



Body Builders Layout Book

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SEIC / PTO

SEIC / PTO INDEX

2010
MODEL YEAR

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SEIC / PTO APPLICATION INFORMATION

OVERVIEW

- **SEIC strategy**
 - 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.
 - Standard in all PCM's for Super Duty F-Series light truck, and E-Series, over-8500 lb. GVWR, all powertrains.
 - Replaces the Auxiliary Powertrain Control Module (APCM) used with 2004 model year and prior diesel engines.
- **Blunt-cut wires to access SEIC, and customer access for VSO, CTO, PARK, PARK-NEUTRAL signals**
 - F-Series: Located in the cabin, tagged and bundled above the parking brake assembly. Pass-thru wires are in the same bundle.
 - E-Series: In the engine compartment, tagged and bundled 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 final stage manufacturer or up-fitter is required to supply the customer interface or controller.
 - Further detailed in the "Circuit Descriptions" section.
- **Blunt-cut wires to access the four optional up-fitter switches**
 - Available as an option on Super Duty F-Series only, Option Code 66S.
 - May be used as a PTO activation switch.
 - Located in the cabin, above the parking brake pedal assembly. Remove the PDJB for easy access.
 - Further detailed in the "Circuit Descriptions" section.
- **Transmission PTO gear and port**
 - Available for Super Duty F-Series & E-Series 6.0L only.
 - Standard with M6OD 6-speed manual transmission.
 - Available for TorqShift 5-speed automatic transmission by ordering "Transmission Power Take Off Provision", Option Code 62R.

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.

SEIC: Stationary Elevated Idle Control (PCM Strategy). Blunt-cut wires provided for customer access.

PCM: Powertrain Control Module

FEAD: Front End Accessory Drive (belt and pulley drive system)

Clutch-Pump: A type of PTO that is driven by the vehicle engine crankshaft through the FEAD pulley system.

VSO: Vehicle Speed Out. Blunt-cut wire provided for access (see "Circuit Descriptions"). 8000 pulses per mile, 2.2 Hz per mile-per-hour.

TPO: Throttle Position Out. Customer access not available.

ECT: Engine Coolant Temperature

CTO: Clean Tach Out. An engine speed signal. Blunt-cut wire provided for access (see "Circuit Descriptions").

VPWR: Battery voltage signal only, not intended to carry high current load.

BCPIL / BCPSW: Battery Charge Protection – Illumination (Lamp) / Switch

Intermittent Duty Usage: Ten (10) minutes or less of continuous operation.

Continuous Duty Usage: Greater than 10 minutes or less 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 off the PTO switch and back on again before SEIC will allow elevated idle to return.

TRO_PN, TRO_P: Transmission Range Output, indicating either combination PARK or NEUTRAL, or PARK-ONLY

GENERAL RECOMMENDATIONS AND WARNINGS

Vehicle used as a stationary power source

Ford trucks are designed principally to provide vehicle motivation and short-term auxiliary power needs. Power activation of hydraulic or mechanically driven devices such as wrecker lift, snowplow blade lift and movement, power tailgate lift, or dump body lift, are a few examples. The variety of factors such as air circulation available, temperature environment, vehicle maintenance level, and other existing conditions, combined with the range of auxiliary horsepower and torque demands that may be placed upon a vehicle in power take-off usage, make it difficult to assess the ultimate performance of a vehicle subjected to extended duration usage as an auxiliary power source. The guidelines in this book are intended to assist the PTO equipment installer with avoiding inadvertent vehicle performance and safety concerns. These guidelines should not be considered all inclusive, and it is the responsibility of the PTO equipment installer to choose and install a PTO system that the vehicle operators will be able to use in a safe manner, and with the necessary precautions to ensure safe operation and customer satisfaction. Additional transmission fluid may be required with the addition of the transmission-mounted PTO.

1. The final stage manufacturer is responsible for alerting the user to proper maintenance. PTO usage may require using the Ford "severe-duty" vehicle maintenance schedules, including transmission fluid changes. May require even more frequent schedule if PTO is in "continuous duty".
2. Route PTO hydraulic lines and hoses away from the vehicle exhaust system.
3. Diesel engines are recommended over gas engines for stationary PTO operation of extended duration.

4. Do not block air flow circulation to the engine coolant radiator, engine, and transmission oil cooler.
5. The following are some maximum temperatures monitored by the PCM. The aftermarket PTO system designer or installer should consider adding a sensor to monitor these for the purpose of aborting the PTO operation to protect against vehicle powertrain damage. Some PTO suppliers may offer temperature monitors for this purpose.
 - a. Maximum Engine Coolant Temperature (ECT): 230° F
 - b. Maximum Engine Oil Sump Temperature: 284° F
 - c. Maximum Transmission Oil Temperature (TOT): 250° F
 - d. Maximum Catalyst Temperature: varies (not intended for aftermarket monitoring).

If any of the above temperatures are exceeded then "de-clutch" the auxiliary load of the PTO operation and return the vehicle engine speed to base engine idle. Allow the temperature to stabilize at a lower level before re-engaging PTO operation. Gas engine strategy uses these to abort SEIC (return engine to base idle speed and unlock automatic transmission torque converter).

6. The blunt-cut wires related to SEIC go directly back to pins on the PCM. Care should be taken with any aftermarket circuitry connecting with these, or neighboring, to prevent feeding those modules with any unwanted, threatening signals or voltages. Unwanted vehicle behavior and/or PCM damage may result.
7. Both gas and diesel powertrains are calibrated to accept up-fitter commands through the SEIC wiring only, which are battery-voltage commands only, no CAN messaging. Any alternate method to obtain stationary elevated idle control may result in unpredictable or inconsistent engine speed or stalling.

SEIC / PTO APPLICATION INFORMATION (Cont'd)

PRODUCT DESCRIPTIONS

"Transmission Power Take-Off Provision" (Option Code 62R): This Option, available for F-Series only, provides a unique TorqShift 5-speed automatic transmission with an internal PTO drive gear and access port in the transmission case. A unique PCM is not included nor required.

Automatic Transmission Fluid Temperature Gauge: Beginning with 2002 model year a Transmission Fluid Temperature Gauge is included with the instrument cluster of Super Duty F-Series, automatic transmission only, signaled by the Transmission Oil Temperature (TOT) sensor. A complete description can be found in the vehicle's Owner Guide. In brief below describes the meanings of the needle readings to help the operator monitor PTO operation.

Cold Range: 50° F or less.

White Area: Normal operating range of 51° F to 248° F.

Yellow Area: Warning: Stop driving the vehicle or remove auxiliary loads at the earliest convenience. Typically, leave the engine running at base idle speed and allow to cool into the normal range before starting to drive or operate the PTO. The transmission fluid is not over-heated, but operating in the Yellow Range for extended periods of time may cause internal transmission damage.

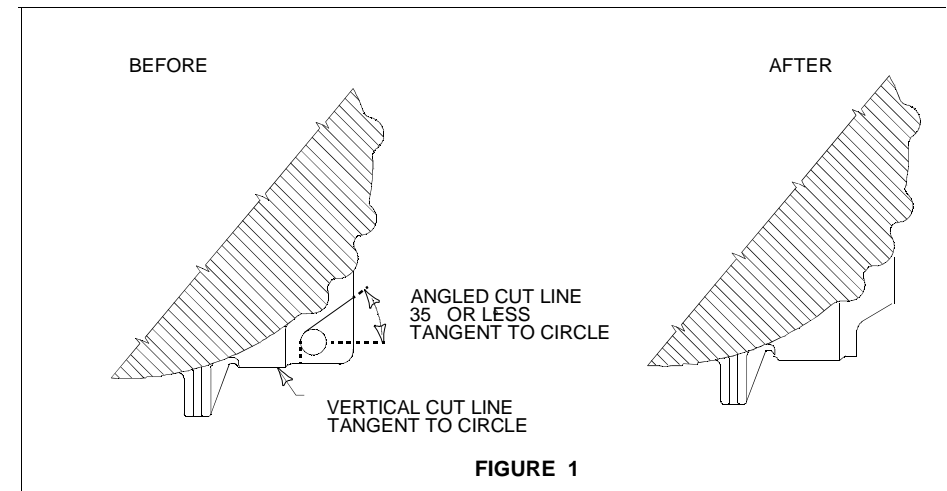
Red Area: The transmission fluid is over-heating. Stop the vehicle, do not drive, and allow to cool into the normal operating temperature range. If the gauge continues to show high temperatures then see your Ford dealer.

For readings in the Red and Yellow areas make sure that snow or debris is not blocking airflow to the radiator and transmission fluid cooler, that cooler lines are not kinked or restricted, and that vehicle load capacities or PTO duty cycles are not excessive.

SEIC (Stationary Elevated Idle Control): New for 2005 model year, this feature is included in the powertrain control strategy of all F250/350/450/550 and E250/350/450, over-8500 lb GVWR, all powertrains. It replaces the APCM (Auxiliary Powertrain Control Module) previously included with Ford "Auxiliary Idle Control Kit" Option Codes 96P (F-Series) and 961 (E-Series). For a stationary vehicle it allows the operator to elevate engine idle speed to operate a transmission-mounted PTO, or engine FEAD-mounted clutch-pump, air compressor, or generator; or be used to help keep the vehicle battery charged. SEIC uses CAN messaging internally. It is activated by the up-fitter by applying discrete voltage signals to a wire bundle located in the F-Series cabin above the parking brake release handle, and in the E-Series engine compartment. The up-fitter will need to complete the circuits as described herein, and provide the customer interface (i.e. buttons, LCD read-out for engine speed, PTO switch, etc.). Note: The F-Super Duty light truck offers four relayed rocker switches on the instrument panel for the up-fitter to use. Ramp-up rate is fixed and approximately 200 rpm/sec for diesel engine and 400 rpm/sec for gas engine.

PTO Control (For automatic transmission-mounted PTO only): This is PCM strategy within the SEIC feature that automatically looks for and recognizes whether the vehicle has a TorqShift automatic transmission with a side-mount PTO ("Transmission PTO Provision", Option Code 62R), and makes the internal PTO gear function by commanding the torque converter to lock at 1200 rpm minimum speed. The PTO gear is splined directly to the transmission torque converter turbine shaft. When all of the vehicle safety enablers are met, and the engine speed is commanded by the operator to at least 1200 rpm, then the strategy automatically commands the torque converter to lock at 1200 rpm to deliver engine torque to the PTO gear (actual lock-up begins at approximately 1050 rpm), and elevates the transmission hydraulic line pressure to 150 psi nominal for the aftermarket PTO to use to hold its engagement clutch. NOTE: Applying battery voltage to the Diesel "PTO" or Gas "PTO-Mode" wires is what the transmission looks for to initiate these commands. Failing to do so may show up as low or oscillating hydraulic line pressure and low or no aftermarket PTO torque or pump flow output. Any attempt to operate the aftermarket PTO at elevated idle without these commands may result in under-capacity PTO clutch wear, resulting in rapid contamination of transmission fluid and internal transmission damage. This applies to both stationary and mobile automatic transmission PTO operations.

The M60D manual transmission case will require a slight modification to package PTO pumps that are mounted directly to the PTO and facing rearward. Refer to Figure 1 for instructions on removing a small tab on the case to obtain clearance for the pump.



BB0443

Instructions for removing M60D case tab (for PTO clearance)

A section of the aluminum tab may be removed as indicated above. Use a mechanical tool only, such as a die grinder. DO NOT use a flame torch of any kind to remove aluminum transmission case material.

- NOTES** — M60D USES ALL METRIC FASTENERS EXCEPT FOR COOLER LINES.
 — DO NOT SCALE DRAWINGS.
 — PTO OPENING IS A STANDARD 6 BOLT SAE #J704B.



SEIC / PTO APPLICATION INFORMATION (Cont'd)

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 1200 rpm (900 rpm, 6.4L), 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.

- If the Transmission Oil Temperature (TOT) sensor reaches 240°F, then TorqShift torque converter may disengage, preventing torque to be 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 200 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 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.

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 ¹	Yes ²
Vehicle in PARK (automatic trans.)	Vehicle taken out of PARK	Yes	Yes
Foot off of clutch (manual trans.)	Clutch depressed	Yes	Yes 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 ¹	No
	Engine Coolant Temperature Limit (ECT)	Yes ¹	No
	Catalyst Temperature Limit	Yes ¹	No

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 proceeds 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.

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



SEIC / PTO

APPLICATION INFORMATION (Cont'd)

GUIDELINES FOR SPECIFIC APPLICATIONS

FEAD-Mounted Auxiliary Equipment:

1. An auxiliary crankshaft bearing support is required on all modular gas engine applications where the clutch-pump is drawing greater than 5-hp from the engine crankshaft pulley. This further applies to all tangentially-mounted auxiliary aftermarket equipment in general.
 - a. A "spider" bracket kit can be obtained for this purpose by contacting DewEze Manufacturing, 151 E. Hwy. 160, Harper, Kansas, 67058. Toll-free phone: (800) 835-1042, or fax: (316) 896-7129. It provides up to 70 lb-ft of torque at the clutch-pump. Part Numbers: (6.8L) XC2E-7275-BB, (5.4L) XC2E-7275-AB.
2. Always maintain the clearance relationship between the Ford OEM fan, radiator, and shroud to help maintain optimum engine cooling performance.
3. Always consider engine roll and body/frame torsion when packaging clearances.
4. Restrict FEAD-PTO application to 5.4L and 6.8L gas, and 6.0L diesel engines.
5. Temperature monitoring of powertrain fluids as discussed earlier in this section is recommended.
6. Avoid the use of aftermarket "power chips" in the engine powertrain control system. These boost engine power by dumping fuel, which heats the engine, turning on the cooling fan 100%, resulting in accelerated FEAD belt and tensioner wear-out.
7. Belt spans greater than 250 mm require a pulley or tensioner support within the span.

Split-Shaft PTO: Light truck automatic transmissions from Ford are not prepared for split-shaft PTO operation. The electronic control strategy is affected, and the powertrain has not been fully qualified for the higher horsepower and extended duration usage typical of this application. However, a PTO on the side of a transmission, sharing hydraulic fluid with the transmission, poses a higher temperature threat to the transmission than split-shaft PTO for any given horsepower demand. In any event, temperature monitoring and control of the transmission fluid is highly recommended.

Combination PTO/Snowplow/Salt-Spreader/Dump Vehicles:

The powertrain is designed to perform satisfactorily in a mobile operation at full GVWR, assuming no additional torque and horsepower demands are placed upon it other than the normal OEM accessories. Adding transmission-mounted PTO operation to this condition may exceed the capabilities of the powertrain, and premature transmission damage may occur, typically from transmission fluid over-heating. Combination vehicles operating transmission-mounted PTO in a mobile condition may require the total vehicle weight be restricted below GVWR to compensate for the additional PTO horsepower demand.

Automatic transmission PTO operation below torque converter lockup speed:

A typical application is aerial man-lifting using vehicle engine speeds below torque converter lockup speed of 1200 rpm to move the bucket slowly. The aftermarket PTO clutch is engaged electrically, but there may be insufficient hydraulic line pressure serving that clutch. The following threats may be present as a result:

- a. Additional slippage of the aftermarket PTO clutch causing clutch debris to contaminate the transmission fluid.
- b. Transmission and aftermarket PTO clutch slippage accelerating transmission fluid heat build-up.
- c. Bucket movement may vary or stall due to a wide variation or fluctuation in torque output to the aftermarket PTO.
- d. Diesel engine damage due to coking caused by extended time running at low idle speed with light loads.

The likelihood of these treats actually occurring, and the protection against them, is the responsibility of the final stage manufacturer, who has the best knowledge of the customer's usage and aftermarket PTO system design. However, since the duty cycle is typically short, and using only 2 to 3 gallons per minute pump output, the likelihood of any concern is rare. It is recommended in this application to change the automatic transmission fluid and filter more often, and drive the diesel engine at highway speeds for 10 minutes or more to remove any coke deposits forming.



SEIC / PTO ENGINE PCM PINS E-250/350/450

Circuit Descriptions: 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 <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 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 C1-15 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 (PTOIC-2)	PCM Pin C1-06 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: 1200 rpm to 2400 rpm
Reference Voltage	PTO_VREF	PCM Pin C1-44 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_GND	PCM Pin C1-32 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)	BCPSW	PCM Pin C1-09 Circuit No. CE926 Wire Color: Violet / Brown <ul style="list-style-type: none"> 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 C1-16 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	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

E-250/350/450 – Gas Engine PCM		
Circuit Intent	Wire Tag	Description
INPUT (VPWR)	PTORS1 PTO	PCM Pin (5.4L/6.8L) C2-03/C2-26 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 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_OK (PTO-IND)	PCM Pin (5.4L/6.8L) C2-11/C2-42 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)	PTOIR (PTOIC-2)	PCM Pin (5.4L/6.8L) C2-08/C2-07 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 PTORS2. Speed range available: 910 rpm to 2400 rpm
INPUT (VPWR)	PTORS2 (PTO-ENGAGE)	PCM Pin (5.4L/6.8L) C2-06/C2-09 Circuit No. CE924 Wire Color: Blue / Green <ul style="list-style-type: none"> 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

NOTE — FOR PASS THRU CIRCUITS- REFER TO THE ELECTRICAL SECTION OF THIS BOOK.



SEIC / PTO ENGINE PCM PINS F-250/350/450/550

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 <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 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	PCM Pin C2-54 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 C1-27 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-RTN. Speed range available: 1200 rpm to 2400 rpm
Reference Voltage	PTO_VREF	PCM Pin C1-20 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_GND	PCM Pin C1-21 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)	BCPSW	PCM Pin C1-43 Circuit No. CE926 Wire Color: Purple / Brown <ul style="list-style-type: none"> 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 <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.

F-250/350/450/550 – Gas Engine PCM		
Circuit Intent	Wire Tag	Description
INPUT (VPWR)	PTO	PCM Pin C2-26 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 900 rpm "standby" speed if it finds an "open-circuit" at PTO-RPM_Select. Invokes the PTOIndicator 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 <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 C2-07 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-ENGAGE. Speed range available: 910 rpm to 2400 rpm
INPUT (VPWR)	PTO_Engage	PCM Pin C2-09 Circuit No. CE924 Wire Color: Blue / Green <ul style="list-style-type: none"> 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.

NOTE — FOR PASS THRU CIRCUITS- REFER TO THE ELECTRICAL SECTION OF THIS BOOK.



SEIC / PTO BATTERY VOLTAGE SOURCES (VPWR) & CUSTOMER ACCESS SIGNALS E-250/350/450

E-250/350/450 Battery Voltage Sources (VPWR)

Circuit Intent	Wire Tag	Description
Hot-at-all-times	(no tag)	Circuit no. SBB68 Wire Color: Green / Red <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Found: under windshield cowl on drivers side engine zone. Requires Upfitter Switch Option 52-S

E-250/350/450 – Diesel Engine Customer Access Signal Circuits

Circuit Intent	Wire Tag	Description
OUTPUT PARK-Only	TRO_P	PCM Pin C1-07 Circuit No. CET22 Wire Color: Gray / Brown
OUTPUT Vehicle Speed	VS_OUT	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

E-250/350/450 – Gasoline Engine Customer Access Signal Circuits

Circuit Intent	Wire Tag	Description
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	VS_OUT	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

NOTE — FOR PASS THRU CIRCUITS- REFER TO THE ELECTRICAL SECTION OF THIS BOOK.



SEIC / PTO BATTERY VOLTAGE SOURCES (VPWR) & CUSTOMER ACCESS SIGNALS F-250/350/450/550

F-250/350/450/550 Battery Voltage Sources (VPWR)

Circuit Intent	Wire Tag	Description
Ignition Hot-in-RUN		Circuit no. CBP44 Wire Color: Purple <ul style="list-style-type: none"> • 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.

F-250/350/450/550 - Diesel Engine Customer Access Signal Circuits

Circuit Intent	Wire Tag	Description
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: Purple / Orange
OUTPUT Engine Speed	CTO	PCM Pin C1-19 Circuit No. CE913 Wire Color: Blue

F-250/350/450/550 - Gasoline Engine Customer Access Signal Circuits

Customer Access Signal Circuits		
Circuit Intent	Wire Tag	Description
OUTPUT PARK-Only	TRO_P	PCM Pin C2-46 Circuit No. CLS05 Wire Color: Blue / Gray
OUTPUT NEUTRAL-Only	TRO_N	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: Purple / Orange
OUTPUT Engine Speed	CTO	PCM Pin C2-25 Circuit No. CE913 Wire Color: Blue

NOTE — FOR PASS THRU CIRCUITS- REFER TO THE ELECTRICAL SECTION OF THIS BOOK.

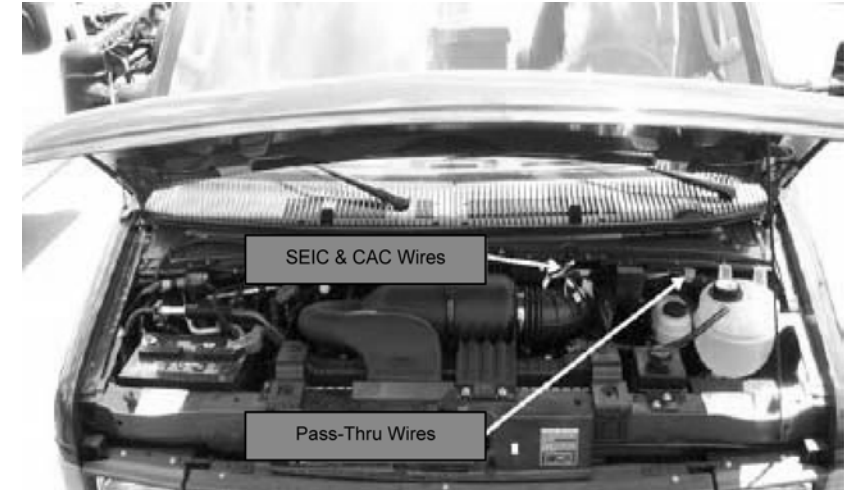


SEIC / PTO ACCESS & PASS-THRU WIRING LOCATIONS E-250/350/450

E250/350/450 Engine Compartment

- Blunt-cut access wires for SEIC, and the "Customer Access" signal circuits for CTO, VSO, PARK, PARK-NEUTRAL, 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 wire.

- 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.

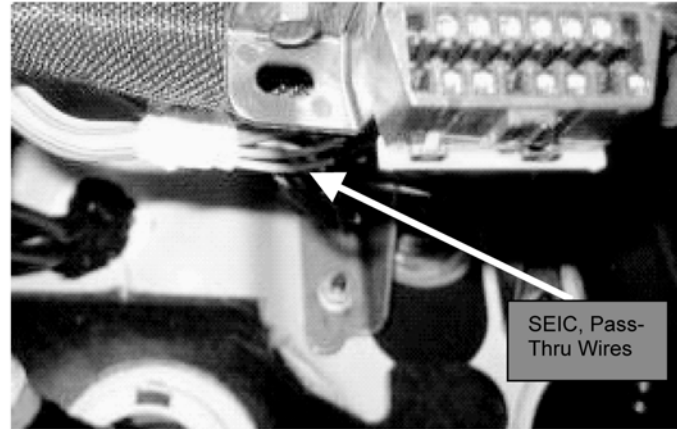


SEIC / PTO ACCESS & PASS-THRU WIRING LOCATIONS F-250/350/450/550

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.





SEIC / PTO RPM / RESISTANCE / VOLTAGE CHARTS GASOLINE & DIESEL ENGINES

Gas Engine		
Engine Target Speed (RPM)	Resistor (Ohms) (5%, 1/4 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	279	10.75
2064	220	11.20
2128	180	11.60
2160	150	11.90
2208	120	12.23
2256	100	12.46
2320	0 (closed circuit)	13.77

* TorqShift automatic transmission only; manual transmission requires a resistor.

Diesel Engine		
Engine Target Speed (RPM)	Resistor (Ohms) (5%, 1/4 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



SEIC / PTO TRANSMISSION SPECIFICATIONS

		TorqShift 5-speed automatic	M6OD 6-Speed Manual HD
Transmission Fluid Type ⁽¹⁾		Type D	Type H
Hydraulic Fluid Line Pressure ⁽¹⁾	At base engine speed:	50-60 psi	-----
	At 1200 rpm engine speed:	150 psi nominal ⁽²⁾	-----
Transmission Gear Ratios	Low	-----	5.79
	1 st	3.114	3.30
	2 nd	2.218	2.10
	3 rd	1.545	1.30
	4 th	1.000	1.00
	5 th	0.712	0.72
	Reverse	2.88	5.23
	Torque Converter	1.86	-----
PTO Drive Gear Function	All Forward Drive Gears ⁽³⁾ :	Yes	Yes
	Reverse ⁽³⁾ :	Yes	Yes
	Overdrive ⁽³⁾ :	Yes	Yes
	PARK (Stationary)	Yes	-----
	NEUTRAL (Stationary)	No	Yes
PTO Drive Gear Data	PTO Port	<ul style="list-style-type: none"> • LH (Driver Side) Only • Non-standard 6-bolt pattern • Requires Option Code 62R 	<ul style="list-style-type: none"> • LH (Driver Side) Only • Standard 6-bolt pattern • Available Standard
	Gear Torque Rating	250 lb-ft	250 lb-ft
	Gear Ratio	3.09	5.79 (Low)
	Number of gear teeth	121	39
	Diametral Pitch		9.2364
	Pitch Diameter	215.985 mm	132.568 mm
	Normal Pressure Angle	17.989°	20°
	Angle and Hand of Helix	Spur	36° RH
	Gear RPM at 1000 Engine RPM	1000	590
Pitch Line Diameter Velocity @ 1000 Engine RPM	2226 ft/min	806 ft/min	
Aftermarket PTO Model Series ⁽⁴⁾	Chelsea Technical Service: (662) 895-1052, chelseatech@parker.com	246	442
	Muncie Customer Service: 1-800-FOR-PTOS, info@munciepower.com	4x2: FR62 or FR64 4x4: FR64 only	TG
Torque Converter – Minimum lock-up speed (vehicle stationary – in PARK or NEUTRAL)		1200 rpm ⁽⁵⁾	-----
Internal Transmission Fluid Temperature Monitor		Yes	No

Footnotes:

- (1) Affects the "holding power" of the aftermarket PTO clutch.
- (2) Requires battery voltage applied to "PTO" (diesel engine) or "PTO-Mode" (gas engine) circuit, engine at 1200 rpm, and torque converter locked.
- (3) Vehicle road speed must be greater than zero.
- (4) Consult the PTO manufacturer for more complete detail.
- (5) Although actual lock-up occurs above 1050 rpm, and unlocks below 950 rpm, drawing full torque from the PTO gear is not intended below 1200 rpm engine speed.