
# OBD II Specifications and Connections

**On Board Diagnostics, OBD-II,** is required on all automobiles and light trucks in the Canada and the United States from 1996 onward. OBD-II is a set of specifications for monitoring and reporting on engine emissions, monitoring and performance in modern automobiles.

The **OBD-2 connector** must have pins 4, 5 for ground connections and pin 16 for 12 volt power supply from the vehicle battery. Prior to OBD, auto manufacturers did not standardize **DTC's (diagnostic trouble code).** OBD-I begins standardized DTC's. OBD-II added specific tests to determine the vehicle's emission performance OBD-III adds more features, and is in the regulatory development phase.

If the vehicle's onboard diagnostic system detects a malfunction, a DTC corresponding to the malfunction is stored in the vehicle's specific and related controller, as well as real-time data from the sensors connected to the on-board computer. In addition, the OBD-II interface provides a means to clear the DTC's once maintenance, service and repairs has been completed. A field technician can retrieve the DTC, using a **generic scan tool**, and take appropriate action to resolve the malfunction. Prior to the introduction of digital powertrain controllers, repairing a vehicle relied solely upon the technician's skill and service information from the auto manufacturer. **Generic scan tools** do not offer total controller access or scans, be aware of that when purchasing scan equipment.

**The OBD-II specification** provides for a standardized hardware interface, the female 16-pin (2x8) J1962 connector. Unlike the OBD-I connector, which may have been placed anywhere the vehicle, the OBD-II connector is located on the driver's side of the passenger compartment near the center console.

| Pin | Signal | Description |
|---|---|---|
| 2 | J1850 Bus+ | |
| 4 | CGND | GND |
| 5 | SGND | GND |
| 6 | CAN High | J-2284 |
| 7 | ISO 9141-2 K-LINE | Tx/Rx |
| 10 | J1850 Bus- | |
| 14 | CAN Low | J-2284 |
| 15 | ISO 9141-2 L-LINE | Tx/Rx |
| 16 | +12v | Battery power |

# Five Communications Protocols

There are five protocols in use with the modern OBD-II interface, and often it is possible to confirm the protocol in use based on which pins are present on the J1962 connector. One way to confirm is via manufacturer: The sure way is to remove and inspect the DLC using a wiring schematic.

# ISO 9141 – ISO 14230 – ISO 15765

**ISO 9141-2. This protocol has a data rate of 10.4 kbaud, and is similar to RS-232.**
ISO 9141-2 is primarily used in Chrysler, European, and Asian vehicles.
pin 7: K-line
pin 15: L-line (optional and referred to as “dual K” line)
UART signaling (though not RS-232 voltage levels)
K-line idles high
High voltage is Vbatt
Message length is restricted to 12 bytes, including CRC

**ISO 14230 KWP2000 (Keyword Protocol 2000) used by most European and Asian manufacturers.**
Alfa Romeo, Audi, BMW, Citroen, Fiat, Honda, Hyundai, Jaguar (X300, XK), Jeep since 2004,
Kia, Land Rover, Mazda, Mercedes, Mitsubishi, Nissan, Peugeot, Renault, Saab, Skoda,

Subaru, Toyota, Vauxhall, Volkswagen (VW) since 2001, Volvo to 2004
pin 7: K-line
pin 15: L-line (optional and referred to as “dual K” line)
Physical layer identical to ISO 9141-2
Data rate 1.2 to 10.4 kbaud
Message may contain up to 255 bytes in the data field

**ISO 15765 CAN (250kbit/sec or 500kbit/sec)**
pin 6: CAN High
pin 14: CAN Low

# FORD Motor Company

**SAE J1850 PWM (41.6 kbaud, Standard of the Ford Motor Company)**
pin 2: Bus-
pin 10: Bus+
High voltage is +5V
Message length is restricted to 12 bytes, including CRC
Employs a multi-master arbitration scheme called
"Carrier Sense Multiple Access with Non-Destructive Arbitration" (CSMA/NDA)

# General Motors

**SAE J1850 VPW (Variable Pulse Width) (10.4/41.6 kbaud, standard of General Motors)**
pin 2: Bus+
Bus idles low
High voltage is +7V
Decision point is +3.5V
Message length is restricted to 12 bytes, including CRC Employs CSMA/NDA

Note that pins 4 (battery ground) and 16 (battery positive) are present in all configurations. Also, ISO 9141 and ISO 14230 use the same pinout, therefore you cannot distinguish between the two simply by examining the connector.

CAN bus used in VW, Audi, BMW, Mercedes, Ford, Mazda Volvo, etc., etc., etc,. since 2004 (some earlier, some later). **The CAN protocol** will become tha standard of the automotive industry. By 2008, all vehicles sold in Canada and the US will be required to implement the **CAN bus**, consequently eliminating the uncertainty of the existing five signaling protocols.

The CAN bus is simply a twisted pair of wires and terminated at either end of the two-wire network with resistors of 120 Ohms (in most cases and not all). The only components connected to the CAN bus are the electronic control units (nodes). Other components, such as sensors, motors, lighting, switches, warnings etc. are wired only to the electronic control units. There will be more that one CAN twisted pair system interconnected in the vehicle. Modern vehicles will include the **MOST, LIN, Bluetooth and FlexRay** with the CAN system. Some vehicles have a CAN bus system along side the ISO/KWP2000 system. A vehicle which uses CAN bus for on-board diagnostics can only respond to an OBD-II request from a tester that is CAN bus compliant. From model year 2008 vehicle manufacturers must use the OBD protocol specified in ISO 15765, also known as **Diagnostics On CAN.**

**Two wires of CAN bus, CAN-H and CAN-L**, will have the same voltage when idle (about 2.5V), or a voltage difference of 2V when a signal is placed on the CAN bus. (depending on manufacturer and CAN communication system) When a signal is placed on the CAN bus the CAN-H line is at an opposite voltage than the CAN-L line. Each electronic control unit has its own CAN identity code, like an address. If an electronic control unit is to communicate to another it will need to know the CAN identification of the recipient (not in all cases). Most CAN controllers will “see” the message but it is only the intended controller that “reacts” to the massage.

A simple check to see if the CAN bus is in use in a vehicle, and accessible via the OBD socket, is to connect a resistance meter across pin 6 and pin 14. Due to the combined resistance of the two termination resistors at 120 Ohms each the overall resistance should be read as 60 Ohms. (refer to vehicle specifications)

OBD-II provides access to numerous data from the ECU and offers a valuable source of information when troubleshooting problems inside a vehicle. The SAE J1979 standard defines a method for requesting various diagnostic data and a list of standard parameters that might be available from the ECU. The various parameters that are available are addressed by "parameter identification numbers" or PIDs which are defined in J1979.