CATTRON™

DYNAGEN™

TOUGH Series™ J1939

Reference Manual

CONNECT. CONTROL. PROTECT.

1 Revision History

VERSION	DATE	NOTES
7.0	09/2019	
A	09/2022	Document rebranded and contact information updated.
B	12/2024	Added PGNs 0xFFAD, 0xFFAE, Updates to PGN 0xFFAA

2 Contents

3 Settings

J1939 is enabled when the engine speed, engine temperature, or oil pressure signal source is set to J1939 or when "ECM Comm. Fail" (Communications > J1939 Bus) is enabled.

The following section relates to generic J1939 settings when setting up the controller to work with an ECM. For Engine Speed, Engine Temperature, and Oil Pressure, 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 Comm. Fail (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 Deutz EMR 3/4	Depending on the engine model, there are cases where some special measurement and control functions are required to communicate with the engine ECM. If your engine or ECM is not listed, you can use 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.
DTC Display Active DTC Log Read Stored DTC	Under the DTC menu in the RapidCore Configuration Software. There are other parameters programmable only from RapidCore. Refer to the Diagnostic Trouble Codes (DTC) section 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 shuts down, the controller will wait the length of the ECM Power Delay before turning on the fuel relay again upon returning to Auto Mode. This is to prevent unwanted start-ups due to the engine not being completely shut down.
Cummins PGNs	Refer to the Proprietary ECMs section.	

Name	Range	Description
SPN Conversion	Version 1 Version 2 Version 3	Select the SPN conversion method. See DTC Conversion Methods for more information.
EMS2B Freq Sel	Refer to the Proprietary ECMs section.	
EMS2B Acc Pedal		
The following settings are programmable from the RapidCore Configuration Software only.		
Broadcast Over J1939	SubMenu	RapidCore only. Refer to the Broadcasting section.
Aftertreatment	RapidCore only. Refer to the Aftertreatment section for more info.	
Actual Engine % Torque	Enable Disable	When enabled, the standard J1939 message “Actual Engine % Torque” is displayed. This message is not available for all ECMs.
% Engine Load (RapidCore only)	Enable Disable	When enabled, the standard J1939 message “Percent Engine Load” is displayed. This message is not available for all ECMs.
Ambient Air Temperature Display	Enable Disable	When enabled, the standard J1939 message for ambient air temperature will be displayed on the controller. This message may not be available for all ECMs.
Ambient Air Temperature Control	RapidCore only. Refer to the Ambient Air Temperature section.	
Source Address	0 ~ 253	RapidCore only. In TE350/TE410 since version 1.92. This is the device address for the controller. Default is 253. This is important to set if speed control is desired as most ECMs will not accept speed control commands over J1939 if the address is not correct.
TSC1 Speed Command RPM/Sec	10 ~ 300 RPM/s in 1 RPM/s increments	Sets the ramp rate for the speed control command over J1939. The controller will not accelerate the engine faster than this value when responding to speed setpoint changes.

⚠	**WARNING** IF AN ENGINE PARAMETER DISPLAYS N/A WHILE IN AUTO MODE, THERE MAY BE A COMMUNICATION ISSUE.

3.1 Ambient Air Temperature

This feature is in the TG350/TG410 firmware version 1.86 and above. It is not in the TE350/TE410 controllers.

It controls a switched output depending on the ambient air temperature SPN (SPN 172, PGN 65269).

A switched output must be set to "Amb Temp Out" in addition to the following settings.

Name	Range	Default	Description
Ambient Air Temperature Control	***Sub Menu***	***-----***	***-----***
Ambient Air Temperature Control	Disable Enable	Disable	Enables control of an output based on the ambient air temperature.
Bypass Timer	1 to 120 s in 1 s increments	10 s	When first entering Run Mode, the amount of time to wait before initiating the feature.
Output On Temp	1 to 250 °F in 1 °F increments	10 °F	The temperature, if it rises above this setpoint, turns the switched output on.
Output Off Temp	1 to 250 °F in 1 °F increments	20 °F	The temperature, if it falls below this setpoint, turns the switched output off.

3.2 J1939 Auto Address

There are situations when there may be address conflicts with the TOUGH Series controller and other devices on the CANbus. 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 the bus	The controller will change 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 the bus	The controller will keep its address and it is expected that the new device will change its address.
Device on bus, controller with same address comes onto the bus	The controller coming onto the bus will change its address to 'Current Address + 1.'

3.3 Proprietary ECMs

Some ECM manufacturers have proprietary messages in their J1939 protocol. When selecting your ECM Module in the Settings section, the following settings may need to be set.

Settings

Name	Range	Description
Cummins PGNs	Enable Disable	Enables or disables the broadcasting of PGNs required by certain Cummins G-Drive engines (generators). The PGNs are GCP, GC1, EG, GAP, EAC, CCVS, and GC2. This is typically required on the Cummins generator drive line.

Name	Range	Description
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.

4 Diagnostic Trouble Codes (DTC)

Diagnostic Trouble Codes (DTC) are messages that are broadcast from the 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).
DTC Conversion Methods	Version 1 Version 2 Version 3	For older implementations of the SAE J1939 DTC spec, there are three formats for DTCs, and it is 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.
Custom J1939-DM1 Messages		RapidCore only. Create up to 30 custom messages for SPN / FMI combinations that display on the controller screen when the DTC / FMI combination is active.
DTC Ignore List		RapidCore only. Create up to 6 SPN / FMI combinations that will be ignored by the controller.

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

Note: The TE Series controllers display the DTC screen for 3 to 4 seconds, which then repeats every 50 seconds. This allows the user to continue to view the main pump display screen during an active DTC event.

4.1 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 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.

Note: For TE350/TE410 controllers, a DM2 request cannot be initiated when the controller is running.

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 three times. It will then display 'Requesting Failure' and turn off the fuel output if there is no valid response on the fourth try.

The ECM address for the DM2 request is 0. The controller may also show 'Reading Abort' if communication is unsuccessful.

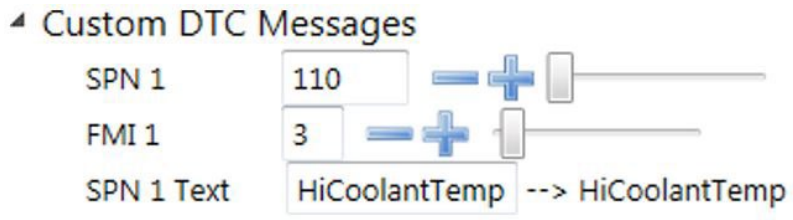
If the request was successful, the controller will show 'Read DTC Success' and start to display the messages.

4.2 Custom DTC Messages

Normally when a DTC is received, it is displayed using the SPN, FMI and OC, and you must consult the engine's documentation to determine the meaning of the fault. Using the Custom DTC Messages in the RapidCore Configuration Software, 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 the DTC code with SPN = 110 and FMI = 3 is received.



Custom DTC Message Example

4.3 DTC Ignore List

There are times when an ECM may be sending out DTC messages that are not applicable to your specific application. Using the RapidCore Configuration Software, 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 the DTC code with SPN = 110 and FMI = 3.

DTC Ignore List Example

4.4 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 the SPN method (Version 4) and can be determined by looking at the CM bit. It will be set to 0 for Version 4 and set to 1 for Versions 1, 2, and 3. If the CM bit is 1, use one of the following conversion methods. Byte 1 to Byte 4 refers to the individual bytes in the controller's DTC Modbus registers.

DTC Conversion Method (Version 1)

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

DTC Conversion Method (Version 2)

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

DTC Conversion Method (Version 3)

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

DTC conversion Method 3 is the same as DTC conversion Method 4, except that the CM bit is 1, making it 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.

5 Aftertreatment

This section describes how to set up the controller to interface with the aftertreatment emissions systems on electronic engines.

These settings are configured from the RapidCore Configuration Software only.

Aftertreatment Settings

Name	Range	Description
Aftertreatment Enabled	Disable DPF DEF/SCR	Selects the Aftertreatment mode used by the engine.
Aftertreatment Display Page Enable (RapidCore only)	Enable Disable	
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 Fluid Level Options	***Sub Menu***	***See DEF Fluid Level Options for more information.***
DEF/SCR Fluid Temperature	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 (Operator Setup > Display)

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.

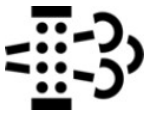
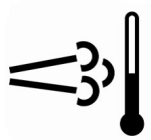
	CAUTION
	THIS SETTING IS FOUND IN THE OPERATOR SETUP MENU AND NOT THE J1939 MENU.

Examples:

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

5.1 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 the high soot level in the exhaust filter.
	Regeneration Disable Lamp	This 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 the exhaust temperature is high / elevated IDLE speed has been triggered / exhaust filter cleaning is in process.

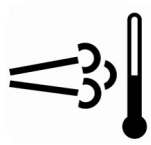
Display Parameters

There are up to four parameters that can be enabled to be displayed on the controller scrolling screen for DPF interface and feedback. When enabled, the parameters will be displayed on the page scrolling screen on the controller. Parameter display can only be enabled by the RapidCore Configuration Software 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 ~ 1,169,744.78 hr	Indicates the time since the last active regeneration event of diesel particulate filter 1.
Exhaust Gas Temperature Display	-273 ~ 1734°C	Indicates the Exhaust temperature of the DPF.
DPF Shutdown Delay	1 ~ 60 min in 1 min increments default is 5 min	This setting only applies, and is visible, when ECM Module set to "Kubota T4F". The controller will shut down after the period specified by this setting when the Kubota ECM regeneration level is 4 or higher. This prevents the DPF from reaching level 5 at which point the DPF system may have to be replaced.

5.2 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 the high soot level in the exhaust filter.
	Regeneration Disable Lamp	This 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 the 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 a warning of the DEF fluid level secondary severity level.

Display Parameters

There are up to three parameters that can be enabled to be displayed on the controller scrolling screen for DEF/SCR interface and feedback. When enabled, the parameters will be displayed on the page scrolling screen on the controller. Parameter display can only be enabled by the RapidCore Configuration Software 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 ~ 1,169,744.78 hr	Indicates the time since the last active regeneration event of diesel particulate filter 1.

5.2.1 DEF Fluid Level Options

The DEF Fluid Level Options provides two features:

1. Control a switched output to pump DEF fluid (aka urea) from a larger holding tank to the smaller tank on the engine. This is often used for stationary engines to decrease the amount of time the user has to fill the urea tank.
2. Provide an automatic shutdown when the DEF fluid level gets too low. This allows the application to comply with emissions regulations while providing a user friendly message (instead of a shutdown due to a diagnostic trouble code from the ECM).

The following settings can only be programmed from the RapidCore Configuration Software:

- The DEF/SCR Tank Level Display (Communications > J1939 Bus > Aftertreatment) must be enabled
- The first item above requires a switched output be set to “DEF Fluid Pump”

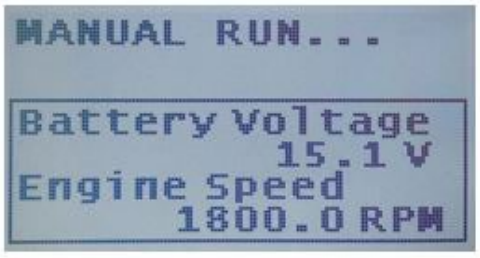
(RapidCore: Communications > J1939 Bus > Aftertreatment)

Name	Range	Default	Description
DEF Fluid Level Options	***Sub Menu***	***-----***	***-----***
DEF Low Level	0 to 100% in 0.1% increments	20%	If the DEF tank level falls below this setpoint, turn on the DEF output.
DEF High Level	0 to 100% in 0.1% increments	80%	If the DEF tank level rises above this setpoint, turn off the DEF output.
DEF Fluid Pump Max. ON Timer	5 to 60 s in 1 s increments	10 s	The amount of time to leave the output on for the ON cycle.
DEF Fluid Pump Re-Cycle Timer	0 to 300 s in 1 s increments	60 s	The amount of time to keep the output off until the next ON cycle.

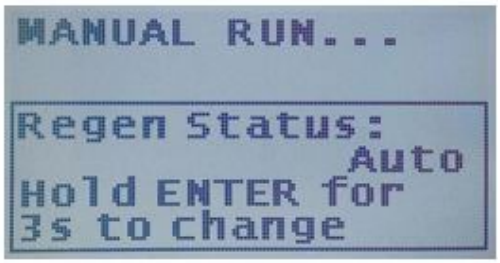
Name	Range	Default	Description
DEF Fluid Level Failure	Disable 0.1 to 20% in 1% increments	Disable	If enabled, if the DEF tank level drops below this setpoint, the controller will shut down on a "FILL DEF NOW" failure.
DEF Fluid Level Trigger Delay	1 to 60 s in 1 s increments	10 s	The amount of time the DEF tank level must be below the "DEF Fluid Level Failure" setpoint before triggering the "FILL DEF NOW" failure.

5.3 Operator Interface

When the controller is running and there are no aftertreatment functions, the controller will scroll through its display parameters as usual, as shown in the following figure on the left side. When the aftertreatment page is displayed, it will show the Regen Status as well as the instruction Hold ENTER for 3s to change, as shown in the following figure on the right side.

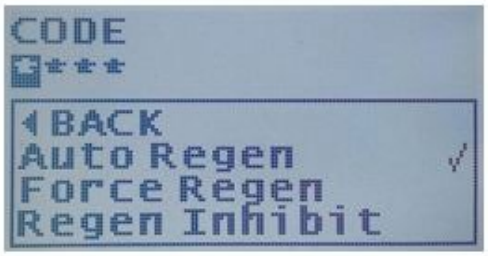


Parameter Page



Aftertreatment Page

Holding the ENTER button for 3 seconds will display one of the following two screens. 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 are shown on the screen to the right.



Password Request

Aftertreatment Menu

The Aftertreatment modes are listed in the following table.

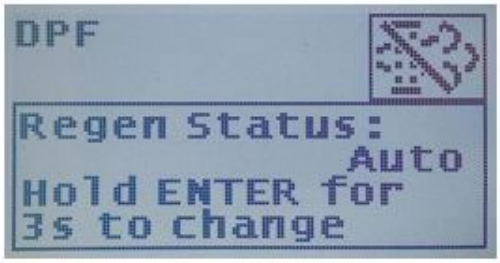
Aftertreatment Modes

Name	Description
Back	Returns to scrolling pages.

Name	Description
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 to 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.

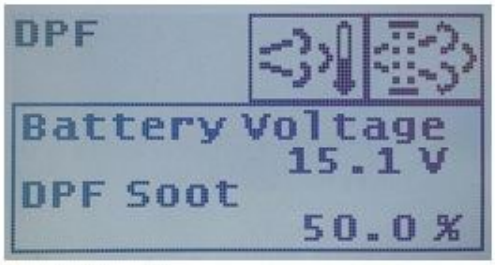
The following screens show how the different icons are displayed on the screen of the controller.

Regeneration Required



Regeneration Inhibited

Low DEF Fluid Level



High Exhaust Temperature

6 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 the 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: 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 any under speed, voltage and frequency warnings and failures when active and changes the engine speed to **Idle RPM** speed.
Primary RPM (60Hz) / Secondary RPM (50Hz) Switch	N/A	When the switched input is inactive, the controller changes the engine speed to **Primary RPM / 60Hz** speed. When the switched input is active, the controller changes the 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 when operating under normal running 60Hz conditions or at Primary RPM.
Secondary RPM / 50Hz		500 ~ 4000	Speed at which the engine runs 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.

These settings are illustrated in the following two examples.

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).

7 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 TSC1 command. See J1939 TSC1 or Switched Output.
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. See J1939 TSC1 or Switched Outputs.
Aux 4 Speed Control	The Auxiliary Sensor 4 is used to determine the set point speed. The speed is adjusted with the J1939 TSC1 command. See Aux 4 Speed Control.

WARNING

SWITCHED OUTPUTS HAVE A FLOATING VOLTAGE OF APPROXIMATELY 8 V WHEN OFF. IF USING THE OUTPUTS FOR DIGITAL LOGIC, IT WILL BE NECESSARY TO PUT A PULL-DOWN RESISTOR (2.2 KΩ, 1 WATT) FROM THE OUTPUT TO GROUND TO ENSURE A LOW LOGIC LEVEL WHEN OUTPUT IS OFF.

7.1 J1939 TSC1 or Switched Outputs

If you are using Increment or Decrement (with either J1939 or Switched Outputs), the settings in the following table apply.

If you are using the Auxiliary Sensor 4 speed control method, see the following section (Aux 4 Speed Control).

Speed Control Settings (in Engine Speed menu)

Name	Parent Menu	Range	Description
Speed Control Enable	(RapidCore 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 the 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	(RapidCore 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.

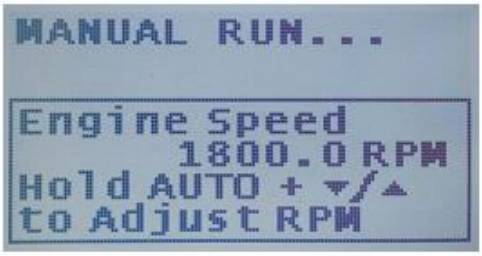
Name	Parent Menu	Range	Description
Speed Bias	Sensors > Engine Speed > RPM Control	0 ~ 600 RPM in 1 RPM increments	The minimum or maximum RPM that the engine speed can be adjusted around the Rated RPM. For example, if Rated RPM is 1800 and Speed Bias is 150, then the minimum RPM will be 1650 and maximum RPM will be 1950. Only valid when the correct Limit Method is chosen.
Min Speed		500 ~ 4000 RPM in 1 RPM increments	The minimum RPM that can be set using speed control. Only valid when the correct Limit Method is chosen.
Max Speed		500 ~ 4000 RPM in 1 RPM increments	The maximum RPM that can be set using speed control. Only valid when the correct Limit Method is chosen.
TSC1 RPM/s (TSC1 Speed Command RPM/Sec)	Sensors > Engine Speed > RPM Control (RapidCore: Communications > J1939 Bus menu)	Disable 10 ~ 300 RPM/s in 10 RPM/s increments	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

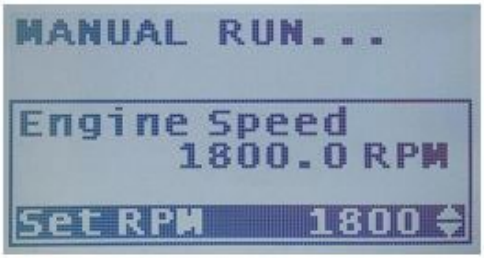
This applies to the TG series only (TG350 and TG410).

When the controller is running and there are 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 instruction Hold AUTO + Up/Down to Adjust RPM, as shown in the following figure on the left side.



Speed Control Parameter Page



Speed Control Adjust Page

Pressing and holding the AUTO button will display the screen on the right side. If a 'Display Adjust Parameter' is set, it too will be displayed underneath the Engine Speed. While still holding the AUTO button, press the UP or DOWN buttons 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.

⚠	**CAUTION**
	WHEN USING SWITCHED OUTPUTS FOR SPEED CONTROL, THE SET RPM WILL DISPLAY '---' INSTEAD OF THE SET SPEED.

7.2 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 the feature properly, the following settings 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	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	... Speed Control	**Must** be set to speed control.
Auxiliary Sensor 4 > Custom Sender	(RapidCore only) Sensors > Aux Sensor 4	N/A	The unit type **must** be set to "Speed". Click Edit to specify the x-value (resistance, voltage, current) and y-value (RPM) for the table. This is the speed control.
Aux Sensor 4 > Display	Sensors	Enable Disable	Enable to see the Aux 4 Sensor Value. This would be the target speed.
TSC1 RPM/s (TSC1 Speed Command RPM/Sec)	(RapidCore only) Communications > J1939 Bus	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 these two methods.

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).

8 Broadcasting

Certain controller parameters can be broadcast over J1939. These settings are only exposed from the RapidCore 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 section in the reference section of this manual 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 3 seconds.
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 References section for details on the exact PGNs and SPNs that are broadcast.

9 Troubleshooting

If you are having issues with CAN communication, please refer to the table below for a solution before contacting technical support at www.cattron.com/contact.

Issue	Solution
Parameters on the Controller are displayed as N/A	Check the wiring. • Terminating resistors (120 Ω) 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 Ω (two 120 Ω resistors in parallel). You may have to power down or disconnect all devices on the bus to get an accurate reading. Check internal terminating resistor configurations to ensure only the end two are enabled, with no external terminating resistor. • CAN L and CAN H connections are reversed • Significant voltage between controller B- and ECM B- • Check for sources of EMI or other noise that could be interfering with communications
Engine not starting or starting intermittently	The ECM may take some time to boot. • 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 "Settings" 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

10 References

This section details the J1939 support, specifically the PGNs and SPNs that the controller supports.

General J1939 notes:

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

10.1 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 C.
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 A. The controller does not support phase A 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 and receive Percent Torque. For receiving, ECM must be at address 0. Controller can also broadcast engine speed.
61443 (0xF003)	Electronic Engine Controller 2	EEC2	50*	3	Used to receive Engine Percent Load at Current Speed (aka Percent Load). * Preferred by standard but may be engine speed dependent.

PGN #	Name	Short Name	Rate (ms)	Priority	Description
65253 (0xFEE5)	Engine Hours, Revolutions	HOURS	N/A	6	Used to receive or broadcast engine hours. Requested by controller every 1 s. Broadcast (if enabled) by controller every 5 s.
65262 (0xFEEE)	Engine Temperature 1	ET1	1000	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 (0xFEF7)	Vehicle Electrical Power 1	VEP1	1000	6	Used to broadcast battery voltage.
65276 (0xFEFC)	Dash Display	DD	1000	6	Used to broadcast fuel level.

Engine SPNs

Parameter Name	SPN	Range	Conversion/ Unit	PGN	PGN Byte/Bit Location	Description
Engine Percent Load At Current Speed	92	0 to 125%	Gain = 1%/bit Offset = 0	61443 (0xF003)	Byte 3	Known as Percent Load in controller and RapidCore. If enabled in the RapidCore Configuration Software, this parameter is displayed on the controller in the Run Mode.
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 = 1°C/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.

Parameter Name	SPN	Range	Conversion/ Unit	PGN	PGN Byte/Bit Location	Description
Battery Potential / Power Input 1	168	0 to 3212.75 V	Gain = 0.05V/bit Offset = 0	65271 (0xFEF7)	Bytes 5 and 6	Used for broadcasting of battery voltage.
Engine Speed	190	0 to 8031.875 RPM	Gain = 0.125RPM/bit Offset = 0	61444 (0xF004)	Bytes 4 and 5	Used to broadcast or receive engine speed. Controller is limited to 6000 RPM.
Engine Total Hours of Operation	247	0 to 210,554,060.75 hr	Gain = 0.05hr/bit Offset = 0	65253 (0xFEE5)	Bytes 1 to 4	Used to broadcast or receive engine hours.
Actual Engine - Percent Torque	513	0 to 125%	Gain = 1%/bit Offset = -125	61444 (0xF004)	Byte 3	If enabled in the RapidCore Configuration Software, displayed on the controller in Run Mode.

Generator SPNs

Parameter Name	SPN	Range	Conversion/ Unit	PGN	PGN Byte/ Bit Location	Description
Generator Average AC Frequency	2436	0 to 501.9921875 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 501.9921875 Hz	Gain = 1/128 Hz/bit Offset = 0	65027 (0xFE03)	Bytes 5 and 6	Broadcast by controller.
Generator Average Line-Line AC RMS Voltage	2440	0 to 64,255 V	Gain = 1V/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 V	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 V	Gain = 1V/bit Offset = 0	65021 (0xFDFD)	Bytes 1 and 2	Broadcast by controller.

Parameter Name	SPN	Range	Conversion/ Unit	PGN	PGN Byte/ Bit Location	Description
Generator Average Line-Neutral AC RMS Voltage	2444	0 to 64,255 V	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 V	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 V	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 V	Gain = 1V/bit Offset = 0	65021 (0xFDFD)	Bytes 3 and 4	Broadcast by controller.
Generator Average AC RMS Current	2448	0 to 64,255 A	Gain = 1A/bit Offset = 0	65030 (0xFE06)	Bytes 7 and 8	Broadcast by controller.
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.

10.2 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	1000	6	Also transmitted on every change but no more than every 100 ms.

PGN #	Name	Short Name	Rate (ms)	Priority	Description
64948 (0xFDB4)	Aftertreatment 1 Intake Gas 2	AT1IG2	500	6	
65110 (0xFE56)	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Information	AT1T1I	1000	6	
65416 (0xFD7C)	Diesel Particulate Filter Control 1	DPFC1	1000	6	Also transmitted on every change but no more than every 100 ms.

For the above PGNs, the controller will disregard any PGN that is sent by a device that is at an address other than zero.

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 1734.96875 °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.

Parameter Name	SPN	Range	Conversion/ Unit	PGN	PGN Byte/Bit Location	Description
Diesel Particulate Filter Active Regeneration Inhibited Due to Inhibit Switch	3703	See Description	N/A	64892 (0xFD7C)	Bits 3, 4, and 5 of Byte 3	00 = not inhibited 01 = inhibited 11 = not available 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 = 1s/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	00 = OFF. Adequate DEF level 01 = 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

Parameter Name	SPN	Range	Conversion/ Unit	PGN	PGN Byte/Bit Location	Description
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 10 = Level 2, second level warning 11 = 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.

10.3 DynaGen Proprietary

These commands are used for communicating information from the TG/TE Series of controllers to the TR100 or TR100-E remote panels.

PGN #	Name	Short Name	Rate (ms)	Priority	Description
65450 (0xFFAA)	DynaGen 1: State	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.
65452 (0xFFAC)	DynaGen 3: Speed Control	N/A	200	6	Used by TR100-E only. TG350 and TG410 controllers do not send this PGN.
65453 (0xFFAD)	DynaGen 4: Aux Sensor 6 – 9	N/A	200	6	Only the PRO controller sends this PGN
65454 (0xFFAE)	DynaGen 5: Aux Sensor 10 and IO	N/A	200	6	Only the PRO controller sends this PGN

PGN #	Name	Short Name	Rate (ms)	Priority	Description

10.3.1 DynaGen 1: State

Parameter Name	SPN	Range	PGN	PGN Byte/ Bit Location	Description
Controller State	520200	0 = Others 1 = Failure 2 = OFF 3 = AUTO 4 = Cooldown 5 = Shutdown 6 = Running	65450 (0xFFAA)	Bits 0 to 3 of Byte 1	
Pressure Unit	520201	0 = kPa 1 = PSI	65450 (0xFFAA)	Bit 7 of Byte 1	
Temperature Unit	520202	0 = Fahrenheit 1 = Celsius	65450 (0xFFAA)	Bit 6 of Byte 1	
Failure State	520203	0 = OK 1 = Warning 2 = Failure 3 = Double Failure	65450 (0xFFAA)	Bits 4 and 5 of Byte 1	
Failures	520204	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	65450 (0xFFAA)	Byte 2	Values from 194 to 202 are items with customizable text the user can program.

Parameter Name	SPN	Range	PGN	PGN Byte/ Bit Location	Description
Failures (con't)		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			

Parameter Name	SPN	Range	PGN	PGN Byte/ Bit Location	Description
First Line Display ID	520205	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 Start... 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	65450 (0xFFAA)	Byte 3	

Parameter Name	SPN	Range	PGN	PGN Byte/ Bit Location	Description
Second Line Display ID	520206	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 = Start on low battery / exerciser prealarm 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	65450 (0xFFAA)	Byte 4	Values 128 to 143 are the expansion pack actions custom test.

Parameter Name	SPN	Range	PGN	PGN Byte/ Bit Location	Description
Second Line Display ID (con't)		35 = (auxiliary sensor 1 text) 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)			

Second Line Display ID (con't)	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 *Values >=90 Differ between ToughSeries 350/410 and PRO* **Values >=90 ToughSeries 350/410** 90 = Refill DEF 91 = No Power 92 = DEF Quality 93 = EXH System 94 = Escape Mode 95 = Force Regen On 96 = Engine Derate 97 = Inducement Level 1 98 = Inducement Level 2 99 = Final Inducement 128 = action 1 129 = action 2 130 = action 3 131 = action 4 132 = action 5 133 = action 6

Parameter Name	SPN	Range	PGN	PGN Byte/ Bit Location	Description
		134 = action 7 135 = action 8 136 = action 9 137 = action 10 138 = action 11			
Second Line Display ID (con't)		139 = action 12 140 = action 13 141 = action 14 142 = action 15 143 = action 16			
AC Group Display	520207	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	65450 (0xFFAA)	Byte 6	The voltage and current configuration.
Current Run Time Units: hours Gain = 0.1 Offset = 0	520208	0 to 6500.0 hr Display limited to 999.9 hr	65450 (0xFFAA)	Bytes 7 and 8	The amount of time the controller has been running since the last start.

10.3.2 DynaGen 2: Aux Sensor

Parameter Name	SPN	Range	Gain/ Offset	PGN	PGN Byte/ Bit Location	Description
Auxiliary Sensor 1	520220	0 to 6553.5	Gain = 0.1 Offset = 0	65451 (0xFFAB)	Bytes 1 and 2	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939.
Auxiliary Sensor 2	520221	0 to 6553.5	Gain = 0.1 Offset = 0	65451 (0xFFAB)	Bytes 3 and 4	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939.
Auxiliary Sensor 3	520222	0 to 6553.5	Gain = 0.1 Offset = 0	65451 (0xFFAB)	Bytes 5 and 6	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939.
Auxiliary Sensor 4	520223	0 to 6553.5	Gain = 0.1 Offset = 0	65451 (0xFFAB)	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).

10.3.3 DynaGen 3: Speed Control

Parameter Name	SPN	Range	Gain/ Offset	PGN	PGN Byte/Bit Location	Description
Tank Unit		0 = foot 1 = meter	Gain = 1 Offset = 0	65452 (0xFFAC)	Bit 0 of Byte 1	
TSC1 Speed Control		0 = off 1 = on	Gain = 1 Offset = 0	65452 (0xFFAC)	Bit 2 of Byte 1	
Front Panel Speed Control		0 = off 1 = on	Gain = 1 Offset = 0	65452 (0xFFAC)	Bit 3 of Byte 1	

Parameter Name	SPN	Range	Gain/ Offset	PGN	PGN Byte/Bit Location	Description
Float/Tank Display		0 = Disable 1 = Float only 2 = Transducer only 3 = Float and Transducer	Gain = 1 Offset = 0	65452 (0xFFAC)	Bit 4,5 of Byte 1	
Transducer Unit		0 = % 1 = PSI 2 = foot/meter	Gain = 1 Offset = 0	65452 (0xFFAC)	Bit 6,7 of Byte 1	
Tank Level		0 ~ 19	Gain = 1 Offset = 0	65452 (0xFFAC)	Bit 0 ~ 4 of Byte 2	Indicates level of the tank from empty to full. 0 = empty 19 = full
Float Autostart Method		0 = dual float 1 = single float	Gain = 1 Offset = 0	65452 (0xFFAC)	Bit 5 of Byte 2	
Lower Float Position		0 = down 1 = up	Gain = 1 Offset = 0	65452 (0xFFAC)	Bit 6 of Byte 2	
Upper Float Position		0 = down 1 = up	Gain = 1 Offset = 0	65452 (0xFFAC)	Bit 7 of Byte 2	
Tank Maximum		0 ~ 100.0	Gain = 0.1 Offset = 0	65452 (0xFFAC)	Bytes 3 and 4	Unit are given by "Transducer Unit" above.
Transducer Value		0 ~ 4095	Gain = 1 Offset = 0	65452 (0xFFAC)	Bytes 5 and 6	The transducer value in analog to digital converter (ADC) counts.
TSC1 Setting Speed		0 ~ 5000	Gain = 1 Offset = 0	65452 (0xFFAC)	Bytes 7 and 8	The current setpoint for TSC1.

10.3.4 DynaGen 4: Aux Sensor 6 – 9

This PGN is only implemented by the TE600A/TG600A

Parameter Name	SPN	Range	Gain/ Offset	PGN	PGN Byte/ Bit Location	Description
Auxiliary Sensor 6		0 to 6553.5	Gain = 0.1 Offset = 0	65453 (0xFFAC)	Bytes 1 and 2	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939.
Auxiliary Sensor 7		0 to 6553.5	Gain = 0.1 Offset = 0	65453 (0xFFAC)	Bytes 3 and 4	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939.
Auxiliary Sensor 8		0 to 6553.5	Gain = 0.1 Offset = 0	65453 (0xFFAC)	Bytes 5 and 6	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939.
Auxiliary Sensor 9		0 to 6553.5	Gain = 0.1 Offset = 0	65453 (0xFFAC)	Bytes 7 and 8	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939.

10.3.5 DynaGen 5: Aux Sensor 10 and IO

This PGN is only implemented by the TE600A/TG600A

Parameter Name	SPN	Range	Gain/ Offset	PGN	PGN Byte/ Bit Location	Description
Auxiliary Sensor 10		0 to 6553.5	Gain = 0.1 Offset = 0	65454 (0xFFAD)	Bytes 1 and 2	0xFFFF = parameter disabled or not available. Units are not transmitted over J1939.
Switch input 1		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 5, bit 0	
Switch input 2		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 5, bit 1	
Switch input 3		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 5, bit 2	

Parameter Name	SPN	Range	Gain/ Offset	PGN	PGN Byte/ Bit Location	Description
Switch input 4		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 5, bit 3	
Switch input 5		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 5, bit 4	
Switch input 6		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 5, bit 5	
Switch input 7		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 5, bit 6	
Switch input 8		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 5, bit 7	
Switch input 9		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 6, bit 0	
Switch input 10		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 6, bit 1	
Switch input 11		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 6, bit 2	
Switch input 12		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 6, bit 3	
Switch output 1		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 6, bit 4	
Switch output 2		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 6, bit 5	
Switch output 3		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 6, bit 6	
Switch output 4		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 6, bit 7	
Switch output 5		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 7, bit 0	
Switch output 6		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 7, bit 1	
Switch output 7		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 7, bit 2	
Switch output 8		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 7, bit 3	

Parameter Name	SPN	Range	Gain/ Offset	PGN	PGN Byte/ Bit Location	Description
Switch output 9		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 7, bit 4	
Switch output 10		0 to 1	Gain = 1 Offset = 0	6545D (0xFFAC)	Byte 7, bit 5	

10.4 DynaGen Control PGNs

There are two methods to start/stop the controller over J1939.

10.4.1 Request PGN Start Method

The J1939 request PGN (RQST) can be used by a "remote" device to send commands to the local controller.

- The address of the remote (address of the request specifically) must be **254 (0xFE)** or the command will be ignored
- The request PGN sent by the remote must be in the form of **0xEAxx** where "xx' is the hexadecimal address of the controller you wish to control
    - If there are only two devices on the J1939 bus (the remote and the controller) then **0xEAFF** (FF meaning global request) can be used, which will send the request to all devices on the bus. This has the benefit of not needing to know the address of the controller and since there is only the one controller on the bus, this will not affect other devices

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.

1. Send request for PGN 40000 to the controller to trigger a start (if controller is in Auto Mode).

TR100-E Note: This is equivalent to a manual run in that manual speed control with the UP and DOWN buttons is allowed while the controller is in the idle and/or at rated speed if enabled.

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2. Send request for PGN 40011 to the controller to trigger a stop (if controller is in Run Mode).
3. Send request for PGN 40018 to the controller to increment the engine speed. TE350/TE410 only.
4. Sent request for PGN 40022 to the controller to decrement the engine speed. TE350/TE410 only.
5. 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: These are not J1939 standard commands. These are 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 controller will display "J1939 Remote" as the reason for starting if the controller is started due to this command.

10.4.2 Start/Stop Method 2

A second method to start/stop the controller over J1939 is to use PGN 65520.

PGN #	Name	Short Name	Rate (ms)	Priority	Description
65520 (0xFFF0)	Proprietary B	PropB_F0	1000 ms*	6	Byte 1 is fixed to 0x80. Byte 2 is fixed to 0x01. Byte 3 is variable. • Should be 0xFF unless a start is desired. Any other value is ignored (acts like 0xFF). • A transition from 0xFF to 0xFD in Auto Mode will start the controller. • A transition from 0xFD to 0xFF in Run Mode will stop the controller. • If the controller does not see a transition, it will not respond. This is a safety feature. Byte 4 to 8 are fixed to 0xFF. Bytes 1 to 3 and 4 to 8 are ignored.

*The transmission rate has no effect. The controller only needs to receive the changed message once. It is good practice to repeat in case of transmission issues.

- The above PGN must be transmitted from source address 0x81 (129)
- If a remote start is received in Auto Mode, the controller will start
- If a remote stop is received while the controller is running (including cranking, preheating, etc.), the controller will stop and go back into the Auto Mode
- Cool-down will be performed if enabled
- If this command does not start the engine, it cannot stop the engine
- "J1939 Remote" is displayed as the reason for start when this command is used. "J1939 Start" is logged in the event log

10.5 DynaGen DM1

The controller can broadcast its warnings and failures over J1939.

It deviates from the J1939 standard in the following ways:

- It sends only one DTC at a time even when multiple trouble codes are active. It alternates between DTCs every 3 seconds
    - As of ToughSeries 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

- It always sends an SPN of 40179 for warnings and SPNs 40181 and 40182 for failures
- The FMI does not indicate the failure mode. The FMI indicates the specific active warning or failure

10.5.1 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 received

FMI	Description
26	Doosan G2 high fuel temperature
27	Doosan G2 high exhaust temperature
28 - 31	reserved

10.5.2 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

FMI	Description
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

11 Technical Support

For remote and communication control systems support, parts and repair, or technical support, visit us online at: https://www.cattron.com/contact.

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