Troubleshooting an Inoperative A/C

Currently Applies To: '00 and later models with A/C

EDITOR'S NOTE: This article replaces "Use PGM-FI Data List to Help Troubleshoot Inoperative A/C," issued in **June 2012**.

Got an inoperative A/C? Using the online job aid ***A/C Diagnostic Process***, your first step is to do the A/C system inspection in the electronic service manual. This includes:

- Visual inspections (such as checking blower operation **at all speeds**)
- HVAC operational checks (including A/C compressor, radiator, and condenser fan operation)
- DTC checks of all vehicle systems (using the HDS, HVAC control panel, or both)

Since the PCM controls both the compressor clutch and fan operation, you can use the **PGM-FI Data List** to help you troubleshoot. Here are the A/C-related signals and what they mean or how you can use them:

Signal	Meaning/Usage
ENGINE SPEED	This is an accurate tachometer you can use during A/C performance testing. A low engine idle speed can cause the PCM to shut off the compressor.
A/C SWITCH	See **A/C Request (Switch) Circuit** section below.
A/C CLUTCH	See **A/C Compressor (Clutch) Circuit** section below.
FAN HIGH CTRL **FAN LOW CTRL** **(some models)**	See **Fan Control Circuit** section below.
TP SENSOR	At idle, the relative TP (throttle position) sensor value should read about **9%**, **0.49 V**, or **-0.2°,** depending on the scale you're reading. At wide open throttle (**90%**, **4.5 V**, or **90**°), some PCMs turn off the compressor during acceleration to improve passing performance. Newer models have a higher TP sensor voltage at idle. Drive-by-wire vehicles can be up to **0.9 V** cold, **0.65 to 0.71 V** fully warm. Relative TP should be about **3%**. Non-drive-by-wire vehicles should read **0%** for relative TP and **0.49 V** for position.
ECT SENSOR	Under normal conditions, the ECT (engine coolant temperature) sensor value should read between **158 to 212**° **F**. If it reads above **230**° **F**, the PCM on some models turns off the compressor to prevent overheating. Some models use ECT2. It should read about **50**° **F** less than the ECT sensor value while the cooling fans are on. It's also the sensor that the A/C system looks at for overheating.
IAC VALVE	The intake air control (IAC) valve value changes when the compressor cycles on and off. If it reads too high compared to a known-good vehicle, the valve could be plugged or the A/C may be overcharged.
MAP SENSOR	At idle without a load, the MAP (manifold absolute pressure) sensor value should read **1 V** or less, no matter what the elevation is. A higher voltage would mean an engine problem related to low idle.

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Signal	Meaning/Usage
CLV (some models)	At idle, the CLV (calculated load value) should read about **21 to 41%**. At **2,500 rpm** with no load, it should read about **13 to 26%**. If it reads higher, the system pressure may be too high, causing too much load on the engine. A high reading with normal system pressures can also be from an engine problem. Check your CLV readings against a known-good vehicle.

For most A/C-related signals, you'll see a value of **ON** with a **green** light, or **OFF** with a **red** light. What that value means depends on circuit design and whether the signal is an input or an output.

By looking at the A/C-related signals, then dividing the HVAC circuits into these sections, you can isolate the problem faster:

- A/C Request (Switch) Circuit
- A/C Compressor (Clutch) Circuit
- Fan Control Circuit

A/C Request (Switch) Circuit

When you turn on the A/C, the **A/C SWITCH** value should switch to **ON (green)**.



That means the control unit getting the A/C switch signal (PCM, MICU, etc.) is seeing the circuit voltage drop to near zero when the HVAC control panel provides a ground path. On most models, part of the A/C request uses the B-CAN and F-CAN networks.

If that value stays **OFF (red)**, check for these items:

- DTCs blocking the A/C request signal
  NOTE: A B-CAN or F-CAN DTC that seems unrelated can block that signal.
- Blower failure **at any of the blower speeds**
- A failed open A/C pressure switch or thermal protector (if equipped)
- A wrong A/C pressure sensor value
- A bad evaporator sensor input
- Too much or too little refrigerant
- An open or high-resistance connection in the A/C request circuit.

Instead of the traditional A/C pressure switch, most models today use a highly accurate, three-wire A/C pressure sensor, which directly reads discharge pressure. It also controls whether the radiator and condenser fans run at low or high speed.

For compressor engagement, the discharge pressure must be in the safe operating range of **28 to 455 psi**. That pressure value should closely match the high side (discharge) gauge reading on your A/C recovery and charging station.

On models where the pressure sensor inputs to the PCM, you can read the actual discharge pressure at the **A/C PRESSURE SENSOR** signal in the PGM-FI **Data List**. An open or short in the A/C pressure sensor circuit will set one of these DTCs:

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- P0532, (A/C pressure sensor circuit low voltage)
- P0533, (A/C pressure sensor circuit high voltage)

Because they have no effect on emissions, you **won't** see the MIL on.

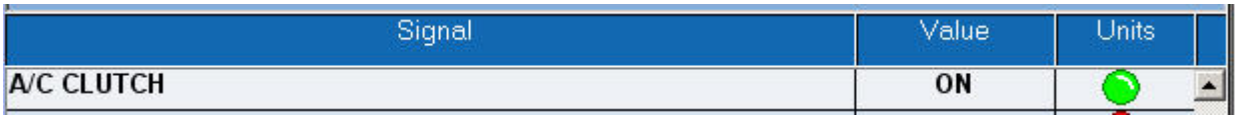
On models where the pressure sensor inputs to the HVAC or climate control unit, you must go into the HVAC control panel self-diagnostics and enter the input display mode to read that pressure. An open or short in the A/C pressure sensor circuit will set one of these DTCs:

- B2978 (open in A/C pressure sensor circuit)
- B2980 (short in A/C pressure sensor circuit)

Keep in mind, A/C pressure sensors **aren't** part of the A/C request (switch) circuit, so you **can't** jumper or bypass them while troubleshooting.

A/C Compressor (Clutch) Circuit

When you turn on the A/C, the **A/C CLUTCH** value should also switch to **ON (green)**.



That means the PCM got the A/C request signal, and is trying to ground the A/C compressor clutch relay. If that value switches to **ON (green)**, but the compressor **doesn't** engage, you've most likely got a problem in the A/C compressor control circuit. Check for these items:

- A blown fuse
- A bad compressor clutch relay
- Too much air gap in the compressor clutch
- An open A/C clutch coil
- An open or high resistance in the compressor control wiring
- An open or high-resistance PCM ground or a bad PCM

  NOTE: The PCM can get damaged by jumping the wrong two terminals at the compressor relay, sending power straight to ground through the PCM. The **A/C CLUTCH** signal will read **ON**, but the clutch is unable to control the clutch relay.

To isolate the cause, follow the A/C compressor clutch circuit troubleshooting in the electronic service manual.

If the **A/C SWITCH** value switches to **ON (green)**, but the **A/C CLUTCH** value stays **OFF (red)**, check for these items:

- Abnormal **Data List** values for such signals as **TP SENSOR**, **ECT SENSOR 1**, **ECT SENSOR 2**, or **ENGINE SPEED**, when compared to a known-good vehicle
- A PGM-FI or A/T DTC that's keeping the compressor from running

You'll find a list of items that can affect compressor operation in the A/C compressor clutch circuit troubleshooting in the electronic service manual.

If the compressor clutch is engaged when the **Data List** says the compressor and fans are off, you've probably got a stuck A/C compressor clutch relay or a short to ground on the compressor relay control wire. For more info, be sure to watch the *Tech2Tech* segment "Poor A/C Performance or a Dead Battery? Could Be a Sticking Compressor Clutch Relay."

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Fan Control Circuit

Whenever you turn on the A/C, the radiator and condenser fans should normally be running at low or high speed. When the A/C pressure sensor (on some older models, it's a triple-function A/C pressure switch) lets the PCM know that the discharge pressure is above a certain threshold (**210 to 230 psi,** depending on the model), the fans switch to high speed.

The fan control circuits generally don't have assigned DTCs, but you can monitor them from the PGM-FI **Data List**. You'll see a **FAN CTRL** signal for single-speed systems, and **FAN HIGH CTRL** and **FAN LOW CTRL** signals for dual-speed systems.



When the PCM commands the A/C clutch to engage, the fan control value should switch to **ON (green)**. That's telling you the PCM is providing a ground for the fan control circuits (high speed, low speed, or both).

If that value stays **OFF (red)**, check for these items:

- A DTC that's preventing fan or compressor operation
- An abnormal **Data List** value, compared to a known-good vehicle, that's preventing fan or compressor operation

  NOTE: Excessively high coolant temperature, low or erratic engine idle speed, unstable throttle position, or wrong A/C pressure signals can affect operation of the compressor, fans, or both.
- No A/C request signal at the PCM or a bad PCM

If the fan control value switches to **ON (green)**, but one or both fans **don't** come on, it's probably a fan control circuit problem. Check for these items:

- A blown fuse
- A bad radiator or condenser fan relay
- A bad 5-pin fan control relay (dual-speed fan system only)
- A bad fan motor or poor ground
- An open or short in the fan circuit wiring

You can check the radiator and condenser fans by running PGM-FI **Inspection** in the HDS. To run it, the engine and A/C must be turned off. If one or both fans **don't** run, or run at the wrong speed, first make sure there are no obvious problems. Then, follow the fan circuit troubleshooting chart in the online service manual to isolate the cause.

A Word on Collision Repairs

Poor collision repair work is a major cause of A/C electrical problems. Here's what's commonly found:

- Reversed fan motor wires, wrong fan, or wrong blade pitch
- Loose or missing grounds; painted-over or non-cutting bolts
- Shorts in the A/C request (switch), compressor control, or fan control circuits
- Substandard aftermarket A/C parts
- Open or shorted fan circuit wiring

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Airflow direction is critical for proper A/C performance. Turn on the fan motor, and watch what happens. If the motor wiring is reversed, the motor will run backwards and blow air in the wrong direction.

For More Info

To learn more about A/C troubleshooting, be sure to check out self-study module ACC32, *A/C Compressor and Fans Electrical*, in the dealer's Online University, and watch the *Tech2Tech* segment "A/C Troubleshooting With the PGM-FI Data List."

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