

OBD On-Board Diagnostics

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GENERAL

This chapter outlines the fundamentals and equipment requirements of On-Board Diagnostics II (OBD II) standards as they apply to BMW vehicles. Also covered here is a listing of BMW and OBD II diagnostic trouble codes (DTCs).

ON-BOARD DIAGNOSTICS (OBD II)

OBD II standards were developed by the SAE (Society of Automotive Engineers) and CARB (California Air Resources Board). OBD II is the second generation of on-board self-diagnostic equipment requirements. These standards were originally mandated for California vehicles. Since 1996 they have been applied to all passenger vehicles sold in the United States.

On-board diagnostic capabilities are incorporated into the hardware and software of the engine control module (ECM) to monitor virtually every component that can affect vehicle emissions. The OBD II system works to ensure that emissions remain as clean as possible over the life of the vehicle.

Each emission-influencing component is checked by a diagnostic routine (called a monitor) to verify that it is functioning properly. If a problem or malfunction is detected, the **diagnostic executive** built into the OBD II system illuminates a malfunction indicator light (MIL) on the instrument panel.

The OBD II system also stores diagnostic trouble codes (DTCs) about the detected malfunction in the ECM so that a repair technician can accurately find and fix the problem.

Specialized OBD II scan tool equipment is needed to access the fault memory and OBD II data.

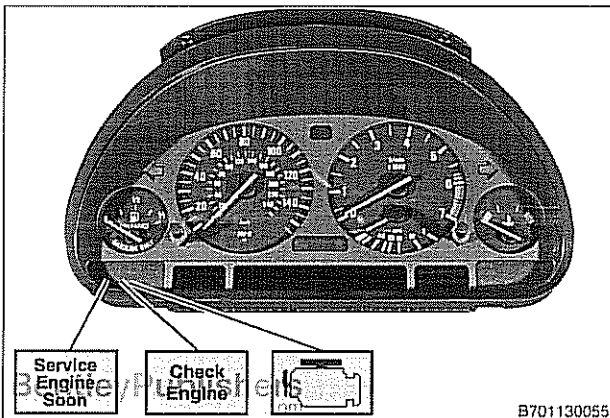
The extra hardware needed to operate the OBD II system consists mainly of the following:

- Additional oxygen sensors downstream of the catalytic converters.
- Fuel tank pressure sensor and device to pressurize fuel storage system.
- Several engine and performance monitoring devices
- Standardized 16-pin OBD II connector under the dashboard.
- Upgraded components for the federally required reliability mandate.

Malfunction indicator light (MIL)

OBD II software illuminates the malfunction indicator light (MIL) when emission levels exceed 1.5 times Federal standards.

➤ For E34 cars covered by this manual, three different MIL symbols were used, depending on year and model.



MIL illuminates under the following conditions:

- Engine management system fault detected for **two** consecutive OBD II drive cycles. See **Drive cycle** in this repair group.
- Catalyst damaging fault detected.
- Component malfunction causes emissions to exceed 1.5 times OBD II standards.
- Manufacturer-defined specifications exceeded.
- Implausible input signal.
- Misfire faults.
- Leak in evaporative system.
- Oxygen sensors observe no purge flow from purge valve / evaporative system.
- ECM fails to enter closed-loop operation within specified time.
- ECM or automatic transmission control module (TCM) in "limp home" mode.
- Ignition key ON before cranking (bulb check function).

OBD II fault memory (including the MIL) can only be reset using a special scan tool. Removing the connector from the ECM or disconnecting the battery does not erase the fault memory.

Additional MIL information:

- A fault code is stored within the ECM upon the first occurrence of a fault in the system being checked.
- Two **complete** consecutive drive cycles with the fault present illuminate the MIL. The exception to the two-fault requirement is a catalyst-damaging fault, which illuminates the MIL immediately.
- If the second drive cycle was not complete and the fault was not checked, the ECM counts the third drive cycle as the next consecutive drive cycle. The MIL illuminates if the system is checked and the fault is still present.
- Once the MIL is illuminated, it remains illuminated until the vehicle completes three consecutive drive cycles without detecting a fault.
- An existing fault code is cleared from memory automatically when the vehicle completes **40** consecutive drive cycles without the fault being detected.

In order to automatically clear a catalyst-damaging fault from memory, the condition under which the fault occurred must be evaluated for 80 consecutive drive cycles without the fault reoccurring.

A generic scan tool connected to the BMW data link connector (DLC) or OBD II plug can display diagnostic trouble codes (DTCs), along with the conditions associated with the illumination of the MIL. Using a more advanced or BMW-dedicated scan tool, additional proprietary information is normally available.

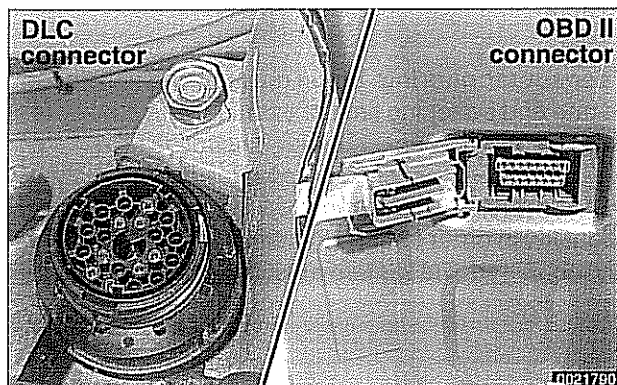
Scan tool and scan tool display

The complexity of the OBD II system requires that all diagnostics begin by connecting a scan tool to the vehicle. Aftermarket scan tools can be connected to either the 16-pin OBD II plug or the 20-pin BMW DLC in the engine compartment (if installed). Data from the OBD II plug may be limited, depending on scan tool and vehicle.

OBD II standards require that the 16-pin OBD II plug be located within three (3) feet of the driver and not require any tools to access.

- Starting with June 2000 production, the 20-pin BMW DLC, previously located in the engine compartment, was discontinued. Diagnostic, coding and programming functions are incorporated into the OBD II plug, located under left side of dashboard.

On cars built up to 06 / 2000: when accessing emissions related DTCs through the 16-pin OBD II plug, make sure the BMW 20-pin DLC cap is installed.



Professional diagnostic scan tools available at the time of this printing include the BMW factory tools (DISplus, GT1, MoDiC) and a small number of aftermarket BMW-specific tools. See **020 Maintenance**.

In addition to the professional line of scan tools, inexpensive generic OBD II scan tool software programs and handheld units are readily available. Though limited, they are nonetheless powerful diagnostic tools. These tools read live data streams and freeze frame data as well as a host of other valuable diagnostic data.

Diagnostic monitors

Diagnostic monitors run tests and checks on specific emission control systems, components, and functions.

A complete drive cycle is required for the tests to be valid. See **Drive cycle** in this repair group. The diagnostic monitor signals the ECM of the loss or impairment of the signal or component and determines if a signal or sensor is faulty based on 3 conditions:

- Signal or component shorted to ground
- Signal or component shorted to B+
- Signal or component missing (open circuit)

The OBD II system monitors all emission control systems that are installed. Emission control systems vary by vehicle model and year. For example, a vehicle may not be equipped with secondary air injection, so no secondary air readiness code would be present.

OBD II software monitors the following:

- Oxygen sensors
- Catalysts
- Engine misfire
- Fuel tank evaporative control system
- Secondary air injection
- Fuel system

Oxygen sensor monitoring. When driving conditions allow, response rate and switching time of each oxygen sensor is monitored. The oxygen sensor heater function is also monitored. The OBD II system differentiates between precataylst and post-catalyst oxygen sensors and reads each one individually. In order for the oxygen sensor to be effectively monitored, the system must be in closed loop operation.

Catalyst monitoring. This strategy monitors the output of the precatalyst and post-catalyst oxygen sensors, comparing the oxygen content going into the catalytic converter to the oxygen leaving the converter.

The diagnostic executive knows that most of the oxygen should be used up during the oxidation phase. If it detects higher than programmed values, a fault is set and the MIL illuminates.

Misfire detection. This strategy monitors crankshaft speed fluctuations and determines if an engine misfire occurs by monitoring variations in speed between each crankshaft sensor trigger point. This strategy is so finely tuned that it can determine the severity of the misfire.

The system determines if a misfire is occurring, as well as other pertinent misfire information such as:

- Specific cylinder(s)
- Severity of the misfire event
- Emissions relevant or catalyst damaging

Misfire detection is an on-going monitoring process that is only disabled under certain limited conditions.

Secondary air injection monitoring. Secondary air injection is used to reduce HC and CO emissions during engine warm up. Immediately following a cold engine start (-10° to 40°C), fresh air (and therefore oxygen) is pumped directly into the exhaust manifold. By injecting additional oxygen into the exhaust manifold, catalyst warm-up time is reduced.

Secondary air system components are:

- Electric air injection pump
- Electric pump relay
- Non-return valve
- Vacuum / vent valve
- Stainless steel air injection pipes
- Vacuum reservoir

The secondary air system is monitored via the use of the pre-catalyst oxygen sensors. Once the air pump is active and air is injected into the system, the signal at the oxygen sensor reflects a lean condition. If the oxygen sensor signal does not change, a fault is set and the faulty bank(s) identified. If after completing the next cold start a fault is again present, the MIL illuminates.

Fuel system monitoring. This monitor looks at the fuel delivery needed (long / short term fuel trim) for proper engine operation based on programmed data. If too much or not enough fuel is delivered over a predetermined time, a DTC is set and the MIL illuminates.

Fuel trim refers to adjustments to base fuel schedule. Long-term fuel trim refers to gradual adjustments to the fuel calibration adjustment as compared to short term fuel trim. Long term fuel trim adjustments compensate for gradual changes that occur over time.

Fuel system monitoring monitors the calculated injection time (ti) in relation to engine speed, load and precatalytic converter oxygen sensor(s) signals.

Using this data, the system optimizes fuel delivery for all engine operating conditions.

Evaporative system monitoring. This monitor checks the the fuel storage system and related fuel lines for leaks. It can detect very small leaks anywhere in the system.

A leak detection unit (LDP or DMTL) is used to pressurize the evaporative control system on a continuous basis (as the drive cycle allows) and to check system integrity.

Drive cycle

The OBD II drive cycle is an important concept in understanding OBD II requirements. The purpose of the drive cycle is to run all of the emission-related on-board diagnostics over a broad range of driving conditions.

A drive cycle is considered complete when all of the diagnostic monitors have run their tests without interruption. For a drive cycle to be initiated, the vehicle must be started cold and brought up to 160°F and at least 40°F above its original starting temperature.

Readiness codes

Inspection/maintenance (I/M) readiness codes are mandated as part of OBD II. The readiness code is stored after complete diagnostic monitoring of specified components and systems is carried out. The readiness code function was designed to prevent manipulating an I/M emission test procedure by clearing faults codes or disconnecting the ECM or battery.

Readiness codes indicate whether the OBD II system is actually ready to monitor the various emission control systems on the vehicle. The vehicle must complete a drive cycle to set readiness codes. The code is binary:

- 0 for ready
- 1 for not ready

➤ The parameters which are monitored for readiness are:

1. Catalyst efficiency
2. Catalyst heating
3. Fuel tank evaporative control
4. Secondary air injection
5. A/C refrigerant
6. Oxygen sensors
7. Oxygen sensor heaters
8. Exhaust gas recirculation

When all zeros are displayed, the system has established readiness. Readiness codes can be displayed using BMW and aftermarket scan tools.

Readiness codes are set to 1 (not ready) in the following cases:

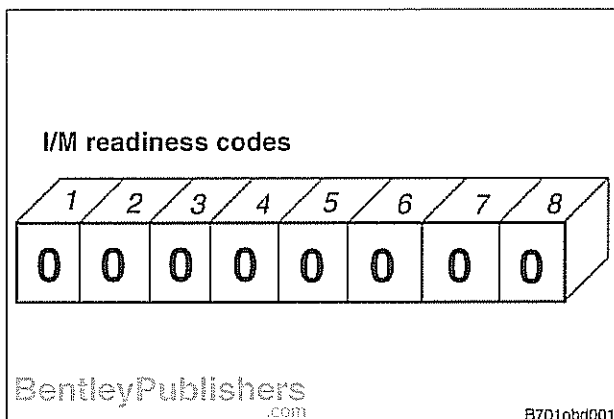
- The battery or ECM is disconnected.
- DTCs are erased after completion of repairs and a drive cycle is not completed.

An OBD II scan tool can be used to determine I/M readiness.

Diagnostic trouble codes (DTCs)

SAE standard J2012 mandates a 5-digit diagnostic trouble code (DTC) standard. Each digit represents a specific value. Emission related DTCs start with the letter P for power train. When the engine service light (MIL) is illuminated it indicates that a DTC has been stored.

- DTCs are stored as soon as they occur, whether or not the engine service light illuminates.
- DTCs store and display a time stamp.
- DTCs record the current fault status: Present, not currently present, or intermittent.



DTC digit interpretation

1st digit	
P	powertrain
B	body
C	chassis
2nd digit	
0	SAE
1	BMW
3rd digit	
0	total system
1	air/fuel induction
2	fuel injection
3	ignition system or misfire
4	auxiliary emission control
5	vehicle speed & idle control
6	ECM inputs/outputs
7	transmission
4th - 5th digits	individual circuits or components

DTC example: P 0 3 0 6

- **P:** A powertrain problem
- **0:** SAE sanctioned or 'generic'
- **3:** Related to an ignition system / misfire
- **06** Misfire detected at cylinder #6

DTCs provide a **freeze frame** or snap-shot of a vehicle performance or emissions fault at the moment that the fault first occurs. This information is accessible through generic OBD II scan tools.

Freeze frame data contains, but is not limited to, the following information:

- Engine load (calculated)
- Engine rpm
- Short and long term fuel trim
- Vehicle speed
- Coolant temperature
- Intake manifold pressure
- Open/closed loop operation
- Fuel pressure (if available)
- DTC

DIAGNOSTIC TROUBLE CODES (DTCs)

Below is a listing of E39 powertrain (automatic transmission and engine) SAE P-codes, the corresponding BMW fault codes, and the fault code definitions.

BMW fault codes expand on the SAE sanctioned DTCs and are accessible primarily through the BMW diagnostic scan tool or a BMW-specific scan tool.

Automatic transmission diagnostic trouble codes		
P-code	BMW-FC	DTC Definition
P0560	96	System Voltage
P0600	129	Serial Communication Link
P0600	144	Serial Communication Link
P0601	80	Internal Control Module Memory Check Sum Error
P0603	81	Internal Control Module Keep Alive Memory (KAM) Error
P0606	82	ECM/PCM Processor
P0705	8	Transmission Range Sensor 'A' Circuit Malfunction (PRNDL Input)
P0705	60	Transmission Range Sensor 'A' Circuit Malfunction (PRNDL Input)
P0709	60	Transmission Range Sensor 'A' Circuit Intermittent
P0715	16	Input/Turbine Speed Sensor 'A' Circuit
P0715	33	Input/Turbine Speed Sensor 'A' Circuit
P0716	33	Input/Turbine Speed Sensor 'A' Circuit Range/Performance
P0717	33	Input/Turbine Speed Sensor 'A' Circuit No Signal
P0720	32	Output Speed Sensor Circuit
P0720	42	Output Speed Sensor Circuit
P0720	59	Output Speed Sensor Circuit
P0720	62	Output Speed Sensor Circuit
P0720	106	Output Speed Sensor Circuit
P0721	59	Output Speed Sensor Circuit Range/Performance
P0722	32	Output Speed Sensor Circuit No Signal
P0727	150	Engine Speed Input Circuit No Signal
P0730	100	Incorrect Gear Ratio
P0730	102	Incorrect Gear Ratio
P0731	50	Gear 1 Incorrect Ratio
P0731	51	Gear 1 Incorrect Ratio
P0731	100	Gear 1 Incorrect Ratio
P0731	131	Gear 1 Incorrect Ratio
P0732	52	Gear 2 Incorrect Ratio

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Automatic transmission diagnostic trouble codes (continued)		
P-code	BMW-FC	DTC Definition
P0732	100	Gear 2 Incorrect Ratio
P0732	132	Gear 2 Incorrect Ratio
P0733	53	Gear 3 Incorrect Ratio
P0733	57	Gear 3 Incorrect Ratio
P0733	122	Gear 3 Incorrect Ratio
P0733	133	Gear 3 Incorrect Ratio
P0734	54	Gear 4 Incorrect Ratio
P0734	58	Gear 4 Incorrect Ratio
P0734	123	Gear 4 Incorrect Ratio
P0734	134	Gear 4 Incorrect Ratio
P0735	55	Gear 5 Incorrect Ratio
P0735	101	Gear 5 Incorrect Ratio
P0735	135	Gear 5 Incorrect Ratio
P0740	4	Torque Converter Clutch Circuit/Open
P0740	48	Torque Converter Clutch Circuit/Open
P0740	111	Torque Converter Clutch Circuit/Open
P0741	48	Torque Converter Clutch Circuit Performance or Stuck Off
P0742	48	Torque Converter Clutch Circuit Stuck On
P0743	4	Torque Converter Clutch Circuit Electrical
P0743	32	Torque Converter Clutch Circuit Electrical
P0745	1	Pressure Control Solenoid 'A'
P0748	1	Pressure Control Solenoid 'A' Electrical
P0748	5	Pressure Control Solenoid 'A' Electrical
P0750	16	Shift Solenoid 'A'
P0751	6	Shift Solenoid 'A' Performance or Stuck Off
P0751	16	Shift Solenoid 'A' Performance or Stuck Off
P0752	16	Shift Solenoid 'A' Stuck On
P0753	16	Shift Solenoid 'A' Electrical
P0753	30	Shift Solenoid 'A' Electrical
P0755	17	Shift Solenoid 'B'
P0756	17	Shift Solenoid 'B' Performance or Stuck Off
P0757	17	Shift Solenoid 'B' Stuck On
P0758	17	Shift Solenoid 'B' Electrical
P0758	33	Shift Solenoid 'B' Electrical
P0760	18	Shift Solenoid 'C'
P0761	18	Shift Solenoid 'C' Performance or Stuck Off

Automatic transmission diagnostic trouble codes (continued)		
P-code	BMW-FC	DTC Definition
P0762	18	Shift Solenoid 'C' Stuck On
P0763	2	Shift Solenoid 'C' Electrical
P0763	18	Shift Solenoid 'C' Electrical
P0763	32	Shift Solenoid 'C' Electrical
P0775	2	Pressure Control Solenoid 'B'
P0782	57	2-3 Shift
P0783	58	3-4 Shift
P0795	3	Pressure Control Solenoid 'C'
P0778	2	Pressure Control Solenoid 'B' Electrical
P0798	3	Pressure Control Solenoid 'C' Electrical
P0962	1	Pressure Control Solenoid 'A' Control Circuit Low
P0963	1	Pressure Control Solenoid 'A' Control Circuit High
P0966	2	Pressure Control Solenoid 'B' Control Circuit Low
P0967	2	Pressure Control Solenoid 'B' Control Circuit High
P0970	3	Pressure Control Solenoid 'C' Control Circuit Low
P0971	3	Pressure Control Solenoid 'C' Control Circuit High
P0973	16	Shift Solenoid 'A' Control Circuit Low
P0976	17	Shift Solenoid 'B' Control Circuit Low
P0979	18	Shift Solenoid 'C' Control Circuit Low
P1700	62	Double Error Output Speed and Input/Turbine Speed
P1719	144	CAN Version Error
P1720	129	CAN Timeout Control Module
P1731	51	Gear 1 manual Incorrect Ratio
P1732	65	Gear Monitoring 4 at Electrical Substitute Program
P1734	1	Pressure Control Solenoid 'B' Electrical
P1734	2	Pressure Control Solenoid 'B' Electrical
P1738	3	Pressure Control Solenoid 'C' Electrical
P1738	29	Pressure Control Solenoid 'C' Electrical
P1743	4	Pressure Control Solenoid 'E' Electrical (M44/M52: Brake Band Electrical)
P1743	5	Pressure Control Solenoid 'E' Electrical (M44/M52: Brake Band Electrical)
P1743	51	Pressure Control Solenoid 'E' Electrical (M44/M52: Brake Band Electrical)
P1746	83	Transmission Control Module Output Stage
P1746	104	Transmission Control Module Output Stage
P1747	128	CAN-Bus Monitoring
P1747	129	CAN-Bus Monitoring
P1747	144	CAN-Bus Monitoring

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Automatic transmission diagnostic trouble codes (continued)		
P-code	BMW-FC	DTC Definition
P1747	150	CAN-Bus Monitoring
P1747	151	CAN-Bus Monitoring
P1747	156	CAN-Bus Monitoring
P1748	15	Transmission Control Module Self-Test
P1748	80	Transmission Control Module Self-Test
P1748	81	Transmission Control Module Self-Test
P1748	82	Transmission Control Module Self-Test
P1748	103	Transmission Control Module Self-Test
P1748	105	Transmission Control Module Self-Test
P1748	110	Transmission Control Module Self-Test
P1749	108	Secondary Pressure Solenoid Communication Error (M52: Internal Transmission Control Module Memory Error)
P1750	54	Secondary Pressure Solenoid Circuit Range/Performance (System Voltage Input Low)
P1750	96	Secondary Pressure Solenoid Circuit Range/Performance (System Voltage Input Low)
P1761	2	Shiftlock Solenoid
P1761	19	Shiftlock Solenoid
P1762	19	Shiftlock Solenoid High Input
P1763	19	Shiftlock Solenoid Low Input
P1764	19	Shiftlock Solenoid Open Circuit
P1765	147	CAN Throttle Valve
P1765	154	CAN Throttle Valve
P1765	158	CAN Throttle Valve
P1770	146	CAN Torque Interface
P1780	152	CAN Torque Reduction
P1780	163	CAN Torque Reduction
P1790	80	Internal Transmission Control Module Memory Checksum/EPROM Error
P1791	81	Internal Transmission Control Module Memory Checksum/EEPROM Error
P1792	82	Internal Transmission Control Module Watchdog Error
P1794	80	Internal Transmission Control Module Memory Checksum Error
P1801	16	Shift Solenoid 'A' Low Input
P1802	17	Shift Solenoid 'B' Low Input
P1803	18	Shift Solenoid 'C' Low Input
P1831	1	Pressure Control Solenoid 'A' Circuit High
P1832	2	Pressure Control Solenoid 'B' Circuit High
P1833	3	Pressure Control Solenoid 'C' Circuit High
P1834	4	Pressure Control Solenoid 'D' Circuit High
P1835	5	Pressure Control Solenoid 'E' Circuit High

Automatic transmission diagnostic trouble codes (continued)		
P-code	BMW-FC	DTC Definition
P1841	1	Pressure Control Solenoid 'A' Circuit Low
P1842	2	Pressure Control Solenoid 'B' Circuit Low
P1843	3	Pressure Control Solenoid 'C' Circuit Low
P1844	4	Pressure Control Solenoid 'D' Circuit Low
P1845	5	Pressure Control Solenoid 'E' Circuit Low
P1882	57	2-3 Shift Circuit High
P1883	58	3-4 Shift Circuit High
P1889	96	System Voltage - Electrical
P1891	96	System Voltage High Input
P1892	96	System Voltage Low Input
P1893	83	Supply Voltage Pressure Control Solenoid/Shift Solenoid Circuit High
P1894	83	Supply Voltage Pressure Control Solenoid/Shift Solenoid Circuit Low
P1895	83	Supply Voltage Pressure Control Solenoid/Shift Solenoid No Signal
P2722	5	Pressure Control Solenoid 'E'
P2729	5	Pressure Control Solenoid 'E' Control Circuit Low
P2730	5	Pressure Control Solenoid 'E' Control Circuit High
P2759	4	Torque Converter Clutch Pressure Control Solenoid Control Circuit Electrical
P2761	4	Torque Converter Clutch Pressure Control Solenoid Control Circuit/Open
P2763	4	Torque Converter Clutch Pressure Control Solenoid Control Circuit High
P2764	4	Torque Converter Clutch Pressure Control Solenoid Control Circuit Low

Engine diagnostic trouble codes: M52 engine		
P-code	BMW-FC	DTC Definition
P0101	8	Mass or Volume Air Flow Circuit Range/Performance
P0111	14	Intake Air Temperature Sensor 1 Circuit Range/Performance
P0116	10	Engine Coolant Temperature Circuit Range/Performance
P0120	112	Throttle/Pedal Position Sensor/Switch 'A' Circuit
P0120	113	Throttle/Pedal Position Sensor/Switch 'A' Circuit
P0120	118	Throttle/Pedal Position Sensor/Switch 'A' Circuit
P0120	173	Throttle/Pedal Position Sensor/Switch 'A' Circuit
P0120	174	Throttle/Pedal Position Sensor/Switch 'A' Circuit
P0125	222	Insufficient Coolant Temperature for Closed Loop Fuel Control
P0128	168	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)
P0130	150	O2 Sensor Circuit (Bank 1 Sensor 1)
P0130	151	O2 Sensor Circuit (Bank 1 Sensor 1)
P0130	152	O2 Sensor Circuit (Bank 1 Sensor 1)

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Engine diagnostic trouble codes: M52 engine (continued)		
P-code	BMW-FC	DTC Definition
P0133	229	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)
P0134	186	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)
P0135	25	O2 Sensor Heater Circuit (Bank 1 Sensor 1)
P0136	156	O2 Sensor Circuit (Bank 1 Sensor 2)
P0136	157	O2 Sensor Circuit (Bank 1 Sensor 2)
P0136	215	O2 Sensor Circuit (Bank 1 Sensor 2)
P0139	220	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)
P0141	61	O2 Sensor Heater Circuit (Bank 1 Sensor 2)
P0150	153	O2 Sensor Circuit (Bank 2 Sensor 1)
P0150	154	O2 Sensor Circuit (Bank 2 Sensor 1)
P0150	155	O2 Sensor Circuit (Bank 2 Sensor 1)
P0153	230	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)
P0154	187	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)
P0155	55	O2 Sensor Heater Circuit (Bank 2 Sensor 1)
P0156	159	O2 Sensor Circuit (Bank 2 Sensor 2)
P0156	160	O2 Sensor Circuit (Bank 2 Sensor 2)
P0156	216	O2 Sensor Circuit (Bank 2 Sensor 2)
P0159	221	O2 Sensor Circuit Slow Response (Bank 2 Sensor 2)
P0161	79	O2 Sensor Heater Circuit (Bank 2 Sensor 2)
P0170	202	Fuel Trim (Bank 1)
P0173	203	Fuel Trim (Bank 2)
P0201	6	Injector Circuit/Open - Cylinder 1
P0202	5	Injector Circuit/Open - Cylinder 2
P0203	22	Injector Circuit/Open - Cylinder 3
P0204	24	Injector Circuit/Open - Cylinder 4
P0205	33	Injector Circuit/Open - Cylinder 5
P0206	23	Injector Circuit/Open - Cylinder 6
P0301	238	Cylinder 1 Misfire Detected
P0302	239	Cylinder 2 Misfire Detected
P0303	240	Cylinder 3 Misfire Detected
P0304	241	Cylinder 4 Misfire Detected
P0305	242	Cylinder 5 Misfire Detected
P0306	243	Cylinder 6 Misfire Detected
P0325	57	Knock Sensor 1 Circuit (Bank 1 or Single Sensor)
P0330	59	Knock Sensor 2 Circuit (Bank 2)
P0335	83	Crankshaft Position Sensor 'A' Circuit

Engine diagnostic trouble codes: M52 engine (continued)

P-code	BMW-FC	DTC Definition
P0340	65	Camshaft Position Sensor 'A' Circuit (Bank 1 or Single Sensor)
P0412	62	Secondary Air Injection System Switching Valve A Circuit
P0420	233	Catalyst System Efficiency Below Threshold (Bank 1)
P0430	234	Catalyst System Efficiency Below Threshold (Bank 2)
P0440	250	Evaporative Emission System
P0441	144	Evaporative Emission System Incorrect Purge Flow
P0442	145	Evaporative Emission System Leak Detected (small leak)
P0443	68	Evaporative Emission System Purge Control Valve Circuit
P0500	214	Vehicle Speed Sensor 'A'
P0505	204	Idle Air Control System
P0600	217	Serial Communication Link
P0601	100	Internal Control Module Memory Check Sum Error
P0601	170	Internal Control Module Memory Check Sum Error
P0601	171	Internal Control Module Memory Check Sum Error
P1132	188	O2 Sensor Heater Control Circuit (Bank 1 Sensor 1)
P1133	189	O2 Sensor Heater Control Circuit (Bank 2 Sensor 1)
P1140	149	Mass or Volume Air Flow Circuit Range/Performance Problem
P1145	50	Solenoid Valve Running Losses Control Circuit Electrical
P1161	122	Fuel Trim Adaptation Additive High (Bank 2) (M52: Engine Oil Temperature Sensor Circuit)
P1180	223	O2 Sensor Signal Circuit Slow Switching from Rich to Lean (Bank 1 Sensor 2)
P1181	224	O2 Sensor Signal Circuit Slow Switching from Rich to Lean (Bank 2 Sensor 2)
P1184	220	HO2S Sensor Voltage Excursion Electrical (Bank 1 Sensor 1)
P1185	221	HO2S Sensor Voltage Excursion Electrical (Bank 2 Sensor 1)
P1178	231	O2 Sensor Signal Circuit Slow Switching from Rich to Lean (Bank 1 Sensor 1)
P1179	232	O2 Sensor Signal Circuit Slow Switching from Rich to Lean (Bank 2 Sensor 1)
P1186	190	O2 Sensor Heater Control Circuit (Bank 1 Sensor 2)
P1187	191	O2 Sensor Heater Control Circuit (Bank 2 Sensor 2)
P1188	227	Fuel Control (Bank 1 Sensor 1)
P1189	228	Fuel Control (Bank 2 Sensor 1)
P1190	235	Pre Catalyst Fuel Trim System (Bank 1)
P1191	236	Pre Catalyst Fuel Trim System (Bank 2)
P1192	225	Post Catalyst Fuel Trim System (Bank 1)
P1193	226	Post Catalyst Fuel Trim System (Bank 2)
P1397	18	Camshaft Position Sensor 'B' Circuit (Bank 1)
P1421	246	Secondary Air System (Bank 2)
P1423	245	Secondary Air System (Bank 1)

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Engine diagnostic trouble codes: M52 engine (continued)		
P-code	BMW-FC	DTC Definition
P1432	247	Secondary Air Injection System Incorrect Flow Detected
P1453	35	Secondary Air Injection Pump Relay Control Circuit Electrical
P1470	126	Leakage Diagnostic Pump Control Circuit Electrical
P1475	140	Leakage Diagnostic Pump Reed Switch Did not Close
P1476	143	Leakage Diagnostic Pump Clamped Tube (M52 MY99/00: Leakage Diagnostic Pump Reed Switch Circuit)
P1478	146	Evaporative Emission System Leak Detected (very small leak)
P1509	53	Idle-Speed Control Valve Opening Solenoid Control Circuit Signal Electrical
P1519	03	Oil-Condition Sensor Temperature Measurement (M62/M52/S52: 'A' Camshaft Position Actuator Bank 1)
P1520	104	Oil-Condition Sensor Level Measurement (M52: 'B' Camshaft Position Actuator Bank 1)
P1522	105	Oil-Condition Sensor Permeability Measurement (M62: 'A' Camshaft Position Actuator Bank 2; M52: 'A' Camshaft Position Actuator Tight or Jammed)
P1523	106	'A' Camshaft Position Actuator Signal Low (Bank 1) (M52: 'B' Camshaft Position Actuator Tight or Jammed)
P1525	21	'A' Camshaft Position Actuator Control Open Circuit (Bank 1)
P1529	19	'B' Camshaft Position Actuator Control Circuit Signal Low (Bank 1)
P1542	110	Pedal Position Sensor Electrical
P1542	111	Pedal Position Sensor Electrical
P1542	117	Pedal Position Sensor Electrical
P1542	120	Pedal Position Sensor Electrical
P1542	172	Pedal Position Sensor Electrical
P1542	175	Pedal Position Sensor Electrical
P1542	176	Pedal Position Sensor Electrical
P1550	27	Idle-Speed Control Valve Closing Coil Electrical
P1580	109	Throttle Valve Mechanically Stuck (M73: Throttle Valve 1 Spring Test)
P1580	114	Throttle Valve Mechanically Stuck (M73: Throttle Valve 1 Spring Test)
P1580	119	Throttle Valve Mechanically Stuck (M73: Throttle Valve 1 Spring Test)
P1593	124	DISA (Differentiated Intake Manifold) Control Circuit Electrical
P1622	123	Map Cooling Thermostat Control Circuit Electrical
P1623	115	Pedal Position Sensor Potentiometer Supply
P1623	116	Pedal Position Sensor Potentiometer Supply
P1624	168	Pedal Position Sensor Potentiometer Supply Channel 1 Electrical (M52: Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature))

Engine diagnostic trouble codes: M54 engine

P-code	BMW-FC	Explanation
P0011	103	'A' Camshaft Position Timing Over-Advanced or System Performance (Bank 1)
P0012	105	'A' Camshaft Position Timing Over-Retarded (Bank 1)
P0014	104	'B' Camshaft Position Timing Over-Advanced or System Performance (Bank 1)
P0015	106	'B' Camshaft Position Timing Over-Retarded (Bank 1)
P0030	25	HO2S Heater Control Circuit (Bank 1 Sensor 1)
P0031	25	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)
P0032	25	HO2S Heater Control Circuit High (Bank 1 Sensor 1)
P0036	79	HO2S Heater Control Circuit (Bank 1 Sensor 2)
P0037	79	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)
P0038	79	HO2S Heater Control Circuit High (Bank 1 Sensor 2)
P0050	55	HO2S Heater Control Circuit (Bank 2 Sensor 1)
P0051	55	HO2S Heater Control Circuit Low (Bank 2 Sensor 1)
P0052	55	HO2S Heater Control Circuit High (Bank 2 Sensor 1)
P0056	61	HO2S Heater Control Circuit (Bank 2 Sensor 2)
P0057	61	HO2S Heater Control Circuit Low (Bank 2 Sensor 2)
P0058	61	HO2S Heater Control Circuit High (Bank 2 Sensor 2)
P0101	149	Mass or Volume Air Flow Circuit Range/Performance
P0102	8	Mass or Volume Air Flow Circuit Low Input
P0103	8	Mass or Volume Air Flow Circuit High Input
P0107	197	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input
P0108	197	Manifold Absolute Pressure/Barometric Pressure Circuit High Input
P0112	14	Intake Air Temperature Sensor 1 Circuit Low
P0113	14	Intake Air Temperature Sensor 1 Circuit High
P0117	10	Engine Coolant Temperature Circuit Low
P0118	10	Engine Coolant Temperature Circuit High
P0121	118	Throttle/Pedal Position Sensor/Switch 'A' Circuit Range/Performance
P0122	112	Throttle/Pedal Position Sensor/Switch 'A' Circuit Low
P0123	112	Throttle/Pedal Position Sensor/Switch 'A' Circuit High
P0125	222	Insufficient Coolant Temperature for Closed Loop Fuel Control
P0128	168	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)
P0131	150	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)
P0132	150	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)
P0133	229	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)
P0133	231	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)
P0134	150	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)
P0135	188	O2 Sensor Heater Circuit (Bank 1 Sensor 1)

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Engine diagnostic trouble codes: M54 engine (continued)		
P-code	BMW-FC	Explanation
P0137	152	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)
P0138	152	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)
P0139	215	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)
P0139	248	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)
P0140	152	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)
P0141	190	O2 Sensor Heater Circuit (Bank 1 Sensor 2)
P0151	151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)
P0152	151	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)
P0153	230	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)
P0153	232	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)
P0154	151	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)
P0155	189	O2 Sensor Heater Circuit (Bank 2 Sensor 1)
P0157	153	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)
P0158	153	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)
P0159	216	O2 Sensor Circuit Slow Response (Bank 2 Sensor 2)
P0159	249	O2 Sensor Circuit Slow Response (Bank 2 Sensor 2)
P0160	153	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)
P0161	191	O2 Sensor Heater Circuit (Bank 2 Sensor 2)
P0171	202	System Too Lean (Bank 1)
P0171	227	System Too Lean (Bank 1)
P0172	202	System Too Rich (Bank 1)
P0172	227	System Too Rich (Bank 1)
P0174	203	System Too Lean (Bank 2)
P0174	228	System Too Lean (Bank 2)
P0175	203	System Too Rich (Bank 2)
P0175	228	System Too Rich (Bank 2)
P0197	122	Engine Oil Temperature Sensor Low
P0198	122	Engine Oil Temperature Sensor High
P0201	6	Injector Circuit/Open - Cylinder 1
P0202	5	Injector Circuit/Open - Cylinder 2
P0203	22	Injector Circuit/Open - Cylinder 3
P0204	24	Injector Circuit/Open - Cylinder 4
P0205	33	Injector Circuit/Open - Cylinder 5
P0206	23	Injector Circuit/Open - Cylinder 6
P0221	119	Throttle/Pedal Position Sensor/Switch 'B' Circuit Range/Performance
P0222	113	Throttle/Pedal Position Sensor/Switch 'B' Circuit Low

Engine diagnostic trouble codes: M54 engine (continued)

P-code	BMW-FC	Explanation
P0223	113	Throttle/Pedal Position Sensor/Switch 'B' Circuit High
P0261	6	Cylinder 1 Injector Circuit Low
P0262	6	Cylinder 1 Injector Circuit High
P0264	5	Cylinder 2 Injector Circuit Low
P0265	5	Cylinder 2 Injector Circuit High
P0267	22	Cylinder 3 Injector Circuit Low
P0268	22	Cylinder 3 Injector Circuit High
P0270	24	Cylinder 4 Injector Circuit Low
P0271	24	Cylinder 4 Injector Circuit High
P0273	33	Cylinder 5 Injector Circuit Low
P0274	33	Cylinder 5 Injector Circuit High
P0276	23	Cylinder 6 Injector Circuit Low
P0277	23	Cylinder 6 Injector Circuit High
P0301	238	Cylinder 1 Misfire Detected
P0302	239	Cylinder 2 Misfire Detected
P0303	240	Cylinder 3 Misfire Detected
P0304	241	Cylinder 4 Misfire Detected
P0305	242	Cylinder 5 Misfire Detected
P0306	243	Cylinder 6 Misfire Detected
P0313	238	Misfire Detected with Low Fuel
P0313	239	Misfire Detected with Low Fuel
P0313	240	Misfire Detected with Low Fuel
P0313	241	Misfire Detected with Low Fuel
P0313	242	Misfire Detected with Low Fuel
P0313	243	Misfire Detected with Low Fuel
P0327	57	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)
P0332	59	Knock Sensor 2 Circuit Low (Bank 2)
P0335	83	Crankshaft Position Sensor 'A' Circuit
P0339	83	Crankshaft Position Sensor 'A' Circuit Intermittent
P0340	65	Camshaft Position Sensor 'A' Circuit (Bank 1 or Single Sensor)
P0344	65	Camshaft Position Sensor 'A' Circuit Intermittent (Bank 1 or Single Sensor)
P0365	18	Camshaft Position Sensor 'B' Circuit (Bank 1)
P0369	18	Camshaft Position Sensor 'B' Circuit Intermittent (Bank 1)
P0413	62	Secondary Air Injection System Switching Valve A Circuit Open
P0414	62	Secondary Air Injection System Switching Valve A Circuit Shorted
P0420	233	Catalyst System Efficiency Below Threshold (Bank 1)

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Engine diagnostic trouble codes: M54 engine (continued)		
P-code	BMW-FC	Explanation
P0430	234	Catalyst System Efficiency Below Threshold (Bank 2)
P0441	250	Evaporative Emission System Incorrect Purge Flow
P0443	68	Evaporative Emission System Purge Control Valve Circuit
P0444	68	Evaporative Emission System Purge Control Valve Circuit Open
P0445	68	Evaporative Emission System Purge Control Valve Circuit Shorted
P0455	143	Evaporative Emission System Leak Detected (large leak)
P0456	143	Evaporative Emission System Leak Detected (very small leak)
P0491	245	Secondary Air Injection System Insufficient Flow (Bank 1)
P0492	246	Secondary Air Injection System Insufficient Flow (Bank 2)
P0500	214	Vehicle Speed Sensor 'A'
P0505	204	Idle Air Control System
P0600	217	Serial Communication Link
P0604	100	Internal Control Module Random Access Memory (RAM) Error
P1083	202	Fuel Control Limit Mixture Too Lean (Bank 1 Sensor 1)
P1084	202	Fuel Control Limit Mixture Too Rich (Bank 1 Sensor 1)
P1085	203	Fuel Control Limit Mixture Too Lean (Bank 2 Sensor 1)
P1086	203	Fuel Control Limit Mixture Too Rich (Bank 2 Sensor 1)
P1087	229	O2 Sensor Circuit Slow Response in Lean Control Range (Bank 1 Sensor 1)
P1088	229	O2 Sensor Circuit Slow Response in Rich Control Range (Bank 1 Sensor 1)
P1089	230	O2 Sensor Circuit Slow Response in Lean Control Range (Bank 1 Sensor 2)
P1090	235	Pre Catalyst Fuel Trim System Too Lean (Bank 1)
P1091	236	Pre Catalyst Fuel Trim System Too Lean (Bank 2)
P1092	235	Pre Catalyst Fuel Trim System Too Rich (Bank 1)
P1093	236	Pre Catalyst Fuel Trim System Too Rich (Bank 2)
P1094	230	O2 Sensor Circuit Slow Response in Rich Control Range (Bank 2 Sensor 1)
P1111	11	Engine Coolant Temperature Sensor Radiator Outlet Low Input
P1112	11	Engine Coolant Temperature Sensor Radiator Outlet High Input
P1120	114	Pedal Position Sensor Circuit
P1121	117	Pedal Position Sensor 1 Range/Performance Problem
P1122	110	Pedal Position Sensor 1 Low Input
P1123	110	Pedal Position Sensor 1 High Input
P1134	25	O2 Sensor Heater Circuit Signal Intermittent (Bank 1 Sensor 1)
P1135	25	O2 Sensor Heater Circuit Low Voltage (Bank 1 Sensor 1)
P1136	25	O2 Sensor Heater Circuit High Voltage (Bank 1 Sensor 1)
P1137	79	O2 Sensor Heater Circuit Signal Intermittent (Bank 1 Sensor 2)
P1138	79	O2 Sensor Heater Circuit Low Voltage (Bank 1 Sensor 2)

Engine diagnostic trouble codes: M54 engine (continued)

P-code	BMW-FC	Explanation
P1139	79	O2 Sensor Heater Circuit High Voltage (Bank 1 Sensor 2)
P1143	215	O2 Sensor Activity Check Signal Too High (Bank 1 Sensor 2)
P1144	215	O2 Sensor Activity Check Signal Too Low (Bank 1 Sensor 2)
P1149	216	O2 Sensor Activity Check Signal Too High (Bank 2 Sensor 2)
P1150	216	O2 Sensor Activity Check Signal Too Low (Bank 2 Sensor 2)
P1151	55	O2 Sensor Heater Circuit Signal Intermittent (Bank 2 Sensor 1)
P1152	55	O2 Sensor Heater Circuit Low Voltage (Bank 2 Sensor 1)
P1153	55	O2 Sensor Heater Circuit High Voltage (Bank 2 Sensor 1)
P1155	61	O2 Sensor Heater Circuit Signal Intermittent (Bank 2 Sensor 2)
P1156	61	O2 Sensor Heater Circuit Low Voltage (Bank 2 Sensor 2)
P1157	61	O2 Sensor Heater Circuit High Voltage (Bank 2 Sensor 2)
P1171	196	Ambient Pressure Sensor Variant Recognition Value in Boot Range Implausible
P1172	196	Ambient Pressure Sensor Variant Recognition Error Value Stored in Boot Range
P1173	196	Ambient Pressure Sensor Variant Recognition Learning Failed
P1190	235	Pre Catalyst Fuel Trim System (Bank 1)
P1191	236	Pre Catalyst Fuel Trim System (Bank 2)
P1192	225	Post Catalyst Fuel Trim System (Bank 1)
P1193	226	Post Catalyst Fuel Trim System (Bank 2)
P1222	111	Pedal Position Sensor 2 Low Input
P1223	111	Pedal Position Sensor 2 High Input
P1314	202	Fuel Mixture Deviation Detected with Low Fuel
P1314	203	Fuel Mixture Deviation Detected with Low Fuel
P1314	227	Fuel Mixture Deviation Detected with Low Fuel
P1314	228	Fuel Mixture Deviation Detected with Low Fuel
P1342	238	Misfire During Start Cylinder 1
P1343	238	Misfire Cylinder 1 with Fuel Cut-Off
P1344	239	Misfire During Start Cylinder 2
P1345	239	Misfire Cylinder 2 with Fuel Cut-Off
P1346	240	Misfire During Start Cylinder 3
P1347	240	Misfire Cylinder 3 with Fuel Cut-Off
P1348	241	Misfire During Start Cylinder 4
P1349	241	Misfire Cylinder 4 with Fuel Cut-Off
P1350	242	Misfire during Start Cylinder 5
P1351	242	Misfire Cylinder 5 with Fuel Cut-Off
P1352	243	Misfire during Start Cylinder 6
P1353	243	Misfire Cylinder 6 with Fuel Cut-Off

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On-Board Diagnostics

Engine diagnostic trouble codes: M54 engine (continued)		
P-code	BMW-FC	Explanation
P1413	35	Secondary Air Injection Pump Relay Control Circuit Signal Low
P1414	35	Secondary Air Injection Pump Relay Control Circuit Signal High
P1444	142	Diagnostic Module Tank Leakage (DM-TL) Pump Control Open Circuit
P1445	140	Diagnostic Module Tank Leakage (DM-TL) Pump Control Circuit Signal Low
P1446	140	Diagnostic Module Tank Leakage (DM-TL) Pump Control Circuit Signal High
P1447	142	Diagnostic Module Tank Leakage (DM-TL) Pump Current Too High during Switching Solenoid Test
P1448	142	Diagnostic Module Tank Leakage (DM-TL) Pump Current Too Low
P1449	142	Diagnostic Module Tank Leakage (DM-TL) Pump Current Too High
P1451	126	Diagnostic Module Tank Leakage (DM-TL) Switching Solenoid Control Circuit Signal Low
P1452	126	Diagnostic Module Tank Leakage (DM-TL) Switching Solenoid Control Circuit Signal High
P1500	211	Idle-Speed Control Valve Stuck Open
P1501	211	Idle-Speed Control Valve Stuck Closed
P1502	27	Idle-Speed Control Valve Closing Solenoid Control Circuit Signal High
P1503	27	Idle-Speed Control Valve Closing Solenoid Control Circuit Signal Low
P1504	27	Idle-Speed Control Valve Closing Solenoid Control Open Circuit
P1506	53	Idle-Speed Control Valve Opening Solenoid Control Circuit Signal High
P1507	53	Idle-Speed Control Valve Opening Solenoid Control Circuit Signal Low
P1508	53	Idle-Speed Control Valve Opening Solenoid Control Open Circuit
P1512	124	DISA (Differentiated Intake Manifold) Control Circuit Signal Low
P1513	124	DISA (Differentiated Intake Manifold) Control Circuit Signal High
P1523	21	'A' Camshaft Position Actuator Signal Low (Bank 1) (M52: 'B' Camshaft Position Actuator Tight or Jammed)
P1524	21	'A' Camshaft Position Actuator Control Circuit Signal High (Bank 1)
P1525	21	'A' Camshaft Position Actuator Control Open Circuit (Bank 1)
P1529	19	'B' Camshaft Position Actuator Control Circuit Signal Low (Bank 1)
P1530	19	'B' Camshaft Position Actuator Control Circuit Signal High (Bank 1) (S54 to 09/00: Throttle Valve Position Control, Control Deviation)
P1531	19	'B' Camshaft Position Actuator Control Open Circuit (Bank 1)
P1602	48	Control Module Self-Test, Control Module Defective
P1602	58	Control Module Self-Test, Control Module Defective
P1602	63	Control Module Self-Test, Control Module Defective
P1602	66	Control Module Self-Test, Control Module Defective
P1602	67	Control Module Self-Test, Control Module Defective
P1602	70	Control Module Self-Test, Control Module Defective
P1602	71	Control Module Self-Test, Control Module Defective
P1602	72	Control Module Self-Test, Control Module Defective
P1603	49	Control Module Self-Test, Torque Monitoring

Engine diagnostic trouble codes: M54 engine (continued)

P-code	BMW-FC	Explanation
P1604	50	Control Module Self-Test, Speed Monitoring
P1604	51	Control Module Self-Test, Speed Monitoring
P1619	123	Map Cooling Thermostat Control Circuit Signal Low
P1620	123	Map Cooling Thermostat Control Circuit Signal High
P1624	146	Pedal Position Sensor Potentiometer Supply Channel 1 Electrical (M52: Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature))
P1625	147	Pedal Position Sensor Potentiometer Supply Channel 2 Electrical
P1632	115	Throttle Valve Adaptation Conditions Not Met
P1633	115	Throttle Valve Adaptation Limp-Home Position Unknown
P1634	115	Throttle Valve Adaptation Spring Test Failed
P1634	135	Throttle Valve Adaptation Spring Test Failed
P1634	136	Throttle Valve Adaptation Spring Test Failed
P1635	115	Throttle Valve Adaptation Lower Mechanical Stop not Adapted
P1636	109	Throttle Valve Control Circuit
P1637	162	Throttle Valve Position Control, Control Deviation
P1638	160	Throttle Valve Position Control Throttle Stuck Temporarily
P1639	161	Throttle Valve Position Control Throttle Stuck Permanently
P1675	135	Throttle Valve Actuator Start Test Re-Adaptation Required
P1694	136	Throttle Valve Actuator Start Test Spring Test and Limp-Home Position Failed
P2088	21	'A' Camshaft Position Actuator Control Circuit Low (Bank 1)
P2089	21	'A' Camshaft Position Actuator Control Circuit High (Bank 1)
P2090	19	'B' Camshaft Position Actuator Control Circuit Low (Bank 1)
P2091	19	'B' Camshaft Position Actuator Control Circuit High (Bank 1)
P2096	225	Post Catalyst Fuel Trim System Too Lean (Bank 1)
P2098	226	Post Catalyst Fuel Trim System Too Lean (Bank 2)
P2228	197	Barometric Pressure Circuit Low
P2229	197	Barometric Pressure Circuit High
P2270	215	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)
P2271	215	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)
P2272	216	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 2)
P2273	216	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 2)
P3041	10481	O2 Sensor Lean and Rich Voltage Thresholds not Reached (Bank 2 Sensor 2)
P3198	10205	Engine Coolant Temperature Gradient Too High
P3199	10207	Engine Coolant Temperature Signal Stuck
P3238	10289	Control Module Monitoring TPU Chip Defective

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Engine diagnostic trouble codes: M62 engine		
P-code	BMW-FC	Explanation
P0010	33	'A' Camshaft Position Actuator Circuit (Bank 1)
P0011	33	'A' Camshaft Position Timing Over-Advanced or System Performance (Bank 1)
P0012	33	'A' Camshaft Position Timing Over-Retarded (Bank 1)
P0020	34	'A' Camshaft Position Actuator Circuit (Bank 2)
P0021	34	'A' Camshaft Position Timing Over-Advanced or System Performance (Bank 2)
P0022	34	'A' Camshaft Position Timing Over-Retarded (Bank 2)
P0030	13	HO2S Heater Control Circuit (Bank 1 Sensor 1)
P0031	13	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)
P0032	13	HO2S Heater Control Circuit High (Bank 1 Sensor 1)
P036	14	HO2S Heater Control Circuit (Bank 1 Sensor 2)
P0037	14	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)
P0038	14	HO2S Heater Control Circuit High (Bank 1 Sensor 2)
P0050	5	HO2S Heater Control Circuit (Bank 2 Sensor 1)
P0051	5	HO2S Heater Control Circuit Low (Bank 2 Sensor 1)
P0052	5	HO2S Heater Control Circuit High (Bank 2 Sensor 1)
P0056	4	HO2S Heater Control Circuit (Bank 2 Sensor 2)
P0057	4	HO2S Heater Control Circuit Low (Bank 2 Sensor 2)
P0058	4	HO2S Heater Control Circuit High (Bank 2 Sensor 2)
P0102	115	Mass or Volume Air Flow Circuit Low Input
P0103	115	Mass or Volume Air Flow Circuit High Input
P0112	124	Intake Air Temperature Sensor 1 Circuit Low
P0113	124	Intake Air Temperature Sensor 1 Circuit High
P0116	123	Engine Coolant Temperature Circuit Range/Performance
P0117	123	Engine Coolant Temperature Circuit Low
P0118	123	Engine Coolant Temperature Circuit High
P0119	123	Engine Coolant Temperature Circuit Intermittent
P0120	117	Throttle/Pedal Position Sensor/Switch 'A' Circuit
P0121	118	Throttle/Pedal Position Sensor/Switch 'A' Circuit Range/Performance
P0122	118	Throttle/Pedal Position Sensor/Switch 'A' Circuit Low
P0123	118	Throttle/Pedal Position Sensor/Switch 'A' Circuit High
P0125	123	Insufficient Coolant Temperature for Closed Loop Fuel Control
P0128	139	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)
P0130	10	O2 Sensor Circuit (Bank 1 Sensor 1)
P0131	10	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)
P0132	10	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)
P0133	15	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)

Engine diagnostic trouble codes: M62 engine (continued)

P-code	BMW-FC	Explanation
P0134	10	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)
P0135	13	O2 Sensor Heater Circuit (Bank 1 Sensor 1)
P0136	12	O2 Sensor Circuit (Bank 1 Sensor 2)
P0137	12	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)
P0138	12	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)
P0139	17	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)
P0140	12	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)
P0141	14	O2 Sensor Heater Circuit (Bank 1 Sensor 2)
P0150	18	O2 Sensor Circuit (Bank 2 Sensor 1)
P0151	18	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)
P0152	18	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)
P0153	21	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)
P0154	18	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)
P0155	5	O2 Sensor Heater Circuit (Bank 2 Sensor 1)
P0156	20	O2 Sensor Circuit (Bank 2 Sensor 2)
P0157	20	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)
P0158	20	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)
P0159	23	O2 Sensor Circuit Slow Response (Bank 2 Sensor 2)
P0160	20	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)
P0161	4	O2 Sensor Heater Circuit (Bank 2 Sensor 2)
P0171	24	System Too Lean (Bank 1)
P0171	26	System Too Lean (Bank 1)
P0172	24	System Too Rich (Bank 1)
P0172	26	System Too Rich (Bank 1)
P0174	25	System Too Lean (Bank 2)
P0174	27	System Too Lean (Bank 2)
P0175	25	System Too Rich (Bank 2)
P0175	27	System Too Rich (Bank 2)
P0201	150	Injector Circuit/Open - Cylinder 1
P0202	157	Injector Circuit/Open - Cylinder 2
P0203	155	Injector Circuit/Open - Cylinder 3
P0204	152	Injector Circuit/Open - Cylinder 4
P0205	151	Injector Circuit/Open - Cylinder 5
P0206	154	Injector Circuit/Open - Cylinder 6
P0207	156	Injector Circuit/Open - Cylinder 7
P0208	153	Injector Circuit/Open - Cylinder 8

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Engine diagnostic trouble codes: M62 engine (continued)

P-code	BMW-FC	Explanation
P0221	119	Throttle/Pedal Position Sensor/Switch 'B' Circuit Range/Performance
P0222	119	Throttle/Pedal Position Sensor/Switch 'B' Circuit Low
P0223	119	Throttle/Pedal Position Sensor/Switch 'B' Circuit High
P0261	150	Cylinder 1 Injector Circuit Low
P0262	150	Cylinder 1 Injector Circuit High
P0264	157	Cylinder 2 Injector Circuit Low
P0265	157	Cylinder 2 Injector Circuit High
P0267	155	Cylinder 3 Injector Circuit Low
P0268	155	Cylinder 3 Injector Circuit High
P0270	152	Cylinder 4 Injector Circuit Low
P0271	152	Cylinder 4 Injector Circuit High
P0273	151	Cylinder 5 Injector Circuit Low
P0274	151	Cylinder 5 Injector Circuit High
P0276	154	Cylinder 6 Injector Circuit Low
P0277	154	Cylinder 6 Injector Circuit High
P0279	156	Cylinder 7 Injector Circuit Low
P0280	156	Cylinder 7 Injector Circuit High
P0282	153	Cylinder 8 Injector Circuit Low
P0283	153	Cylinder 8 Injector Circuit High
P0300	62	Random/Multiple Cylinder Misfire Detected
P0301	50	Cylinder 1 Misfire Detected
P0302	57	Cylinder 2 Misfire Detected
P0303	55	Cylinder 3 Misfire Detected
P0304	52	Cylinder 4 Misfire Detected
P0305	51	Cylinder 5 Misfire Detected
P0306	54	Cylinder 6 Misfire Detected
P0307	56	Cylinder 7 Misfire Detected
P0308	53	Cylinder 8 Misfire Detected
P0316	62	Engine Misfire Detected on Startup (First 1000 Revolutions)
P0324	214	Knock Control System Error
P0324	215	Knock Control System Error
P0324	216	Knock Control System Error
P0327	210	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)
P0328	210	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)
P0332	212	Knock Sensor 2 Circuit Low (Bank 2)
P0333	212	Knock Sensor 2 Circuit High Input (Bank 2)

Engine diagnostic trouble codes: M62 engine (continued)

P-code	BMW-FC	Explanation
P0335	111	Crankshaft Position Sensor 'A' Circuit
P0340	113	Camshaft Position Sensor 'A' Circuit (Bank 1 or Single Sensor)
P0342	113	Camshaft Position Sensor 'A' Circuit Low (Bank 1 or Single Sensor)
P0343	113	Camshaft Position Sensor 'A' Circuit High (Bank 1 or Single Sensor)
P0345	114	Camshaft Position Sensor 'A' Circuit (Bank 2)
P0347	114	Camshaft Position Sensor 'A' Circuit Low (Bank 2)
P0348	114	Camshaft Position Sensor 'A' Circuit High (Bank 2)
P0363	62	Misfire Detected - Fueling Disabled
P0370	112	Timing Reference High Resolution Signal 'A'
P0412	85	Secondary Air Injection System Switching Valve A Circuit
P0413	85	Secondary Air Injection System Switching Valve A Circuit Open
P0414	85	Secondary Air Injection System Switching Valve A Circuit Shorted
P0418	84	Secondary Air Injection System Control 'A' Circuit
P0420	40	Catalyst System Efficiency Below Threshold (Bank 1)
P0430	45	Catalyst System Efficiency Below Threshold (Bank 2)
P0440	93	Evaporative Emission System
P0442	183	Evaporative Emission System Leak Detected (small leak)
P0442	188	Evaporative Emission System Leak Detected (small leak)
P0443	98	Evaporative Emission System Purge Control Valve Circuit
P0444	98	Evaporative Emission System Purge Control Valve Circuit Open
P0445	98	Evaporative Emission System Purge Control Valve Circuit Shorted
P0450	185	Evaporative Emission System Pressure Sensor/Switch
P0452	185	Evaporative Emission System Pressure Sensor/Switch Low
P0453	185	Evaporative Emission System Pressure Sensor/Switch High
P0455	183	Evaporative Emission System Leak Detected (large leak)
P0456	187	Evaporative Emission System Leak Detected (very small leak)
P0491	80	Secondary Air Injection System Insufficient Flow (Bank 1)
P0492	81	Secondary Air Injection System Insufficient Flow (Bank 2)
P0500	120	Vehicle Speed Sensor 'A'
P0506	32	Idle Air Control System RPM Lower Than Expected
P0507	32	Idle Air Control System RPM Higher Than Expected
P0600	220	Serial Communication Link
P1102	163	Idle Control System, Adaptation of Unmetered Air Mass Too Low
P1103	163	Idle Control System, Adaptation of Unmetered Air Mass Too Large
P1130	17	O2 Sensor Circuit Dynamic Test (Bank 1 Sensor 2)
P1131	23	O2 Sensor Circuit Dynamic Test (Bank 2 Sensor 2)

Engine diagnostic trouble codes: M62 engine (continued)		
P-code	BMW-FC	Explanation
P1134	13	O2 Sensor Heater Circuit Signal Intermittent (Bank 1 Sensor 1)
P1135	13	O2 Sensor Heater Circuit Low Voltage (Bank 1 Sensor 1)
P1136	13	O2 Sensor Heater Circuit High Voltage (Bank 1 Sensor 1)
P1137	14	O2 Sensor Heater Circuit Signal Intermittent (Bank 1 Sensor 2)
P1138	14	O2 Sensor Heater Circuit Low Voltage (Bank 1 Sensor 2)
P1139	14	O2 Sensor Heater Circuit High Voltage (Bank 1 Sensor 2)
P1151	5	O2 Sensor Heater Circuit Signal Intermittent (Bank 2 Sensor 1)
P1152	5	O2 Sensor Heater Circuit Low Voltage (Bank 2 Sensor 1)
P1153	5	O2 Sensor Heater Circuit High Voltage (Bank 2 Sensor 1)
P1155	4	O2 Sensor Heater Circuit Signal Intermittent (Bank 2 Sensor 2)
P1156	4	O2 Sensor Heater Circuit Low Voltage (Bank 2 Sensor 2)
P1157	4	O2 Sensor Heater Circuit High Voltage (Bank 2 Sensor 2)
P1158	28	Fuel Trim Adaptation Additive Low (Bank 1)
P1159	28	Fuel Trim Adaptation Additive High (Bank 1)
P1160	29	Fuel Trim Adaptation Additive Low (Bank 2)
P1161	29	Fuel Trim Adaptation Additive High (Bank 2)
P1327	211	Knock Sensor 2 Circuit Low Input (Bank 1)
P1328	211	Knock Sensor 2 Circuit High Input (Bank 1)
P1332	213	Knock Sensor 4 Circuit Low Input
P1333	213	Knock Sensor 4 Circuit High Input
P1340	62	Multiple Cylinder Misfire During Start
P1341	62	Multiple Cylinder Misfire with Fuel Cut-Off
P1342	50	Misfire During Start Cylinder 1
P1343	50	Misfire Cylinder 1 with Fuel Cut-Off
P1344	57	Misfire During Start Cylinder 2
P1345	57	Misfire Cylinder 2 with Fuel Cut-Off
P1346	55	Misfire During Start Cylinder 3
P1347	55	Misfire Cylinder 3 with Fuel Cut-Off
P1348	52	Misfire During Start Cylinder 4
P1349	52	Misfire Cylinder 4 with Fuel Cut-Off
P1350	51	Misfire during Start Cylinder 5
P1351	51	Misfire Cylinder 5 with Fuel Cut-Off
P1352	54	Misfire during Start Cylinder 6
P1353	54	Misfire Cylinder 6 with Fuel Cut-Off
P1354	56	Misfire during Start Cylinder 7
P1355	56	Misfire Cylinder 7 with Fuel Cut-Off

Engine diagnostic trouble codes: M62 engine (continued)

P-code	BMW-FC	Explanation
P1356	53	Misfire during Start Cylinder 8
P1357	53	Misfire Cylinder 8 with Fuel Cut-Off
P1381	215	Control Module Self-Test, Knock Control Offset (Bank 1)
P1382	216	Control Module Self-Test, Knock Control Test Pulse (Bank 1)
P1386	214	Control Module Self-Test, Knock Control Circuit Baseline Test (Bank 1)
P1413	84	Secondary Air Injection Pump Relay Control Circuit Signal Low
P1414	84	Secondary Air Injection Pump Relay Control Circuit Signal High
P1441	1	Leakage Diagnostic Pump Control Open Circuit
P1442	1	Leakage Diagnostic Pump Control Circuit Signal Low
P1443	1	Leakage Diagnostic Pump Control Circuit Signal High
P1444	186	Diagnostic Module Tank Leakage (DM-TL) Pump Control Open Circuit
P1445	186	Diagnostic Module Tank Leakage (DM-TL) Pump Control Circuit Signal Low
P1446	186	Diagnostic Module Tank Leakage (DM-TL) Pump Control Circuit Signal High
P1447	189	Diagnostic Module Tank Leakage (DM-TL) Pump Current Too High during Switching Solenoid Test
P1448	189	Diagnostic Module Tank Leakage (DM-TL) Pump Current Too Low
P1449	189	Diagnostic Module Tank Leakage (DM-TL) Pump Current Too High
P1450	2	Diagnostic Module Tank Leakage (DM-TL) Switching Solenoid Control Open Circuit
P1451	2	Diagnostic Module Tank Leakage (DM-TL) Switching Solenoid Control Circuit Signal Low
P1452	2	Diagnostic Module Tank Leakage (DM-TL) Switching Solenoid Control Circuit Signal High
P1476	184	Leakage Diagnostic Pump Clamped Tube
P1523	165	'A' Camshaft Position Actuator Signal Low (Bank 1)
P1524	165	'A' Camshaft Position Actuator Control Circuit Signal High (Bank 1)
P1525	165	'A' Camshaft Position Actuator Control Open Circuit (Bank 1)
P1526	166	'A' Camshaft Position Actuator Control Open Circuit (Bank 2)
P1527	166	'A' Camshaft Position Actuator Control Circuit Signal Low (Bank 2)
P1528	166	'A' Camshaft Position Actuator Control Circuit Signal High (Bank 2)
P1633	136	Throttle Valve Adaptation Limp-Home Position Unknown
P1634	133	Throttle Valve Adaptation Spring Test Failed
P1635	134	Throttle Valve Adaptation Lower Mechanical Stop not Adapted
P1636	132	Throttle Valve Control Circuit
P1637	130	Throttle Valve Position Control, Control Deviation
P1638	131	Throttle Valve Position Control Throttle Stuck Temporarily
P1639	131	Throttle Valve Position Control Throttle Stuck Permanently
P1643	135	Throttle Valve Actuator Start Test Amplifier Balancing Plausibility
P2088	165	'A' Camshaft Position Actuator Control Circuit Low (Bank 1)
P2089	165	'A' Camshaft Position Actuator Control Circuit High (Bank 1)

On-Board Diagnostics

Engine diagnostic trouble codes: M62 engine (continued)

P-code	BMW-FC	Explanation
P2092	166	'A' Camshaft Position Actuator Control Circuit Low (Bank 2)
P2093	166	'A' Camshaft Position Actuator Control Circuit High (Bank 2)
P2096	225	Post Catalyst Fuel Trim System Too Lean (Bank 1)
P2098	226	Post Catalyst Fuel Trim System Too Lean (Bank 2)
P2177	26	System Too Lean Off Idle (Bank 1)
P2178	26	System Too Rich Off Idle (Bank 1)
P2179	27	System Too Lean Off Idle (Bank 2)
P2180	27	System Too Rich Off Idle (Bank 2)
P2187	28	System Too Lean at Idle (Bank 1)
P2188	28	System Too Rich at Idle (Bank 1)
P2189	29	System Too Lean at Idle (Bank 2)
P2190	29	System Too Rich at Idle (Bank 2)
P2191	24	System Too Lean at Higher Load (Bank 1)
P2192	24	System Too Rich at Higher Load (Bank 1)
P2193	25	System Too Lean at Higher Load (Bank 2)
P2194	25	System Too Rich at Higher Load (Bank 2)
P2270	17	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)
P2271	17	O2 Sensor Signal Stuck Rich (Bank 1 Sensor 2)
P2272	23	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 2)
P2273	23	O2 Sensor Signal Stuck Rich (Bank 2 Sensor 2)

