Q-235R1

SVE BULLETIN

SPECIAL VEHICLE ENGINEERING – BODY BUILDERS ADVISORY SERVICE

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QVM Bulletin: Q-235R1 Date: August 06, 2015

Revision	Update	Revision Date
Q-235R1	• Added 2017MY 6.2L SEIC	09 December, 2016

2016 and later 6.2L and 6.8L E-Series Stationary Elevated Idle Control

Models Affected

2016 and later Model Year E-350/450 Cutaways with 6.2L or 6.8L gasoline engine.

Purpose

To explain changes and functions of the stationary elevated engine idle speed control system (SEIC) for power take-off (PTO) applications.

Contents:

1. Overview

Stationary Elevated Idle Control (SEIC)

- A powertrain control module (PCM) strategy that provides elevated engine speed to drive auxiliary commercial equipment such as hydraulic pumps, generators, air compressors; or maintain vehicle battery charge under extreme electrical demands.
- SEIC is standard on E-Series Cut-away with 6.2L / 6.8L engines with 6 speed TorqShift transmission.

Customer Access Wires for SEIC and VSO/CTO/PARK Signals

- Located in the engine compartment, tagged and bundled with large harness running below windshield/cowl. Remove some of the plastic harness tape where the harness exits its plastic support gutter above the engine air induction tube to reveal the blunt-cut wires.
- The final stage manufacturer or up-fitter is required to supply the customer interface equipment.
- Additional information in the "Circuit Descriptions" section.
- Transmission PTO - Not Available on E-Series.

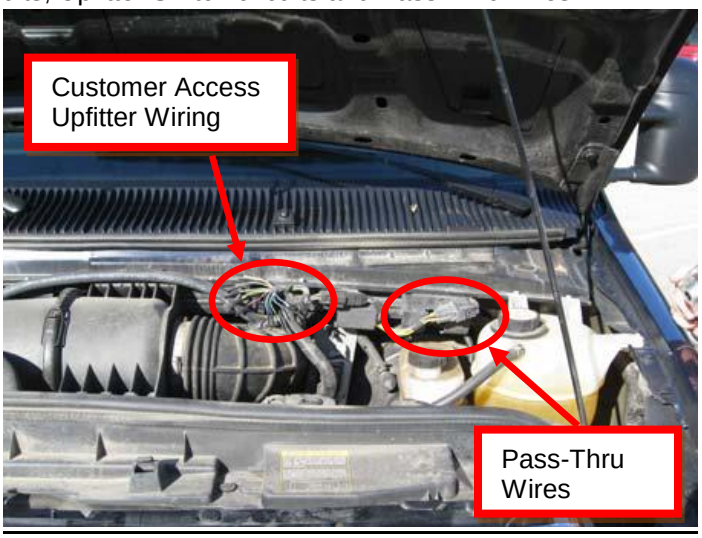
Customer Access circuit / SEIC Wire Locations

SEIC circuits, BCP Circuits, Customer Access signal circuits, Upfitter Switch circuits and Pass-Thru wires.

E350/450

Engine Compartment

- Blunt-cut access for SEIC, "Customer Access" signal circuits for CTO, VSO, PARK, BCP, optional Upfitter Switch output, and Pass-Thru wires are located below the driver's side windshield/cowl.



E350/450

Engine Compartment

- To find Blunt-cut Customer access wires, remove some of the plastic harness tape where the large harness (below the engine cowl) exits its plastic support gutter above the engine air induction tube to reveal the blunt-cut wires.

E350/450

Engine Compartment

- The two pass-thru wires are part of the same modified vehicle wiring kit as prior years. Located at the 4-pin connector in the harness below the cowl, outboard of the brake master cylinder, as shown. Mating pigtail connector, 4C24-14A411, found in dunnage. Opposite ends located above driver-side kick-panel.

Customer Accessible Signal Circuit Description

E-350/450 - 6.2L Gasoline / 6.8L Gasoline Engines		
Circuit Intent	Wire Tag	Description
OUTPUT Park-Only	TRO_P	PCM Pin 6.2 L / 6.8L C1551E-19 Circuit No. CET22 Wire Color: Gray/Brown • An output from the PCM that indicates when the Transmission Range Sensor is indicating that the Transmission is in the Park Position. The Low Side driver in the PCM will pull this output to ground when active (Transmission is in the PARK Position). To properly reference this output, the customer supplied external controller/device needs to pull this output up to VPWR with a 10K Ohm resistor. Thus when the output is active, the voltage at this output will be 0 volts. When this output is not active, the output will be pulled up to VPWR by the 10K Ohm pull up resistor.
OUTPUT Neutral-Only	TRO_N	PCM Pin 6.2 L / 6.8L C1551B-43 Circuit No. CET21 Wire Color: White • An output from the PCM that indicates when the Transmission Range Sensor is indicating that the Transmission is in the Neutral Position. The Low Side driver in the PCM will pull this output to ground when active (Transmission is in the Neutral Position). To properly reference this output, the customer supplied external controller/device needs to pull this output up to VPWR with a 10K Ohm resistor. Thus when the output is active, the voltage at this output will be 0 volts. When this output is not active, the output will be pulled up to VPWR by the 10K Ohm pull up resistor.
OUTPUT Vehicle Speed	VSOUT	PCM Pin 6.2 L / 6.8L C1551B-78 Circuit No. VMC05 Wire Color: Violet / Orange • An output from the PCM that provides 8000 pulse per mile signal with a 50% duty cycle. The low side driver in the PCM will switch the output off and on (off will allow the output to be pulled up close to VPWR), (on will put the output to 0 volts). To properly reference this output, the customer supplied external controller/device needs to pull this output down to ground with a 10K Ohm resister.
OUTPUT Engine Speed	CTO	PCM Pin 6.2 L / 6.8L C1551B-77 Circuit No. CE913 Wire Color: Blue • An output from the PCM that indicates a Clean Tachometer Output to provide an indication of engine RPM. The low side driver in the PCM will switch the output off and on (off will allow the output to be pulled up close to VPWR), (on will put the output to 0 volts), at a frequency = ((Engine RPM's * Number of cylinders) / 120), with a duty cycle of 50%. To properly reference this output, the customer supplied external controller/device needs to pull this output down to ground with a 10K Ohm resister.
PASS-THRU		Circuit No. CAC17 Wire Color: Violet / Gray Found: at 4-pin customer access connector
PASS-THRU		Circuit No. CAC18 Wire Color: Yellow / Gray Found: at 4-pin customer access connector

Battery Voltage Sources (VPWR)

E-350/450 6.2L / 6.8L Gasoline		
Circuit Intent	Wire Tag	Description
Hot-at-all-times		Circuit no. SBB68 Wire Color: Green / Red • A fused 50 amp circuit. • Found: at 4-pin customer access connector above the brake master cylinder or above and to the right of parking brake release handle by the relay pack (part of the Modified Vehicle Wiring)
Ignition Hot-in-RUN		Circuit no. CAC14 Wire Color: Yellow / Orange • A fused 40 amp circuit. • Found: at 4-pin customer access connector above the brake master cylinder or above and to the right of parking brake release handle by the relay pack (part of the Modified Vehicle Wiring)
Upfitter switch Output: Ign-Hot/ACC •Found: under windshield cowl on driver's side engine zone. •Requires Upfitter Switch Option 52S	Aux-1	[30-amp] Circuit No. CAC05 Wire Color: Yellow
	Aux-2	[30-amp] Circuit No. CAC06 Wire Color: Green / Brown
	Aux-3	[10-amp] Circuit No. CAC07 Wire Color: Violet / Green
	Aux-4	[15-amp] Circuit No. CAC08 Wire Color: Brown

2. Stationary Elevated Idle Control for 6.2L / 6.8L Gasoline

Product Description

SEIC

- Intended to be commanded ONLY by applying battery voltage to certain customer-access blunt-cut wire circuits, and adding a target-speed resistor, and is only available when the vehicle road speed signal is zero.
- Includes a link circuit which changes from open-circuit to ground when enablers are met, that may be used to turn on an indicator lamp, while providing battery power to an aftermarket PTO clutch or solenoid.
- Ramp rates are fixed and cannot be altered by the customer.
- Maximum engine speed is 2400 rpm.
- Minimum engine speed – 6.2L / 6.8L Gas engine: 910 rpm approximately. Gas engine has a 900 rpm "stand-by" speed that it first goes to when SEIC is initiated to step it away from stall speed that it could dip to as PTO load is applied. This is an unusable speed for any application. However, a resistor can be chosen that sets the useable target speed for carrying an auxiliary load to just above 900 rpm. This is mainly intended for applications using a FEAD-driven PTO device like a clutch-pump.

Typical SEIC Sequence

Initiating SEIC by applying battery voltage to the PTO_REQUEST_1 wire immediately commands the PCM to first look for enabling conditions, such as vehicle gearshift selector in PARK, engine at base idle speed of about 650 rpm, etc. A complete list of enablers is provided in the "SEIC / BCP Enable/Disable Conditions" section of this bulletin. Once enablers are satisfied then the following takes place:

1. Command is sent to increase engine speed to 900 rpm standby.
2. The low-side driver circuit changes from open-circuit to ground.
3. Engine speed increases to the target RPM determined by resistor (see Table A).

6.2L / 6.8L Operating Modes

Stationary mode

-operates in Park at elevated engine speed.

Split-Shaft PTO (Not Available)

-The Ford powertrain control strategy will not allow for this operation, whether using SEIC, or an aftermarket controller commanding engine speed directly at the foot pedal throttle or through the Ford data-link connector. The PCM will typically react by restricting power and engine speed, and possibly varying speed while searching for a solution. It may not do this immediately, but after days or a week of customer operation. It also will not guarantee a 1:1 transmission ratio command, typically required by split-shaft PTO applications.

Battery Charge Protect

-For 2016 and later E-350/450 Cutaways with 6.2L or 6.8L gas engines, Battery Charge Protect Mode is available. BCP CANNOT BE ACTIVE WHEN SEIC OR PTO MODES ARE ACTIVE. Activating BCP while SEIC is engaged will deactivate SEIC. Activating SEIC while BCP is engaged will deactivate BCP.

When it is switched on the engine speed goes immediately to a minimum of 600 rpm. Note that this may be higher for other normal operating conditions. From this state, the PCM uses battery voltage as well as ambient air temp., engine oil temperature information to raise engine speed higher to maintain a minimum battery charge of 12.8 Volts. Maximum engine speed in BCP mode is 1200 rpm. Loss of an operating condition after BCP is engaged will require the BCP switch to be cycled before BCP will re-engage. Auto entry into BCP is not allowed.

Additional Notes:

Alternative Calibration

-All new Ford light trucks have an "Alternative Calibration" or ALT-CAL installed in the PCM that conditions the powertrain during its early lifetime. It may increase the PARK-idle or drive-idle speed of the engine, by as small as 50 rpm or by several hundred. It affects SEIC initiation by not letting it activate, because one of the SEIC enablers is having a steady, base, idle speed, generally near 650 rpm. If ALT-CAL sets the idle at 700 rpm then SEIC activation will be prevented. ALT-CAL is normally removed after 50 key-on starts, or by driving over 5 continuous miles; it is also sometimes erased by disconnecting the battery for a minute or so.

Input Resistor

-ALL modes (SEIC, BCP) require usage of an input resistor, the resistor value may be obtained in table A.

Table A: 6.8L SEIC Resistor Chart

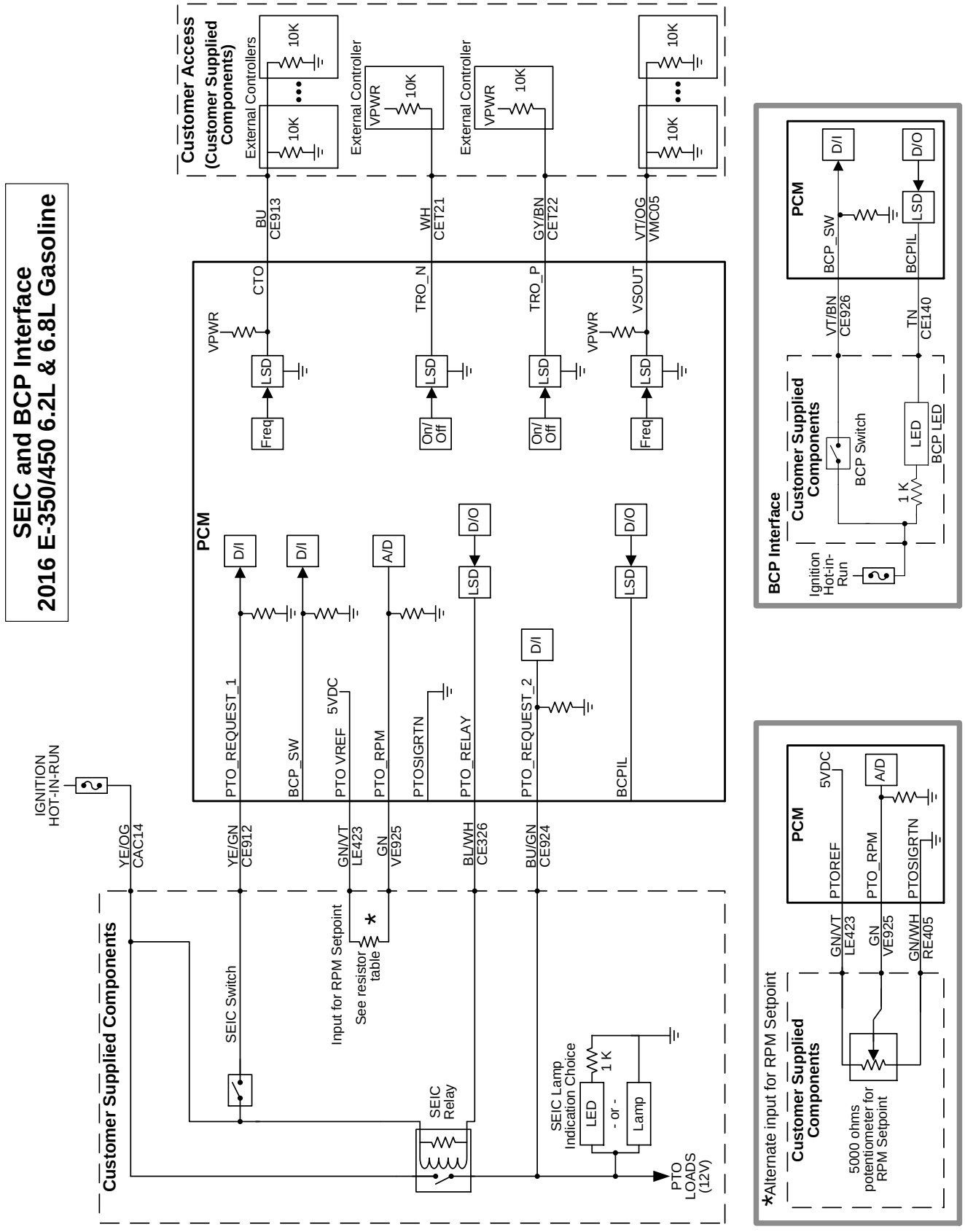
6.2L / 6.8L Gasoline Engine						
Engine Target Speed (RPM)	Resistor (Ohms)	Voltage (volts)		Engine Target Speed (RPM)	Resistor (Ohms)	Voltage (volts)
(Base)	100000	0.218		1500	4250	2.63
650	54400	0.4		1600	3430	2.89
750	30880	0.665		1700	2740	3.162
800	25320	.787		1800	2168	3.426
900	17520	1.06		1900	1684	3.685
1000	13280	1.31		2000	1247	3.954
1100	10220	1.578		2100	891	4.203
1200	8130	1.837		2200	544	4.482
1300	6500	2.102		2300	255	4.741
1400	5220	2.375		2400	0 (closed circuit)	5

** Voltages are exact to achieve RPM shown.
Resistors are standard 5% values (1 watt) and yield RPM values +/- 32rpm

Circuit Description

All circuits lead back to pins on the PCM

E-350/450 – - 6.2L Gasoline / 6.8L Gasoline Engine PCM		
Circuit Intent	Wire Tag	Description
INPUT (VPWR)	PTO_REQUEST	6.2L / 6.8L - C1551B-84 Circuit No. CE912 Wire Color: Yellow / Green • Applying vehicle battery voltage to this wire begins SEIC process. • Verifies safety enablers. • Turns off OBD and other emission-related monitoring. • Elevates engine speed to 900 rpm "standby" speed if it finds an "open-circuit" at PTO_RPM Select. • Invokes the PTO Indicator circuit when safety enablers are met. • Looks for the target engine speed requested at the PTO_RPM Select circuit using a resistor or potentiometer.
OUTPUT	PTO_OK	6.2L / 6.8L - C1551B-98 Circuit No. CE326 Wire Color: Blue / White • A low-side driver, changing from "open-circuit" to "ground" indicating that the engine is ready for the PTO operation to begin, and that a PTO load may be applied. • Intended for powering a PTO indicator lamp, or turn on a relay coil (not to exceed 1 amp). LED lights require adding a resistor in series.
OUTPUT	PTO_VREF	6.2L / 6.8L - C1551B-52 Circuit No. LE423 Wire Color: Green / Violet +5VDC reference voltage.
INPUT (resistor)	PTO_RPM	6.2L / 6.8L - C1551B-85 Circuit No. VE925 Wire Color: Green • Add a resistor or a potentiometer to obtain fixed or variable engine target speed. • Combine in circuit with PTO_VREF (+5VDC). • Speed range available: 650 rpm to 2400 rpm
INPUT	PTO_SIGRTN	6.2L / 6.8L - C1551B-51 Circuit No. RE405 Wire Color: Green / White •A ground reference, buffered, used to complete the potentiometer circuit for engine speed selection.
INPUT (VPWR)	PTO_ENGAGE	6.2L / 6.8L - 6.8L C1551B-88 Circuit No. CE924 Wire Color: Blue / Green • Applying vehicle battery voltage to this wire signals the PCM that the PTO load is being applied.
OUTPUT	BCPIL	6.2L / 6.8L - C1551B-17 Circuit No. CE140 Wire Color: Tan • A low-side driver, changing from "open-circuit" to "ground" indicating that BCP is in effect. • Intended for powering an indicator lamp (not to exceed 40mA).
INPUT	BCP_SW	6.2L / 6.8L - C1551B-82 Circuit No. CE926 Wire Color: Violet / Brown • Applying vehicle battery voltage to this wire begins BCP. • BCP regulates engine speed between 600 to1200 rpm to maintain charge system voltage


SEIC and BCP Interface
2016 E-350/450 6.2L & 6.8L Gasoline
Customer Access
(Customer Supplied Components)
External Controllers
External Controller
External Controller
10K
VPWR
BU CE913
WH CET21
GY/BN CET22
VT/OG VMC05
CTO
TRO_N
TRO_P
VSOUT
LSD
Freq
On/ Off
PCM
D/I
A/D
D/O
PTO_REQUEST_1
BCP_SW
PTO VREF
5VDC
PTO_RPM
PTOSIGRTN
PTO_RELAY
PTO_REQUEST_2
BCPIL
IGNITION HOT-IN-RUN
YE/OG CAC14
YE/GN CE912
GN/VT LE423
GN VE925
BL/WH CE326
BU/GN CE924
Customer Supplied Components
SEIC Switch
Input for RPM Setpoint
See resistor table
*
SEIC Relay
SEIC Lamp Indication Choice
LED
1 K
- or -
Lamp
PTO LOADS (12V)
BCP Interface
Customer Supplied Components
Ignition Hot-in-Run
BCP Switch
1 K
LED
BCP LED
VT/BN CE926
TN CE140
BCP_SW
BCPIL
*Alternate input for RPM Setpoint
PTOREF
GN/WH RE405
5000 ohms potentiometer for RPM Setpoint

SEIC / BCP Enable / Disable Conditions

Vehicle Conditions to Enable SEIC (all are required)	Vehicle Conditions that Disable SEIC (any one required)	Gasoline Engine
Parking brake applied.	Parking brake disengaged.	Yes
Foot off of service brake	Depressing service brake	Yes (See Note-2)
Vehicle in PARK (automatic trans.)	Vehicle taken out of PARK	Yes
Foot off of accelerator pedal		Yes
Vehicle speed is 0 mph (stationary)		Yes
Engine at a stable base idle speed		Yes (See Note-1)
	Transmission Oil Temperature (TOT) Limit exceeds 240 degrees F.	Yes (See Note-2)
Engine Coolant Temperature (ECT) 6.2L/ 6.8L : 40° F minimum	Engine Coolant Temperature Limit (ECT)	Yes (See Note-2)
	Catalyst Temperature Limit	Yes (See Note-2)

Note-1: If a SEIC disabling condition occurs, the engine must be allowed to reach stable base idle before the system can be re-initiated. This could take up to 15 seconds. If an attempt is made to reinitiate SEIC before the engine has reached a stable base idle SEIC will not engage. The operator will have to turn SEIC off and then back on once the vehicle has reached a stable base idle.

Note-2: A “change-of-state” at both the “PTO_REQUEST (PTO)” and "PTO_ENGAGE” circuits is required to re-invoke SEIC. When a disabler is seen by the PCM, the "PTO_OK (PTO_IND)" circuit changes from "ground-source" to “open-circuit". After approximately 3 seconds SEIC drops out, returning the engine speed to base idle. To re-initiate SEIC the operator must turn off voltage to both the “PTO_REQUEST (PTO)” and "PTO_ENGAGE" circuits and turn it back on again.

3. SEIC / PTO – General System Behavior

• If an SEIC enabling condition is not met upon SEIC initialization:
- SEIC will not initiate. SEIC will require a "change-of-state" (voltage to both the “PTO_REQUEST” and "PTO_ENGAGE" circuits removed completely.) The enabling conditions must be met, and then SEIC and PTO operation may then be reinitiated.

• If an SEIC disabler occurs:
- The "PTO_OK (PTO_IND)" circuit changes from "ground-source" to “open-circuit". After approximately 3 seconds SEIC drops out, returning the engine speed to base idle. SEIC will require a "change-of-state” (voltage to both the “PTO_REQUEST (PTO)” and "PTO_ENGAGE" circuits removed completely). The enabling conditions must be met, and then SEIC and PTO operation may then be reinitiated.

• SEIC/PTO strategy function in the PCM is not affected by the loss of vehicle battery electrical power.

• SEIC Ramp Rate (fixed, not programmable):
- 400 rpm/second.

• Correlation between engine speed and resistor values:
- The external voltage source that the aftermarket PTO system designer uses to command SEIC through the "PTO" or "PTO-REQUEST" circuits must be the same as that used by the PCM internally for predictable SEIC function. Reasoning is that a fully-charged vehicle battery fluctuates with ambient temperature.

SEIC / PTO – General System Behavior, continued

- The 6.2L / 6.8L Gasoline E-Series application uses a 5 volt reference signal and ground for the PTO_RPM input circuit.
- Normal base engine calibration allows approximately +/-50 rpm fluctuation. If any factory vehicle accessories are used during SEIC, e.g. a/c, defroster, etc., then that fluctuation may increase to approximately +/-100 rpm or more.
- The sudden loss of aftermarket PTO hydraulic pressure during SEIC/PTO operation, like a ruptured hose, may send SEIC engine speed to near 3000 rpm. It is recommended that a hydraulic pressure switch linked to SEIC/PTO be added to disable SEIC/PTO when a hose ruptures.
- Because of a service brake circuit characteristic at engine-start, invoking SEIC may cause the diagnostic error code FFG_BOO to get flagged (recorded in the PCM). To avoid this, simply tap the service brake pedal sometime after engine-start and prior to invoking SEIC. Once the code is set, SEIC may not be available until it is erased.
- Gas engines require a "change-of-state" at the PTO-REQUEST and PTO-ENGAGE circuits whenever a disabler turns off SEIC (remove battery voltage signal and re-apply).
- For aftermarket remote engine start-stop: a change-of-state is required to get SEIC to function again.

4. APPENDIX

Vocabulary / Definitions

PTO Applications: Includes all forms of mechanical power, using the vehicle powertrain as the source, including transmission side-mounted PTO, split-shaft PTO, crankshaft PTO, and FEAD-mounted clutch-pumps, air compressors, and generators.
Clutch-Pump: A type of PTO that is driven by the vehicle engine crankshaft through the FEAD pulley system.
PCM: Powertrain Control Module
FEAD: Front End Accessory Drive (belt and pulley drive system)
SEIC: Stationary Elevated Idle Control
VSO, VSOUT: Vehicle Speed Out – see Customer Accessible Signal Description
TPO: Throttle Position Out. Direct customer access not provided.
ETC: Engine Coolant Temperature
CTO: Clean Tach Out - Customer Accessible Signal Description
VPWR: Vehicle Power Battery Voltage.
BCP_IL / BCP_SW: Battery Charge Protection Illumination Lamp / Battery Charge Protection Switch
Intermittent Duty Usage: 5 minutes out of a 15 minute period or less of continuous operation.
Continuous Duty Usage: Greater than 5 minutes out of a 15 minute period of continuous operation.
Change-of-State: Part of the SEIC strategy. If any condition is met that disables SEIC, the operator is required to turn the PTO switch OFF and back ON again before SEIC will allow elevated idle to return.
TRO_N, TRO_P: Transmission Range Output, indicating NEUTRAL ONLY, or PARK-ONLY
BCM: Body Control Module, located at lower passenger-side of instrument panel

NOTE:

SOME EARLY BUILD 2016 E-SERIES VEHICLES HAVE THREE IDENTICALLY COLORED WIRES FOR PTO, WHICH ARE LOCATED IN THE BLUNT CUT HARNESS IN THE ENGINE COMPARTMENT. THEY ARE GREEN W/WHITE STRIPES. USE AN OHM METER TO IDENTIFY WHICH CIRCUIT YOU NEED

One wire is open circuit to ground (TRO-N, C1551B-43 Circuit No. CET21)
One has a low resistance to ground (PTOSIGRTN, C1551B-51 Circuit No. RE405)
One has high resistance to ground (PTO_RPM, C1551B-85 Circuit No. VE925)

These circuits will change to the colors shown in the circuit descriptions section above in later production.