Q-173

SVE BULLETIN

SPECIAL VEHICLE ENGINEERING – BODY BUILDERS ADVISORY SERVICE

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Stationary Elevated Idle Control

Models Affected 2009 Model Year F-250/350/450/550 and E-250/350/450.

Purpose

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

Overview

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 in all PCM's for Super Duty F-Series light truck and E-Series, over-8500 lb. GVWR, with gas or diesel engines and TorqShift™ automatic or M6 manual transmissions. SEIC is not available on 4.6L & 5.4L with 4R75E transmission.

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

- F-Series: Located in cabin, tagged and bundled above parking brake pedal assembly behind data link connector. Pass-thru wires are in the same bundle.
- E-Series: 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 Gear and Port

- Available on Super Duty F-Series and E-Series 6.0L.
- Standard with M6 manual transmission (some PTO installations are prevented by exhaust system interference).
- Available for TorqShift™ 5-speed automatic transmission by ordering “Transmission Power Take-Off Provision”. The PTO gear is direct-splined to the torque converter output shaft and thus receives any torque the torque converter is delivering, whether the vehicle is stationary or mobile (i.e. no internal PTO clutch).
- NEVER use any sealer, especially silicone-based, on the PTO port gasket.

Torque and Horsepower

- TorqShift™ Automatic Transmission: The PTO gear delivers up to 250 ft-lbs torque to the aftermarket PTO, and can manage the heat of 40 hp continuously. Higher horsepower can be delivered, but for shorter durations depending on the amount of power required.
- M6 Manual Transmission: The PTO gear delivers up to 250 ft-lbs torque, but has less-capable cooling for PTO usage than TorqShift.
- Typically, the aftermarket PTO cannot use all this available torque and horsepower, so contact the individual aftermarket PTO supplier.

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, VS_OUT: Vehicle Speed Out. 8000 pulses per mile signal. Blunt-cut wire provided for customer access.
TPO: Throttle Position Out. Direct customer access not provided.
ETC: Engine Coolant Temperature
CTO: Clean Tach Out. An engine speed signal. A blunt-cut wire is provided for customer access.
VPWR: Vehicle Power Battery voltage signal only, not intended to carry high current load.
BCPIL / BCPSW: Battery Charge Protection Illumination Lamp / Battery Charge Protection Switch.
Intermittent Duty Usage: Ten (10) minutes or less of continuous operation.
Continuous Duty Usage: Greater than 10 minutes of continuous operation.
Change-of-State: Part of the Gas engine SEIC strategy only. 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
SPDJB: Smart Power Distribution Junction Box, located at lower passenger-side of instrument panel.

Product Descriptions / Special Situations

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 – Diesel engine: 1200 rpm
- Minimum engine speed – 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, or manual transmission PTO, because the TorqShift™ torque converter cannot fully lock until 1200 rpm engine speed. **WARNING**: Using the TorqShift™ PTO below 1200 rpm risks transmission damage from over-heating, or aftermarket PTO clutch slippage debris.

Typical SEIC Sequence for TorqShift™ PTO
Initiating SEIC by applying battery voltage to the SEIC-PTO 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 Enable/Disable Conditions" section of this bulletin. Once enablers are satisfied then the following takes place:

1. Command is sent to boost hydraulic line pressure in the transmission about 20-30 psi, which is used by the aftermarket PTO supplier to hold their PTO clutch.
2. Command is sent to use a unique torque converter lock-up schedule for stationary PTO.
3. Command is sent to increase engine speed to 1200 rpm default, or a target speed using a resistor.
4. The low-side driver circuit changes from open-circuit to ground. If the up-fitter uses the circuit wiring offered in this bulletin then this will provide battery voltage to the aftermarket PTO solenoid to engage the PTO.
5. Engine speed increases to the target, the torque converter locks at 1200 rpm, and hydraulic line pressure increases with engine speed to a maximum of 150 psi at 1200 rpm.

Special Situations

Mobile PTO Operation (TorqShift™ Automatic or M6 manual Transmissions)
Mobile PTO is an unintended function and may require additional safety enabler logic by utilizing the CTO or VSO signals to prevent transmission damage. It is required to apply battery voltage to the SEIC/PTO Request wire to keep SEIC active during Mobile PTO mode. The increased line pressure and torque converter commands must remain active to protect the automatic transmission. Engine speed is no longer commanded by SEIC, instead it is controlled by foot throttle. Convert PTO solenoid power to a switch controlled direct-battery feed instead of through the SEIC circuit suggested in this bulletin. A slightly harsher automatic transmission shift can be expected but is harmless.
WARNING: Using the TorqShift™ PTO below 1200 rpm risks transmission damage from over-heating, or aftermarket PTO clutch slippage debris.

Diesel Engine DPF Regeneration
SEIC takes priority over 6.4L diesel DPF regeneration. Use of an aftermarket "throttle-kicker" that simulates the foot pedal throttle, or commands through the data-link connector, may not take priority over DPF regeneration.

Adaptive Cooling
This PCM strategy is new for 2008 6.4L diesel engine. It automatically restricts engine power when it senses an over-temperature condition, and may interrupt the SEIC-PTO operation. Typically, the over-temperature condition it reacts to will also show up on the temperature gage on the instrument panel. Elevated engine speed, typical of SEIC operation, may help avoid Adaptive Cooling occurrence due to the resultant additional engine and transmission coolant flow. However, depending on the auxiliary PTO power being demanded, 1200 rpm may not be enough to prevent the powertrain from entering Adaptive Cooling mode, but 1500 rpm may.

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.

Split-Shaft PTO (Not Recommended)
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.

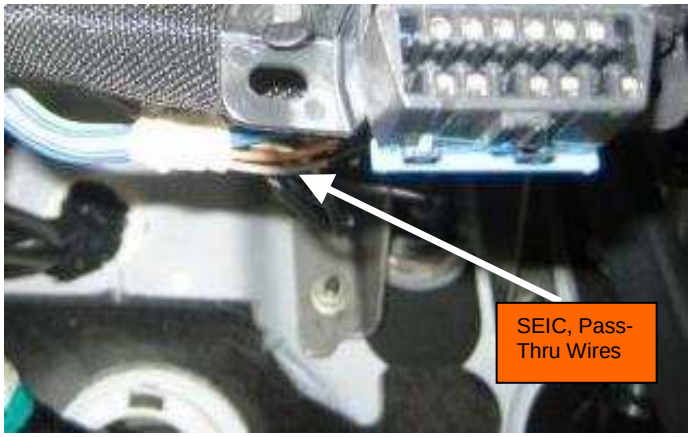
Wire Locations

SEIC circuits, Customer Access Signal Circuits, Pass-Thru Wires.

F250/350/450/550

Cabin / Instrument Panel

- Blunt-cut access wires for SEIC, "Customer Access" signal circuits for CTO, VS_OUT, PARK, TRO_N, and 4 pass-thru wires, are bundled together at the harness above the parking brake pedal assembly behind the data link connector.



F250/350/450/550

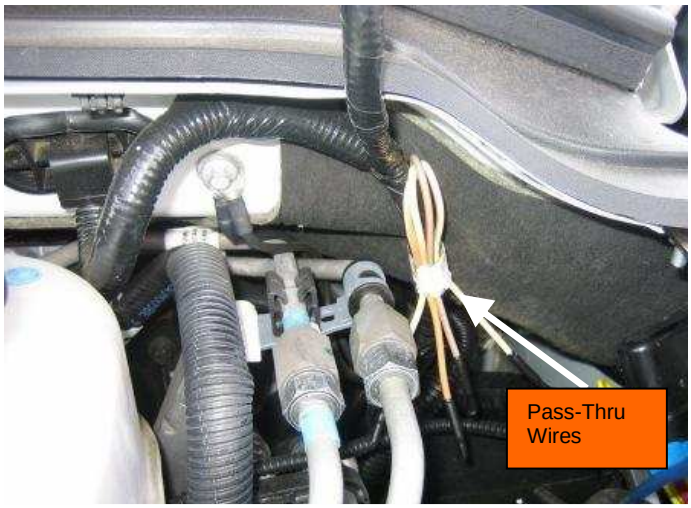
Cabin / Instrument Panel

- Blunt-cut access wires for the 4 optional "Upfitter Switches" are taped on a harness near the relay pack that can be found beneath the instrument panel and to the left of the steering column.

F250/350/450/550

Engine Compartment

- The 4 blunt-cut pass-thru wires are found in the harness below the cowl, just outboard of the brake master cylinder, as shown.



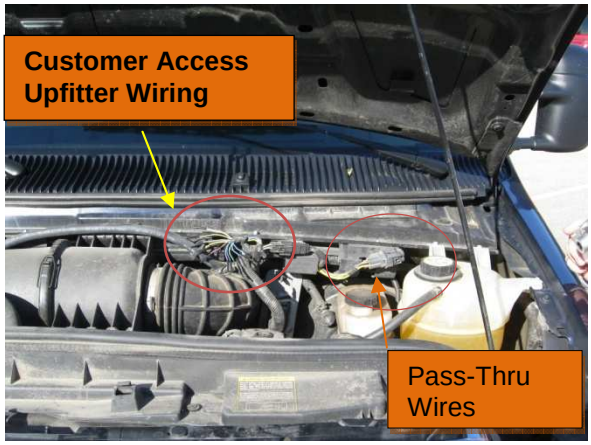
Wire Locations (continued)

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

E250/350/450

Engine Compartment

- Blunt-cut access wires for SEIC, and the "Customer Access" signal circuits for CTO, VSO, PARK, and optional Upfitter Switch wires are with the large harness running below the 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 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.

Circuit Descriptions for SEIC and Customer Access Signal Circuits

All circuits lead back to pins on the PCM.

F-250/350/450/550 – Diesel Engine PCM		
Circuit Intent	Wire Tag	Description
INPUT (VPWR)	PTO	PCM Pin C1-30 Circuit No. CE912 Wire Color: Yellow / Green • Applying vehicle battery voltage to this wire begins SEIC process. • Signals TorqShift™ transmission to enter SEIC strategy. • Verifies safety enablers. • Turns off OBD and other emission-related monitoring. • Elevates engine speed to target found at PTO-RPM circuit. • Invokes the PTOC circuit when safety enablers are met. • Looks for the target engine speed requested at the PTO_RPM circuit using a resistor or POT.
OUTPUT	PTO_OK (PTO-IND)	PCM Pin C2-54 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.
INPUT (resistor)	PTO_RPM	PCM Pin C1-27 Circuit No. CE914 Wire Color: Green • Add a resistor or potentiometer to obtain fixed or variable engine target speed. • Combine in circuit with PTO-VREF and PTO-RTN. • Speed range available: 1200 rpm to 2400 rpm
Reference Voltage	PTO_VREF	PCM Pin C1-20 Circuit No. LE434 Wire Color: White / Brown • A 5-volt reference, buffered against shorts to ground or power, used to complete the resistor circuit for engine speed selection.
PCM Ground	PTO_GND	PCM Pin C1-21 Circuit No. RE327 Wire Color: Gray / Violet • A ground reference, buffered, used to complete the resistor circuit for engine speed selection.
INPUT (VPWR)	BCPSW	PCM Pin C1-43 Circuit No. CE926 Wire Color: Violet / Brown • Applying vehicle battery voltage to this wire begins BCP. • Engine speed is sent to 900 rpm when all safety enablers are met, regardless of the degree of battery charge. • After 900 rpm, BCP regulates engine speed based upon the degree of battery charge, up to 2400 rpm maximum.
OUTPUT	BCHPL	PCM Pin C2-45 Circuit No. CE140 Wire Color: Brown • A low-side driver, changing from "open-circuit" to "ground" indicating that BCP is in effect. • Intended for powering an indicator lamp.
CUSTOMER ACCESS SIGNAL CIRCUITS		
OUTPUT PARK-Only	TRO-P	TCM Pin C1-27 Circuit No. CLS05 Wire Color: Blue / Gray
OUTPUT NEUTRAL-Only	TRO-N	TCM Pin C1-30 Circuit No. CET21 Wire Color: Green / White
OUTPUT Vehicle Speed	VS_OUT	PCM Pin C1-32 Circuit No. VMC05 Wire Color: Violet / Orange
OUTPUT Engine Speed	CTO	PCM Pin C1-19 Circuit No. CE913 Wire Color: Blue

Circuit Descriptions, continued

All circuits lead back to pins on the PCM.

F-250/350/450/550 – Gas Engine PCM		
Circuit Intent	Wire Tag	Description
INPUT (VPWR)	PTO (PTO-REQ)	PCM Pin C2-26 Circuit No. CE912 Wire Color: Yellow / Green • Applying vehicle battery voltage to this wire begins SEIC process. • Signals TorqShift™ transmission to enter SEIC strategy. • 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	PCM Pin C2-42 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.
INPUT (resistor)	PTO_RPM	PCM Pin C2-07 Circuit No. CE914 Wire Color: Green • Add a resistor or potentiometer to obtain fixed or variable engine target speed. • Combine in circuit with PTO-ENGAGE. • Speed range available: 910 rpm to 2400 rpm
INPUT (VPWR)	PTO_Engage	PCM Pin C2-09 Circuit No. CE924 Wire Color: Blue / Green • Applying vehicle battery voltage to this wire signals the PCM that the PTO load is being applied. • Also used to complete the resistor circuit for engine speed selection.
CUSTOMER ACCESS SIGNAL CIRCUITS		
OUTPUT PARK-Only	PARK	PCM Pin C2-46 Circuit No. CLS05 Wire Color: Blue / Gray
OUTPUT NEUTRAL-Only	NEUTRAL	PCM Pin C2-22 Circuit No. CET21 Wire Color: Green / White
OUTPUT Vehicle Speed	VS_OUT	PCM Pin C2-01 Circuit No. VMC05 Wire Color: Violet / Orange
OUTPUT Engine Speed	CTO	PCM Pin C2-25 Circuit No. CE913 Wire Color: Blue

Circuit Descriptions, continued

All circuits lead back to pins on the PCM.

E-250/350/450 – Diesel Engine PCM		
Circuit Intent	Wire Tag	Description
INPUT (VPWR)	PTO	PCM Pin C1-12 Circuit No. CE912 Wire Color: Yellow / Green • Applying vehicle battery voltage to this wire begins SEIC process. • Signals TorqShift™ transmission to enter SEIC strategy. • Verifies safety enablers. • Turns off OBD and other emission-related monitoring. • Elevates engine speed to target value found at PTO-RPM circuit. • Invokes the PTOC circuit when safety enablers are met. • Looks for the target engine speed requested at the PTO_RPM circuit using a resistor or potentiometer.
OUTPUT	PTOC	PCM Pin C2-15 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.
INPUT (resistor)	PTO_RPM (PTOIC-2)	PCM Pin C1-06 Circuit No. CE914 Wire Color: Green • Add a resistor or potentiometer to obtain fixed or variable engine target speed. • Combine in circuit with PTO-VREF and PTO-RTN. • Speed range available: 1200 rpm to 2400 rpm
Reference Voltage	PTO_VREF	PCM Pin C1-44 Circuit No. LE434 Wire Color: White / Brown • A 5-volt reference, buffered against shorts to ground or power, used to complete the resistor circuit for engine speed selection.
PCM Ground	PTO_GND	PCM Pin C1-32 Circuit No. RE327 Wire Color: Gray / Violet • A ground reference, buffered, used to complete the resistor circuit for engine speed selection.
INPUT (VPWR)	BCPSW	PCM Pin C1-09 Circuit No. CE926 Wire Color: Violet / Brown • Applying vehicle battery voltage to this wire begins BCP. • Engine speed is sent to 1200 rpm when all safety enablers are met, regardless of the degree of battery charge. • After 1200 rpm, BCP regulates engine speed based upon the degree of battery charge, up to 2400 rpm maximum.
OUTPUT	BCPIL	PCM Pin C2-16 Circuit No. CE140 Wire Color: Brown • A low-side driver, changing from "open-circuit" to "ground" indicating that BCP is in effect. • Intended for powering an indicator lamp.
CUSTOMER ACCESS SIGNAL CIRCUITS		
OUTPUT PARK-Only	TRO_P	PCM Pin C1-07 Circuit No. CET22 Wire Color: Gray / Brown
OUTPUT Vehicle Speed	VSO	PCM Pin C1-22 Circuit No. VMC05 Wire Color: Violet / Orange
OUTPUT Engine Speed	CTO (PTOIC-1)	PCM Pin C1-01 Circuit No. CE913 Wire Color: Blue

Circuit Descriptions, continued

All circuits lead back to pins on the PCM.

E-250/350/450 – Gas Engine PCM		
Circuit Intent	Wire Tag	Description
INPUT (VPWR)	PTORS1 PTO	PCM Pin C-03 Circuit No. CE912 Wire Color: Yellow / Green • Applying vehicle battery voltage to this wire begins SEIC process. • Signals TorqShift™ transmission to enter SEIC strategy. • 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	PTOIL (PTO-IND)	PCM Pin C-11 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.
INPUT (resistor)	PTOIR (PTOIC-2)	PCM Pin C-08 Circuit No. CE914 Wire Color: Green • Add a resistor or potentiometer to obtain fixed or variable engine target speed. • Combine in circuit with PTORS2. • Speed range available: 910 rpm to 2400 rpm
INPUT (VPWR)	PTORS2 (PTO-ENGAGE)	PCM Pin C-06 Circuit No. CE924 Wire Color: Blue / Green • Applying vehicle battery voltage to this wire signals the PCM that the PTO load is being applied. • Also used to complete the resistor circuit for engine speed selection.
CUSTOMER ACCESS SIGNAL CIRCUITS		
OUTPUT Park-Only	TRO-P	PCM Pin T-14 Circuit No. CET22 Wire Color: Gray / Brown
OUTPUT Neutral-Only	TRO-N	PCM Pin T-39 Circuit No. CET21 Wire Color: Green / White
OUTPUT Vehicle Speed	VSOUT	PCM Pin C-05 Circuit No. VMC05 Wire Color: Violet / Orange
OUTPUT Engine Speed	CTO (PTOIC-1)	PCM Pin C-10 Circuit No. CE913 Wire Color: Blue

Battery Voltage Sources (VPWR)

F-250/350/450/550

Circuit Intent	Wire Tag	Description
Ignition Hot-in-RUN		Circuit no. CBP44 Wire Color: Violet • A fused 10 amp circuit. • Found: Blunt-cut & taped, on the harness behind the Diagnostic Link Connector.
Ford upfitter switches: Ign-Hot-ACC	Aux-1 Aux-2 Aux-3 Aux-4	[30-amp] Circuit No. CAC05 Wire Color: Yellow [30-amp] Circuit No. CAC06 Wire Color: Green / Brown [10-amp] Circuit No. CAC07 Wire Color: Violet / Green [15-amp] Circuit No. CAC08 Wire Color: Brown • Found: above and to the right of parking brake release handle by the relay pack.

E-250/350/450

Circuit Intent	Wire Tag	Description
Hot-at-all-times	(no tag)	Circuit no. SBB68 Wire Color: Green / Red • A fused 50 amp circuit. • Found: at 4-pin 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	(no tag)	Circuit no. CAC14 Wire Color: Yellow / Orange • A fused 40 amp circuit. • Found: at 4-pin 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.
Ford upfitter switches: Ign-Hot-ACC	Aux-1 Aux-2 Aux-3 Aux-4	[30-amp] Circuit No. CAC05 Wire Color: Yellow [30-amp] Circuit No. CAC06 Wire Color: Green / Brown [10-amp] Circuit No. CAC07 Wire Color: Violet / Green [15-amp] Circuit No. CAC08 Wire Color: Brown • Found: under windshield cowl on drivers side engine zone.

SEIC Resistor Charts

Diesel Engine

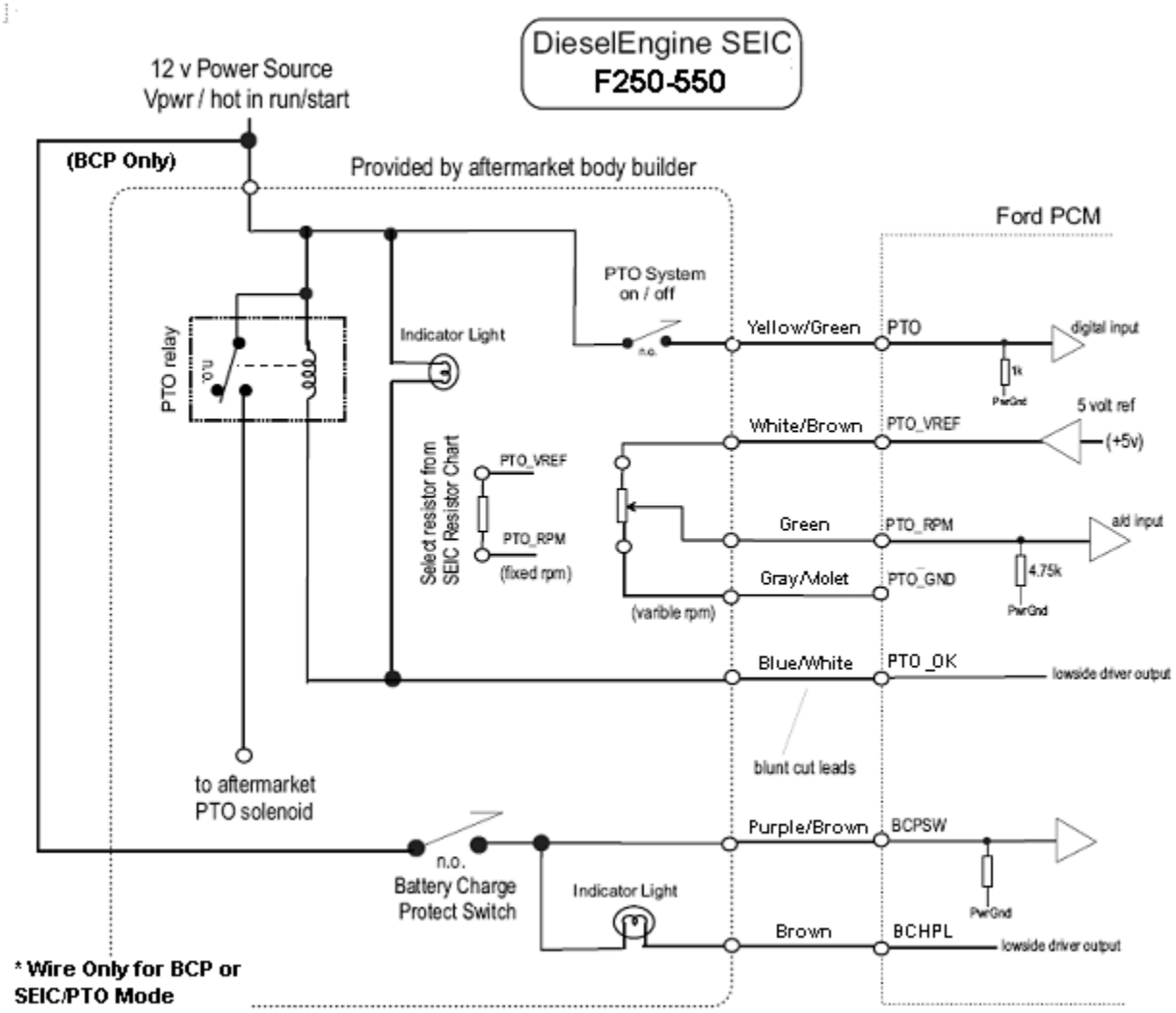
Engine Target Speed (RPM)	Resistor (Ohms) (5%, 1 Watt)	Voltage (volts) (± 0.0875 v)
680 (Base)		
1200	Open Circuit	
1200	43K	
1260	27K	0.6875
1320	22K	0.8875
1380	16K	1.0875
1440	13K	1.2875
1500	11K	1.4875
1560	9K	1.6875
1620	7.5K	1.8875
1680	6.2K	2.0875
1740	5.6K	2.2875
1800	4.7K	2.4875
1860	3.9K	2.6875
1920	3.3K	2.8875
1980	2.7K	3.0875
2040	2.4K	3.2875
2100	2.0K	3.4875
2160	1.6K	3.6875
2220	1.3K	3.8875
2280	1.0K	4.0875
2340	750	4.2875
2400	510	4.4875

Gas Engine

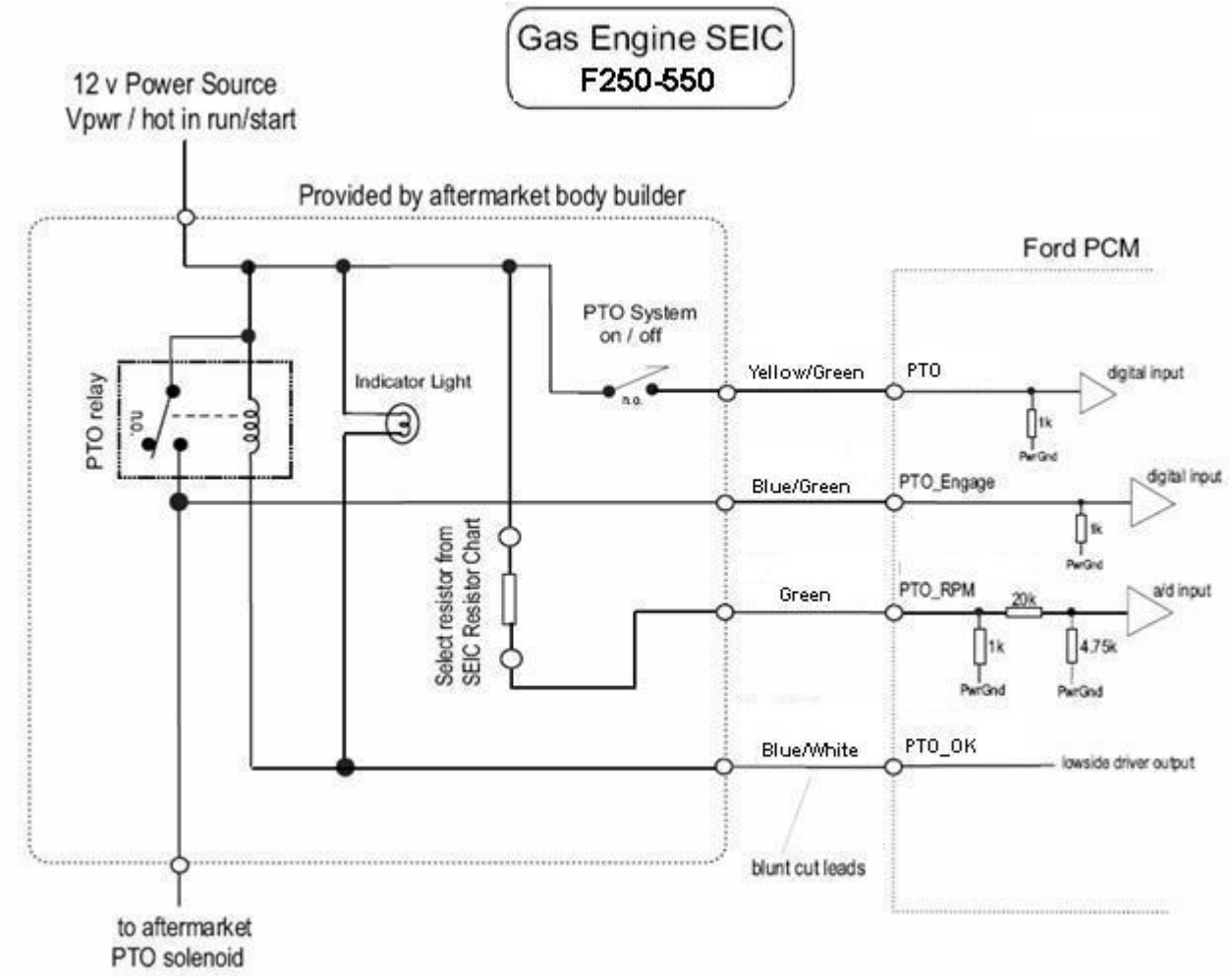
Engine Target Speed (RPM)	Resistor (Ohms) (5%, 1 watt)	Voltage (volts)
650 (Base)		
900	Open Circuit	0.00
912	3.9K	
1024	2.7K	3.61
1056	2.2K	4.18
1184	1.8K	4.80
1264	1.5K	5.39
1440	1.0K	6.76
1536	820	7.43
1648	680	8.06
1712	560	8.70
1792	470	9.25
1904	380	9.89
1936	330	10.27
2000	270	10.75
2064	220	11.20
2128	180	11.60
2160	150	11.90
2208	120	12.23
2256	100	12.46
2320	0	13.77
	(closed circuit)	

Wiring Diagrams

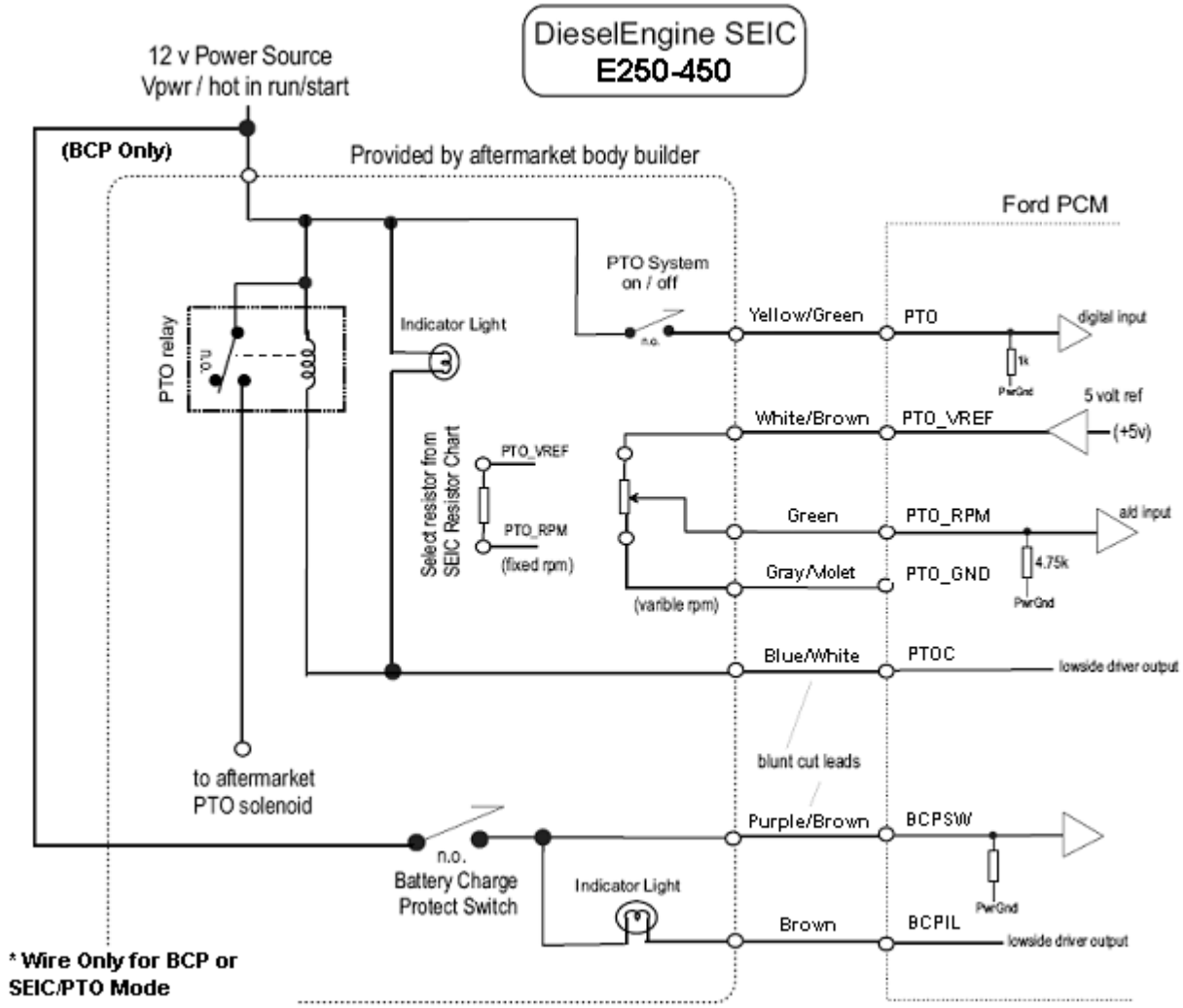
The following diagrams suggest a method to complete the SEIC circuits for gas and diesel engines.



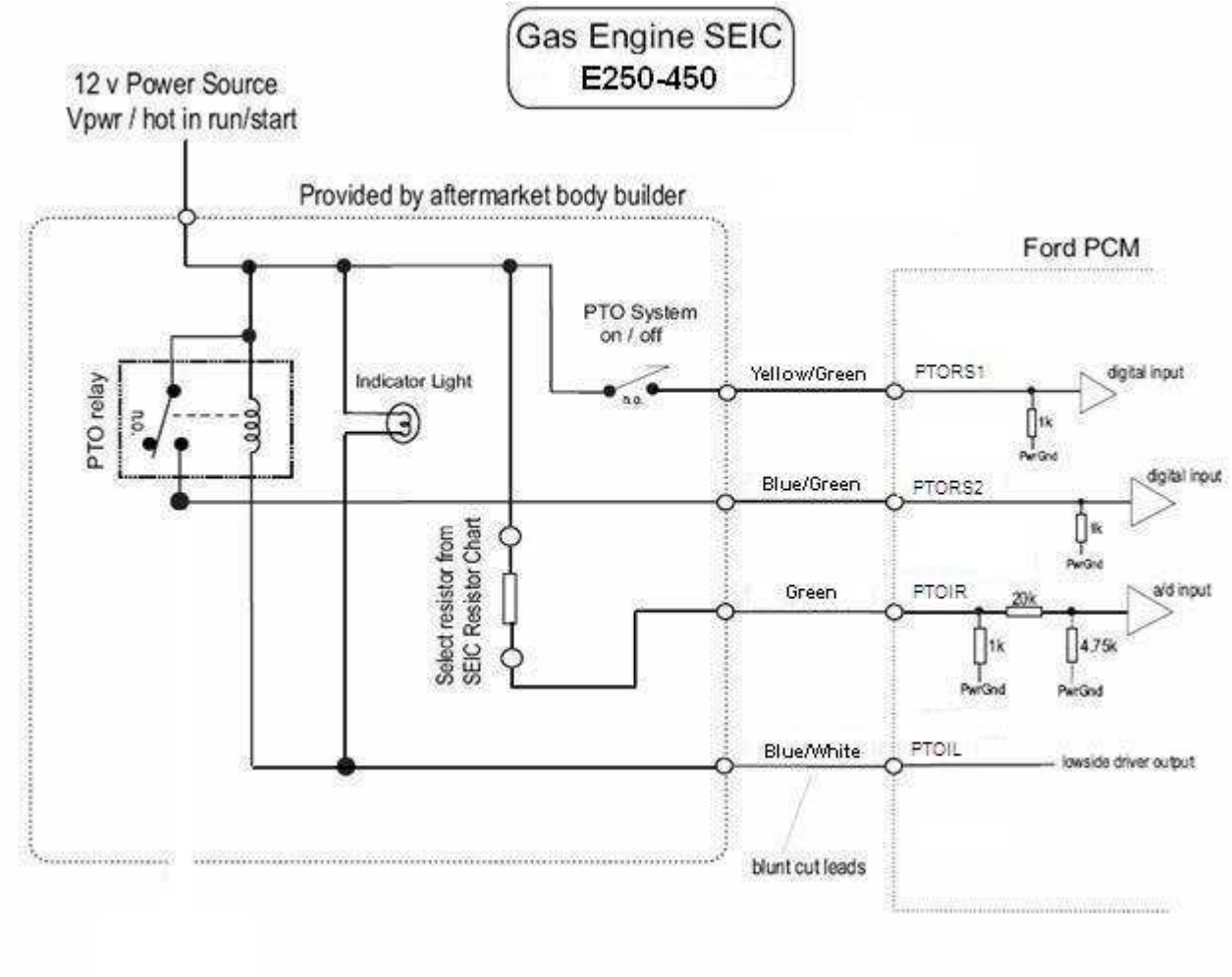
Wiring Diagrams (continued)



Wiring Diagrams (continued)



Wiring Diagrams (continued)



SEIC Enable/Disable Conditions

Vehicle Conditions to Enable SEIC (all are required)	Vehicle Conditions that Disable SEIC (any one required)	Gas Engine	Diesel Engine
Parking brake applied.	Parking brake disengaged.	Yes	Yes
Foot off of service brake	Depressing service brake	Yes (See Note-1)	Yes (See Note-2)
Vehicle in PARK (automatic trans.)	Vehicle taken out of PARK	Yes	Yes
Foot off of clutch (manual trans.)	Clutch depressed	Yes	Yes (See Note-2)
Foot off of accelerator pedal		Yes	Yes
Vehicle speed is 0 mph (stationary)		Yes	Yes
Brake lights functional	Brake light circuit disconnected	Yes	Yes
Engine at a stable base idle speed		Yes	Yes
	Transmission Oil Temperature (TOT) Limit exceeds 240 degrees F.	Yes (See Note-1)	No
Engine Coolant Temperature (ECT) 140 degree F minimum.	Engine Coolant Temperature Limit (ECT)	Yes (See Note-1)	No
	Catalyst Temperature Limit	Yes (See Note-1)	No

Note-1: A “change-of-state” at the “PTO-Request” circuit is required to re-invoke SEIC. When a disabler is seen by the PCM the "PTO-Indicator" circuit changes from "ground-source" to “open-circuit". After approximately 3 seconds SEIC drops out, returning the engine speed to base idle. For vehicle-stationary operation, the automatic transmission torque converter unlocks as engine speed drops below 1200 rpm. To re-initiate SEIC the operator must turn off the aftermarket PTO switch (removing command voltage to the “PTO-Mode” circuit) and turn it back on again.

Note-2: SEIC is automatically re-activated after approximately 3 seconds after the disabling condition is removed.

SEIC / PTO – General System Behavior

• To guarantee full advertised torque capability at the automatic transmission PTO gear and through the aftermarket PTO clutch, the transmission torque converter must be locked, and the hydraulic line pressure serving the aftermarket PTO clutch must be elevated. Applying battery voltage to the PTO circuit is the signal to the transmission to enter SEIC strategy and command these two important functions. This applies to both stationary and mobile PTO operations.

• If an SEIC disabler occurs:

- GAS engines will require a "change-of-state", meaning the operator is required to turn off voltage to the “PTO-Request” circuit, and back on again to re-invoke SEIC and PTO operation.
- DIESEL engines do not require a “change-of-state” at the “PTO” circuit. Once the disabling condition is removed, the strategy re-invokes SEIC after approximately 3 seconds, automatically returning the engine speed back to what was commanded by the operator prior to the disabling condition.

• Battery Charge Protection (BCP): A diesel-only function. When it is switched on the engine speed goes immediately to 900 rpm (1200rpm, 6.0L), and stays there even if the battery is fully charged. From this state it uses system voltage as well as ambient air temp., engine oil temperature information to raise engine speed higher to maintain a certain battery charge. Maximum engine speed in BCP mode is 2400 rpm. The BCPSW circuit may be wired to circuit to Ignition-Hot-in-Run to make it "automatic" for ambulance. Park-Brake-Set is one of the enablers of BCP.

SEIC / PTO – General System Behavior, continued

• If the Transmission Oil Temperature (TOT) sensor reaches 240°F, then the TorqShift™ torque converter may disengage, preventing torque from being delivered to the transmission PTO gear.

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

• SEIC Ramp Rate (fixed, not programmable):
  - GAS engines: 400 rpm/second.
  - DIESEL engines: When first applying battery voltage to the PTO circuit the PCM directs the engine to go to the initial target that it sees at the RPM circuit at 250 rpm/second (1200 rpm if there is no resistor in the RPM circuit – open circuit). If resistance is subsequently changed at the RPM circuit then the ramp rate to this second speed target is virtually instantaneous (as fast as the diesel engine can get there).

• 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.
  - The correlation will be better for diesel engines since the diesel engine SEIC system offers buffered PCM voltage and ground circuits to complete the resistor circuits for engine speed, while the gas engine system forces the SEIC circuit installer to use chassis voltage and ground.
  - If there is a high electrical demand on the chassis battery, such as from aftermarket inverters or generators, etc., the actual elevated idle engine speed may vary with that demand for any given resistance in the SEIC circuit. More so for gas engine systems than diesel since gas engine uses chassis battery voltage as a reference.

• GAS Engine Only:

  - 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-Mode 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.