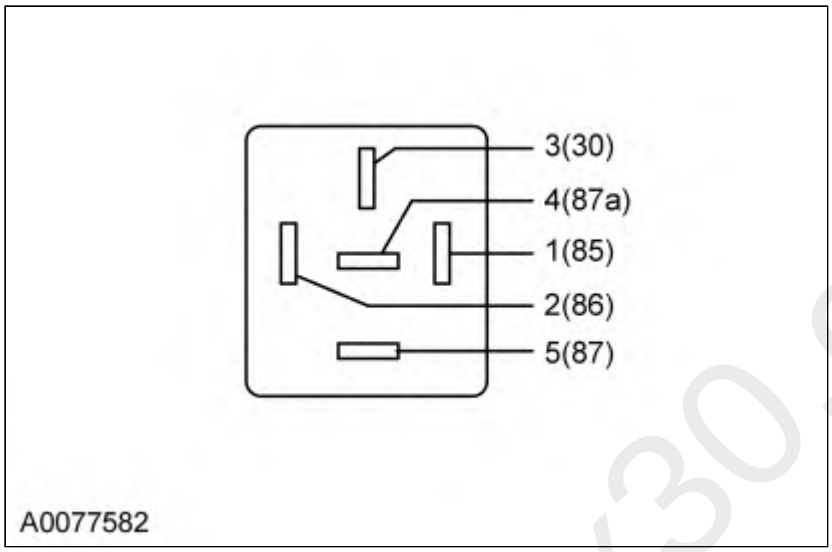
KG: Fuel Injector

This pinpoint test is intended to diagnose the following:

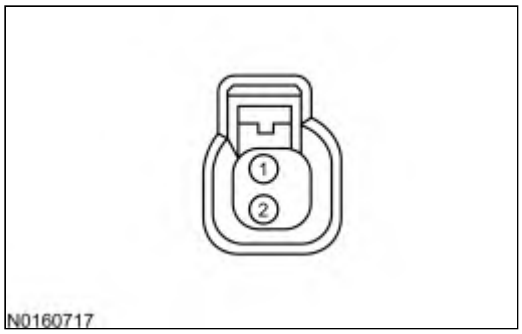
- fuel injectors (9F593)
- injector relay
- harness circuits: INJ1, INJ2, INJ3, INJ4, INJ5, INJ6, INJ7, INJ8, INJ9, INJ10 INJRLY, INJPWRM and VPWR
- PCM (12A650)

Injector Relay Connector



Pin	Circuit
5	VPWR (Vehicle Power)
1	INJRLY (Injector Relay)
2, 3	B+ (Battery Positive Voltage)

Injector (INJ) Connector



Vehicle	Connector	Pin	Circuit
EcoSport, Escape/Kuga 1.5L, KA	A	2 1	INJ VPWR
All other vehicles	A	1 2	INJ VPWR

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to Section 6, Reference Values.

Vehicle	Connector	Pin	Circuit
Continental	198 PIN	E1 E3 E31 E2 E16 E46	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
Corsair, Escape/Kuga 2.5L	198 PIN	E52 E55 E53 E54	INJ1 INJ2 INJ3 INJ4
E-Series	198 PIN	E1 E62 E46 E3 E2 E31 E61 E16	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8
EcoSport 1.5L Automatic Transmission	198 PIN	E52 E53 E54 E18	INJ1 INJ2 INJ3 INJPWRM
EcoSport 1.5L Manual Transmission	112 PIN	E39 E26 E40 E22	INJ1 INJ2 INJ3 INJPWRM
Escape/Kuga 1.5L	198 PIN	E4 E8 E18	INJ1 INJ2 INJ3

Vehicle	Connector	Pin	Circuit
Expedition, F-150 3.5L High Output, Navigator	198 PIN	E43 E30 E45 E58 E42 E72	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
F-150 5.0L	306 PIN	E39 E110 E38 E123 E17 E18 E81 E36	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8
F-650 / F-750	198 PIN	E1 E31 E61 E63 E3 E2 E46 E62 E64 E16	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8 INJ9 INJ10
F-Series Super Duty, Motorhome / Stripped Chassis / Step Van	306 PIN	E39 E36 E17 E81 E38 E18 E123 E110 B14	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8 INJPWRM
Flex	198 PIN	E1 E3 E31 E2 E16 E46 B21	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJPWRM

Vehicle	Connector	Pin	Circuit
Ford GT	198 PIN	B81	INJ1
		B80	INJ2
		B22	INJ3
		B40	INJ4
		B21	INJ5
		E16	INJ6
		B95	INJPWRM
		B42	INJRLY
Fusion	198 PIN	E52	INJ1
		E55	INJ2
		E53	INJ3
		E54	INJ4
		B21	INJPWRM
KA 1.0L	128 PIN	E35	INJ1
		E44	INJ2
		E45	INJ3
		E29	INJPWRM
KA 1.2L, KA 1.5L Manual Transmission	112 PIN	E39	INJ1
		E26	INJ2
		E40	INJ3
KA 1.5L Automatic Transmission	198 PIN	E52	INJ1
		E53	INJ2
		E54	INJ3
Mustang 5.0L, Mustang 5.2L Supercharged	306 PIN	E39	INJ1
		E36	INJ2
		E17	INJ3
		E81	INJ4
		E38	INJ5
		E18	INJ6
		E123	INJ7
		E110	INJ8
Mustang TiVCT 5.2L	198 PIN	E1	INJ1
		E61	INJ2
		E31	INJ3
		E3	INJ4
		E2	INJ5
		E62	INJ6
		E46	INJ7
		E16	INJ8
Ranger	128 PIN	E34	INJ1
		E45	INJ2
		E44	INJ3
		E46	INJ4

Vehicle	Connector	Pin	Circuit
Transit Connect	198 PIN	B52	INJ1
		B55	INJ2
		B53	INJ3
		B54	INJ4
All other vehicles	306 PIN	E39	INJ1
		E81	INJ2
		E18	INJ3
		E38	INJ4
		E110	INJ5
		E17	INJ6

KG1 CHECK FOR DTCS
Are DTCs P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0209, P0210, P2149, P21CF, P21D0, P21D1, P21D2, P21D3, P21D4, P21D5, P21D6, P2C27 or P2C28 present?

Yes	For DTCs P2149, P2C27 or P2C28, GO to KG10. For all others, GO to KG2.
No	For symptoms without DTCs, GO to KG3. For all others, RETURN to Section 3, Symptom Charts for further direction.

KG2 CHECK FOR OTHER DTCS

Note: *On some vehicles, these DTCs may be accompanied by body control module (BCM) fuel pump relay DTCs or PCM fuel system related DTCs. Diagnose any BCM fuel pump relay DTCs or PCM fuel system related DTCs first.*

- Clear the PCM DTCs.
- Crank the engine.
- Ignition ON, engine OFF.
- Carry out the PCM self-test.
- Carry out the BdyCM self-test.

Are any BCM DTCs present?

Yes	REFER to the applicable Workshop Manual Section to continue diagnosis.
No	GO to KG3.

KG3 CHECK THE VPWR CIRCUIT FOR AN OPEN

Note: *Disconnect the suspect fuel injector harness connector. Only the suspect injector needs to be diagnosed.*

Note: *On some vehicles, the injector voltage is only present when the fuel pump relay is energized. Measure the injector voltage within 2 seconds of the ignition ON.*

- Ignition OFF.
- INJ connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) INJ Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	GO to KG4.
No	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KG4 CHECK THE INJ CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) INJ Connector, Harness Side	(-) PCM Connector, Harness Side
INJ	Suspect INJ

Is the resistance less than 5 ohms?

Yes	GO to KG5.
No	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KG5 CHECK THE INJ CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) INJ Connector, Harness Side	(-)
INJ	Ground

Is the resistance greater than 10K ohms?

Yes	GO to KG6.
No	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KG6 CHECK THE INJ CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- Measure the voltage between:

(+) INJ Connector, Harness Side	(-)
INJ	Ground

Is any voltage present?

Yes	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.
No	GO to KG7.

KG7 CHECK THE RESISTANCE OF THE FUEL INJECTOR

- Ignition OFF.
- Measure the resistance between:

(+) INJ Connector, Component Side	(-) INJ Connector, Component Side
VPWR	INJ

Is the resistance between 11 - 18 ohms?

Yes	GO to KG8.
No	INSTALL a new fuel injector. REFER to the Workshop Manual Section 303-04, Fuel Charging and Controls. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test.

KG8 CHECK THE FUNCTIONALITY OF THE INJ CIRCUIT

- PCM connector connected.
- Ignition ON, engine OFF.
- Connect a non-powered test lamp between:

Point A INJ Connector, Harness Side	Point B INJ Connector, Harness Side
VPWR	INJ

- Ignition ON, engine running.

Is the test lamp blinking?

Yes	GO to KG9.
No	GO to KG15.

KG9 CARRY OUT A THOROUGH WIGGLE TEST ON THE FUEL INJECTOR HARNESS

- Ignition OFF.
- INJ connector connected.
- Ignition ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the INJ_F (MODE) PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the fuel injector to the PCM.

Are any injector values fluctuating in and out of range?

Yes	ISOLATE the concern and REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.
No	Unable to duplicate or identify the concern at this time. GO to Pinpoint Test Z.

KG10 CHECK THE INJECTOR RELAY

- Carry out the injector relay component test. Refer to the Wiring Diagrams Cell 149, Component Testing.

Does the injector relay pass the component test?

Yes	GO to KG11.
No	INSTALL a new Injector relay. Clear the PCM DTCs. REPEAT the self-test.

KG11 CHECK THE B+ VOLTAGE TO INJECTOR RELAY

- Ignition OFF.
- Injector Relay connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Injector Relay Connector, Harness Side	(-)
B+ - Pin 2, 3	Ground

Is the voltage greater than 10.5 V?

Yes	GO to KG12.
No	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KG12 CHECK FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) Injector Relay Connector, Harness Side	(-) PCM Connector, Harness Side
INJRLY - Pin 1	INJRLY
VPWR - Pin 5	INJPWRM

Are the resistances less than 5 ohms?

Yes	GO to KG13.
No	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KG13 CHECK FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Injector Relay Connector, Harness Side	(-)
INJRLY - Pin 1	Ground
VPWR - Pin 5	Ground

Are the resistances greater than 10K ohms?

Yes	GO to KG14.
No	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KG14 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Injector Relay Connector, Harness Side	(-)
INJRLY - Pin 1	Ground
VPWR - Pin 5	Ground

Is any voltage present?

Yes	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.
No	GO to KG15.

KG15 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test.
- Verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new PCM. REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM), Programming the VID Block for a Replacement PCM.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.