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J1939 Reference Manual



TOUGHSeries
Digital Generator Controllers



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J1939 Reference

1 Settings

The following section relates to generic J1939 settings when setting up the controller to work with an ECM. For Engine Temperature, Oil Pressure and Engine Speed, their **Signal Source** setting must be set to **J1939 Bus** in order to receive those values from the ECM.

Generic Settings

Name	Range	Description
ECM Communication Failure	Enable ~ Disable	If no CAN messages are received for more than 6 seconds, the controller shuts down the engine. If an engine parameter displays N/A while in AUTO mode there may be a communication issue.
ECM Model	Generic J1939 John Deere JDEC Volvo EMS Cummins CM850 Yanmar ECO Detroit Diesel Volvo EMS2B Isuzu 4H GM PSI eControl Kubota T4F Scania S8 T4F Doosan G2	Depending on the engine model there are cases where some special measurement and control functions are required to communicate with engine ECM. If your engine or ECM is not listed you can utilize the Generic J1939 setting which utilizes the standard messaging for Oil Pressure, Engine Temperature and Engine Speed which is commonly available with most engine ECM brands supporting J1939.
Controller Address	0 ~ 253	This is the device address for the controller. Default is 153. The controller has built in functionality to handle conflicts on the bus, see the J1939 Auto Address section for more information.
ECM Address	0 ~ 253	This is the device address for the ECM. Default is 0 which is standard of most ECMs.
SPN Conversion	Version 1 Version 2 Version 3	Select the SPN conversion method. See DTC Conversion Methods for more information.
Auto Power ECM	Enable ~ Disable	When enabled, the fuel relay is enabled in AUTO mode so that the ECM is already booted up and initialized before the user decides to start the engine.
ECM Power Delay	5 ~ 30 seconds	Used in conjunction with Auto Power ECM. When the engine shutdown, the controller will wait the ECM Power Delay before turning on the fuel relay again upon returning to AUTO. This is to prevent unwanted start ups due to the engine not being completely shut down.
Actual Engine % Torque	Enable ~ Disable	When enabled, the standard J1939 message Actual Engine % Torque is displayed.

 **WARNING:** If an engine parameter displays N/A while in AUTO mode there may be a communication issue.

1.1 J1939 Auto Address

There are situations when there may be address conflicts with the TOUGH Series controller and other devices on the CAN bus. The following tables describes how the controller will respond in those situations:

Scenario	Description
Controller on bus, new device with same address and higher priority comes onto bus	The controller will changes its address to 'Current Address + 1' in order to accommodate the device with the higher priority.

Controller on bus, new device with same address and same or lower priority comes onto bus	The controller will keep its address and it is expected of the new device to change its address.
Device on bus, controller with same address comes onto the bus	The controller coming onto the bus will change it address to 'Current Address + 1.'

1.2 Proprietary ECMs

Some ECM manufacturers have proprietary messages in their J1939 protocol. When selecting your ECM Module in the [Settings](#) section, there also may be the following settings that may need to be set.

Settings

Name	Range	Description
Cummins PGNs	Enable ~ Disable	Enables or disables the broadcasting of PGNs required by Cummins engines.
EMS2B Frequency Select	Primary Secondary	For Volvo EMS2B Engine Control Modules only.
EMS2B Accelerator Pedal	40.0 ~ 60.0%	For Volvo EMS2B Engine Control Modules only.

1.3 Doosan G2

If the ECM Module is set to "Doosan G2" the following additional settings are exposed. These settings are only exposed from the Configuration Software.

Doosan G2 ECM Settings

Name	Range	Description
ECM Calibration Version	10 ASCII chars length	Compares the entered string to the PGN 65242, Software Identification. If they do not match the controller refuses to start.
High Exhaust Temperature Warning	1000°F to 2000°F in 1°F increments, Disable	Set a warning and/or failure off the High Turbine Inlet Temperature which is read from the J1939 bus. This is SPN 173, Engine Exhaust Gas Temperature, of PGN 65270.
High Exhaust Temperature Failure	1000°F to 2000°F in 1°F increments, Disable	
High Fuel Temperature Warning	100°F to 300°F in 1°F increments, Disable	Set a warning and/or failure off the High Fuel Temperature which is read from the J1939 bus. This is SPN 174, Engine Fuel Temperature 1, of PGN 65262.
High Fuel Temperature Failure	100°F to 300°F in 1°F increments, Disable	

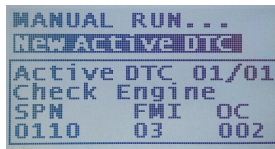
2 Diagnostic Trouble Codes (DTC)

Diagnostic Trouble Codes (DTC referred to as DM1) are messages that are broadcasted from engine ECM over J1939 to allow operators and users to identify engine related warnings and failures. When this feature is enabled the TOUGH series controller will display information on the front panel display which identifies the particular diagnostic code.

Relevant Settings

Name	Range	Description
DTC Display	Disable Global Running	Enables or disables active fault messages (DM1) monitoring. If set to Global, diagnostic messages will appear while in any mode. If set to Running, diagnostic messages will only display while the engine is running.
Active DTC Log	Enable ~ Disable	Enables or disables the storing of active faults (DM1).
Read Stored DTC	Enable ~ Disable	Enables or disables the ability to request stored fault codes from the ECM (DM2).
SPN Conversion	Version 1 Version 2 Version 3	For older implementations of the SAE J1939 DTC spec there are three formats for DTCs and it was not possible to tell them apart. The user must select the appropriate SPN conversion

		method for their engine. This does not apply to newer engines.
--	--	--



New Active DTC Received

DM1 Breakdown

Name	Description
Suspect Parameter Number (SPN)	The number describes the parameter being affected.
Failure Mode Indicator (FMI)	The number describes the type of failure. You must refer to the engine manufacturer's documentation to identify the meaning of the failure mode indicator number.
Occurrence Count (OC)	This number identifies the number of times the failure has occurred.

The controller Event History can store up to 30 DM1 messages (DM2 messages are not stored). Once the 30 limit has been reached the oldest message is removed from the log to be replaced by the incoming DM1.

2.1 Requesting DM2

DM2 messages are previously active fault messages which are stored to permanent memory on the engine ECM. These stored messages can be retrieved by the host controller controller and displayed on the controller when a request is initiated by the user. The DM2 messages display the same type of information as the DM1 messages.

The controller can support a maximum of 32 messages. When previously active DTC messages are requested and received, the controller will display the stored messages on the controller front panel LCD screen. If multiple stored messages are received the user can either manually scroll through each stored message or the screen will scroll between each DTC stored message.

To Trigger a DM2 Request, simultaneously press the UP and DOWN keys for a period of 3 seconds in either the AUTO, OFF, or RUNNING modes. The UP and DOWN keys can also be pressed to remove the DM2 message screen.

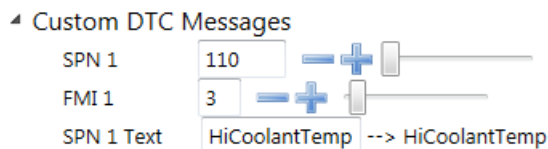
If the controller is in the OFF or AUTO mode when the request is triggered, the ECM may not be powered on, so the controller will energize the fuel relay output and wait for the ECM to power on. The controller then sends out the DM2 request. In the event there is no response from the ECM, the controller will re-attempt an additional 3 times. It will then display 'Requesting Failure' and turn off the fuel output if there is no valid response on the fourth try. The default ECM address for DM2 request is 0 and the ECM address can only be changed by using the DYNAGEN Configurator. The controller may also show 'Reading Abort' if communication is unsuccessful. If the request was successful, the controller will show 'Read DTC Success' and start to display the messages.

2.2 Custom DTC Messages

Normally when a DTC is received, it is displayed using the SPN, FMI and OC and you must consult the engines documentation to determine the meaning of the fault. Using the Custom DTC Messages in the DYNAGEN Configurator you are able to apply a 13 character message that will display when the associated DTC is received.

If the FMI is set to zero (0) then all FMIs under the SPN will display the given text.

Example: The user wants 'HiCoolantTemp' to be displayed when DTC code with SPN = 110 and FMI = 3 is received.

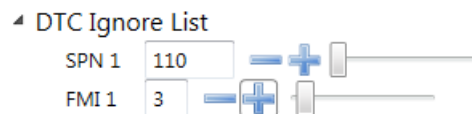


Custom DTC Message Example

2.3 DTC Ignore List

There are times when an ECM may be sending out a DTC messages that are not applicable to your application. Using the DYNAGEN Configurator, you can choose up to 6 DTC messages to ignore when they are received. In order to ignore the message, you must enter the SPN and the FMI numbers of the DTC you want to ignore.

Example: The user wants to suppress receiving DTC code with SPN = 110 and FMI = 3.



DTC Ignore List Example

2.4 DTC Conversion Methods

This section is used to decode the information contained in the J1939 DTC (DM1 and DM2) registers if the ECM does not support the newest DTC conversion method. The DTCs for J1939 are specified in a specific format. Older J1939 specifications had three conversion methods and is impossible to tell them apart without contacting the engine manufacturer.

Newer J1939 specifications follow SPN method (Version 4) and can be determined by looking at the CM bit. It will be set to 1 for Version 4 and set to 0 for Versions 1, 2, and 3. If the CM bit is 0, use conversion methods listed below. Byte 1 to Byte 4 refers to the individual bytes in the controllers DTC Modbus registers..

DTC Conversion Method (Version 1)

Byte	Conversion
Byte 1	8 most significant bits of 16 most significant bits of SPN
Byte 2	8 least significant bits of 16 most significant bits of SPN
Byte 3	3 most significant bits of byte contain the 3 least significant bits of SPN 5 least significant bits of byte contain the FMI
Byte 4	Most significant bit of byte contains CM 7 least significant bits of byte contains OC

DTC Conversion Method (Version 2)

Byte	Conversion
Byte 1	8 least significant bits of 16 most significant bits of SPN
Byte 2	8 most significant bits of 16 most significant bits of SPN
Byte 3	3 most significant bits of byte contain the 3 least significant bits of SPN 5 least significant bits of byte contain the FMI
Byte 4	Most significant bit of byte contains CM 7 least significant bits of byte contains OC

DTC Conversion Method (Version 3)

Byte	Conversion
Byte 1	8 least significant bits of SPN
Byte 2	8 second byte of SPN
Byte 3	3 most significant bits of byte contain the 3 most significant bits of SPN 5 least significant bits of byte contain the FMI
Byte 4	Most significant bit of byte contains CM 7 least significant bits of byte contains OC

DTC conversion method 3 is the same as DTC conversion Method 4 except that the CM bit is 1 so it is impossible to tell it apart from versions 1 and 2. Version 4 has the bit set to 0 which allows the user to know the conversion format without consulting the engine manufacturer.

3 Aftertreatment

Aftertreatment Settings

Name	Range	Description
Aftertreatment Enabled	Disable DPF DEF/SCR	Selects the Aftertreatment mode used by the engine.
Aftertreatment Mode	Inhibit Auto LastRunning	This is the default aftertreatment state of the controller when first starting the engine. You can change the mode during running as described in the Operator Interface section. Inhibit or Auto always resets the mode to Inhibit or Auto on engine run. LastRunning remembers the mode the controller was in when it last ran and sets it to that mode.
Soot % Display	Enable ~ Disable	Enables or disables the display of Soot % on the LCD screen.
Ash % Display	Enable ~ Disable	Enables or disables the display of Ash % on the LCD screen.
Time Since Last Regen Display	Enable ~ Disable	Enables or disables the display of Time Since Last Regen on the LCD screen.

Exhaust Temperature Display	Enable ~ Disable	Enables or disables the display of Exhaust Temperature on the LCD screen.
DEF/SCR Tank Level Display	Enable ~ Disable	Enables or disables the display of Tank Level on the LCD screen.
DEF Low Level	0 ~ 100%	Determines the level when a switched output set to <u>DEF Fluid Level</u> turns on.
DEF High Level	0 ~ 100%	Determines the level when a switched output set to <u>DEF Fluid Level</u> turns off.
DEF/SCR Fluid Temperature Display	Enable ~ Disable	Enables or disables the display of Fluid Temperature on the LCD screen.
Password	Enable ~ Disable	Enables or disables the requirement of needing a password to change Regeneration Modes.

Display Settings

Name	Range	Description
DPF/DEF Display Time	0 ~ 10 seconds	Controls the alternating time of DPF/DEF symbols and status messages on the LCD screen.





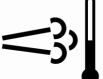
NOTE: This setting is found in the Operator Setup menu and not the J1939 menu.

Examples

1. Display Time = 0 -> The Aftertreatment Lamps will always be displayed.
2. Display Time = 5 -> The Aftertreatment lamps and Status Messages will alternate every 5 seconds.
3. Display Time = 10 -> The Aftertreatment lamps will never be displayed.

3.1 Tier 4 Interim (DPF)

Indicator Lamps

Lamp	Name	Description
	Regeneration Lamp	This status lamp is ON when the soot level in the exhaust filter requires cleaning. A warning text message must also be illuminated on the screen indicating aftertreatment requires regeneration. When the icon is flashing this indicates that the machine performance is being de-rated due to high soot level in exhaust filter.
	Regeneration Disable Lamp	The icon is displayed as solid and indicates that the automatic regeneration exhaust cleaning is disabled.
	High Exhaust Temperature Lamp	This icon is displayed on the screen indicating exhaust temperature is high / elevated IDLE speed has been triggered / exhaust filter cleaning is in process.



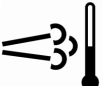

Display Parameters

There are up to 4 parameters that can be enabled to be displayed on the controller scrolling screen for DPF interface and feedback. The parameters when enabled will be displayed on the page scrolling screen on the controller. Parameter display can only be enabled by PC configuration tool and not from front panel controller menu.

Name	Range	Description
DPF Soot Level	0 ~ 250%	This parameter specifies DPF Soot level in %.
DPF Ash Level	0 ~ 250%	This parameter specifies DPF Ash level in %.
Time Since Last Active Regeneration	0 ~ 1169744.78 hours	Indicates the time since the last active regeneration event of diesel particulate filter 1.
Exhaust Gas Temperature	-273 ~ 1734°C	Indicates the Exhaust temperature of the DPF.

3.2 Tier 4 Final (DEF/SCR)

Indicator Lamps

Lamp	Name	Description
	Regeneration Lamp	This status lamp is ON when the soot level in the exhaust filter requires cleaning. A warning text message must also be illuminated on the screen indicating aftertreatment requires regeneration. When the icon is flashing this indicates that the machine performance is being de-rated due to high soot level in exhaust filter.
	Regeneration Disable Lamp	The icon is displayed as solid and indicates that the automatic regeneration exhaust cleaning is disabled.
	High Exhaust Temperature Lamp	This icon is displayed on the screen indicating exhaust temperature is high / elevated IDLE speed has been triggered / exhaust filter cleaning is in process.
	Diesel Exhaust Fluid Lamp	This icon indicator is used to alert the operator of the diesel exhaust fluid level status. When the icon is solid this indicates that the DEF level is low, when the icon is flashing this is warning of the DEF fluid level secondary severity level.

negneg

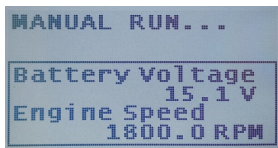
Display Parameters

There are up to 3 parameters that can be enabled to be displayed on the controller scrolling screen for DEF/SCR interface and feedback. The parameters when enabled will be displayed on the page scrolling screen on the controller. Parameter display can only be enabled by PC configuration tool and not from front panel controller menu.

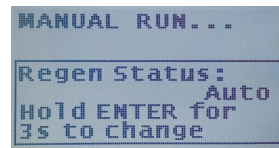
Name	Range	Description
DEF Fluid Tank Level	0 ~ 100%	This parameter specifies the DEF Tank fluid level in %.
DEF Fluid Tank Temperature	-40 ~ 210°C	This parameter specifies the DEF Tank fluid Temperature.
Time Since Last Active Regeneration	0 ~ 1169744.78 hours	Indicates the time since the last active regeneration event of diesel particulate filter 1.

3.3 Operator Interface

When the controller is running and there is no aftertreatment functions the controller will scroll through its display parameters as usual. When the aftertreatment page is displayed, it will show the Regen Status as well as the following instructions Hold Enter for 3s to change.

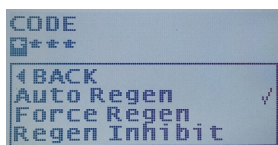


Parameter Page

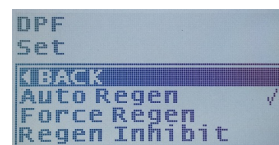


Aftertreatment Page

Holding the ENTER button for 3 seconds will display one of the following screens:



Password Request



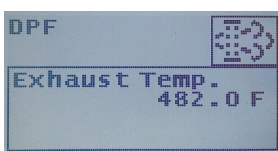
Aftertreatment Menu

If the Password setting in the Aftertreatment Settings is enabled then the screen on the left will be displayed. If so, enter the 4 digit passcode to gain access to changing the aftertreatment modes which shown on the screen to the right.

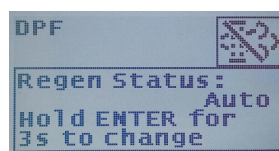
Aftertreatment Modes

Name	Description
Back	Returns to scrolling pages.
Automatic Regeneration	This mode gives the ECM complete control of the aftertreatment functions. This means that it can automatically perform a regeneration or inhibit as required.
Forced Regeneration	This allows the operator force the ECM to perform a regeneration. It will send the command to force a regeneration for 10 seconds before returning to Automatic Regeneration. The ECM can reject a Forced Regeneration.
Regeneration Inhibit	This allows the operator to inhibit the ECM from performing a regeneration. The controller will continuously send the inhibit command while in this mode. The operator must manually return the controller to Automatic Regeneration.

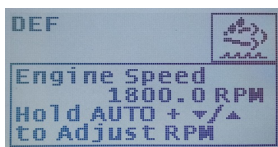
The following screens show how the different icons are displayed on the screen of the controller.



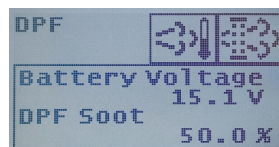
Regeneration Required



Regeneration Inhibited



Low DEF Fluid Level



High Exhaust Temperature

4 Speed Control - Rated and Idle

The controller has the ability to change the speed of the engine to the following specific setpoints: Primary RPM (or 60Hz), Secondary RPM (or 50Hz) and Idle RPM. This is done through use of switched inputs which trigger the controller to command the ECM to change the engine speed using the TSC1 command over J1939.

NOTE: Using either Primary/Secondary RPM or the 60/50Hz designations are dependent upon how the engine is being used. If

the engine is being used as a generator then the primary RPM setpoint is 60Hz and the secondary RPM setpoint is 50Hz.
NOTE 2: The switched inputs are only monitored before engine start. They are ignored while the engine is running.

Switched Inputs Settings (in Switched I/O menu)

Name	Range	Description
Idle Mode	N/A	Controller ignores under speed, voltage and frequency warnings and failures when active and changes engine speed to Idle RPM speed.
Primary RPM (60Hz) / Secondary RPM (50Hz) Switch	N/A	When switched input is inactive, controller changes engine speed to Primary RPM / 60Hz speed. When switched input is active, changes engine speed to Secondary RPM / 50Hz speed. Only monitored before engine start.

Speed Control Settings

Name	Parent Menu	Range	Description
Primary RPM / 60Hz	Sensors>Engine Speed>RPM Switch	500 ~ 4000	Speed at which the engine runs at when operating under normal running 60Hz conditions or at Primary RPM.
Secondary RPM / 50Hz		500 ~ 4000	Speed at which the engine runs at when operating under normal running 50Hz conditions or at Secondary RPM.
Idle RPM	Sensors>Engine Speed>Speed Settings	300 ~ 2000	Speed at which the engine runs when it is idling.
Frequency Source	AC Monitor>Genset Freq.	50Hz 60Hz RPM Switch	The wiring configuration of the generator. Selecting RPM Switch will use the Primary RPM (60Hz) / Secondary RPM (50Hz) switched input to determine the speed setpoint to use.

Example #1: If engine is started up at a Primary RPM (E.g. 1800) and the Idle Mode switched input becomes active, the controller will command the engine speed to the Idle RPM (E.g. 900) speed.


Example #2: If engine is started up at a Primary RPM (E.g. 1800) and the Primary RPM (60Hz) / Secondary RPM (50Hz) switched input becomes active, the controller will command the engine speed to Secondary RPM (E.g. 1500).

5 Front Panel Speed Control

The operator is able to adjust the speed of the engine through use of the controller front panel. This section will describe the two methods in which speed control is implemented.

Speed Control Methods

Method	Description
Front Panel Speed Control using J1939 TSC1	The controller can instruct the ECM of an electronic engine to adjust its speed by broadcasting the the TSC1 command.
Front Panel Speed Control using Switched Outputs	The controller can instruct the ECM of an electronic engine to adjust its speed by using switched outputs on the controller set to RPM Increment and RPM Decrement to interface with digital inputs on the ECM. When the speed is changed, the corresponding switched output will be on for 1 second each time increment or decrement is pressed.
Aux 4 Speed Control	The Auxiliary sensor 4 is used to determine the setpoint speed. The speed is adjusted with the TSC1 J1939 command.

 **WARNING:** Switched outputs have a floating voltage of approximately 8V when off. If using the outputs for digital logic, it will be necessary to put a pull down resistor (1k Ω) from the output to ground to ensure a low logic level when output is off.

If using Increment or Decrement (with either J1939 or Switched Outputs) the below applies. If using the Auxiliary Sensor 4 speed control method see the next section.

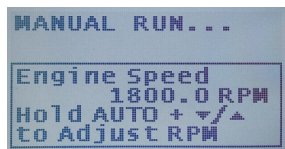
Speed Control Settings (in Engine Speed menu)

Name	Parent Menu	Range	Description
Speed Control Enable	Configuration Software only. Engine Speed menu.	Enable ~ Disable	Enables or disables front panel speed control.

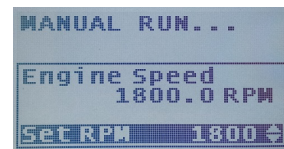
RPM Display	Sensors > Engine Speed	Nothing / Blank AC Frequency Auxiliary Sensor 1 Auxiliary Sensor 2	Parameter to display when adjusting speed from front panel. This is used to provide operator feedback in the case that the engine RPM affects another parameter such as AC Frequency or an Auxiliary Sensor (Example: Flow rate of pump).
Limit Method	Configuration Software only. Engine Speed menu.	Speed Bias Min RPM / Max RPM	The method in which the minimum and maximum speeds the operator is allowed to adjust is determined.
Speed Bias	Sensors > Engine Speed > RPM Control	0 ~ 600	The minimum or maximum RPM that the engine speed can be adjusted around the Rated RPM. Example: Rated RPM is 1800 and Speed Bias is 150. The minimum RPM will be 1650 and maximum RPM will be 1950. Only valid when the correct limit method is chosen.
Min Speed		500 ~ 4000	The minimum RPM that can be set using speed control. Only valid when the correct Limit Method is chosen.
Max Speed		500 ~ 4000	The maximum RPM that can be set using speed control. Only valid when the correct Limit Method is chosen.
TSC1 Speed Command RPM/Sec	Configuration Software only. Communications > J1939 Bus menu.	10 to 300 RPM/s in 10 RPM/s increments. Disable	This applies to the TSC1 version only. Does not apply if using the switched outputs. You can limit the speed control ramp rate. This setting can be disabled.

Speed Control Instructions

When the controller is running and there is other functions occurring the controller will scroll through its display parameters as usual. When the speed control page is displayed, it will show the Engine Speed as well as the following instructions Hold AUTO + Up/Down to Adjust RPM.



Speed Control Parameter Page



Speed Control Adjust Page

Pressing and holding the AUTO button will display the screen to the right. If a 'Display Adjust Parameter' is set, it too will be displayed underneath the Engine Speed. While still holding the AUTO key, press the up or down arrows to adjust the RPM. The Engine Speed display should update as the engine physically changes its speed to accommodate the speed request.

Pressing the up or down button will increment/decrement the speed by one RPM. If using TSC1 speed control there is a fast step mode that is accessed by pressing and holding the up or down button. This mode will increment the speed in steps of 10 RPM continuously until the up or down button is released. Fast step is not available when using the switched outputs.

NOTE: When using switched outputs for speed control, the Set RPM will display '---' instead of the set speed.

5.1 Aux 4 Speed Control

The Aux 4 Speed Control re-purposes the Auxiliary Sensor 4 input. The Aux 4 Speed control feature allows the user to use an external device (such as a potentiometer) to control the J1939 TSC1 speed command sent to the ECM based on the Auxiliary sensor 4 input's sender table.

To enable properly the following settings below must be set.

Aux 4 Speed Control Settings (in Sensors menu unless otherwise noted)

Name	Parent Menu	Range	Description
Aux Sensor 4 > Signal Source	Sensors menu.	Sensor Port A Sensor Port B Sensor Port C Sensor Port D	Select the sensor port that will be used for the speed control.
Aux Sensor 4 > Function Select	Sensors menu.	... Speed Control	Must be set to speed control.

Auxiliary Sensor 4 > Custom Sender	Configuration Software only. Sensors > Aux Sensor 4 menu	N/A	The unit type must be set to "Speed". Click Edit to specify the x-value (resistance, voltage, current) and y-values (RPM) for the table. This is the speed control.
Aux Sensor 4 > Display	Sensors menu.	Enable ~ Disable	Enable to see the Aux 4 Sensor Value. This would be the target speed.
TSC1 Speed Command RPM/Sec	Configuration Software only. Communications > J1939 Bus menu.	10 to 300 RPM/s in 10 RPM/s increments. Disable	You can limit the speed control ramp rate. This setting can be disabled.

When the Aux 4 Sensor is set to Speed Control the Increment/Decrement speed control methods are disabled. The Aux 4 speed control overrides the two.

The 50/60 Hz switched input is disabled when this feature is used.
 The Aux 4 speed control takes priority over the rated RPM setting under Sensors > Speed.
 Idle has priority over the Aux 4 speed control (idle control means being the idle switched input and the Auto Idle feature under engine logic).

6 Broadcasting

Certain controller parameters can be broadcast over J1939. These settings are only exposed from the Configuration Software.

Broadcasting Settings (in Communications > J1939 menu)

Name	Range	Description
AC Sensing	Enable ~ Disable	Send AC voltage and AC current data over J1939.
Fuel Level	Enable ~ Disable	Send Fuel Level over J1939.
Warnings and Failures	Enable ~ Disable	Send Warnings and Failures over J1939 as DTCs. This does not exactly follow the J1939 DTC standard. Refer to the Dynagen DM1 in the reference section for more information.
DTC Warning Broadcast Mode	Multiple Warning ~ Single Warning	If set to single warning only the first warning will be broadcast. Otherwise each warning will be broadcast one at a time alternating every 3s.
Battery Voltage	Enable ~ Disable	Send DC Battery Voltage over J1939.
Engine Speed	Enable ~ Disable	Send Engine Speed over J1939.
Engine Temperature	Enable ~ Disable	Send Engine Temperature over J1939.
Oil Pressure	Enable ~ Disable	Send Oil Pressure over J1939.
Engine Hours	Enable ~ Disable	Send Engine Hours over J1939.

See the reference section for details on the exact PGNs and SPNs broadcasted.

7 Troubleshooting

If you are having issues with CAN communication, please refer to the table below for a solution before contacting technical support.

Issue	Solution
Parameters on the Controller are displayed as N/A	Check the wiring. <ul style="list-style-type: none"> Terminating resistors (120 Ohm) are required at each end of the bus. Unplug the J1939 connector from the controller and measure across CAN L and CAN H with an ohm meter. It should measure 60 Ohms (two 120 Ohm resistors in parallel. You may have to power down or disconnect all devices on the bus to get an accurate reading. CAN L and CAN H connections are reversed. Check for sources of EMI or other noise that could be interfering with communications.

Engine not starting or starting intermittently.	<p>The ECM may take some time to boot.</p> <ul style="list-style-type: none"> • The ECM power inputs should be powered from the battery. • The ECM enable/disable input(s) should be connected to the controller fuel output. • Since the fuel comes on during preheat which precedes cranking, set a preheat time to give the ECM enough time to boot up before the starter engages. • If a preheat time is not desirable the "Auto Power ECM" in the Communications > J1939 menu can be used. This leaves the Fuel output on in the Auto mode to keep the ECM ready to go.
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Contacting DYNAGEN can be done by any of the methods below. Technical support is offered Monday - Friday, 8:00am - 4:00pm (EST). If you are unable to get a hold of one of our engineers, please leave a message and they will return your call as soon as possible.

Type	Information
Website	www.dynagen.ca/support
Email	support@dynagen.ca
Phone Number	(902) 406-0133
Twitter	@DynaGenTech
Facebook	www.facebook.com/DYNAGEN
Address	3 Spectacle Lake Drive, Unit B105 Dartmouth, NS B3B1W8, Canada

8 Reference

This section details the J1939 support. Specifically the PGN and SPNs the controller supports.

General J1939 notes:

- (1) 0xFF indicates that a parameter is not available.
- (2) The least significant byte (LSB) is always the first.

8.1 Standard

List of PGNs

PGN #	Name	Short Name	Rate (ms)	Priority	Description
65021 (0xFDFD)	Generator Phase C Basic AC Quantities	GPCAC	100	3	Transmits AC Frequency, AC Voltage, and AC RMS Current for Phase A.
65024 (0xFE00)	Generator Phase B Basic AC Quantities	GPBAC	100	3	Transmits AC Frequency, AC Voltage, and AC RMS Current for Phase B. The controller does not support phase B frequency.
65027 (0xFE03)	Generator Phase A Basic AC Quantities	GPAAC	100	3	Transmits AC Frequency, AC Voltage, and AC RMS Current for Phase C. The controller does not support phase C frequency.
65030 (0xFE06)	Generator Average Basic AC Quantities	GAAC	100	3	Average of phase A, B, and C for Line-Line, Line-Neutral, AC Frequency, and AC RMS current.
59904 (0xEA00)	PGN Request	RQST	N/A	6	This is used by the controller to request engine hours from the ECM.
61444 (0xF004)	Electronic Engine Controller 1	EEC1	100	3	Used to broadcast or receive engine speed. For receiving ECM must be at address 0. Controller can also broadcast engine speed.
65253 (0xFEE5)	Engine Hours, Revolutions	HOURS	N/A	6	Used to receive or broadcast engine hours. Requested by controller every 1s. Broadcast (if enabled) by controller every 5s.
65262 (0xFEEE)	Engine Temperature 1	ET1	100	6	Used to receive or broadcast engine temperature. For receiving ECM must be at address 0.
65263 (0xFEEF)	Engine Fluid Level/ Pressure 1	EFL/P1	500	6	Used to receive or broadcast oil pressure from ECM. For receiving ECM must be at address 0.
65271	Vehicle Electrical Power 1	VEP1	100	6	Used to broadcast battery voltage.

(0xFE7)			0		
65276 (0xFEFC)	Dash Display	DD	100 0	6	Used to broadcast fuel level.

Engine SPNs

Parameter Name	SPN	Range	Conversion/ Unit	PGN	PGN Byte/ Bit Location	Description
Fuel Level 1	96	0 to 100%	Gain = 0.4 %/bit Offset = 0	65276 (0xFEFC)	Byte 2	Used for broadcasting of fuel level.
Engine Oil Pressure	100	0 to 1000kPa	Gain = 4kPa/bit Offset = 0	65263 (0xFEEF)	Byte 4	Used to broadcast or receive oil pressure.
Engine Coolant Temperature	110	-40 to 210 °C	Gain = 1degC/ bit Offset = -40	65262 (FEEE)	Byte 1	Used to broadcast or receive engine temperature. Controller is limited to 0°C for failure set-point purposes.
Battery Potential / Power Input 1	168	0 to 3212.75 V	Gain = 0.05V/bit Offset = 0	65271 (0xFE7)	Bytes 5 and 6	Used for broadcasting of battery voltage.
Engine Speed	190	0 to 8,031.875 rpm	Gain = 0.125rpm/bit Offset = 0	61444 (0xF004)	Bytes 4 and 5	Used to broadcast or receive engine speed. Controller is limited to 6000rpm.
Engine Total Hours of Operation	247	0 to 210,554.0 60.75 hr	Gain = 0.05hr/ bit Offset = 0	65253 (0xFEE5)	Bytes 1 to 4	Used to broadcast or receive engine hours.

Generator SPNs

Parameter Name	SPN	Range	Conversion/ Unit	PGN	PGN Byte/ Bit Location	Description
Generator Average AC Frequency	2436	0 to 501.992 1875 Hz	Gain = 1/128 Hz/bit Offset = 0	65030 (0xFE06)	Bytes 5 and 6	Broadcast by controller.
Generator Phase A AC Frequency	2437	0 to 501.992 1875 Hz	Gain = 1/128Hz/ bit Offset = 0	65027 (0xFE03)	Bytes 5 and 6	Broadcast by controller.
Generator Average Line-Line AC RMS Voltage	2440	0 to 64 255 Volts	Gain = 1 V/bit Offset = 0	65030 (0xFE06)	Bytes 1 and 2	Broadcast by controller.
Generator Phase AB Line-Line AC RMS Voltage	2441	0 to 64 255 V	Gain = 1V/bit Offset = 0	65027 (0xFE03)	Bytes 1 and 2	Broadcast by controller.
Generator Phase BC Line-Line AC RMS Voltage	2442	0 to 64 255 Volts	Gain = 1V/bit Offset = 0	65024 (0xFE00)	Bytes 1 and 2	Broadcast by controller.
Generator Phase CA Line-Line AC RMS Voltage	2443	0 to 64 255 Volts	Gain = 1V/bit Offset = 0	65021 (0XDFD)	Bytes 1 and 2	Broadcast by controller.
Generator Average Line-Neutral AC RMS Voltage	2444	0 to 64 255 Volts	Gain = 1V/bit Offset = 0	65030 (0xFE06)	Bytes 3 and 4	Broadcast by controller.
Generator Phase A Line-Neutral AC RMS Voltage	2445	0 to 64 255 Volts	Gain = 1V/bit Offset = 0	65027 (0xFE03)	Bytes 3 and 4	Broadcast by controller.
Generator Phase B Line-Neutral AC RMS Voltage	2446	0 to 64 255 Volts	Gain = 1V/bit Offset = 0	65024 (0xFE00)	Bytes 3 and 4	Broadcast by controller.
Generator Phase C Line-Neutral AC RMS Voltage	2447	0 to 64 255 Volts	Gain = 1V/bit Offset = 0	65021 (0XDFD)	Bytes 3 and 4	Broadcast by controller.
Generator Average	2448	0 to 64	Gain = 1A/bit	65030	Bytes 7	Broadcast by controller.

AC RMS Current		255 Amps	Offset = 0	(0xFE06)	and 8	
Generator Phase A AC RMS Current	2449	0 to 64 255 A	Gain = 1A/bit Offset = 0	65027 (0xFE03)	Bytes 7 and 8	Broadcast by controller.
Generator Phase B AC RMS Current	2450	0 to 64 255 A	Gain = 1A/bit Offset = 0	65024 (0xFE00)	Bytes 7 and 8	Broadcast by controller.
Generator Phase C AC RMS Current	2451	0 to 64 255 A	Gain = 1A/bit Offset = 0	65021 (0xFDFD)	Bytes 7 and 8	Broadcast by controller.

8.2 Aftertreatment (DPF and DEF/SCR)

The following PGNs and SPNs are used by the controller to implement the J1939 aftertreatment support. Some ECMs use proprietary PGNs; these are not included here.

Aftertreatment PGNs

PGN #	Name	Short Name	Rate (ms)	Priority	Description
64891 (0xFD7B)	Aftertreatment 1 Service	AT1S	N/A	6	Message transmitted on request.
64892 (0xFD7C)	Diesel Particulate Filter Control 1	DPFC1	100 0	6	Also transmitted on every change but no more than every 100ms.
64948 (0xFDB4)	Aftertreatment 1 Intake Gas 2	AT1IG2	500	6	
65110 (0xFE56)	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Information	AT1T1I	100 0	6	
65416 (0xFD7C)	Diesel Particulate Filter Control 1	DPFC1	100 0	6	Also transmitted on every change but no more than every 100ms.

Aftertreatment SPNs

Parameter Name	SPN	Range	Conversion/ Unit	PGN	PGN Byte/ Bit Location	Description
Aftertreatment 1 Diesel Exhaust Fluid Tank Level	1761	0 to 100%	Gain = 0.4 %/ bit Offset = 0	65110 (0xFE56)	Byte 1	Used for the DEF/SCR Tank Level Display. Scania ECM uses a different SPN.
Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	3031	-40 to 210°C	Gain = 1 °C/bit Offset = -40 °C	65110 (0xFE56)	Byte 2	Used for the DEF/SCR Fluid Temperature Display.
Aftertreatment 1 Exhaust Gas Temperature 1	3241	-273 to 1734.9687 5 °C	Gain = 0.03125 °C/bit Offset = -273 °C	64948 (0xFDB4)	Bytes 1 and 2	Used for the exhaust temperature display.
Diesel Particulate Filter Lamp Command	3697	See Description	N/A	64892 (0xFD7C)	Bits 1, 2, and 3 of Byte 1	000 = OFF 001 = On - solid 100 = fast blink (1 HZ) 111 = Not available Used by the regeneration lamp.
Exhaust System High Temperature Lamp Command	3698	See Description	N/A	64892 (0xFD7C)	Bits 3, 4, and 5 of Byte 7	000 = Off 001 = On - solid 111 = not available Used by the high exhaust temperature lamp.
Diesel Particulate Filter Active Regeneration	3703	See Description	N/A	64892 (0xFD7C)	Bits 3, 4, and 5 of Byte 3	00 = not inhibited 01 = inhibited 11 = not available

Inhibited Due to Inhibit Switch						Used by the regeneration disable lamp.
Diesel Particulate Filter 1 Soot Load Percent	3719	0 to 250 %	Gain = 1 %/bit Offset = 0	64891 (0xFD7B)	Byte 1	Used to display DPF Soot Level.
Diesel Particulate Filter 1 Ash Load Percent	3720	0 to 250 %	Gain = 1 %/bit Offset = 0	64891 (0xFD7B)	Byte 2	Used to display EPF Ash Level.
Diesel Particulate Filter 1 Time Since Last Active Regeneration	3721	0 to 4 211 081 215 s	Gain = 1 s/bit Offset = 0	64891 (0xFD7B)	Bytes 3 to 6	Used to display time since last active regeneration.
Aftertreatment Selective Catalytic Reduction Operator Inducement Active	5245	See Description	N/A	65110 (0xFE56)	Bits 6, 7, and 8 of Byte 5	000 - Off - Adequate DEF level. 001 - On solid - Low DEF level. 100 - fast blink (1 Hz) - DEF level is even lower. 111 - not available Used by the Diesel Exhaust Fluid Lamp. Scania ECM uses a different SPN.
Aftertreatment SCR Operator Inducement Severity	5246	See Description	N/A	65110 (0xFE56)	Bits 6, 7, and 8 of Byte 6	000 - not active 001 - Inducement Level 1, Warning. 010 - Level 2, second level warning 011 - Level 3 -EPA Engine Derate 100 - Level 4 -Severe Inducement Pre-Trigger 101 - EPA - Severe Inducement 110 - Temporary inducement override 111 - not available / not supported Used by the Diesel Exhaust Fluid Lamp. Scania ECM uses a different SPN.

8.3 Dynagen Proprietary

PGN #	Name	Short Name	Rate	Priority	Description
65450 (0xFFAA)	Dynagen 1	N/A	200	6	Broadcasting of internal controller parameters useful to a remote panel.
65451 (0xFFAB)	Dynagen 2: Aux Sensor	N/A	200	6	Broadcasting of the auxiliary sensors 1 to 4. Units or custom text are not broadcast.

Dynagen 1 PGN

Parameter Name	SPN	Range	Gain/Offset	PGN	PGN Byte/Bit Location	Description
Controller State	52020 0	0 = Others 1 = Failure 2 = OFF 3 = AUTO 4 = Cooldown 5 = Shutdown 6 = Running	Gain = 1 Offset = 0	65450 (0xFFAA)	Bits 0 to 3 of Byte 1	
Pressure Unit	52020 1	0 = kPa 1 = PSI		65450 (0xFFAA)	Bit 7 of Byte 1	
Temperature Unit	52020 2	0 = Fahrenheit 1 = Celsius		65450 (0xFFAA)	Bit 6 of Byte 1	

				A)		
Failure State	52020 3	0 = OK 1 = Warning 2 = Failure 3 = Double Failure	Gain = 1 Offset = 0	65450 (0xFFFA A)	Bits 4 and 5 of Byte 1	
Failures	52020 4	0 = Failed To Stop 1 = Breaker Failed 2 = Load Imbalance 3 = (Reserved) 4 = Over Current 5 = DM1 stop lamp 6 = High Engine Temperature 7 = Low Oil Pressure 8 = Under Speed 9 = Over Speed 10 = Low Fuel Level 11 = Low Battery 12 = Low Coolant Level 13 = Over Crank 14 = Over Voltage 15 = Under Voltage 16 = (reserved) 17 = Kubota Level 3 shutdown 18 = Low Air Pressure 19 = Low Hydraulic 20 = High Battery 21 = Loss of ECM Comm 22 = Under Frequency 23 = Over Frequency 24 = DPF SRVC REQ'D (Kubota Level 4) 25 = SERVICE DPF!!! (Kubota Level 5) 26 = Calibration Fail (Doosan) 27 = High Fuel Temp (Doosan) 28 = High Exhaust (Temp (Doosan) 194 = User Configurable Failure 1 195 = User Configurable Failure 2 196 = Auxiliary Sensor 1 Failure 197 = Auxiliary Sensor 2 Failure 198 = Auxiliary Sensor 3 Failure 199 = Auxiliary Sensor 4 Failure 201 = User Configurable Failure 3 202 = Exception Fault	Gain = 1 Offset = 0	65450 (0xFFFA A)	Byte 2	Values from 194 to 202 are items with customizable text the user can program.
First Line Display ID	52020 5	0 = (empty) 1 = Auto State 2 = Not In Auto 3 = Menu Setting 4 = Start Engine 5 = (reserved) 6 = Preheating 7 = J1939 Remote 8 = Speed Valid 9 = Dly To Stat...	Gain = 1 Offset = 0	65450 (0xFFFA A)	Byte 3	

		<ul style="list-style-type: none"> 10 = Preheating... 11 = Cranking... 12 = Warm-up... 13 = Crank Rest 14 = Running... 15 = Cooldown 16 = Shutdown... 17 = Idle Running... 18 = System Failed 19 = Emergency ... 20 = Speed Detect ... 21 = Idle Cool ... 22 = Remote Run ... 23 = Manual Run ... 24 = Modbus Run ... 25 = Charging ... 26 = Schedule Run ... 27 = ETS Shutdown ... 28 = Set Speed 29 = Sensor Run ... (plus count down) 30 = Sensor Run ... 31 = AMF Run ... 32 = Switch Run ... 33 = Cranking ... 34 = Idle Speed ... 35 = Expansion Run 				
Second Line Display ID	520206	<ul style="list-style-type: none"> 0 = (empty) 1 = (scroll lock symbol) 2 = Waiting To Start 3 = Enter To Reset 4 = Warning 5 = Crank Failed 6 = No System Comm 7 = Low Batt InCrank 8 = New Stored DTC 9 = Service Required 10 = Dummy Load On 11 = Engine Started 12 = Lock Screen 13 = Requesting DTC 14 = High Fuel Level 15 = Under Voltage 16 = Recharge Alert 17 = Fuel Off 18 = Under Speed 19 = Over Speed 20 = Over Voltage 21 = High Engine Temp 22 = Low Oil Pressure 23 = Low Fuel Level 24 = Exerciser Alert 25 = . m To Run Note: low battery or exerciser time to start countdown. 26 = No Stored DTC 27 = DTC Read Failed 28 = Midheat ON 29 = False Restart 30 = Remote Start 31 = Modbus Start 32 = ECM Power ON 33 = New Active DTC 34 = ECM No Power 35 = (auxiliary sensor 1 text) 	Gain = 1 Offset = 0	65450 (0xFFFA)	Byte 4	Values 128 to 143 are the expansion pack actions custom text.

		<p>36 = Exception Reset 37 = (auxiliary sensor 2 text) 38 = Under Speed 39 = Rotor Locked 40 = Fuel In Basin 41 = Low Battery 42 = High Battery 43 = Low Engine Temp. 44 = (reserved) 45 = (reserved) 46 = (reserved) 47 = Emergency Stop 48 = Battle Running 49 = Under Frequency 50 = Over Frequency 51 = Emergency Stop 52 = Manual Stop 53 = Remote Stop 54 = Modbus Shutdown 55 = Postheat ON 56 = Charger Fault 57 = (config warn 1 input text) 58 = (config warn 2 input text) 59 = Sensor Start 60 = Sensor Shutdown 61 = Switch Start 62 = Switch Stop 63 = Regen Required 64 = Active Regen 65 = Over Current 66 = (start inhibit text) 67 = (auxiliary sensor 3 text) 68 = (auxiliary sensor 4 text) 69 = ECM Preheating 70 = DEF Pump On 71 = DEP Pump Off 72 = Remote Reset 73 = Genset Disable 74 = Do not load. 75 = (Up) + (Down) For Unlatch 76 = Breaker Tripped 77 = Load Imbalance 78 = Start Inhibit 79 = DEF Fluid Level 80 = DEF EngineDerate 81 = DEF Fluid Empty 82 = DEF Severe Indum 83 = SCR EngienDerate 84 = SCR Severe Indum 85 = Inducmt Pending 86 = Final Inducmt 87 = Reserved 88 = High Fuel Temp 89 = High Exhaust Temp 128 = action 1 129 = action 2 130 = action 3</p>				
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		131 = action 4 132 = action 5 133 = action 6 134 = action 7 135 = action 8 136 = action 9 137 = action 10 138 = action 11 139 = action 12 140 = action 13 141 = action 14 142 = action 15 143 = action 16				
AC Group Display	52020 7	17 (0x11) = single phase 2 wire with current 1 (0x01) = single phase 2 wire without current 18 (0x12) = 3 wire single phase A-B with current 2 (0x02) = 3 wire single phase A-B without current 146 (0x92) = 3 wire single phase A-C with current 130 (0x82) = 3 wire single phase A-C without current 19 (0x13) = 3-wire 3-phase with current 3 (0x03) = 3-wire 3-phase without current 20 (0x14) = 4-wire 3-phase with current 4 (0x04) = 4-wire 3-phase without current 21 (0x15) = 4-wire Delta 3-phase with current 5 (0x05) = 4-wire Delta 3-phase without current	Gain = 1 Offset = 0	65450 (0xFFFA A)	Byte 6	The voltage and current configuration.
Current Run Time	52020 8	0 to 6500.0 hr. Display limited to 999.9 hours.	Units: hours Gain = 0.1 Offset = 0	65450 (0xFFFA A)	Bytes 7 and 8	The amount of time the controller has been running since the last start.

Dynagen 2: Aux Sensor

Parameter Name	SPN	Range	Gain/Offset	PGN	PGN Byte/Bit Location	Description
Auxiliary Sensor 1	52022 0	0 to 6553.5	Gain = 0.1 Offset = 0	65451 (0xFFFA B)	Bytes 1 and 2	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939.
Auxiliary Sensor 2	52022 1	0 to 6553.5	Gain = 0.1	65451 (0xFFFA B)	Bytes 3 and 4	0xFFFF = parameter disabled or not available.

			Offset = 0	B)		Units are not transmitted over J1939.
Auxiliary Sensor 3	52022 2	0 to 6553.5	Gain = 0.1 Offset = 0	65451 (0xFFA B)	Bytes 5 and 6	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939.
Auxiliary Sensor 4	52022 3	0 to 6553.5	Gain = 0.1 Offset = 0	65451 (0xFFA B)	Bytes 7 and 8	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939. Will not be broadcasted if this input was programmed with an RPM table (for speed control).

8.4 Dynagen Control PGNs

The J1939 request PGN (RQST, 59904 or 0xEA00) is used to send commands to the local controller.

Dynagen Remote Control

A remote device can use the request PGN to send start, stop, and forced stop commands to the local controller. The PGN # sent as part of the request PGN is the command. The address of the remote must be 254 (0xFE).

- (1) Send request for PGN 40000 to the controller to trigger a start (if controller is in AUTO mode).
- (2) Send request for PGN 40011 to the controller to trigger a stop (if controller is in RUN mode).
- (3) Send request for PGN 40044 to the controller to trigger a forced stop (if controller is in RUN mode). The controller will be forced to do a shutdown if it was in the running or cooldown state. The controller will be forced to OFF mode if it was in the Failure mode.

Note: this is not in the J1939 standard. This is a proprietary extension of the request PGN in the standard.

Dynagen Off to Auto Command

A device sends a request for PGN 40055 (0x9C77) to put the controller that is in the OFF mode into the AUTO mode. The address of the request must be 254 (0xFE).

8.5 Dynagen DM1

The controller can broadcast it's warnings and failures over J1939.

It deviates from the J1939 standard in the following ways:

- (1) It sends only one DTC at a time even when multiple trouble codes are active. It alternates between DTCs every 3s.
 - (a) As of firmware 1.75 it can alternatively (via a setting) only display the first active warning. It will continue to display the warning until the warning is inactive. Then it will display the next active warning.
- (2) It always sends an SPN of 40179 for warnings and SPNs 40181 and 40182 for failures.
- (3) The FMI does not indicate the failure mode. The FMI indicates the specific active warning or failure.

8.5.1 Warnings

SPN 40179

FMI	Description
0	Low Engine Temperature
1	High Engine Temperature
2	Low Oil Pressure
3	Under Speed
4	Over Speed
5	Low Fuel Level

6	High Fuel Level
7	Low Battery Voltage
8	High Battery Voltage
9	Under AC Frequency
10	Over AC Frequency
11	AC Under Voltage
12	AC Over Voltage
13	Battery Charger Fault
14	Over Current Warning
15	Fuel In Basin
16	Switched Input Configurable Warning 1
17	Switched Input Configurable Warning 2
18	Auxiliary Sensor 1
19	Auxiliary Sensor 2
20	Auxiliary Sensor 3
21	Auxiliary Sensor 4
22	Load Imbalance
23	Remote Start Inhibit
24	J1939 expansion pack warning
25	DTC message recieved
26	Doosan G2 high fuel temperature
27	Doosan G2 high exhaust temperature
28 - 31	reserved

8.5.2 Failures

SPN 40181

FMI	Description
0	Overcrank
1	Engine Failed to Stop
2	DM1 Stop Lamp
3	High Engine Temperature
4	Low Oil Pressure
5	Low Fuel Level
6	Under Speed
7	Over Speed
8	Low Battery Voltage
9	High Battery Voltage
10	Low Coolant Level
11	Low Air Pressure
12	Low Hydraulic Pressure
13	Under Frequency
14	Over Frequency
15	AC Under Voltage
16	AC Over Voltage
17	ECM Communication
18	Switched Input Configurable Failure 1
19	Switched Input Configurable Failure 2

20	Auxiliary Sensor 1
21	Auxiliary Sensor 2
22	Auxiliary Sensor 3
23	Auxiliary Sensor 4
24	Over Current
25	Switched Input Configurable Failure 3
26	Load Imbalance
27	Tripped Breaker
28	Regen Needed
29	DPF SRVC REQ'D! (DPF Service Required)
30	Service DPF!!!
31	J1939 expansion pack failure

SPN 40182

FMI	Description
0	Exception Fault
1	Doosan G2 Calibration Error
2	Doosan G2 High Fuel Failure
3	Doosan G2 High Exhaust Temperature Failure