O-239

SVE BULLETIN

SPECIAL VEHICLE ENGINEERING – BODY BUILDERS ADVISORY SERVICE

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2016 and later Transit Stationary Elevated Idle Control

Models Affected
All 2016 and later Model Year Transit Vans, Wagons, Cutaways, and Chassis Cab Vehicles.

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

SEIC (3.5L Gas/3.7L Gas /3.2L Diesel)
- 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 Transit models

Customer Access Wires for SEIC and Transmission Park/ Trans. Neutral/CTO/Signals
- Located in the engine compartment.
- 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 Transit.
- Additional customer access circuits may be found in the Transit Body and Equipment Mounting Manual.

SEIC Wire Locations

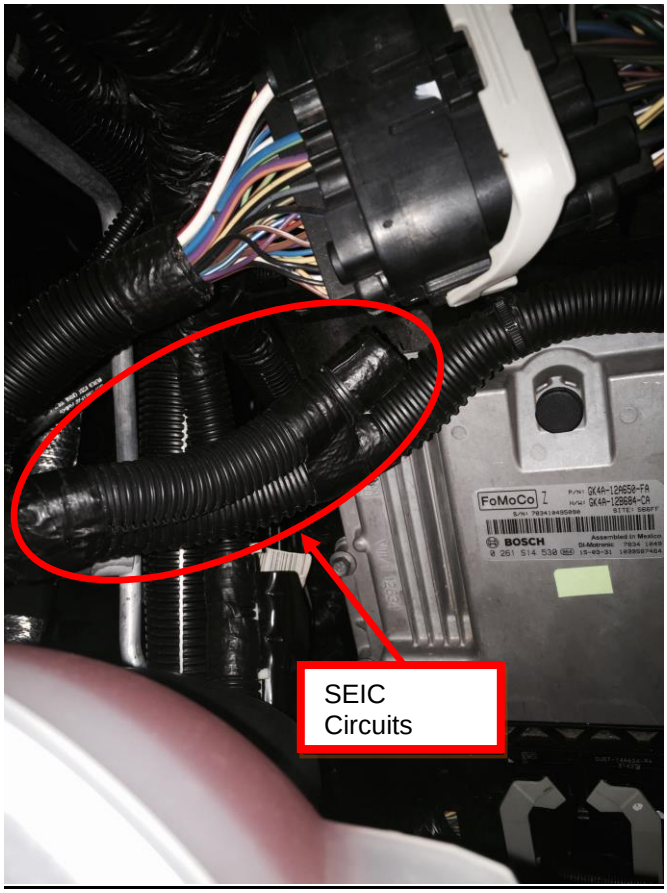
SEIC and Customer Access signal circuits

3.2L / 3.5L / 3.7L SEIC circuit Location

- Found under hood, wrapped in convolute, taped to harness behind coolant reservoir

3.5L/3.7L SEIC circuit Location

- Found under hood taped to harness next to Engine Junction Box



Refer to the electrical section of the BEMM For additional customer access circuit location information

Customer Access Signal Circuit Descriptions

Refer to the Body Equipment Mounting Manual for more information.

CUSTOMER ACCESS SIGNAL CIRCUITS		
OUTPUT Park-Only	TRO-P	3.5L - PCM Pin C1551B-40 Circuit No. CET22 Wire Color: Gray / Yellow 3.7L - PCM Pin C175B-19 Circuit No. CET22 Wire Color: Gray / Yellow
OUTPUT Neutral-Only	TRO-N	3.5L - PCM Pin C1551B-81 Circuit No. CET21 Wire Color: Green / Orange 3.7L - PCM Pin C175B-43 Circuit No. CET21 Wire Color: Green / Orange
OUTPUT Vehicle Speed	VSOUT	Circuit No. VMC05 Connector: C33-E Pin:4 See BEMM for signal specification.
OUTPUT Engine Speed	CTO	3.5L - PCM Pin C1551B-40 Circuit No. VMC02 Wire Color: Blue / White 3.7L - PCM Pin C175B-19 Circuit No. VMC02 Wire Color: Blue / White 3.2L Diesel - PCM Pin C1232B Circuit No. VMC02 Wire Color: Blue / Orange
PASS-THRU		Circuit No. CAC17 • Found: at: - Vehicle interface connector **C11-H** (4-pin connector), **Pin #2,** at firewall on driver side of the engine compartment - Vehicle interface connector **C12-A** (6-pin connector), **Pin #1,** behind left side of center stack. - Requires modified vehicle wiring option (53K)
PASS-THRU		Circuit No. CAC18 • Found at: - Vehicle interface connector **C11-H** (4-pin connector), **Pin #3,** at firewall on driver side of the engine compartment - Vehicle interface connector **C12-A** (6-pin connector), **Pin #2,** behind left side of center stack. - Requires modified vehicle wiring option (53K)

Battery Voltage Sources (VPWR)

Refer to the Body Equipment Mounting Manual for more information.

Transit		
Circuit Intent	Wire Tag	Description
Hot-at-all-times		Circuit no. SB153 • A fused 40 amp circuit (F53). • Requires modified vehicle wiring option (53K) • Found at: - Vehicle interface connector **C11-H** (4-pin connector), **Pin #4,** at firewall on driver side of the engine compartment - Vehicle interface connector **C12-A** (6-pin connector), **Pin #3,** behind left side of center stack. - Vehicle interface connector **C33-C** (6-pin connector), **Pin #3**, behind Passenger side airbag, above glove box. Circuit no. SB118 Connector: C33-C Pin:6 • A fused 40 amp circuit (F18). • Found: at vehicle interface connector **C33-C** (6-pin connector), **Pin #6**, behind Passenger side airbag, above glove box. • Requires modified vehicle wiring option (53K) Customer Connection Point • A fused 60 amp VBATT feed. • Found: at right side rear of driver seat pedestal.

Ignition Hot-in-RUN		Circuit no. CB121 Connector: C33-E Pin:6 • A fused 10 amp circuit. • Found: at vehicle interface connector C33-E (6-pin connector) on right side of driver seat pedestal beneath driver seat. Circuit no. CAC14 • A fused 40 amp circuit (F52). • Requires modified vehicle wiring option (53K) • Found at: - Vehicle interface connector **C11-H** (4-pin connector), **Pin #1,** at firewall on driver side of the engine compartment - Vehicle interface connector **C12-A** (6-pin connector), **Pin #4**, behind left side of center stack - Vehicle interface connector **C33-C** (6-pin connector), **Pin #5**, behind Passenger side airbag, above glove box.
Upfitter switch Output: Ign-Hot/ACC •Found: at vehicle interface connector C33-H (4-pin connector) on right side of driver seat pedestal beneath driver seat. . •Requires Upfitter Switch Option 67C	Aux-1	[20-amp] Circuit No. CAC05 Connector: C33-H Pin:1
	Aux-2	[20-amp] Circuit No. CAC06 Connector: C33-H Pin:2
	Aux-3	[20-amp] Circuit No. CAC07 Connector: C33-H Pin:3
	Aux-4	[20-amp] Circuit No. CAC08 Connector: C33-H Pin:4

2. Stationary Elevated Idle Control for 3.5L, and 3.7L Gasoline Engines

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.
- Minimum engine speed – ~ 800 RPM
- Maximum engine speed – 2400RPM

Typical SEIC engagement Sequence

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 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).

Special Situations

Alternative Calibration

All new Ford vehicles 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.

Battery Charge Protect
Battery charge protect mode is available on 3.5L and 3.7L gas engine models. On these powertrains, Battery Charge protect mode is determined through resistor selection (see resistor chart). **Note:** PTO RPM REQ must have a voltage input between .16 and .20 for BCP to function.

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.

Table A: Gasoline SEIC Resistor Charts

3.7L Gas & 3.5L GTDI Engines		
Engine Target Speed (RPM)	Resistor (Ohms) (5%, 1/4 watt)	Voltage (volts)
804	72000	0.3
850	48000	0.444
900	35200	0.591
950	27000	0.743
1000	21900	0.885
1100	15400	1.174
1200	11200	1.47
1300	8580	1.77
1400	6670	2.067
1500	5240	2.365
1600	4170	2.664
1700	3260	2.952
1800	2590	3.221
1900	1917	3.548
2000	1424	3.836
2100	986	4.13
2200	620	4.413
2300	284	4.711
2396	255	4.995
BCP		
700-1200*	5200	0.1857

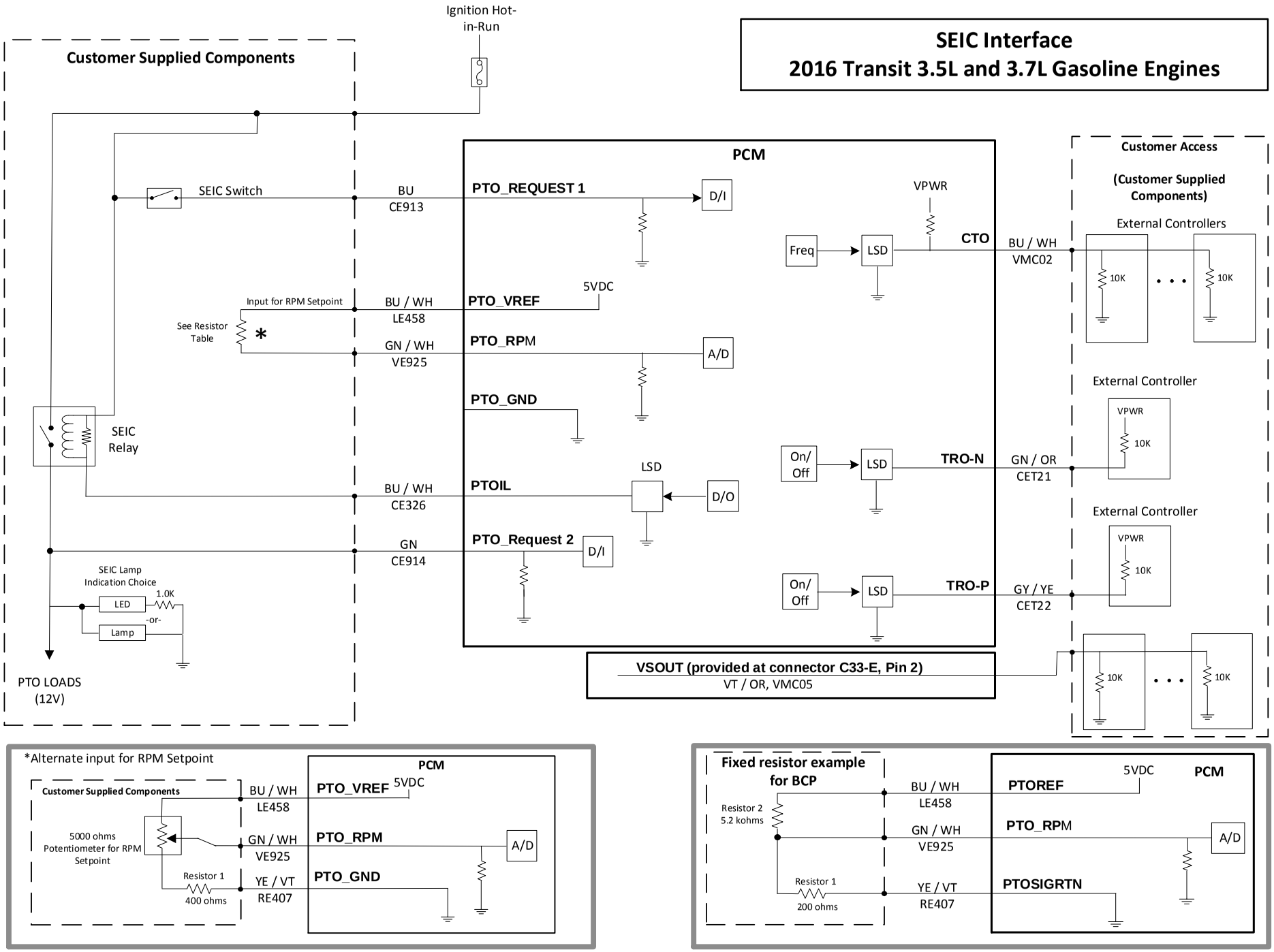
*RPM varies as a function of battery charge state- see BCP description

SEIC Circuit Descriptions

All circuits lead back to pins on the PCM

Transit– 3.5L and 3.7L Gasoline Engine PCM		
Circuit Intent	Wire Tag	Description
INPUT (VPWR)	PTO_REQUEST1	3.5L - PCM Pin C1551B-87 Circuit No. CE913 Wire Color: Blue 3.7L - PCM Pin C175B-84 Circuit No. CE913 Wire Color: Blue • Applying vehicle battery voltage to this wire begins SEIC process. • Signals PCM to enter SEIC strategy. • Verifies safety enablers. • Elevates engine speed to target found at PTO-RPM circuit. • Invokes the PTOIL 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	3.5L - PCM Pin C1551B-91 Circuit No. VE935 Wire Color: Green 3.7L - PCM Pin C175B-88 Circuit No. VE935 Wire Color: Green • RPM Increase Command Monitor
OUTPUT	PTOIL	3.5L - PCM Pin C1551B-80 Circuit No. CE326 Wire Color: Blue / White 3.7L - PCM Pin C175B-96 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	3.5L - PCM Pin C1551B-33 Circuit No. CE925 Wire Color: Green / White 3.7L - PCM Pin C175B-85 Circuit No. CE925 Wire Color: Green / White • Add a resistor or a potentiometer to obtain fixed or variable engine target speed. • Combine in circuit with PTO_VREF (+5V). • Speed range available: 910 rpm to 2400 rpm
OUTPUT	PTO_VREF	3.5L - PCM Pin C1551B-11 Circuit No. LE458 Wire Color: Blue / White 3.7L - PCM Pin C175B-52 Circuit No. LE458 Wire Color: Blue / White • A 5-volt reference, buffered against shorts to ground or power, used to complete the resistor circuit for engine speed selection.
INPUT	PTO_GND	3.5L - PCM Pin C1551B-18 Circuit No. RE407 Wire Color: Yellow / Violet 3.7L - PCM Pin C175B-51 Circuit No. RE407 Wire Color: Yellow / Violet • A ground reference, buffered, used to complete the resistor circuit for engine speed selection when a potentiometer is used.

SEIC Interface
2016 Transit 3.5L and 3.7L Gasoline Engines



SEIC Enable/Disable Conditions

Vehicle Conditions to Enable SEIC (all are required)	Vehicle Conditions that Disable SEIC (any one required)	Gas 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) 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.

4. 3.2L Diesel Engines

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.
- Minimum engine speed – ~ 800 RPM
- Maximum engine speed – 2400RPM

Typical SEIC engagement Sequence

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:

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

Special Situations

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.

Battery Charge Protect

Battery charge protect mode is available on 3.2L diesel engine models. On diesel powertrains, Battery Charge protect mode is activated through dedicated PCM inputs.

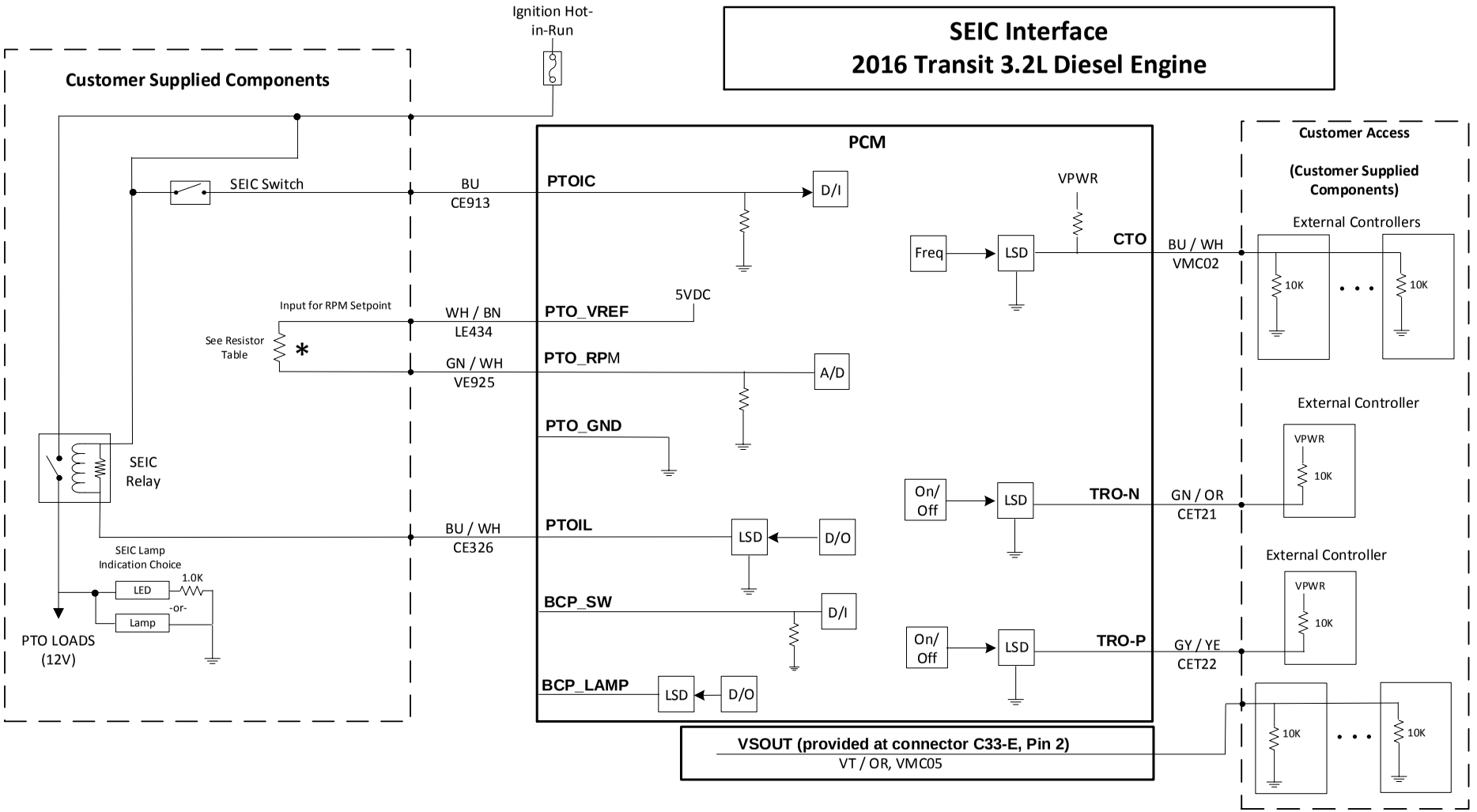
When it is switched on the engine speed goes immediately to 600. From this state, the PCM uses battery voltage as well as ambient air temp., engine oil temperature information to raise engine speed higher to maintain a certain battery charge. Maximum engine speed in BCP mode is 1200 rpm. Loss of an operating condition after BCP is engaged will require the BCP switch to be cycled before BCP will re-engage.

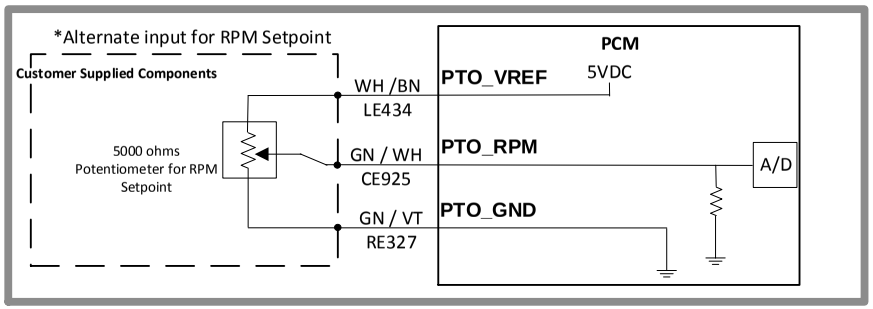
Transit– 3.2L Diesel Engine PCM		
Circuit Intent	Wire Tag	Description
INPUT (VPWR)	PTO_NO	PCM Pin C1232B-33 Circuit No. CE913 Wire Color: Blue • Applying vehicle battery voltage to this wire begins SEIC process. • Signals PCM to enter SEIC strategy. • Verifies safety enablers. • Elevates engine speed to target found at PTO-RPM circuit. • Invokes the PTOIL circuit when safety enablers are met. • Looks for the target engine speed requested at the PTO_RPM circuit using a resistor or POT.
OUTPUT	PTOIL	PCM Pin C1232T-1 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 C1232B-43 Circuit No. CE925 Wire Color: Green / White • Add a resistor or a potentiometer to obtain fixed or variable engine target speed. • Combine in circuit with PTO_VREF (+5V). • Speed range available: 910 rpm to 2400 rpm
OUTPUT	PTO_VREF	PCM Pin C1232B-51 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.
INPUT	PTO_GND	PCM Pin C1232B-24 Circuit No. RE327 Wire Color: Green / Violet • A ground reference, buffered, used to complete the resistor circuit for engine speed selection when a potentiometer is used.
INPUT	BCP_SW	PCM Pin C1232T-43 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 required charge system voltage
OUTPUT	BCP_LAMP	PCM Pin C1232T-42 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.

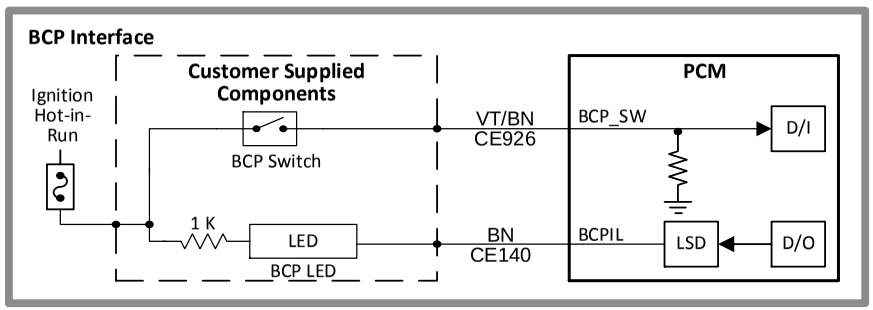
Table B: Diesel SEIC Resistor Charts

3.2L Diesel Engine		
Engine Target Speed (RPM)	Resistor (Ohms) (5%, 1/4 watt)	Voltage (volts)
900	53800	0.4
950	40000	0.52
1000	31450	0.64
1100	21410	0.9
1200	15710	1.15
1300	12050	1.4
1400	9550	1.64
1500	7640	1.9
1600	6200	2.15
1700	5060	2.4
1800	4150	2.65
1900	3400	2.89
2000	2740	3.15
2100	2200	3.4
2200	1724	3.65
2300	1319	3.9
2400	959	4.14
2500	628	4.4

SEIC Interface
2016 Transit 3.2L Diesel Engine







SEIC Enable/Disable Conditions

Vehicle Conditions to Enable SEIC (all are required)	Vehicle Conditions that Disable SEIC (any one required)	Gas 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) 40° F minimum	Engine Coolant Temperature Limit (ECT)	Yes (See Note-2)
	Catalyst Temperature Limit	Yes (See Note-2)

1. 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.

2. 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.

4. 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.
- 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.
- 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 (PTO) 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. 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.
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 Gas engine 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 behind the knee bolster below the driver's side instrument panel.