED BY: LIMIT OR FAULT CONDITION
332	ISM '04: Injector Solenoid Valve Cyl #4 Circuit – Open Circuit	Act4_FF_Circuit_Open_Error OR Act4_FF_Shorted_HS_To_Ground_Error OR Act4_FF_Loss_of_Boost_Voltage_Error OR Act4_FF_Fault_Catch_All_Error OR Act4_FF_HW_Command_Stuck_On_Error OR Act4_FF_HW_Command_Stuck_Off_Error OR Act4_FF_SW_Command_Stuck_Error OR Act4_FF_Mode_Error	Injector Solenoid Valve Cyl#4 Open Circuit
338	Idle Shutdown Vehicle Accessories Relay Driver – shorted high.	T_Idle_Shutdown_Driver_PWM_Low_Control_Error	Idle Shutdown PWM Output Driver Shorted HIGH
339	Idle Shutdown Vehicle Accessories Relay Driver – shorted low.	T_Idle_Shutdown_Driver_PWM_High_Control_Error	Idle Shutdown PWM Output Driver Shorted LOW
341	Engine Control Module – data lost.	All_Powerdown_Data_Lost_Error	Invalid Data within Parameter Blocks
343	Engine Control Module – warning internal hardware failure.	Poweroff_Command_Ignored_Error	Poweroff_Command_Ignored = TRUE
352	Sensor Supply 1 Voltage Circuit - shorted low.	Sensor_Supply_1_Voltage_Low_Error	Sensor_Supply_1_Voltage_Low_Limit
359	Engine Failed to Start.	ES_Auto_Start_Error	ICON Auto Start Error
386	Sensor Supply 1 Voltage Circuit - shorted high.	Sensor_Supply_1_Voltage_High_Error	Sensor_Supply_1_Voltage_High_Limit
387	Accelerator Pedal Sensor Supply Voltage Circuit – shorted high.	Throttle_Sensor_Supply_Voltage_High_Error	Throttle_Sensor_Supply_Voltage_High_Limit
415	Oil Pressure - data indicates very low oil pressure.	Oil_Pressure_RPM_Error	Oil Pressure Engine Protection
418	Water Detected In Fuel.	Water_In_Fuel_Error	Water_In_Fuel = WATER_IN_FUEL (2)
428	Water In Fuel Sensor Circuit – shorted high.	Water_In_Fuel_Postprocessed_High_Error	Water_In_Fuel_High_Limit
429	Water In Fuel Sensor Circuit – shorted low.	Water_In_Fuel_Postprocessed_Low_Error	Water_In_Fuel_Low_Limit
431	Accelerator Pedal Idle Validation Circuit - data incorrect.	Throttle_Validation_Switch_Low_Error	Idle_Switch and Not_Idle_Switch are ACTIVE
432	Accelerator Pedal Idle Validation Circuit - out of calibration.	Throttle_Validation_Process_Error	Idle_Switch and Not_Idle_Switch Invalid Input
433	Boost Pressure – data incorrect. (In-Range High Error)	Charge_Pressure_Keyon_Error	Key-On Pressure In-Range Check
434	Power Lost Without Ignition Off.	Powerdown_Data_Lost_Error	Power Loss Before Powerdown Data Saved
435	Oil Pressure - data incorrect.	Oil_Pressure_Keyon_Error	Key-On Pressure In-Range Check
443	Accelerator Pedal Sensor Supply Voltage Circuit 0 – shorted low.	Throttle_Sensor_Supply_Voltage_Low_Error	Throttle_Sensor_Supply_Voltage_Low_Limit
449	ISX '04: Fuel Pressure High - warning.	Fuel_Supply_Pressure_High_Error	FPM_lp_HighThreshold_c
482	ISX '04: Fuel Pressure Low - warning.	Fuel_Supply_Pressure_Low_Error	FPM_lp_LowThreshold_c
486	ISX '04: Injector Metering Rail #2 Pressure Low – warning.	Fuel_Error_Rear_Underfuel_Error	Uncontrolled Underfueling in Rear Bank
546	ISX '04: Fuel Delivery Pressure Sensor Circuit – shorted high.	Fuel_Rail_Pressure_High_Error	Fuel_Rail_Pressure_High_Limit
547	ISX '04: Fuel Delivery Pressure Sensor Circuit – shorted low.	Fuel_Rail_Pressure_Low_Error	Fuel_Rail_Pressure_Low_Limit
551	Accelerator Pedal Idle Validation Circuit – shorted low.	Throttle_Validation_Switch_High_Error	Idle_Switch and Not_Idle_Switch are INACTIVE
559	ISX '04: Injector Metering Rail #1 Pressure Low - warning.	Fuel_Error_Front_Underfuel_Error	Uncontrolled Underfueling in Front Bank
584	Starter Relay Circuit – shorted high	T_Starter_Lockout_Driver_PWM_Low_Control_Error	Starter Relay PWM Driver circuit – shorted HIGH
585	Starter Relay Circuit – shorted low	T_Starter_Lockout_Driver_PWM_High_Control_Error	Starter Relay PWM Driver circuit – shorted LOW

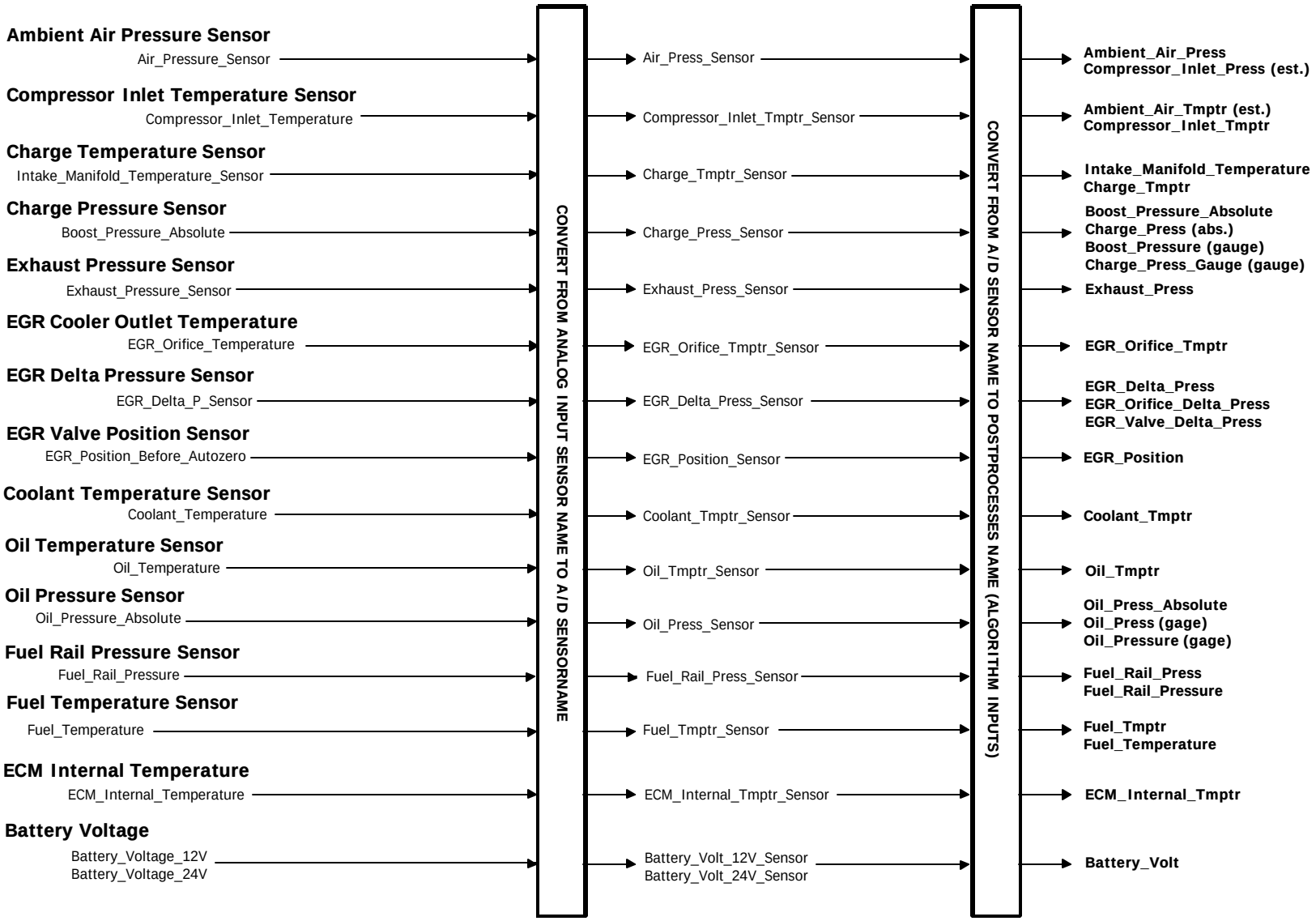
FAULT CODE	DESCRIPTION OF FAULT	SYSTEM ERROR PARAMETER NAME	CAUSED BY: LIMIT OR FAULT CONDITION
595	Turbocharger #1 Speed High - warning.	AH_Fuel_Derate_Latch_Error OR Turbo_Speed_High_Error	Turbo Speed above set limit: Turbo_Speed_High_Limit
596	Electrical Charging System Voltage High - warning.	AFW_High_Voltage_Error	AFW_12V[24V]_High_Voltage
597	Electrical Charging System Voltage Low - warning.	AFW_Low_Voltage_Error	AFW_12V[24V]_Low_Voltage
598	Electrical Charging System Voltage Low – critical.	AFW_Very_Low_Volts_Error	AFW_12V[24V]_Very_Low_Voltage
649	Change Lubricating Oil and Filter – maintenance	OCM_Interval_Warning_Error	OCM_Warning_Percent
687	Turbocharger #1 Speed Low - warning.	Turbo_Speed_Low_Error	Turbo_Speed_Low_Limit
689	Primary Engine Speed Sensor Error	EPS_Main_No_Sync_Error	Incorrect Tooth count since last tooth sync EPS_Main_Sync_State = NO_SYNC
689	ISX '04: Primary Engine Speed Sensor Error	EPS_Main_No_Pulse_Error	No signal from Primary (Crank) ESS EPS_Main_Sync_State = NO_PULSE
689	ISM '04: Primary Engine Speed Sensor Error	EPS_Main_Lost_Sync_Error	Main channel has lost sync
691	Compressor Inlet Temperature Sensor Circuit – shorted high	Compressor_Inlet_Temperature_High_Error	Compressor_Inlet_Temperature_High_Limit
692	Compressor Inlet Temperature Sensor Circuit – shorted low	Compressor_Inlet_Temperature_Low_Error	Compressor_Inlet_Temperature_Low_Limit
731	ISX '04: Engine Speed/Position #2 - mechanical misalignment between CAM and CRANK sensors.	EPS_Phase_Shift_Error	Phase between Cam and Crank EPS has deviated beyond calibration limits
778	Secondary Engine Position Sensor Error	EPS_Backup_No_Sync_Error	Incorrect Tooth count since last tooth sync EPS_Backup_Sync_State = NO_SYNC
778	ISX '04: Secondary Engine Position Sensor Error	EPS_Backup_No_Pulse_Error	No signal from Backup EPS EPS_Backup_Sync_State = NO_PULSE
778	ISM '04: Secondary Engine Position Sensor Error	EPS_Backup_Lost_Sync_Error	Backup channel has lost sync
784	Adaptive Cruise Control – loss of communication.	Adaptive_Cruise_Control_Error	Adaptive Cruise Control (EATON VORAD) Error
951	Power Imbalance Between Cylinders Detected.	CBD_Trim_Limit_Error	CBD can no longer adjust balance to cylinders
1119	Engine Coolant Temperature – Data Valid but Above Normal Operating Range	EMO_Extreme_Amb_AECD_Indicator	Coolant_Tmptr above the threshold C_EMO_Extreme_Amb_AECD_On_Thd (ISM '04 = 216F, ISX1 & 2 '04 = 230F, ISX3 '04 = 235F)
1137	Hall effect speed sensors connected incorrectly – condition exists	EPS_Sensor_Swapped_Error	Hall effect speed sensors connected incorrectly
1228	EGR Valve Position – Position Rate exceeds limit	EGR_Position_Rate_Error	C_EGR_Position_Rate_Thd (7.00%)
2271	Exhaust Gas Recirculation Valve Position Circuit - shorted high.	EGR_Position_Before_Autozero_High_Error	EGR_Position_Before_Autozero_High_Limit
2272	Exhaust Gas Recirculation Valve Position Circuit - shorted low.	EGR_Position_Before_Autozero_Low_Error	EGR_Position_Before_Autozero_Low_Limit
2273	Exhaust Gas Recirculation Valve Delta Pressure - shorted high.	EGR_Delta_P_Sensor_High_Error OR EGR_Orifice_Delta_Pressure_High_Error	EGR_Delta_P_Sensor_High_Limit EGR_Orifice_Delta_Pressure_High_Limit
2274	Exhaust Gas Recirculation Valve Delta Pressure - shorted low.	EGR_Delta_P_Sensor_Low_Error OR EGR_Orifice_Delta_Pressure_Low_Error	EGR_Delta_P_Sensor_Low_Limit EGR_Orifice_Delta_Pressure_Low_Limit
2311	ISX '04: Fueling Actuator #1 Circuit – open/grounded	Front_Fueling_Actuator_Impaired_Error OR Front_Fueling_Actuator_Severe_Error	Electrical Failure of Front Fueling Actuator / Actuator Driver
2312	ISX '04: Timing Actuator #1 Circuit – open/grounded	Front_Timing_Actuator_Impaired_Error OR Front_Timing_Actuator_Severe_Error	Electrical Failure of Front Timing Actuator / Actuator Driver
2313	ISX '04: Fueling Actuator #2 Circuit – open/grounded	Rear_Fueling_Actuator_Impaired_Error OR Rear_Fueling_Actuator_Severe_Error	Electrical Failure of Rear Fueling Actuator / Actuator Driver

FAULT CODE	DESCRIPTION OF FAULT	SYSTEM ERROR PARAMETER NAME	CAUSED BY: LIMIT OR FAULT CONDITION
2314	ISX '04: Timing Actuator #2 Circuit – open/grounded	Rear_Timing_Actuator_Impaired_Error OR Rear_Timing_Actuator_Severe_Error	Electrical Failure of Rear Timing Actuator / Actuator Driver
2321	ISX '04: Primary Engine Speed Sensor Intermittent Error	EPS_Main_Intermittent_Sync	Main EPS Sensor Intermittent Sync Error
2346	Turbine Inlet Temperature (calc.) – data above normal range.	Exhaust_Metal_Tmptr_Torque_Error OR Exhaust_Metal_Tmptr_RPM_Error	Exhaust Temperature Engine Protection; least severe
2347	Compressor Outlet Temperature (calc.) - data above normal range.	COT_Torque_Error OR COT_RMP_Error	Compressor Outlet Temperature Engine Protection; Least severe
2348	EGR Valve Position – failed automatic calibration procedure (autozero)	EGR_Valve_Autozero_Error	C_EGR_Position_AZ_Tolerence
2349	EGR Output Circuit – shorted high or open	EGA_Fault_HB1A OR EGA_Fault_HB1B	EGR Valve H-Bridge Circuit Fault
2351	EGR Output Circuit – shorted low	EGA_Fault_HB1_OC_HI	EGR Valve H-Bridge Circuit Fault – Overcurrent
2352	EGR Output Circuit – shorted high	EGA_Fault_HB1_OC_LO	EGR Valve H-Bridge Circuit Fault – Overcurrent
2353	EGR Output Circuit – excessive current detected	EGA_Fault_HB1_Inrush	EGR Valve H-Bridge Circuit Fault – High Current
2357	EGR Valve Control – EGR Motor Overcurrent detected; Mechanical System not responding properly or out of adjustment	EGA_Driver_OC_Fault	C_EGA_Driver_OC_Threshold
2359	EGR Valve Delta Pressure – data valid but above normal operating range EGR Valve Delta Pressure – Key-on Pressure check In-Range diagnostics	EGR_Delta_P_Autozero_Error OR EGR_DP_IR_Open_Error OR EGR_DP_IR_Closed_Error	C_EGR_Delta_P_AZ_Tolerence C_EGR_DP_IR_Startup_Pos_Thd C_EGR_DP_IR_Startup_Press_Thd
2362	Engine Brake Actuator Circuit #1 – shorted low	EB_Drv_1_PWM_High_Control_Post_Processing_Error	Engine Brake PWM Output Driver #1 short LOW
2363	Engine Brake Actuator Circuit #2 – shorted low	EB_Drv_2_PWM_High_Control_Post_Processing_Error	Engine Brake PWM Output Driver #2 short LOW
2365	ISX '04: Engine Brake Actuator Circuit #3 – shorted low	EB_Drv_3_PWM_High_Control_Post_Processing_Error	Engine Brake PWM Output Driver #3 short LOW
2366	Engine Brake Actuator Circuit #1 – shorted high	EB_Drv_1_PWM_Low_Control_Post_Processing_Error	Engine Brake PWM Output Driver #1 short HIGH
2367	Engine Brake Actuator Circuit #2 – shorted high	EB_Drv_2_PWM_Low_Control_Post_Processing_Error	Engine Brake PWM Output Driver #2 short HIGH
2368	ISX '04: Engine Brake Actuator Circuit #3 – shorted high	EB_Drv_3_PWM_Low_Control_Post_Processing_Error	Engine Brake PWM Output Driver #3 short HIGH
2372	ISX '04: Fuel Filter Restriction Sensor Circuit – Warning Level	Prs_Fuel_Filter_Clogged_Error	Triggered at High Engine Speed/low load (i.e. large fuel flow) and low fuel pressure. 482 is triggered at low engine speed and low fuel pressure
2373	Exhaust Pressure Sensor – Shorted High	Exhaust_Pressure_Sensor_High_Error	Exhaust_Pressure_Sensor_High_Limit
2374	Exhaust Pressure Sensor Circuit – Shorted Low	Exhaust_Pressure_Sensor_Low_Error	Exhaust_Pressure_Sensor_Low_Limit
2375	EGR Orifice Temperature (ERT) Sensor Circuit – Shorted High	EGR_Orifice_Temperature_High_Error	EGR_Orifice_Temperature_High_Limit
2376	EGR Orifice Temperature (ERT) Sensor Circuit – Shorted Low	EGR_Orifice_Temperature_Low_Error	EGR_Orifice_Temperature_Low_Limit
2377	Fan Clutch Circuit – shorted high	T_Fan_Clutch_1_PWM_Low_Control_Error	Fan Clutch PWM Output Driver Shorted HIGH
2384	Variable Geometry Turbo Output Device Driver – shorted low	T_VGT_Actuator_Pneumatic_High_Control_Error OR VGT_Actuator_Pneumatic_Power_High_Control_Error	Herion Valve shorted low
2385	Variable Geometry Turbo Output Device Driver – shorted high	T_VGT_Actuator_Pneumatic_Low_Control_Error OR VGT_Actuator_Pneumatic_Power_Low_Control_Error	Herion Valve shorted high
2551	ISX '04: Injector Metering Rail #2 Pressure High – data valid but above normal operating range; moderately severe	Fuel_Error_Rear_Overfuel_Error	Uncontrolled Overfueling in Rear Bank

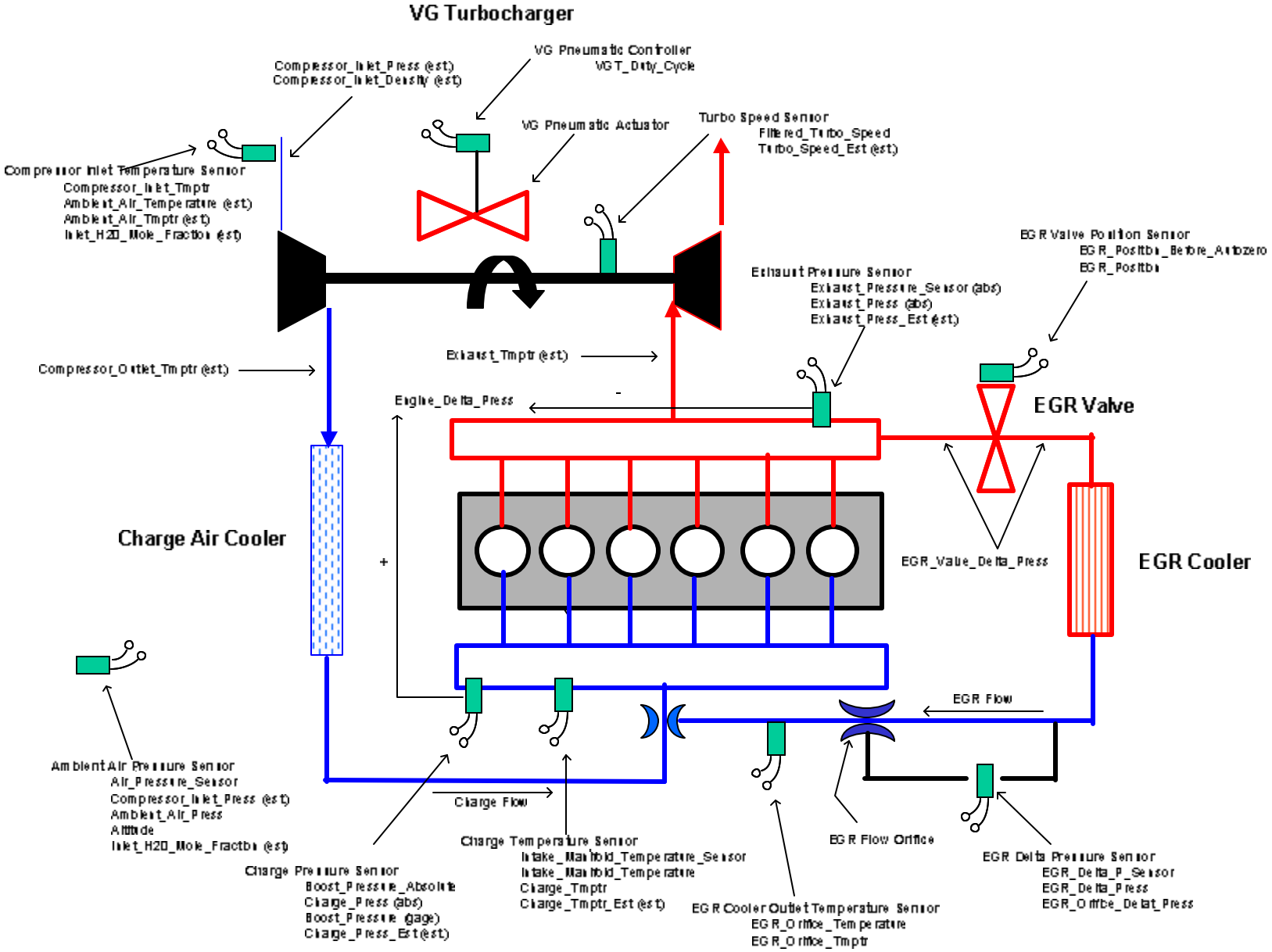
FAULT CODE	DESCRIPTION OF FAULT	SYSTEM ERROR PARAMETER NAME	CAUSED BY: LIMIT OR FAULT CONDITION
2552	ISX '04: Injector Metering Rail #1 Pressure High – data valid but above normal operating range; moderately severe	Fuel_Error_Front_Overfuel_Error	Uncontrolled Overfueling in Front Bank
2554	Exhaust Pressure Sensor Circuit – Data Invalid	Exhaust_Pressure_Keyon_Error OR Exhaust_Press_IR_Low_Error	Key-On Pressure In-Range Check OR Exhaust_Press_Sensor <= C_Exhaust_Press_IR_Low_Thd while other engine conditions are met
2961	EGR Orifice Temperature – Data above normal range	EGR_Orifice_Tmptr_Torque_Error OR CHH_EGRT_Over_Temperature	EGR Orifice Temperature (ERT) Engine Protection C_CHH_EGRT_Disable_Thd
2962	EGR Orifice Temperature – Data above normal range - Critical	EGR_Orifice_Tmptr_RPM_Error	EGR Orifice Temperature (ERT) Engine Protection
2963	Coolant Temperature – Data Above Normal Range	Coolant_Temperature_Torque_Error	Coolant Temperature Engine Protection
2964	Intake Manifold Temperature – Data Above Normal Range	IMT_Torque_Error	IMT Engine Protection
2973	Intake Manifold Pressure Sensor Circuit – Data Incorrect	Charge_Press_IR_Error	Charge Pressure In-Range Error Detection
9121	EGR Valve Actuator Over Temp (Calculated)	EGA_Over_Temerature	EGA_Temperature > C_EGA_Tmptr_High_Threshold (356F)

A/D Sensor Input System Name Configuration:

ANALOG TO DIGITAL (A/D) SENSOR INPUT SYSTEM NAME CONFIGURATION

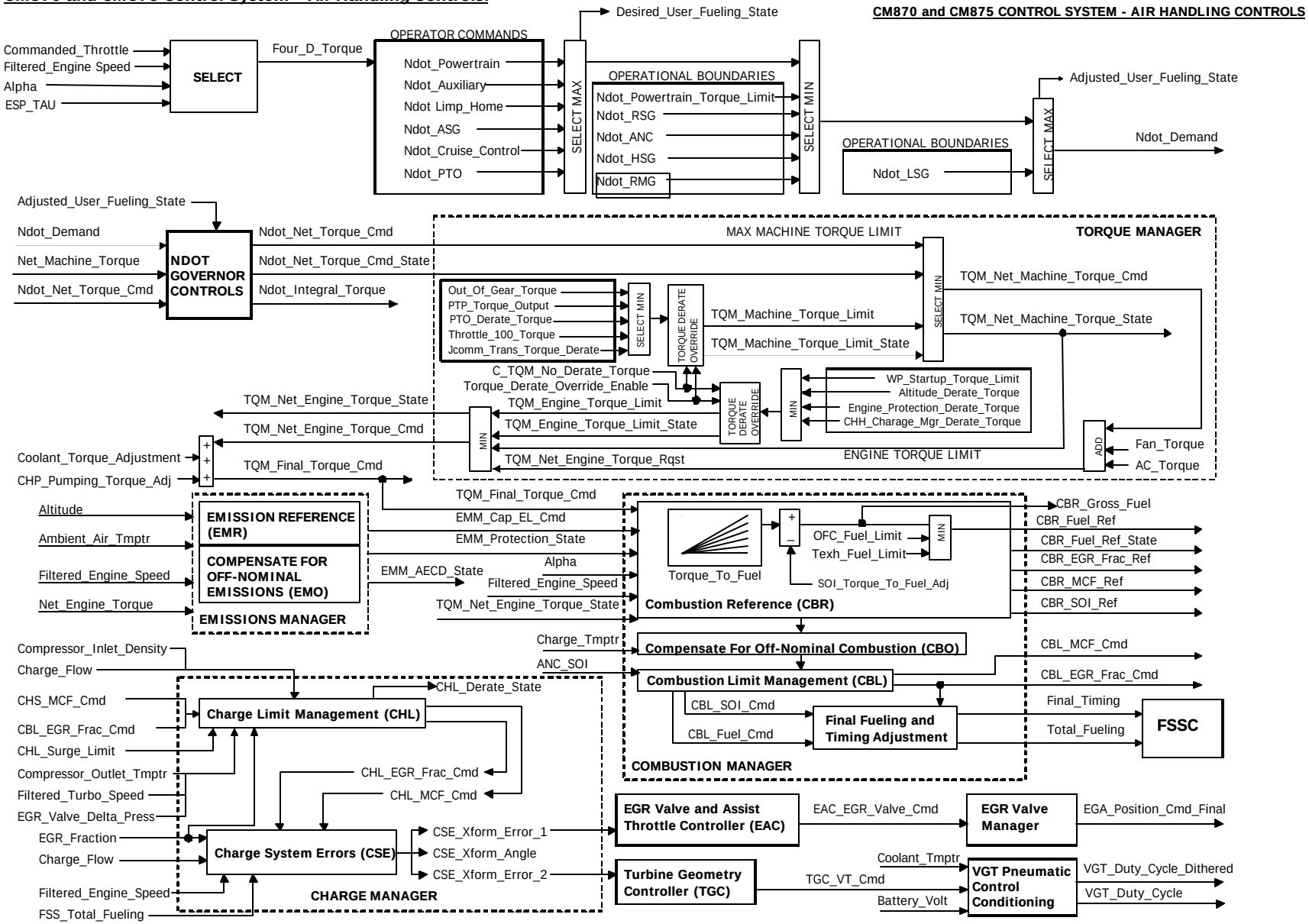


Air Handling Control System Overview:

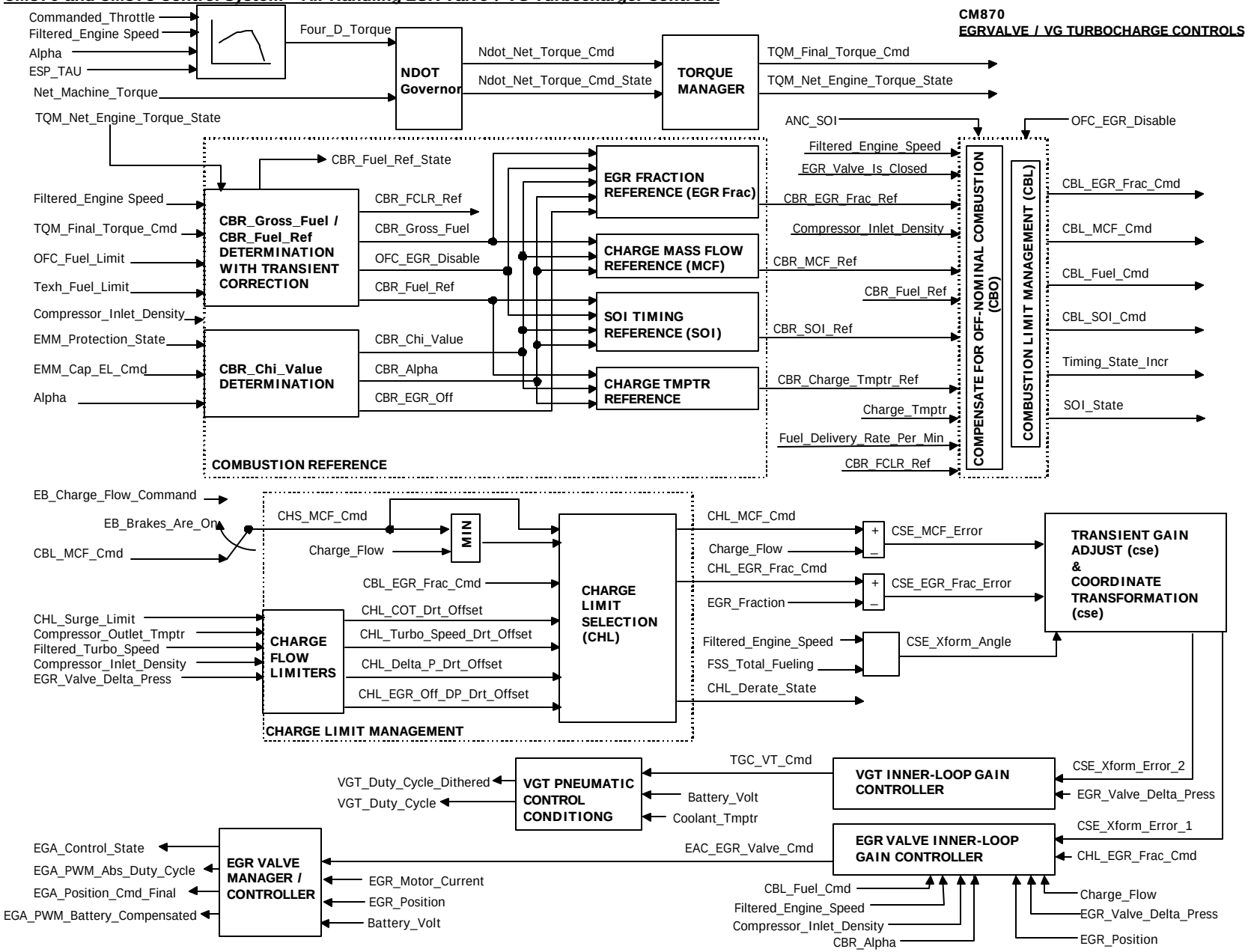


CM870 and CM875 CONTROL SYSTEM DIAGRAMS

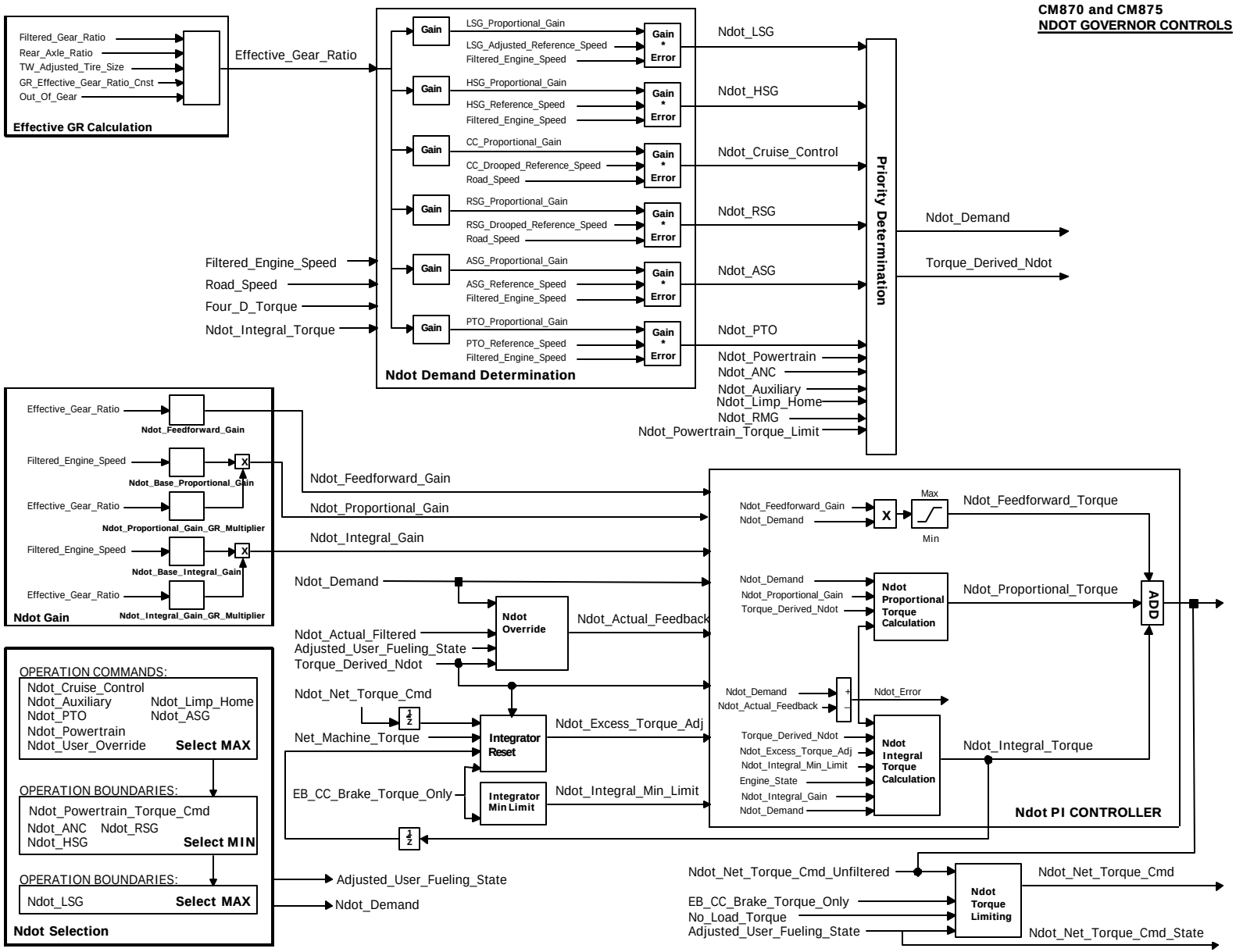
CM870 and CM875 Control System – Air Handling Controls:



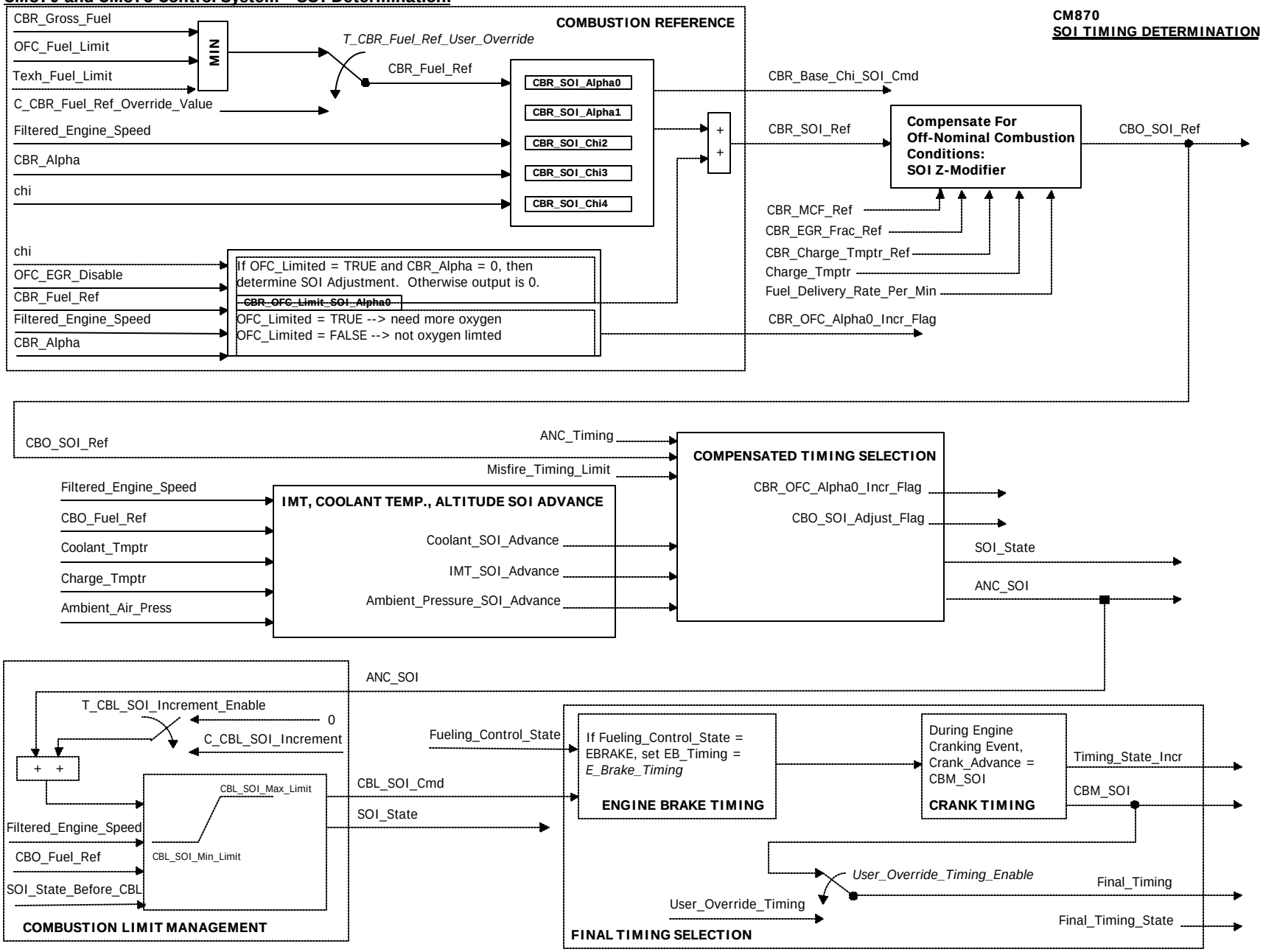
CM870 and CM875 Control System – Air Handling EGR Valve / VG Turbocharger Controls:



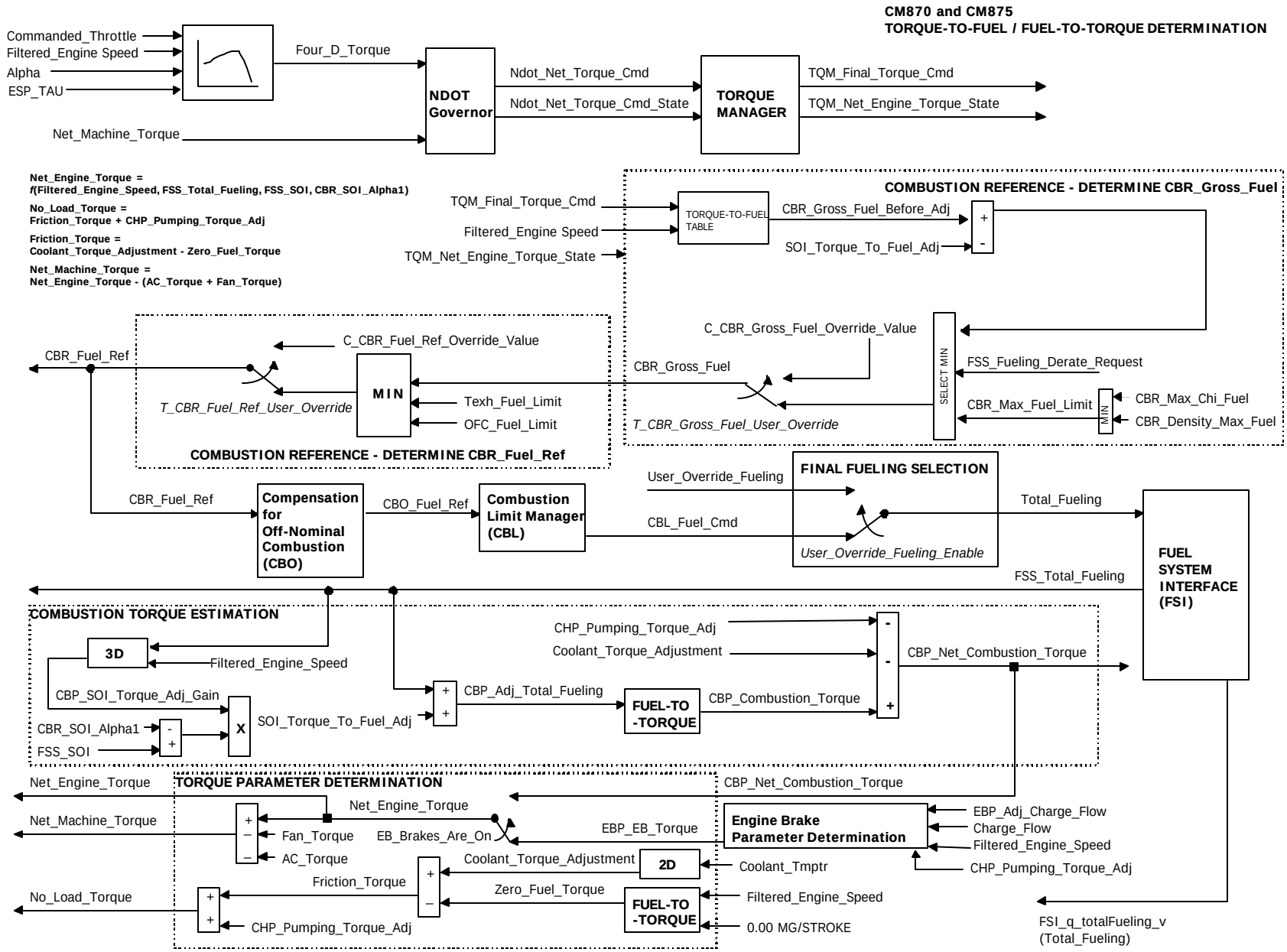
CM870 and CM875 Control System – Ndot Governor Controls:



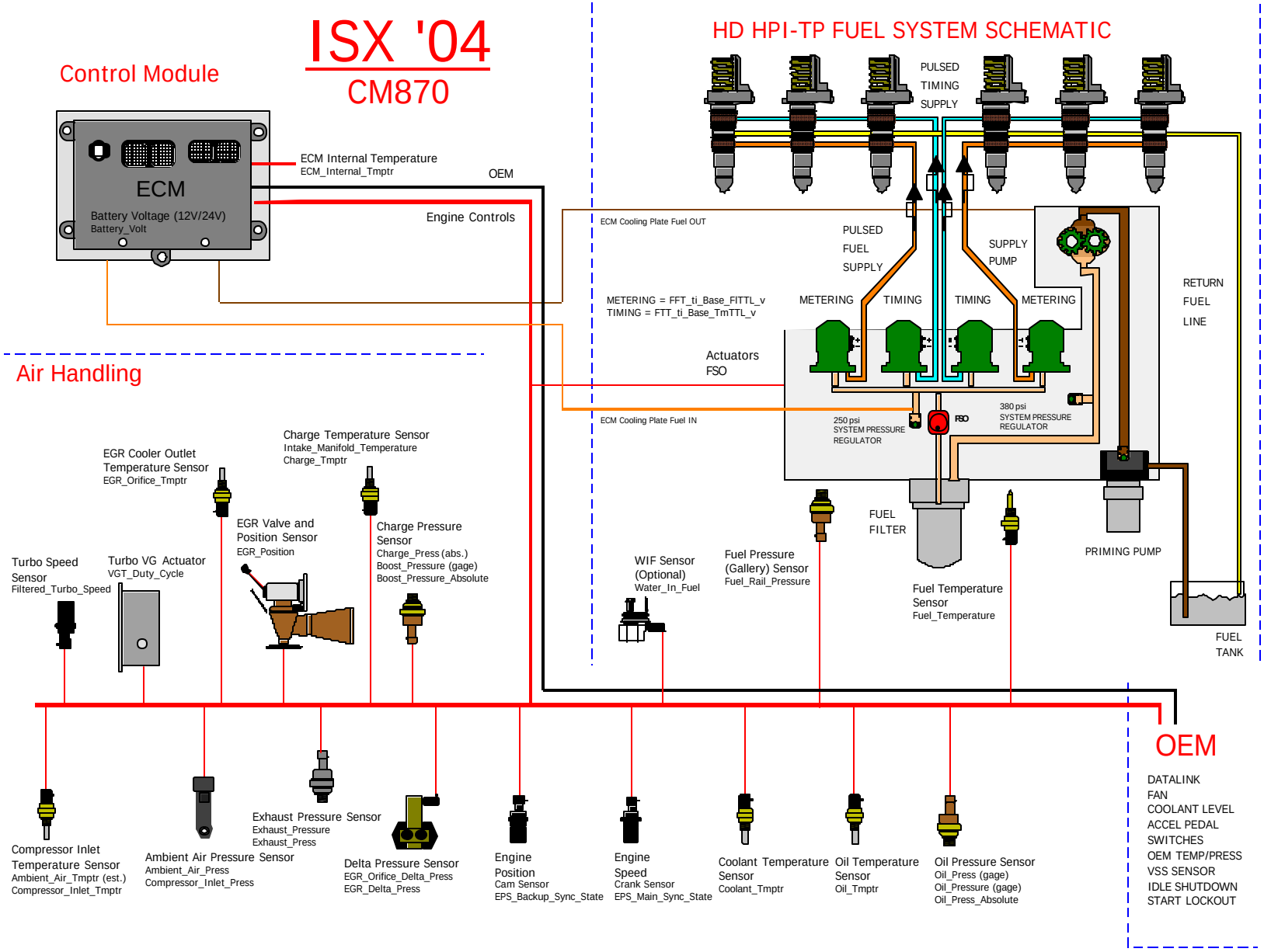
CM870 and CM875 Control System – SOI Determination:



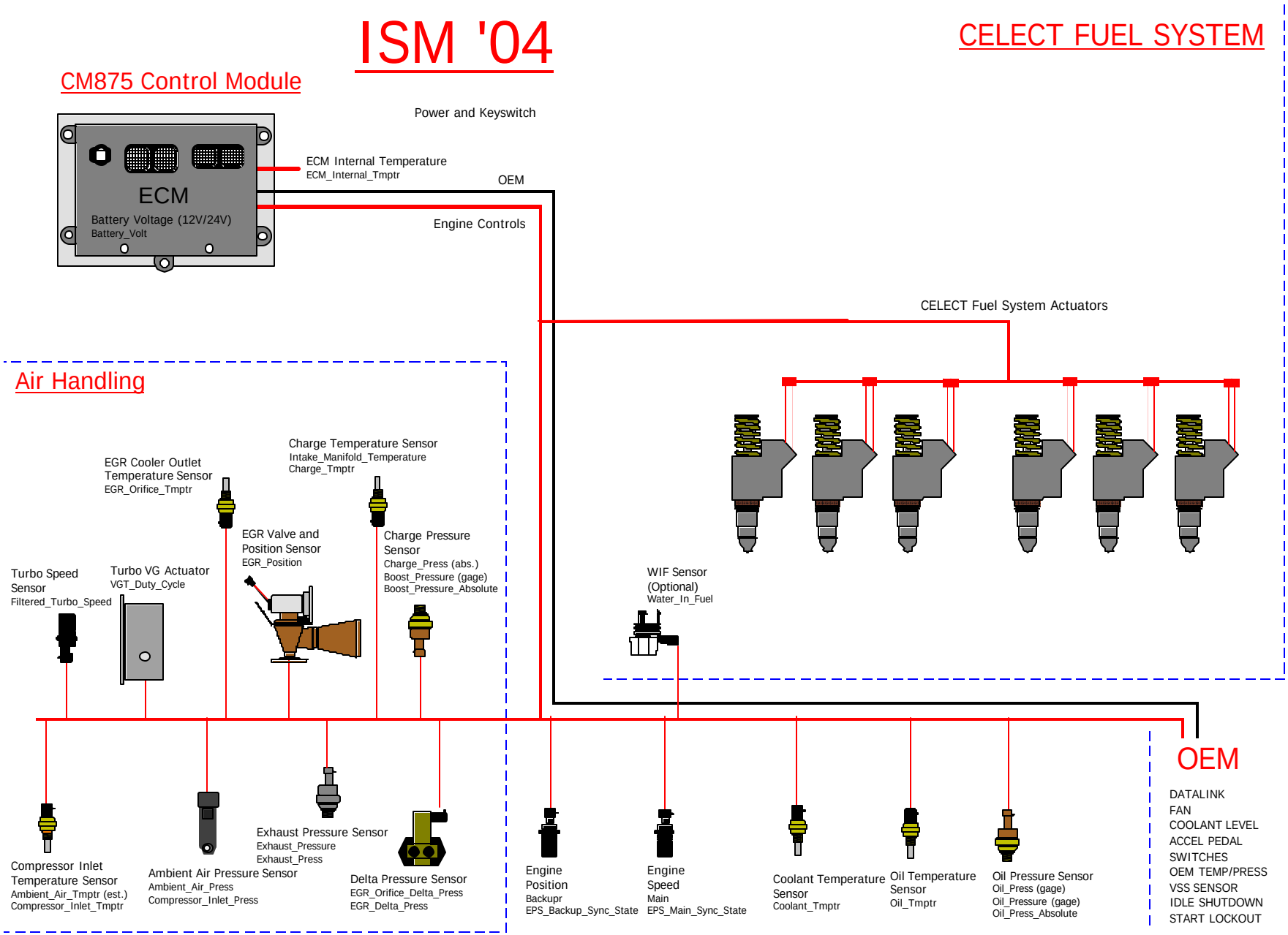
CM870 and CM875 Control System – Torque To Fuel Determination:



CM870 Sensor Interfaces- ISX '04:



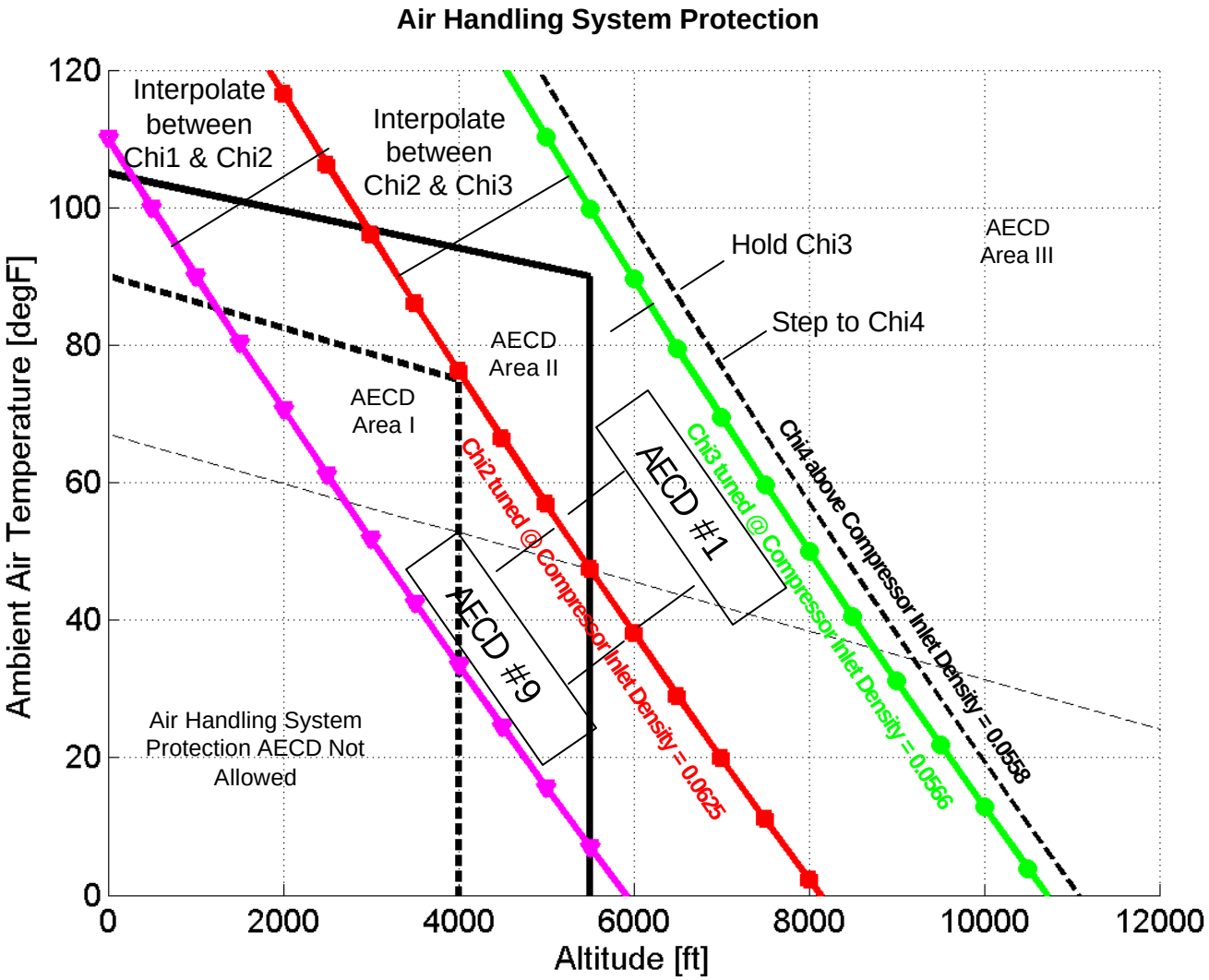
CM875 Sensor Interfaces - ISM '04:



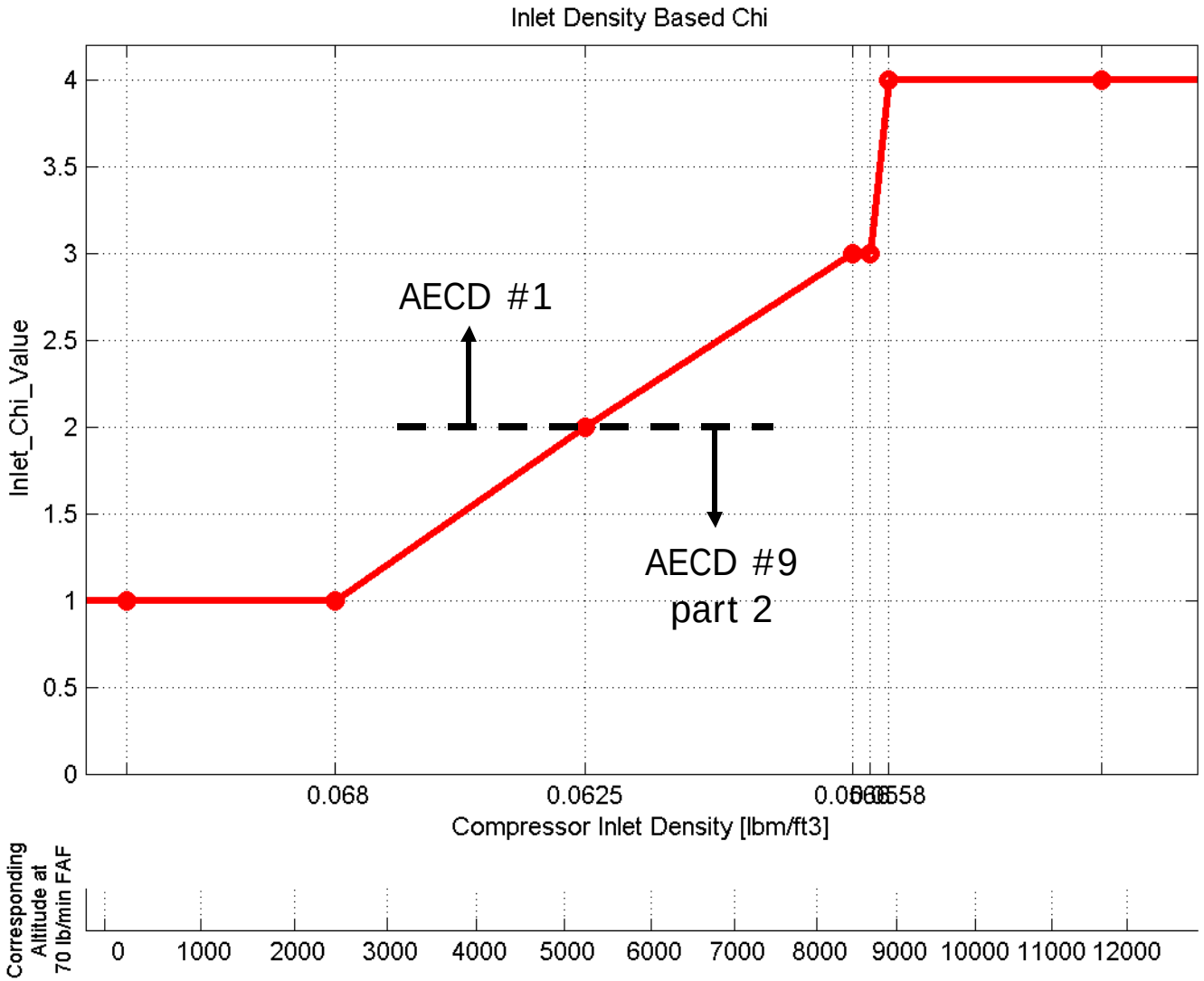
AECD and CHI Determination

Ambient Operating Conditions – Chi Value Determination – ISX '04 and ISM '04:

AECD #1,#9

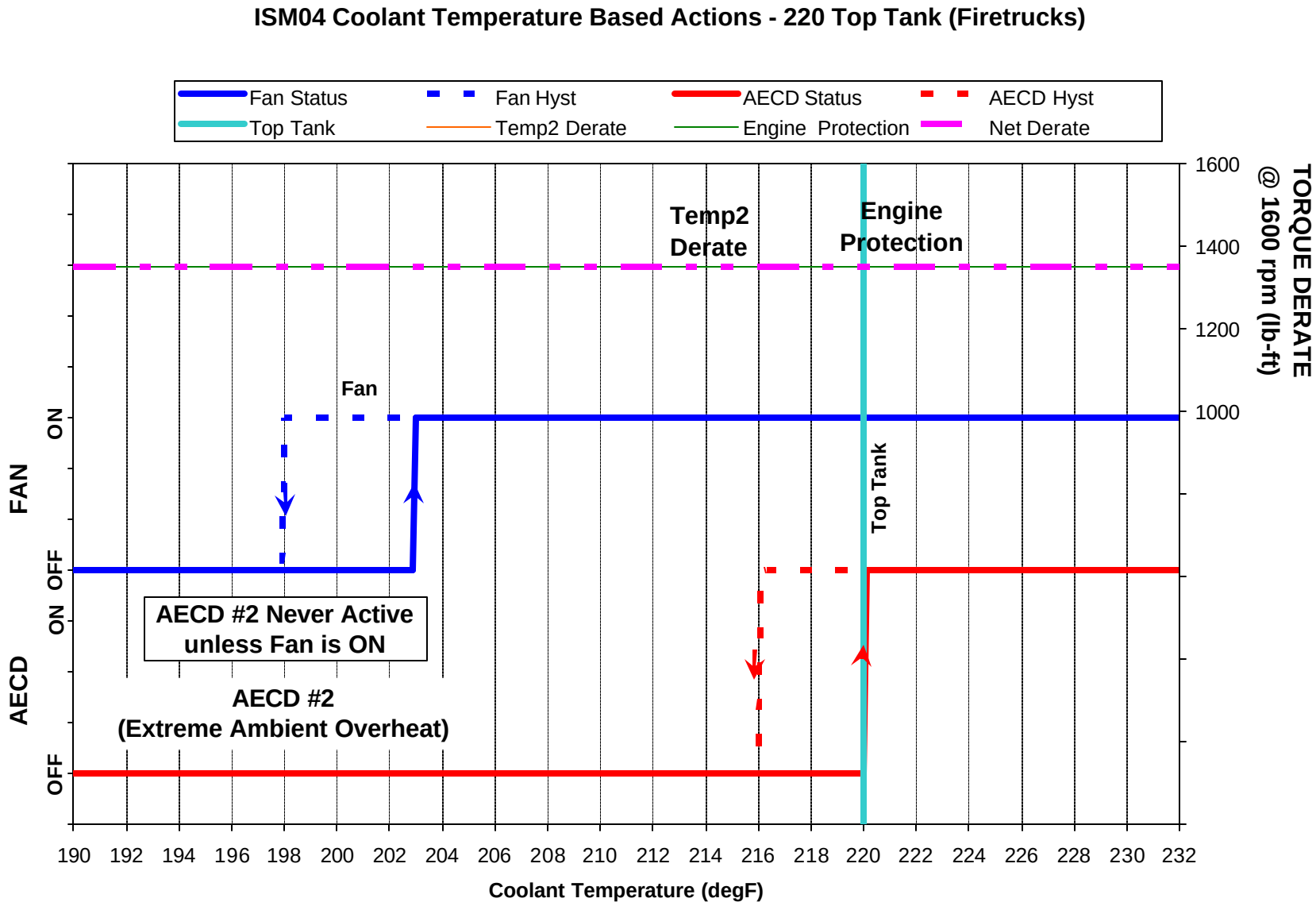


Inlet Density Chi – Chi Value Determination – ISX '04 and ISM '04:



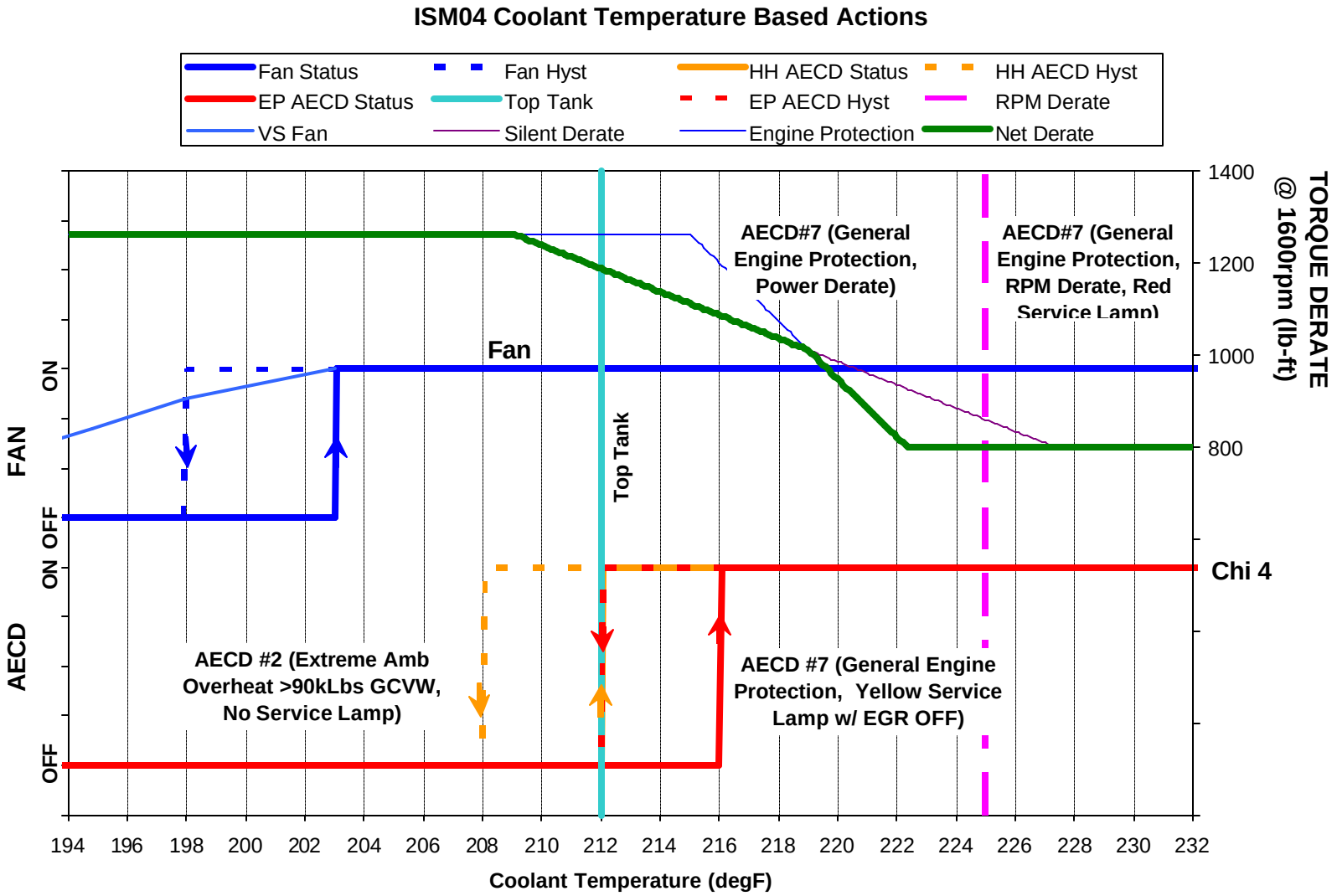
Temperature Based Actions

Coolant Temperature Based Actions – ISM '04 Emergency Vehicle:

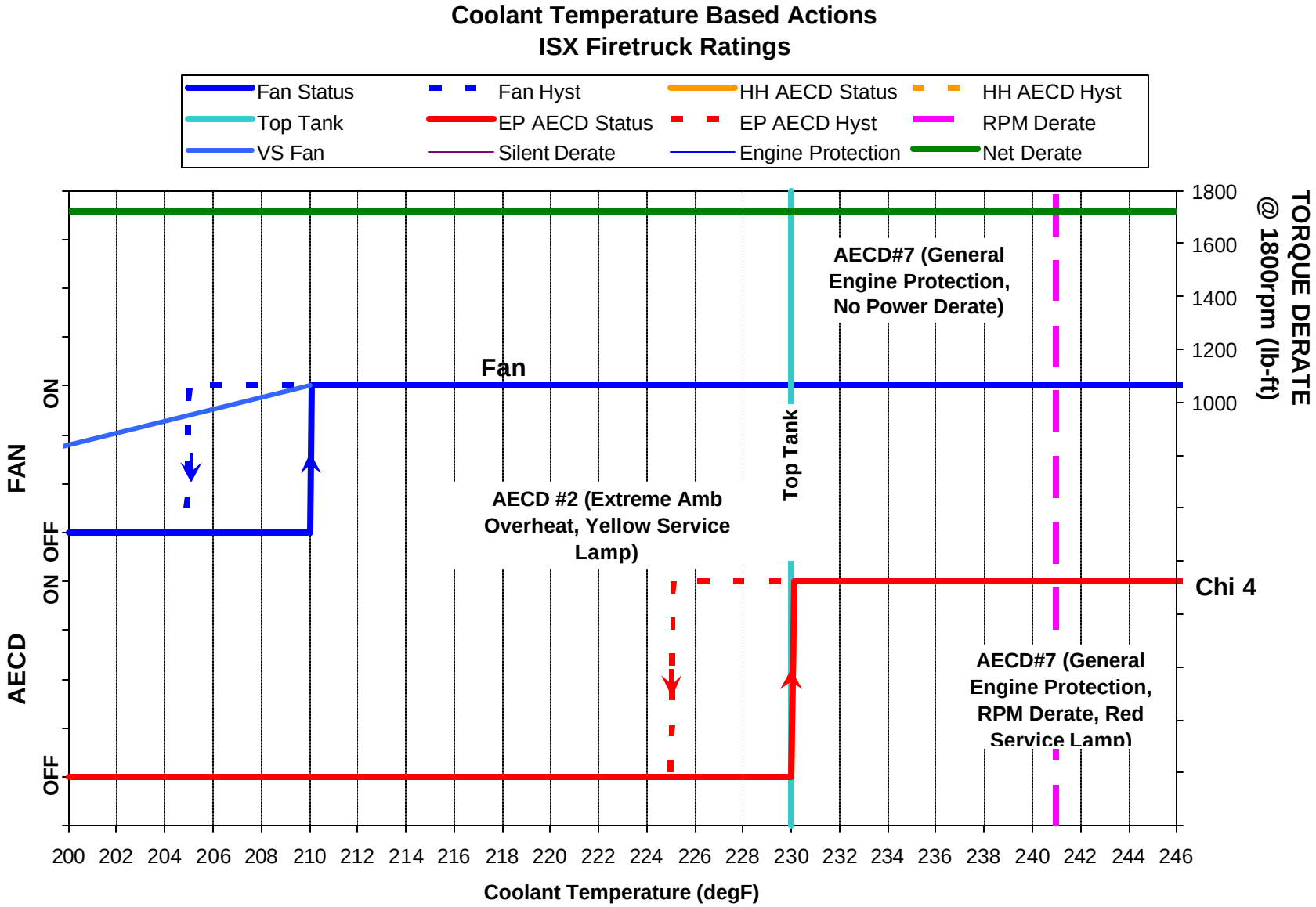


Coolant Temperature Based Actions – ISM '04 Automotive, Ubus, and RV:
(HH = Heavy Haul)

AECD #2

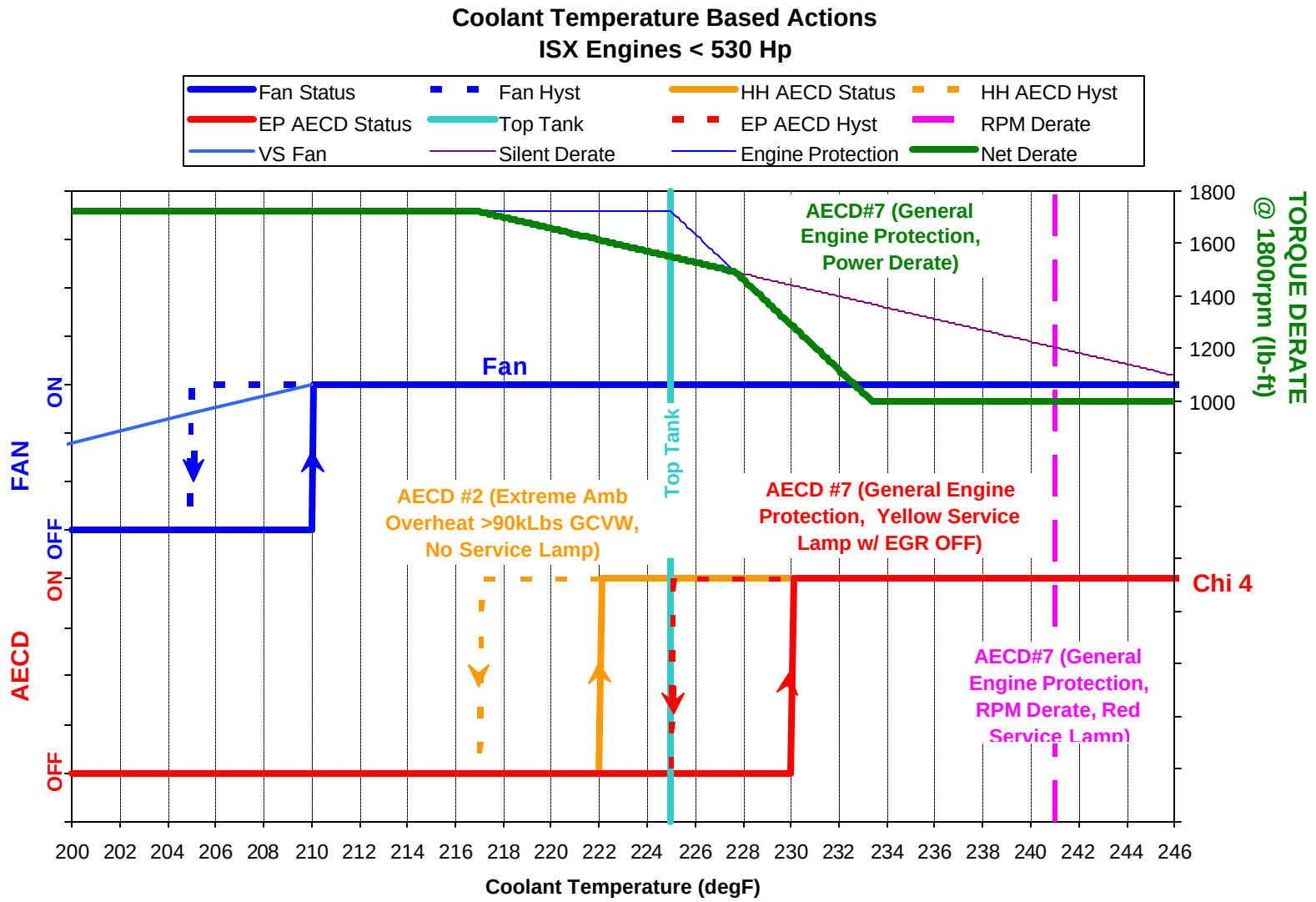


Coolant Temperature Based Actions – ISX '04 Emergency Vehicle:
(Heavey Haul (HH) AECD Status and Hysteresis are the same as Engine Protection (EP) AECD Status and Hysteresis for Firetruck)



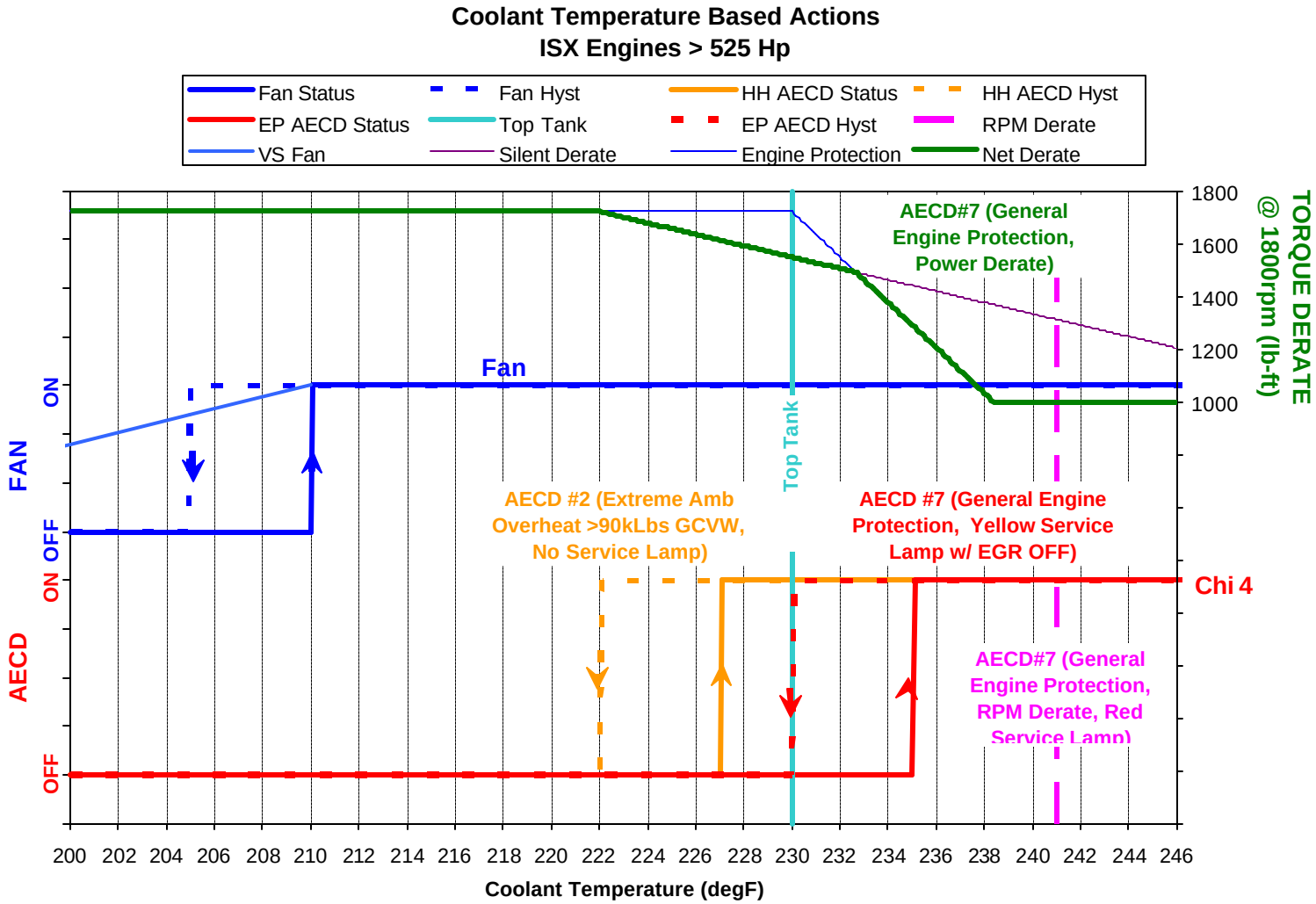
Coolant Temperature Based Actions – ISX '04 < 530 hp Automotive:
(HH = Heavy Haul)

AECD #2,7



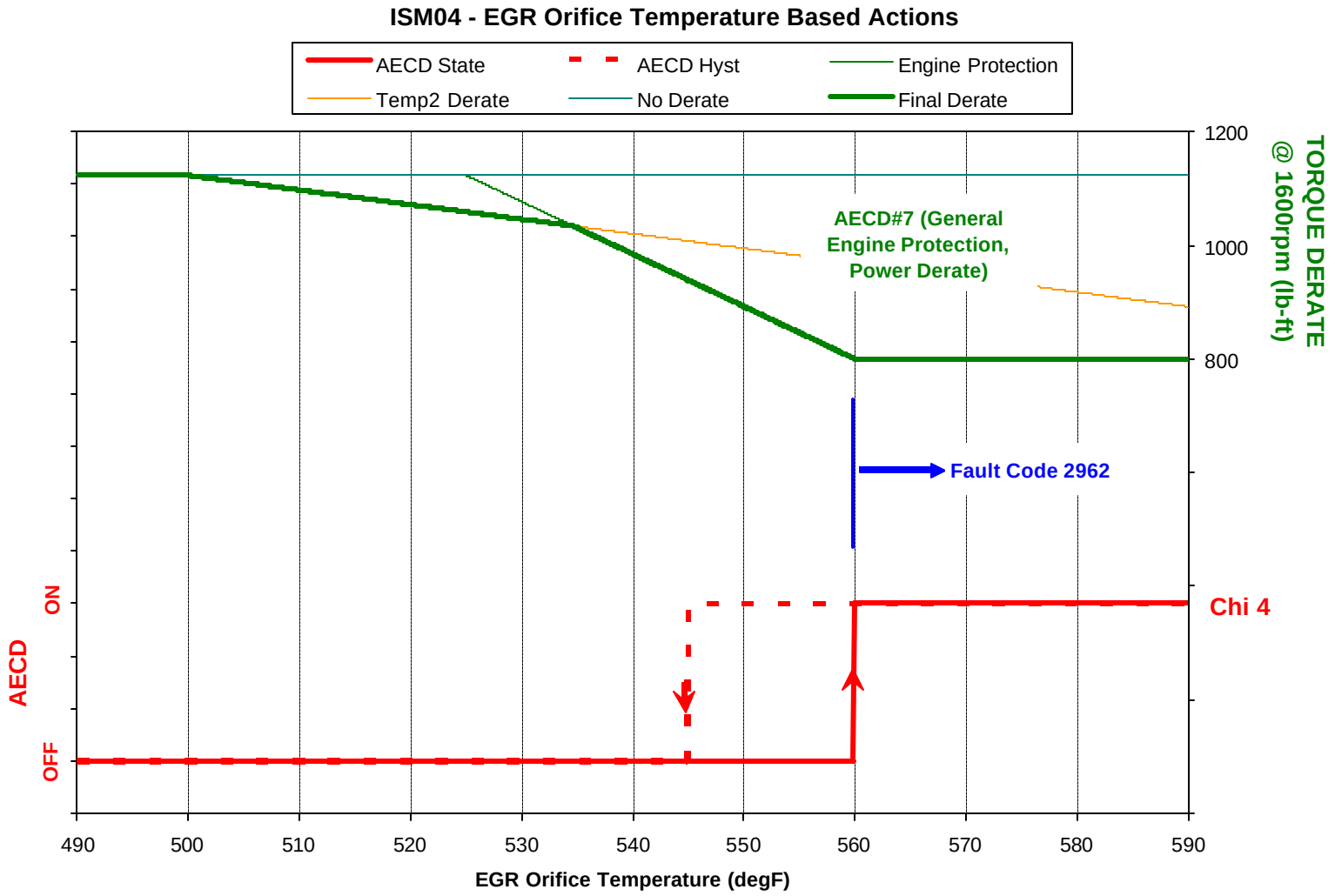
Coolant Temperature Based Actions – ISX '04 > 525 hp Automotive:
(HH = Heavy Haul)

AECD #2



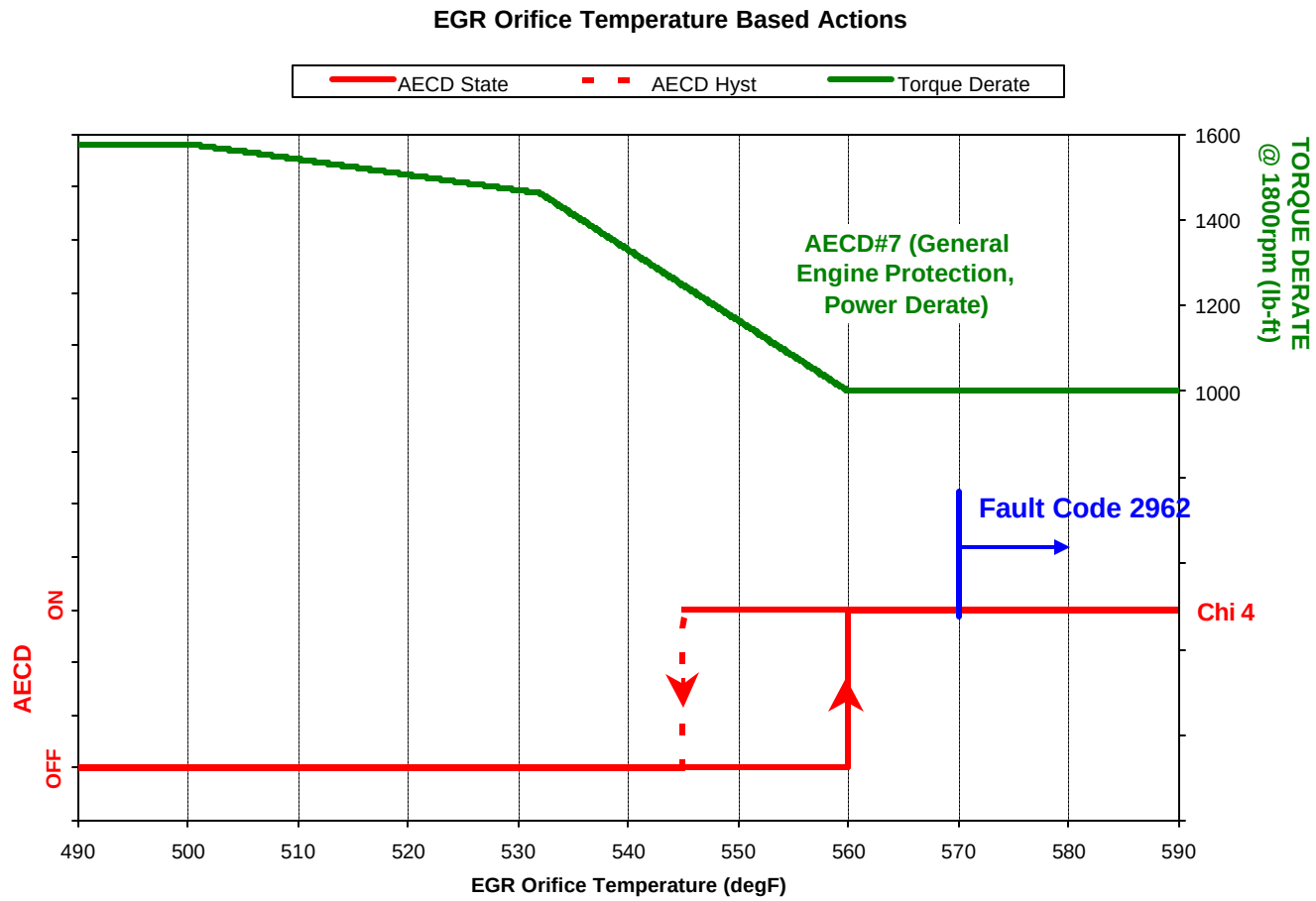
EGR Orifice Temperature Based Actions – ISM '04:

AECD #7



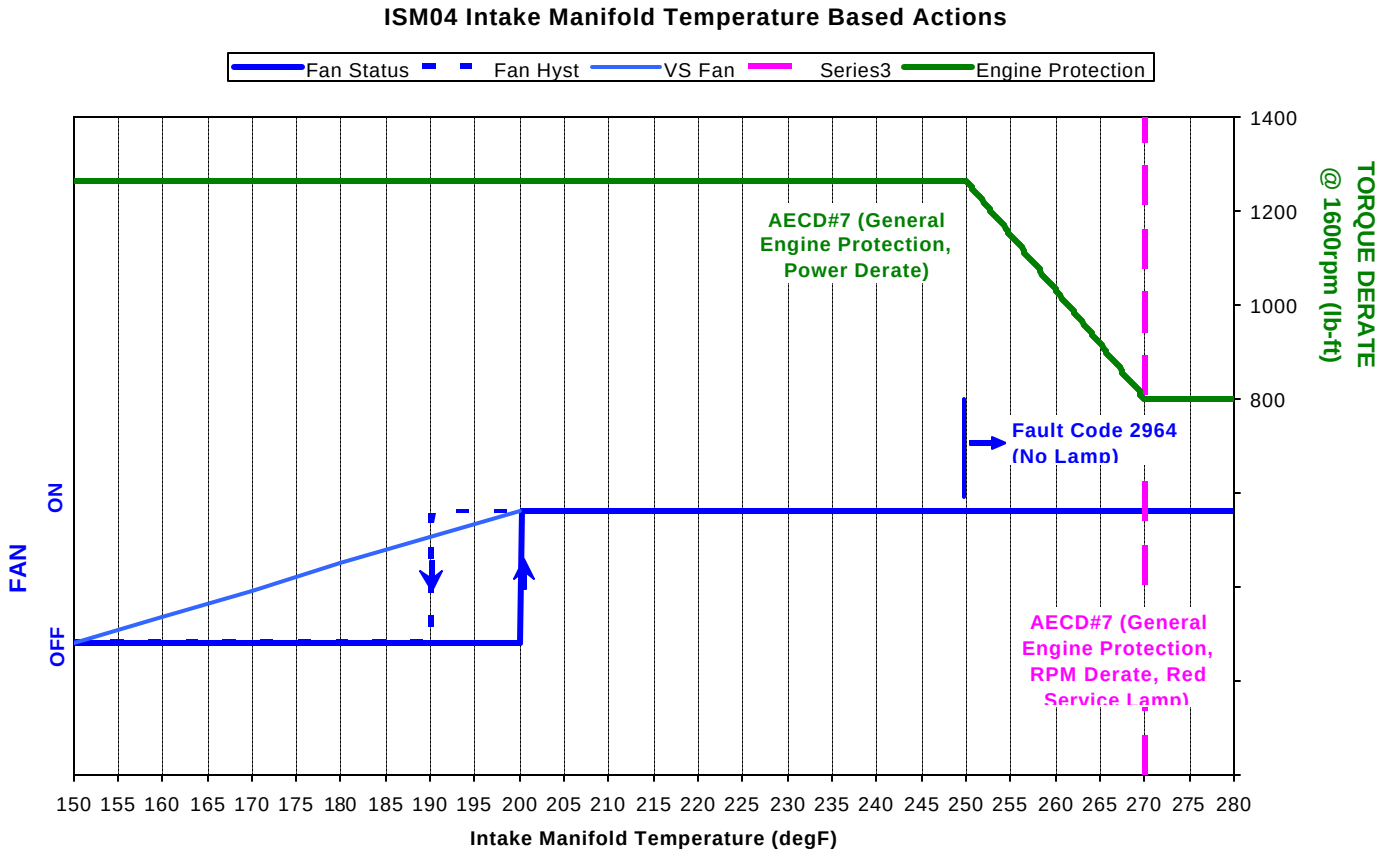
EGR Orifice Temperature Based Actions – ISX '04:

AECD #7



Intake Manifold Temperature Based Actions – ISM '04:

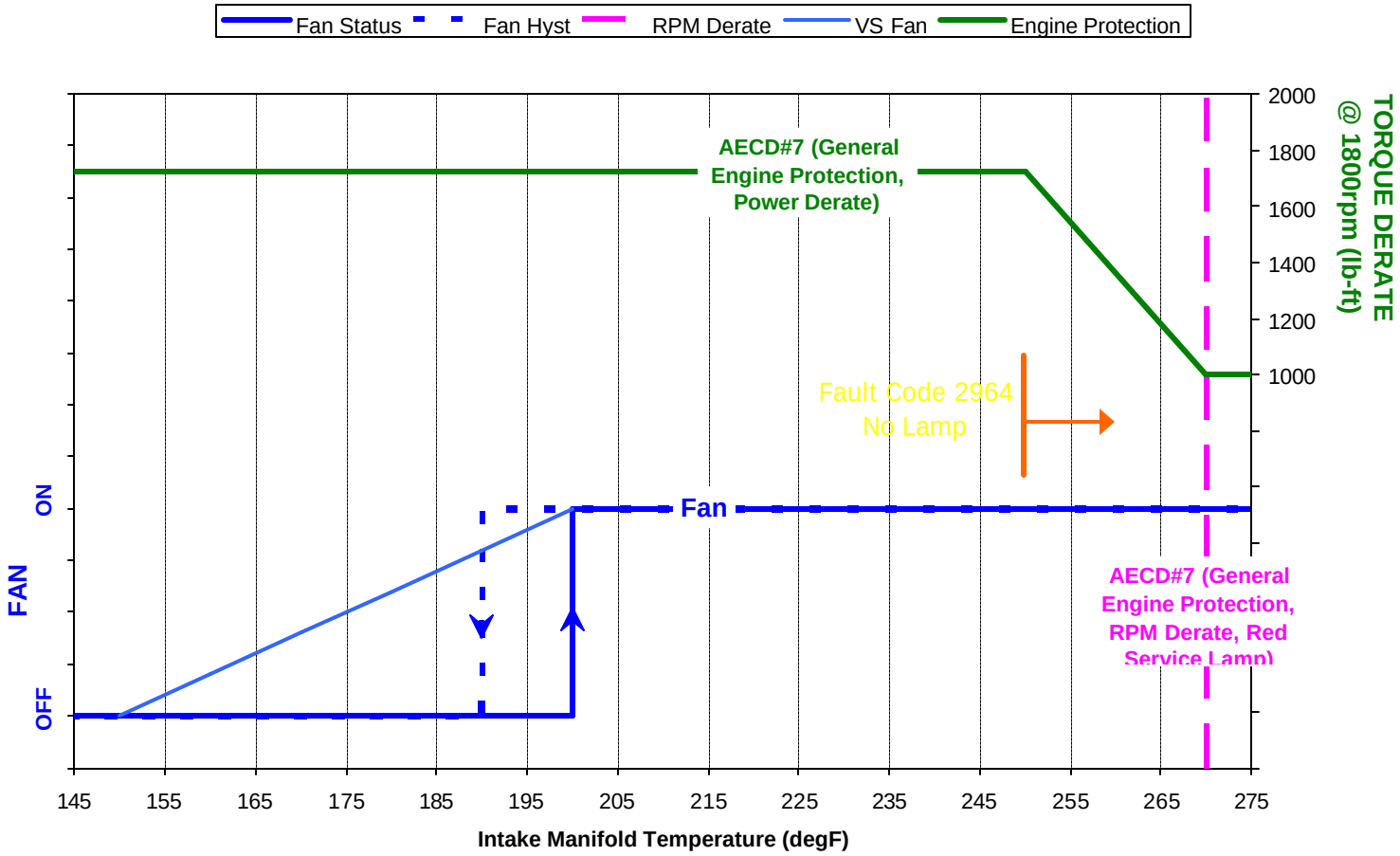
AECD #7



Intake Manifold Temperature Based Actions – ISX '04:

AECD #7

Intake Manifold Temperature Based Actions
ISX Engines



CUSTOMER / DRIVER SURVEY

Questions intended to encourage feedback on engine performance. Make record of vehicle configuration, engine model rating, transmission, axle, etc. Where possible use open ended questions to solicit driver feedback.

Customer Information

Driver Name: _____

Owner / Operator ☐ YES ☐ NO Unit #: _____

Fleet Driver ☐ YES ☐ NO Fleet Name: _____

Years of Driving Experience: _____

Other Engine(s) Driven or Familiar With: _____

Engine Model / Rating / ECM Calibration (if known): _____

How Long Have You Driven With This Engine? _____

Base Location: _____

Typical Route: (Check all that apply)

☐ Local Delivery ☐ Mountainous

☐ Interstate ☐ Hilly Terrain

☐ City ☐ Flat Terrain

☐ Rural ☐ Dirt / Gravel Roads

☐ Off-Road ☐ Snow / Ice Covered Roads

Approx. Gross Vehicle Weight: _____

Truck Model / Year: _____

Transmission Make and Model: _____

Number of Gears: _____ Automatic / Automated Transmission? _____

Power Train Data: Rear Axle Ratio: _____

Tire Size: _____

Clutch Make / Model: _____

Auxiliary Devices: _____
(Ex. Anti-Lock Brakes, Anti-Slip, PTO, Turbo-Conveyor, etc.)

Typical Driving Techniques

Do you normally use the clutch when shifting? _____

What engine speed do you normally use to upshift? _____

What engine speed do you normally use to downshift? _____

Do you maintain Top Gear? Gear-Down? _____

What type of throttle control do you prefer to use? ☐ Automotive (Min/Max) Governor ☐ All-Speed Governor (CAT Throttle)

When do you use Cruise Control? _____

If not, do you run on the road speed governor? _____

Do you use the Smart Road Speed Governor Feature? _____

When climbing a grade do you:
Resume Cruise Control after a downshift? _____

Keep your foot on the throttle? _____

With Engine Brakes, what engine speed do you typically maintain on steep grades:

☐ 1600 – 1700 RPM ☐ 1700 – 1800 RPM ☐ 1800 – 1900 RPM

☐ 1900 – 2000 RPM ☐ 2000 – 2100 RPM ☐ Other (Specify) _____ RPM

Engine Start

Is engine cranking time acceptable? Cold Start ☐ YES ☐ NO Crank Secs _____

Hot Start ☐ YES ☐ NO Crank Secs _____

Does engine start acceptably? ☐ YES ☐ NO

Comments? _____

How long does the engine crank before it fires? _____

Does engine speed overshoot at startup? ☐ YES ☐ NO

Comments? _____

How soon does engine speed settle after the engine starts? _____

Does the engine smoke at startup? ☐ YES ☐ NO

If yes, is smoke: ☐ BLUE ☐ WHITE

Ambient Temp _____ deg Fahrenheit

How does the engine exhaust appear? _____

Is throttle response noticed after startup? Cold Start? ☐ YES ☐ NO

Hot Start? ☐ YES ☐ NO

How well does the engine respond to throttle motion after startup? _____

Comments? _____

Engine Idle

Idle speed setting used _____ RPM Idle Time (Driver Estimate) _____ % ECM Idle Time _____ %

Does the engine idle smoothly? ☐ YES ☐ NO

Does the engine surge at idle? ☐ YES ☐ NO

Does the idle increment/decrement switch operate acceptably? ☐ YES ☐ NO

Does the engine idle at desired speed? ☐ YES ☐ NO

How would you describe the engine at idle speed in terms of:

Sound? _____

Vibration? _____

When do you use the Idle Increment / Decrement (Idle Adjust) Feature? _____

What idle speed do you prefer? RPM

Does idle undershoot when coming off higher RPM engine operation? ☐ YES ☐ NO

Comments? _____

Is there any smoke during idle? ☐ YES ☐ NO

If yes, is smoke: ☐ BLUE ☐ BLACK ☐ WHITE

Ambient Temperature: _____ deg Fahrenheit

Comments? _____

Engine PTO Operation

PTO set speed used _____ RPM PTO Time (Driver Estimate) _____ % ECM PTO Time _____ %

When do you use PTO? _____

What PTO set speeds do you prefer? _____

Does the PTO operate smoothly? ☐ YES ☐ NO

Does the engine surge on PTO? ☐ YES ☐ NO

Does the PTO speed adjustment switch operate acceptably? ☐ YES ☐ NO

Does the PTO operate at desired speed? ☐ YES ☐ NO

Does PTO overshoot or undershoot when engaging PTO or changing RPM? ☐ YES ☐ NO

Comments? _____

Is there any smoke during PTO? ☐ YES ☐ NO

If yes, is smoke: ☐ BLUE ☐ BLACK ☐ WHITE

Ambient Temperature: _____ Deg Fahrenheit

Comments? _____

Clutch Engagement

In what gear do you normally launch the vehicle?

Gear:	1L	1	1H	2L	2	2H	3L	3	3H	4L	4	4H
Loaded:	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Unloaded:	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bobtail:	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Do you use the throttle while releasing the clutch to launch the vehicle? ☐ YES ☐ NO

Do you let the clutch completely out before applying throttle? ☐ YES ☐ NO

Has the engine ever stalled during vehicle launch? ☐ YES ☐ NO

If YES, how often? _____

If YES, what were the conditions when this occurred?

- On-hill Launch? ☐
- Loading Dock? ☐
- Unfamiliar with Truck / Engine? ☐
- Mud / Snow / Ice? ☐
- Released Clutch Too Fast? ☐
- Foot Slipped Off Clutch? ☐
- Chose Wrong Gear? ☐
- Other: _____ ☐

If YES, what adjustments have you made to prevent stall?

- Use Lower Gear? ☐
- Slip / Feather Clutch? ☐
- Use Throttle? ☐
- Raise Idle Speed? ☐
- Nothing? ☐
- Other: _____ ☐

Do you watch your tachometer when launching the vehicle? ☐ YES ☐ NO

If YES: Is engine speed drop excessive? ☐ YES ☐ NO Approx. RPM Drop: _____ RPM

If YES: Is engine speed overshoot excessive? ☐ YES ☐ NO Approx. RPM Overshoot: _____ RPM

Does engine speed decelerate too fast, too slow, or just right on clutch engagement? ☐ Too Fast ☐ Too Slow ☐ Just Right

Explain why: _____

Does engine speed recover (accelerate) too fast, too slow, or just right on clutch engagement? ☐ Too Fast ☐ Too Slow ☐ Just Right

Explain why: _____

Clutch Engagement (cont.)

How would you rate the overall vehicle launch performance (clutch engagement)?

- ☐ Excellent
- ☐ Good
- ☐ Acceptable
- ☐ Poor

Explain why: _____

How would you rate the engine torque (power) during vehicle launch (clutch engagement)?

- ☐ Excellent
- ☐ Good
- ☐ Acceptable
- ☐ Poor

Explain why: _____

How would you rate the engine accepting load during vehicle launch (clutch engagement) on level ground? (Check all that apply)

- ☐ Smooth
- ☐ Jerky
- ☐ Must "feather" clutch
- ☐ Engine accepts load easily
- ☐ Engine struggles to accept load
- ☐ Engine feels like it wants to stall

Comments: _____

How would you rate the engine accepting load during vehicle launch (clutch engagement) on uphill grade? (Check all that apply)

- ☐ Smooth
- ☐ Jerky
- ☐ Must "feather" clutch
- ☐ Engine accepts load easily
- ☐ Engine struggles to accept load
- ☐ Engine feels like it wants to stall
- ☐ Other _____

Comments: _____

How does this engine compare to the last engine you drove in terms of clutch engagement performance?

- ☐ Much Better
- ☐ Better
- ☐ Same
- ☐ Worse
- ☐ Much worse

Comments: _____

Overall vehicle launch (clutch engagement) comments? _____

Cruise Control

Fill in customer trim information to detail how engine is trimmed:

Road Speed Governor Upper Droop _____ MPH

Road Speed Governor Lower Droop _____ MPH

Cruise Control Upper Droop _____ MPH

Cruise Control Lower Droop _____ MPH

When do you use Cruise Control? _____

Driver Input

Can the driver easily set the desired cruise speed? ☐ YES ☐ NO

Comments? _____

Does the cruise control maintain desired set speed? ☐ YES ☐ NO

Comments? _____

When Setting ☐ YES ☐ NO Road Speed Gain MPH _____ Road Speed Loss MPH _____

On Hills ☐ YES ☐ NO Road Speed Gain MPH _____ Road Speed Loss MPH _____

Level Ground ☐ YES ☐ NO Road Speed Gain MPH _____ Road Speed Loss MPH _____

How does the engine feel and sound when:

Cresting a hill? _____

Rolling out at the bottom of a hill? _____

Does the cruise control cause the engine to surge? ☐ YES ☐ NO

At the bottom of hills? ☐ YES ☐ NO

When starting up a hill? ☐ YES ☐ NO

Does the engine respond when over-riding the cruise control with the throttle? ☐ YES ☐ NO

Does the cruise control Auto-Resume perform acceptably? (IF TRIMMED) ☐ YES ☐ NO
(Is there a noticeably time delay before resume occurs?)

Does the cruise control Auto-Resume overshoot/undershoot after clutch event? ☐ YES ☐ NO

On Hills ☐ YES ☐ NO Road Speed Gain MPH _____ Road Speed Loss MPH _____

Level Ground ☐ YES ☐ NO Road Speed Gain MPH _____ Road Speed Loss MPH _____

Engine Response

How well does the engine respond to throttle movements when:
Moving? _____

In-gear? _____

Stationary, at idle? _____

Is there noticeably delay from the time the throttle is depressed until the engine RPM or torque picks up? ☐ YES ☐ NO

Does it occur at all engine speeds or in one range of engine speed? ☐ YES ☐ NO

Range _____ RPM

Is the response predictable when the throttle pedal is depressed? ☐ YES ☐ NO
(Is it more sensitive in lower speed ranges, etc?)

Is it easy to synchronize speed during gear shifts? ☐ YES ☐ NO

Upshifts? ☐ YES ☐ NO Downshifts? ☐ YES ☐ NO

Low Speed Maneuvering

What is idle speed setting when performing parking lot maneuvers? _____ RPM

Is throttle control acceptable for low speed maneuvers (parking lots, delivery terminals, etc)

Loaded ☐ YES ☐ NO Bobtail ☐ YES ☐ NO

Is throttle control in reverse gear acceptable?

Loaded ☐ YES ☐ NO Bobtail ☐ YES ☐ NO

Is there any surge when maneuvering at low speeds? ☐ YES ☐ NO What gear? _____

How well does the engine respond during:

Low speed maneuvers? _____

Parking? _____

Braking? _____

Engine Brake in Cruise Feature

Is the delay time from the expected brake actuation until the brakes actuate acceptable? ☐ YES ☐ NO

Do the correct number of brakes actuate at the desired speed increment above cruise speed? ☐ YES ☐ NO

Does the cruise control resume correctly after the brakes have deactivated? ☐ YES ☐ NO

Does the cruise control surge when resuming? ☐ YES ☐ NO

Does the cruise control overshoot? ☐ YES ☐ NO

Does the cruise control undershoot? ☐ YES ☐ NO

Does the auto cruise braking feature cause a surge when engaging in cruise? ☐ YES ☐ NO

Does the engine brake manual shut off switch work correctly? ☐ YES ☐ NO

Does the manual brake selector switch work correctly? ☐ YES ☐ NO

EGR / VGT Control System

How does the performance of this engine compare to a previous Cummins engine you may have operated?

☐ BETTER ☐ WORSE ☐ NO CHANGE

Comments? _____

Please describe what you experience while operating/driving during:

Rapid Accels _____

Rapid Decels _____

Uphill Climb _____

Downhill Grades _____

In-City Driving _____

Highway Driving _____

Engine Idle _____

Truck Yard Maneuvers _____

During Cruise Control Events _____

During Engine Brake Events _____

Cold Engine Start _____

Approximate outside temperature _____ deg Fahrenheit

Hot Engine Starts _____

Approximate outside temperature _____ deg Fahrenheit

At Altitude _____

Approximate altitude for engine operation _____ feet

NOTES