



SVE BULLETIN

SPECIAL VEHICLE ENGINEERING – BODY BUILDERS ADVISORY SERVICE

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QVM Bulletin: Q-180R2

Date: 26 April, 2010

Revision	Update	Revision Date
Q-180R2	<ul style="list-style-type: none"> Clarified Split-Shaft mode activation sequencing Revised 'fixed' resistor in SEIC wiring diagram 	11 April, 2011

2011 and later F-Super Duty 6.7L Engine Stationary Elevated Idle Control

Models Affected 2011 and later Model Year (MY) F-250/350/450/550 with 6.7L Diesel Engine

Purpose

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

Overview

SEIC

- A power train 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 trucks, over-8500 lb. GVWR, with 6.7L diesel engines and TorqShift™ 6-speed automatic.

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.
- 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.
- Available for TorqShift™ 6-speed automatic transmission by ordering "Transmission Power Take-Off Provision". The PTO gear is direct-splined to the torque converter turbine shaft and thus receives any torque the engine is delivering, whether the vehicle is stationary or mobile (i.e. no internal PTO clutch).
- Split shaft mode engages the transmission output shaft.
- 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.
- 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 power train 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: Power train 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 nominal 0-12v square wave. Blunt-cut wire provided for customer access.

TPO: Throttle Position Out. Direct customer access not provided.

ECT: Engine Coolant Temperature

CTO: Clean Tach Out. An engine speed signal. A blunt-cut wire is provided for customer access. See Body Builders Layout Book for signal description.

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: 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.

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 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.
- Minimum engine speed is 900 rpm.
- Maximum engine speed is 3,000 rpm.

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 increase engine speed to 900 rpm and when transmission is ready, ramps to target speed using a resistor.
3. 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.
4. Engine speed increases to the target and hydraulic line pressure increases with engine speed to a maximum of 150 psi at 900 rpm.

Special Situations

Stationary mode, Live Drive and Split Shaft operation are supported.

Stationary mode operates in Park at elevated engine speed. The maximum load at the transmission PTO gear is 250 ft-lbs.

Special Situations

LiveDrive Mode operates in all gears and all vehicle speeds. The engine idle speed is slightly elevated, but peak engine speed is not limited beyond normal operating ranges. An additional rev limiter may be required to prevent over speed damage to attached pumps and equipment. The maximum load allowable for mobile mode is 150 ft-lbs at the transmission PTO gear. If the PTO feature is used for extended periods of time without vehicle movement it is recommended to switch to Stationary Mode.

Split Shaft Mode

To install Split-Shaft mode, wire according to the diagram shown on page 7. Select elevated idle speed by installing a resistor (which provides voltage to PTO RPM input) as indicated in the wiring diagram. Split-Shaft mode requires that supply voltage (nominal 12vdc) be applied to both the PTORS1 and PTORS2 circuits.

- 1) Ensure that engine is running and engine coolant temperature is above 20° F.
- 2) Apply park brake.
- 3) Disconnect vehicle drive train (transmission in NEUTRAL, 4x4 DISENGAGED) and engage PTO load.
- 4) With foot off both the service brake and accelerator pedals, turn Split-Shaft PTO on.
- 5) Without pressing service brake, shift transmission into drive*.
- 6) The system will shift the transmission into 4th gear, lock the converter and then ramp up to the target idle speed in a controlled manner.

*If vehicle unexpectedly lurches or moves, immediately depress brake pedal and shift transmission into PARK or NEUTRAL to secure vehicle. Contact Upfitter immediately.

Adaptive Cooling

This PCM strategy is new for 2011 6.7L 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, 900 rpm may not be enough to prevent the power train from entering Adaptive Cooling mode, but 1500 rpm may.

Input Resistor

ALL modes (SEIC, PTO, BCP) require usage of an input resistor. The resistor value may be obtained in table "B".

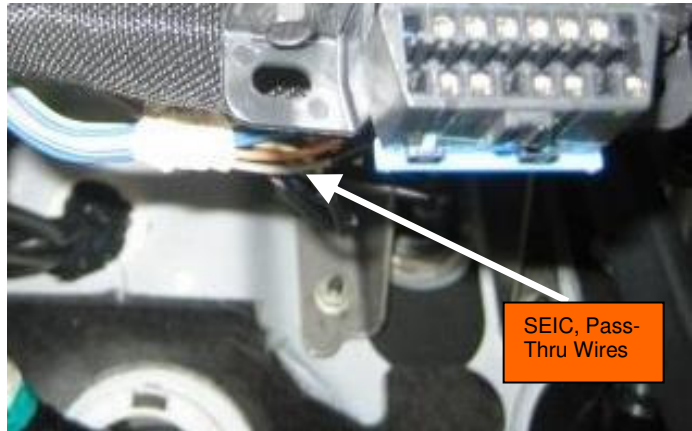
Wire Locations

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.



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 REQUEST1	PCM Pin C1232B-6 Circuit No. CE912 Wire Color: Yellow / Green <ul style="list-style-type: none"> 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 PTO relay circuit when safety enablers are met. Looks for the target engine speed requested at the PTO_RPM circuit using a resistor or POT.
INPUT (VPWR)	PTO REQUEST2	<ul style="list-style-type: none"> PCM Pin C1232B-4 Circuit No. CE933 Wire Color: Blue/Orange Applying vehicle battery voltage to this wire begins Live Drive PTO Mode. Signals TorqShift™ transmission to enter Live Drive mode. Verifies safety enablers. Turns off OBD and other emission-related monitoring. Invokes the PTO relay when safety enablers are met. Still requires valid resistance on PTO_RPM input for system to function
INPUT (VPWR)	PTO REQUEST1 PTO REQUEST2	PCM Pin C1232B-6 Circuit No. CE912 Wire Color: Yellow / Green PCM Pin C1232B-4 Circuit No. CE933 Wire Color: Blue/Orange <ul style="list-style-type: none"> Applying vehicle battery voltage to both of these wires begins Split-Shaft Mode. Signals TorqShift™ transmission to enter Split-Shaft mode. Verifies safety enablers. Turns off OBD and other emission-related monitoring. Elevates engine speed to target found at PTO-RPM circuit. Invokes the PTO RELAY circuit when safety enablers are met.
OUTPUT	PTO RELAY (PTO-IND)	PCM Pin C1232B-11 Circuit No. CE326 Wire Color: Blue / White <ul style="list-style-type: none"> 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 C1232B-8 Circuit No. CE914 Wire Color: Green <ul style="list-style-type: none"> Add a resistor or potentiometer to obtain fixed or variable engine target speed. Combine in circuit with PTO-VREF and PTO-GND. Speed range available: 900 rpm to 3000 rpm (700 min RPM for split shaft operation).
Reference Voltage	PTO REF	PCM Pin C1232B-55 Circuit No. LE434 Wire Color: White / Brown <ul style="list-style-type: none"> A 5-volt reference, buffered against shorts to ground or power, used to complete the resistor circuit for engine speed selection.
PCM Ground	PTO RTN	PCM Pin C1232B-22 Circuit No. RE327 Wire Color: Gray / Violet <ul style="list-style-type: none"> A ground reference, buffered, used to complete the resistor circuit for engine speed selection.
INPUT (VPWR)	BCP SW	PCM Pin C1232B-21 Circuit No. CE926 Wire Color: Violet / Brown <ul style="list-style-type: none"> Applying vehicle battery voltage to this wire begins BCP. BCP regulates engine speed between 600 to 1200 rpm to maintain required charge system voltage
OUTPUT	BCP LAMP	PCM Pin C1232B-20 Circuit No. CE140 Wire Color: Brown <ul style="list-style-type: none"> 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	TROP	TCM Pin C1750-27 Circuit No. CLS05 Wire Color: Blue / Gray
OUTPUT NEUTRAL-Only	TRON	TCM Pin C1750-30 Circuit No. CET21 Wire Color: Green / White
OUTPUT Vehicle Speed	VSOUT	PCM Pin C1232B-5 Circuit No. VMC05 Wire Color: Violet / Orange
OUTPUT Engine Speed	CTO	PCM Pin C1232B-10 Circuit No. CE913 Wire Color: Blue
PASS-THRU		Circuit No. CAC09 Wire Color: Brown / White
PASS-THRU		Circuit No. CAC10 Wire Color: White
PASS-THRU		Circuit No. CAC11 Wire Color: White / Orange
PASS-THRU		Circuit No. CAC12 Wire Color: Gray/Orange

Battery Voltage Sources (VPWR)

F-250/350/450/550

Circuit Intent	Wire Tag	Description
Ignition Hot-in-RUN/ACC Park Brake		<p>Circuit no. CDC64 Wire Color: Yellow/Orange ONLY found in 2011MY early builds White/Blue 2011MY later build vehicles White/Blue 2012MY</p> <ul style="list-style-type: none"> A fused (F10 in BCM) circuit. <p>Circuit no. CMC25 Wire Color: White/Violet</p> <ul style="list-style-type: none"> Output Signal wire <p>• Found: Blunt-cut & taped, on the harness behind the Diagnostic Link Connector.</p>
Ford upfitter switches: Ign-Hot-ACC	Aux-1 Aux-2 Aux-3 Aux-4	<p>[25-amp] Circuit No. CAC05 Wire Color: Yellow 16awg [25-amp] Circuit No. CAC06 Wire Color: Green / Brown 16awg [10-amp] Circuit No. CAC07 Wire Color: Violet / Green 20awg [15-amp] Circuit No. CAC08 Wire Color: Brown 20awg</p> <p>• Found: above and to the right of parking brake release handle by the relay pack.</p>

SEIC Resistor Charts

Table B

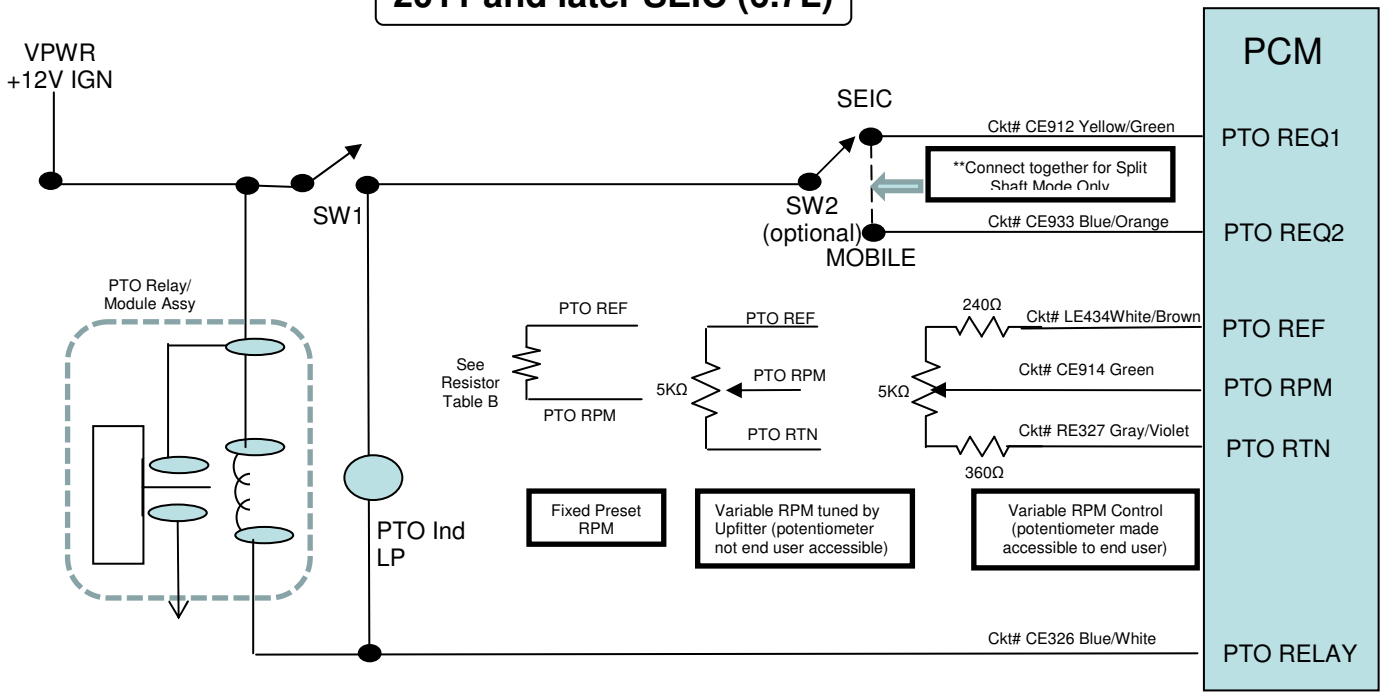
RPM	Ohms	Volts	RPM	Ohms	Volts
SEIC Mode			Split-Shaft Mode		
900	51000	0.400	700	51000	0.400
1000	36000	0.590	800	36000	0.574
1200	20000	0.971	1000	20000	0.922
1400	12000	1.352	1200	13000	1.270
1600	9100	1.733	1400	10000	1.617
1800	6200	2.114	1600	7500	1.965
2000	4700	2.495	1800	5600	2.313
2200	3300	2.876	2000	4300	2.661
2400	2400	3.257	2200	3000	3.009
2600	1800	3.638	2400	2200	3.357
2800	1100	4.019	2600	1600	3.704
3000	680	4.400	2800	1100	4.052
			3000	680	4.400
Mobile Mode					
		360			4.644269

** Voltages are exact to achieve RPM shown.

Resistors are standard 5% values and yield RPM values +/- 32rpm

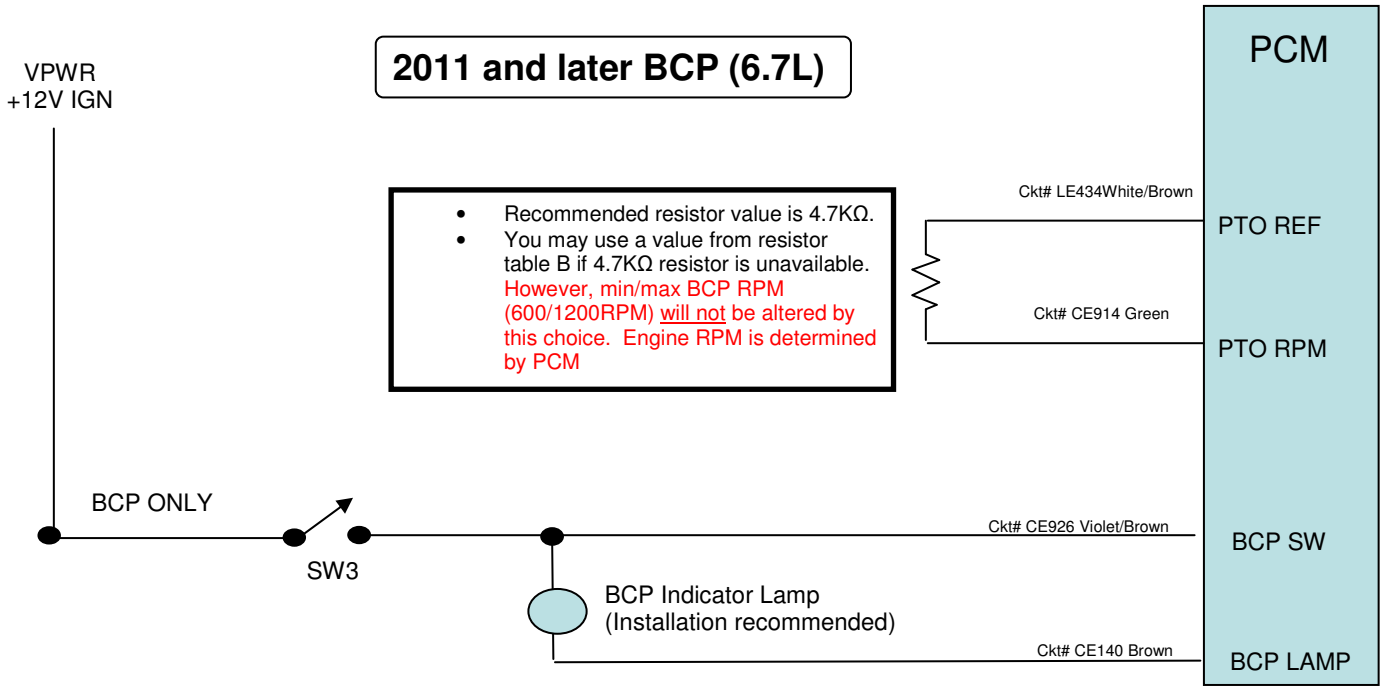
Wiring Diagrams

2011 and later SEIC (6.7L)



** For Split Shaft operation, both PTORS1 & PTORS2 must have line voltage applied.

2011 and later BCP (6.7L)



SEIC Enable/Disable Conditions

Vehicle Conditions to Enable SEIC (all are required)	Vehicle Conditions that Disable SEIC (any one required)	SEIC	Live Drive
Parking brake applied.	Parking brake disengaged.	Yes	No
Foot off of service brake	Depressing service brake	Yes	No
Vehicle in PARK	Vehicle taken out of PARK	Yes	No
Foot off of accelerator pedal	Accelerator pedal depressed	Yes	No
Vehicle speed is 0 mph (stationary)	Vehicle speed is not 0 mph (stationary)	Yes	No
Engine at a stable base idle speed		Yes	No
Transmission oil Temp above 20° F	Transmission Oil Temperature (TOT) exceeds 240° F.	Yes	Yes
Engine Coolant Temperature (ECT) 140° F minimum for vehicles <u>built on or before 11/5/10.</u> 20° F minimum for vehicles built <u>after 11/5/10</u>	Engine Coolant Temperature (ECT) exceeds 234° F	Yes	Yes
	Catalyst Temperature Limit	Yes	Yes

Note: 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”, 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 900 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.

SEIC / PTO / BCP– General System Behavior

- To guarantee full advertised torque capability at the automatic transmission PTO gear and through the aftermarket PTO clutch, 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 these important functions. This applies to both stationary and mobile PTO operations.
- **If an SEIC disabler occurs:**
 - **ALL 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.**
- Battery Charge Protection (BCP): **BCP CANNOT BE ACTIVE WHEN SEIC OR PTO MODES ARE ACTIVE**
When it is switched on the engine speed goes immediately to 600. 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 certain battery charge. 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: The BCP and Live-Drive operation modes allow PTO to engage automatically once the engine started provided the input switch is left in the on position prior to starting the engine. However, loss of an operating condition after PTO is initially engaged will require the switch to be cycled before PTO will re-engage.
- If the Transmission Oil Temperature (TOT) sensor reaches 240°F, the PTO system 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 / PTO / BCP– General System Behavior, continued

• SEIC Ramp Rate (fixed, not programmable):

- When first applying battery voltage to the PTO circuit the PCM directs the engine to ramp to the initial target that it sees at the RPM circuit at a rate of 200 rpm/sec
- 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.
- 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.

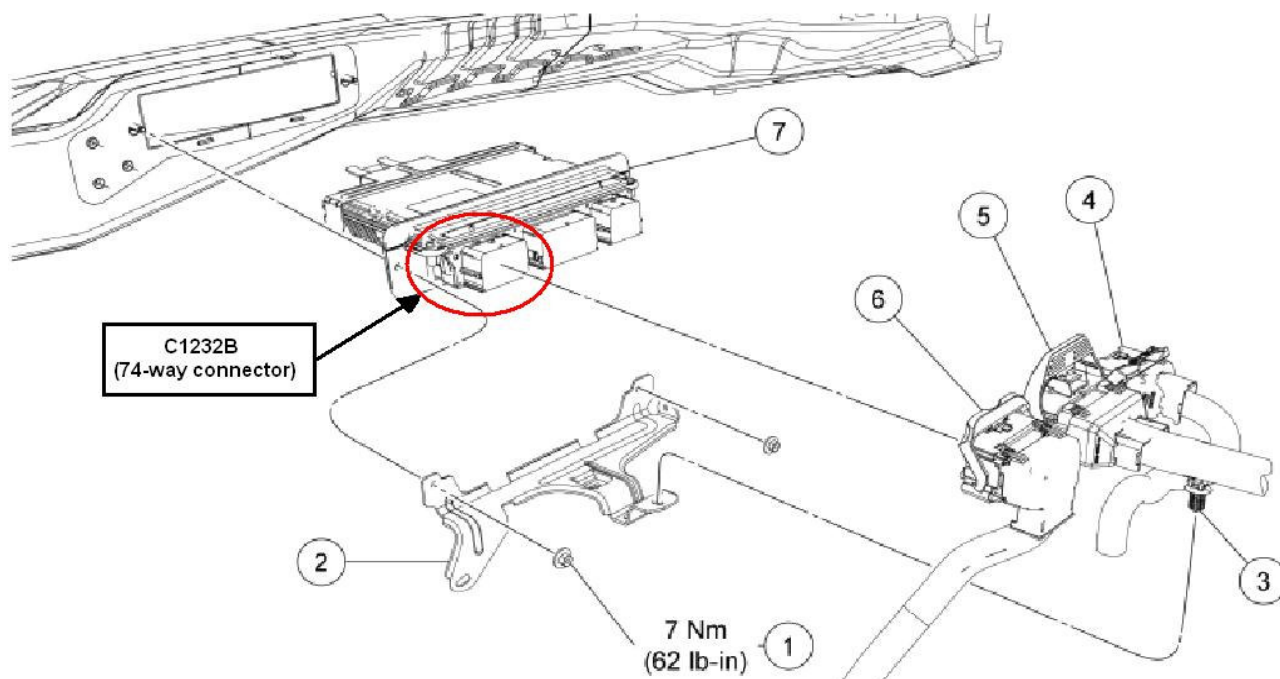
Early build vehicles; 2 wires with same color

SOME EARLY BUILD 2011 F-SUPER DUTY VEHICLES HAVE TWO IDENTICALLY COLORED WIRES FOR PTO IN THE BLUNT CUT HARNESS UNDER THE DASH. THEY ARE BOTH BLUE W/GRAY STRIPES. ONE WIRE IS AN INPUT TO THE ECM TO INVOKE PTO MODE IN MOBILE MODE (PTORS2 CIRCUIT #CE933). THE OTHER WIRE IS AN OUTPUT FROM THE TCM TO INDICATE WHEN THE VEHICLE IS IN PARK (TRO-P CIRCUIT #CLS05).

USE AN OHM METER TO IDENTIFY WHICH BLUE-GRAY WIRE YOU NEED.

To verify which circuit is which, measure resistance from one of the blunt cut wires to the PCM connector C1232B (74-way connector), pin 4. If the resistance is zero, you have identified circuit CE933. If the resistance is open, check the resistance to TCM connector C1750, pin 27. It should read zero. This will identify that you have positively identified circuit CLS05.

THE PTORS2 WIRE WILL CHANGE TO BLUE WITH ORANGE STRIPE IN PRODUCTION



Location of connector C1232B (74-way connector)