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Motronic Diagnosis

CHECK THE BASICS

Before any electrical diagnosis takes place always **consider** the basics. The following list will assist you in **considering** other areas of the motorcycles operating systems that may prevent operation or effect performance.

Determine if any of the listed items below might be a contributing factor to the malfunction of the motorcycle. Check them.

1. **Battery Fully Charged:** >12.6 VDC

2. **Check Fuel Supply:** If necessary perform fuel pressure test.
   K Models - 2.5 ± 0.05; R Models - 30 ± 0.05 bar

   Leakdown should hold 80% of 3000 RPM pressure for 40 minutes. If fuel pressure holds leakdown test but fuel pressure is low with the engine running, gently squeeze the fuel rerun line to the fuel tank with tool 88 88 6 133 010 while watching the fuel pressure gauge. Pressure should raise quickly, **Do not exceed 4 bar of fuel pressure.**

   If the pressure does not raise quickly, check for pinched supply line, clogged fuel filter or pump intake screen, defective pressure regulator, etc.

3. **Fuel Control:** check Ti at injectors. Use the BMW Multi-Tester and the Fuel Injector Test Adapter Cable covered in the Test Equipment section.

   With all test equipment hooked up to the motorcycle start the engine (if possible) and maintain an engine speed of 950 RPM's. Press the "Ignition Dwell Angle & Duty Cycle" button on the BMW Multi-Tester. The display of the BMW Multi-Tester should read: 3.5 to 4.0%

   If tested Ti value differs from nominal value above, consider all of the factors contributing to Ti:

   - Throttle Potentiometer
   - Engine Temp (NTC) (K Bikes Only)
   - Oil Temp (NTC) (R 1100 RS Only)
   - Engine speed and TDC - from Hall Sensors
   - CO potentiometer - M2.1 only
   - O_2 Sensor - M2.2 Only

3. **Adjust CO (M2.1 Only):** If necessary adjust at CO potentiometer. Read with exhaust gas analyzer= 1.80%

4. **Integrity of Air Intake System:** If necessary perform False Air Quick Test.

   A. Change engine oil. Disconnect Lamda probe.

   Note: False Air Quick Test should only be performed in a well ventilated area, free from open flame or sparks. Use Caution, have a fire extinguisher present and wear protective gear.

   B. Use acetylene gas (3 to 5 lbs) with a medium tip to determine if a false air leak is present.

   C. Start engine and run at the first idle position.

   Caution: In the following step if the engine backfires the acetylene could start to burn. If this should occur, pull back and shut off the torch.

   D. Position the acetylene around all hose clamps, joints, O-rings, and gaskets (any place air can enter).

      - If engine runs faster: air leak present

   If an air leak is present, engine speed will rise at the point of leak. Fix leak and recheck.

5. **Static Ignition Timing Setting:** K Models = 6° BTDC
   R Models = 0° TDC

6. **Engine Compression Test:**

   Allow engine to warm up to normal temperature. Remove all spark plugs, disconnect supply voltage at terminal 15 of the coils. Unplug the 25 pin connector from the Motronic Control Unit. Put side stand down. Check that battery is fully charged.

   Throttle wide open, press start button, allow six pulses of the compression tester needle.

   Results: K Modesl = 140 - 200 lbs per cylinder.
   R Models = 130 - 145 lbs per cylinder.

   All cylinders should be within 20% of each other.

Motronic Test Steps

The Motronic System is diagnosed using the BMW Multi-Tester in conjunction with ABS / Motronic Diagnosis KTE-201 to access the fault codes and the BMW Multi-Tester in conjunction with the Volt / Ohm Leads and Adapters for various test steps. The Fuel Injector Test Adapter Cable is used to check for voltage at the injectors.

All of the equipment connections are made with the special harness adapters as outlined in the test equipment section of this manual.

Prior to doing any testing or disconnecting of components, access the fault codes. Record the codes on a Repair Order. Erase the fault codes and then perform the Test Drive, page Motronic Diagnosis - 9. Again access the fault codes and perform the test procedures for each fault code as provided in this section. If no fault codes are stored, test drive the motorcycle and check for fault codes.

If the engine will not operate with the "emergency program" in the Motronic Control Unit, the following problems may be the cause. Perform the tests listed for the problems and then access the fault codes.

- Check for TD signal.
- Power supply to Control Unit - Test 1
- Fuel pump does not operate - Test 2
- Ti signal missing - Test 3
- Ignition spark missing - Test 4

Test Lead Hook Up

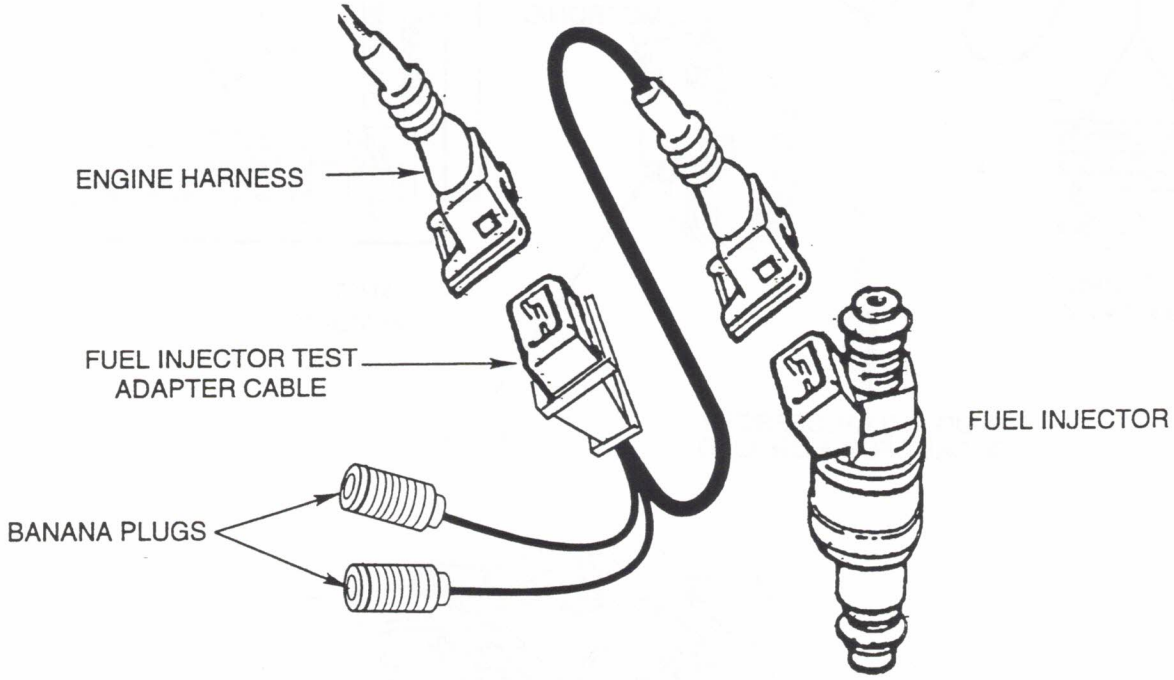
Test Lead Hook Up For Fuel Injector Voltage Check

1. Set ignition switch to OFF position.

2. Disconnect engine harness connector from fuel injector.

3. Connect the injector connector of the Fuel Injector Test Adapter Cable to the fuel injector. Connect the other connector to the engine harness connector.

4. Position the banana plugs for easy access away from any moving component or other component which may damage the plugs.

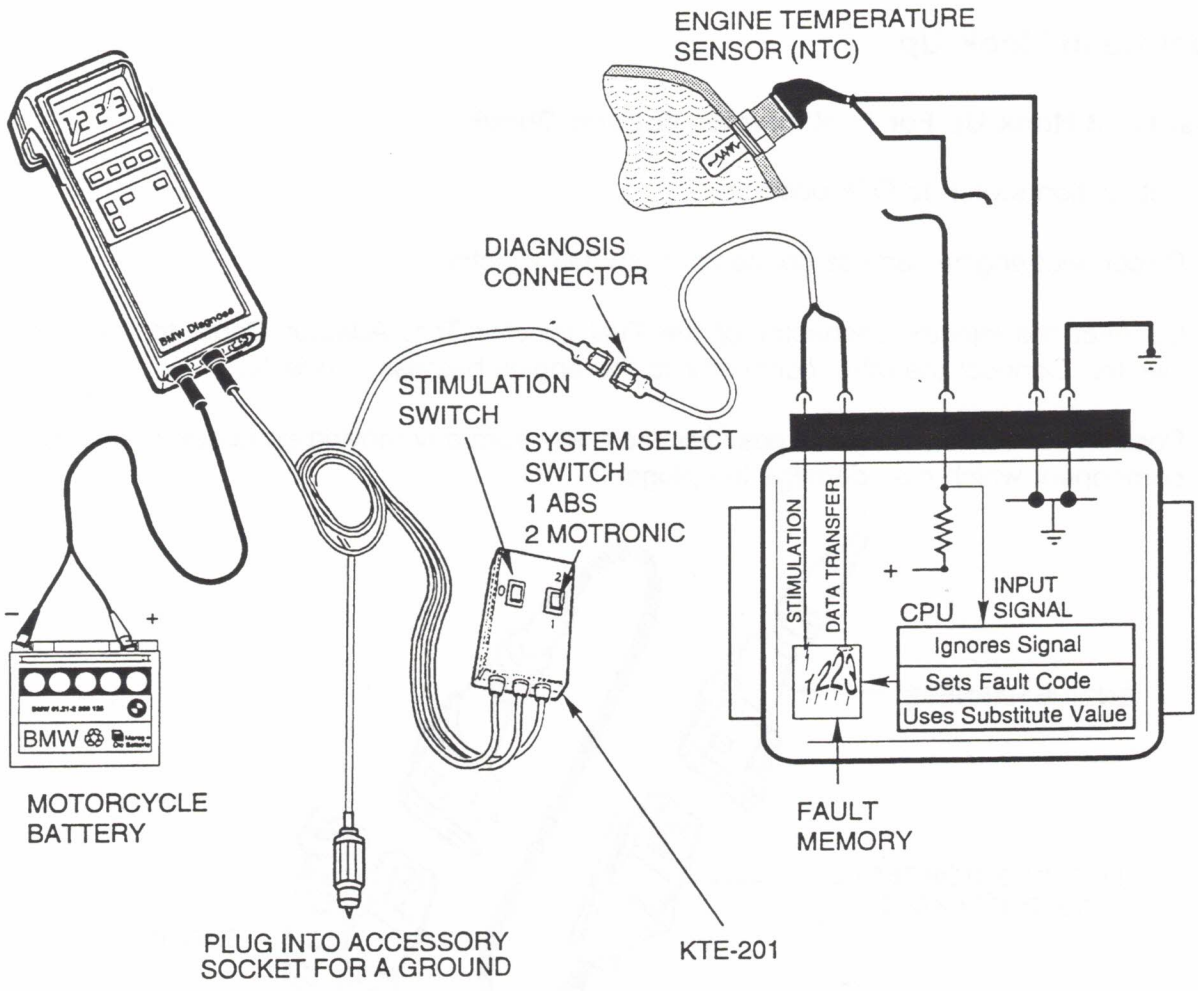


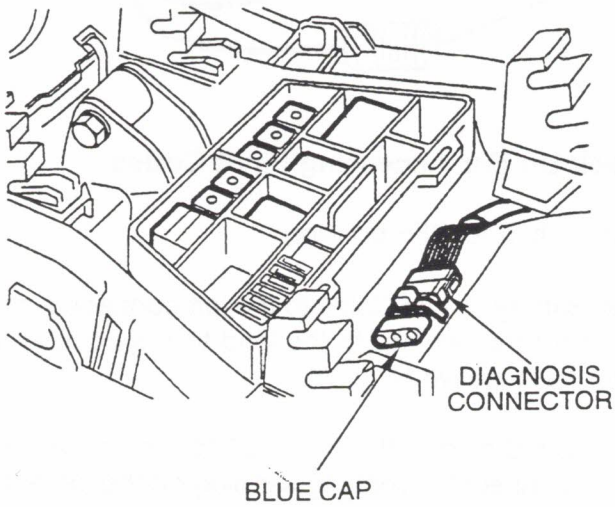
Test Lead Hook Up For Accessing Fault Codes

1. Turn ignition switch to OFF position.

2. Connect the Battery Power Cable to the left connector on the bottom of the BMW Multi-Tester. Connect the red clip to the lead to the positive terminal of the battery and the black clip to the negative terminal.

3. Connect the round plug of the KTE-201 to the center plug on the bottom of the BMW Multi-Tester. Connect the rectangular plug on the cable to the diagnosis plug (with blue cap) on the motorcycle. Plug the round plug with the spring loaded contact into the motorcycles auxiliary power socket for a ground connection. Make sure the socket ground and plug connection is good.


ENGINE TEMPERATURE
SENSOR (NTC)
DIAGNOSIS
CONNECTOR
STIMULATION
SWITCH
SYSTEM SELECT
SWITCH
1 ABS
2 MOTRONIC
STIMULATION
DATA TRANSFER
CPU
INPUT
SIGNAL
Ignores Signal
Sets Fault Code
Uses Substitute Value
FAULT
MEMORY
MOTORCYCLE
BATTERY
PLUG INTO ACCESSORY
SOCKET FOR A GROUND
KTE-201


DIAGNOSIS
CONNECTOR
BLUE CAP

Test Lead Hook Up For Volt / Ohm Reading

1. Set ignition switch to OFF position.

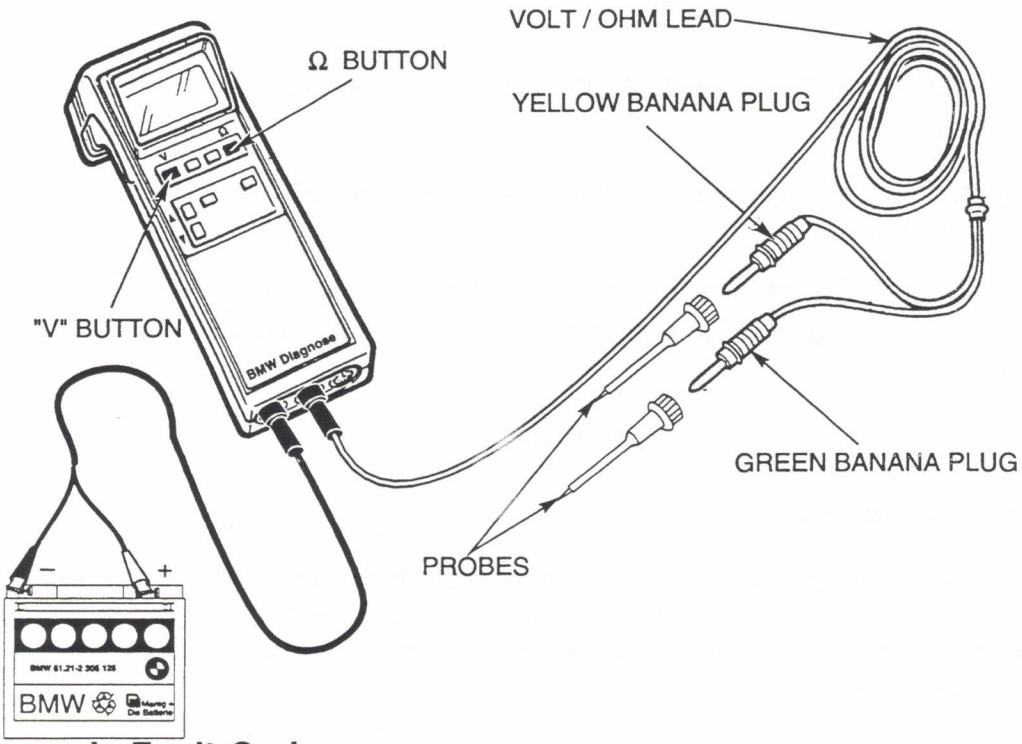
2. Connect the round 4 pin plug on the Volt / Ohm lead to the center plug on the bottom of the BMW Multi-Tester.

3. Place the yellow probe on the yellow banana plug for positive (+) connection and the green probe on the green banana plug for negative (-) connection.

4. Connect the Battery Power Cable to the left connector on the bottom of the BMW Multi-Tester. Connect the red clip to the lead to the positive terminal of the battery and the black clip to the negative terminal.

5. When testing for resistance, continuity or open circuit, zero the BMW Multi-Tester as directed in BMW Motorcycle Test Equipment Section, page Test Equipment - 8.

6. Never test a control unit for ohms.



Diagnosis Fault Codes

The Motronic System has the capability of monitoring its operation. When a malfunction occurs, the Motronic Control Unit (MCU) detects it and stores the information about the malfunction in a portion of the control unit known as the fault memory. The information in the fault memory is in the form of a numeric code. These codes correspond to an actual circuit or component that is found to be defective on the system.

If a fault is detected, the MCU will provide a substitute value for the faulted signal. This allows the rider to continue riding the motorcycle, even with a fault in the system, to obtain service.

The only input signal the MCU does not provide a substitute value for is the engine speed and reference signals produced by the hall sensors. The MCU will set a fault code but can not function without these signals.

Two Motronic Systems are used on BMW motorcycles; M2.1 with CO potentiometer (without catalytic converter) and M2.2 with O_2 Sensor (with catalytic converter). The fault codes other than the CO potentiometer (M2.1) and O_2 Sensor (M2.2) codes are the same.

ACCESSING FAULT CODES

NOTE

Do not disconnect the battery nor the connector to the Motronic Control Unit before accessing the fault code. Disconnecting the battery or the Motronic Control Unit will erase the code.

- Connect the BMW Multi-Tester and KTE-201 to the motorcycle as directed in "Test Lead Hook Up" above.
- On the KTE-201 switch box, set the System Select Switch to "2". Set the Fault Memory Stimulation Switch to "0.
- On the BMW Multi-Tester, press the "V" button. Press the ▲ & ▼ buttons simultaneously. In the display, a large "0" will light up on the left with a small "0" on either side.

CAUTION

Do not remove Fuse #5.

- Remove fuse 6. Turn the ignition on. Briefly operate the starter. Press and hold the Stimulation Switch on the KTE-201 Cable box for at least 5 seconds. The code for the first stored fault will be displayed on the tester. If there is no fault in memory, code 4 4 4 4 will be displayed.

NOTE

If engine is not cranked briefly, the MCU will set a fault code for hall signals.

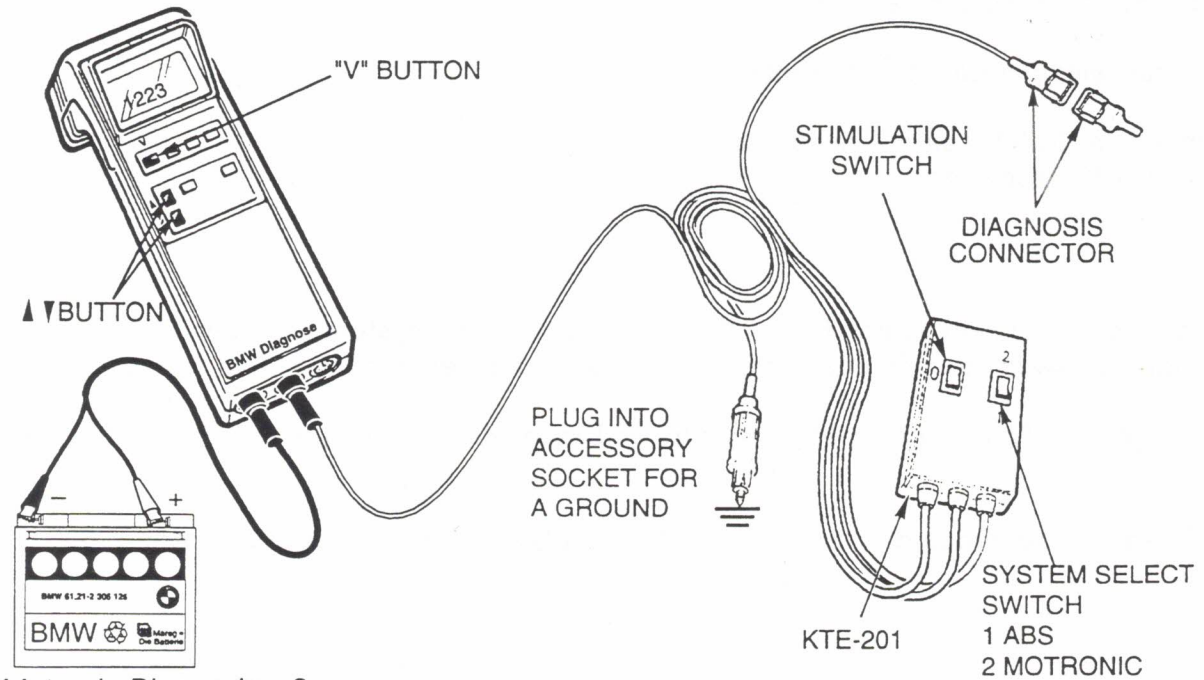
- Again press and hold the switch for at least 5 seconds. If another fault code is stored, it will be displayed.

- Continue reading out codes until the code 0 0 0 0 is displayed. This code indicates that no additional codes are stored.

- Record fault codes on Repair Order.

FAULT CODES FOR MOTRONIC M2.1 AND M2.2

CODES	FAULT DESCRIPTION
4 4 4 4	No fault in memory
0 0 0 0	No additional fault in memory
1 1 1 1	CO Potentiometer
1 1 2 2	Hall Signal missing
1 1 3 3	Hall Signal missing
1 2 2 3	Engine Temperature Sensor
1 2 2 4	Air Temperature Sensor
1 2 1 5	Throttle Potentiometer
2 3 4 2	O_2 Sensor Signal un-realistic
2 3 4 1	O_2 Sensor Control limit reached
2 3 4 3	Mixture adjustment limit reached
2 3 4 4	Short to (-), O_2 Sensor Signal
2 3 4 5	Short to (+), O_2 Sensor Signal



MOTRONIC CONTROL SYSTEM

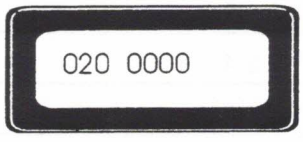
ERASING FAULT CODE(S)

Prior to erasing the fault, record the code(s) on the Repair Order. Erase the fault code(s) as follows:

1.Hook up test equipment as directed in "Test Lead Hook-Up - Accessing Fault Codes". page Motronic Diagnosis - 4.

2.Turn ignition switch to OFF position.

3.Press and hold Stimulation Switch on KTE-201 box. Turn ignition switch to ON and hold Stimulation Switch for 10 seconds.



•**Boxer Models** - The BMW Multi-Tester display will indicate 0 0 0 0

•**K Models** - The system will test the coolant fan control and display:

•vehicles with catalytic converter 3 3 3 3

•vehicles without catalytic converter 3 3 3 3

•the coolant fan will operate with interruptions

•press Stimulation Switch again. The fan will go off.
Code 0 0 0 0 will be displayed.

4.Press and hold Stimulation Switch for another 10 seconds. The system will leave the erase mode. Set ignition switch to OFF position. The memory is now erased.

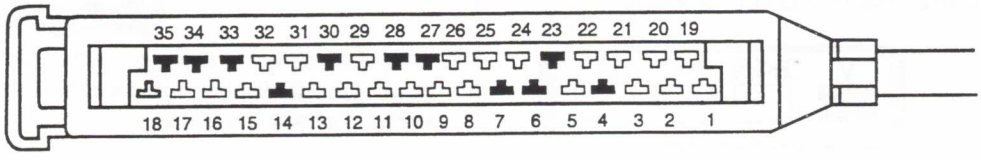
5.Perform "Accessing Fault Codes", page 7 Motronic Diagnosis - to be sure all codes are erased.

6.Perform Road Test as directed on page 44 of Motronic Diagnosis - to see if fault reoccurs.

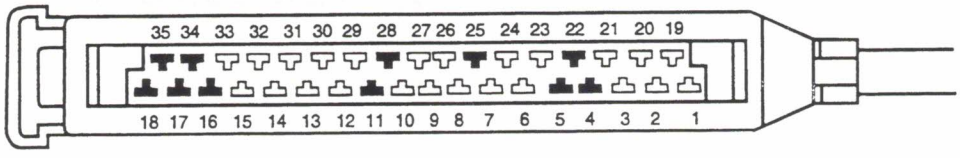
MOTRONIC CONTROL UNIT CONNECTOR

On K Models, the wiring to the Motronic CU connector was changed on the 1994 models. Beginning with the 1994 Models, the wiring to the pins in the connector are the same for both K Models and R Models. The pin locations in the connectors varies between K Models nd R Models. The illustrations in the testing section are of the K Models up to 1993 and 1994 and after. Refer to the illustrations below and on the schematics for pin locations on the R Models.

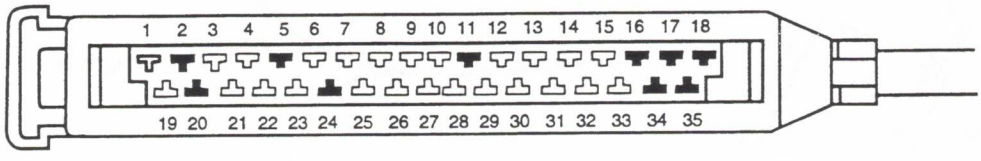
K MODELS UP TO 1993



K MODELS FROM 1994



R MODELS



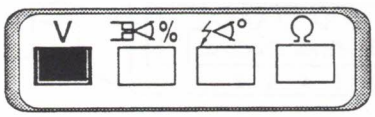
1. Motronic Control Unit Power Supply and Ground (Continued on next page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 15 (K Models from 1994 and R1100) or pin 18 (K Models to 1993) of Motronic MCU to ground - battery voltage

Test Conditions:

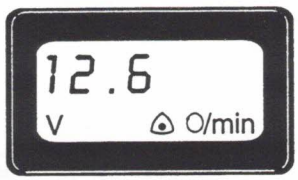
1. Ignition switch to OFF position.
2. Motronic MCU plug disconnected.
3. BMW Multi-Tester V button pressed.



4. Volt/Ohm leads from BMW Multi-Tester connected yellow to pin 15 or 18 of MCU plug and green to frame ground.

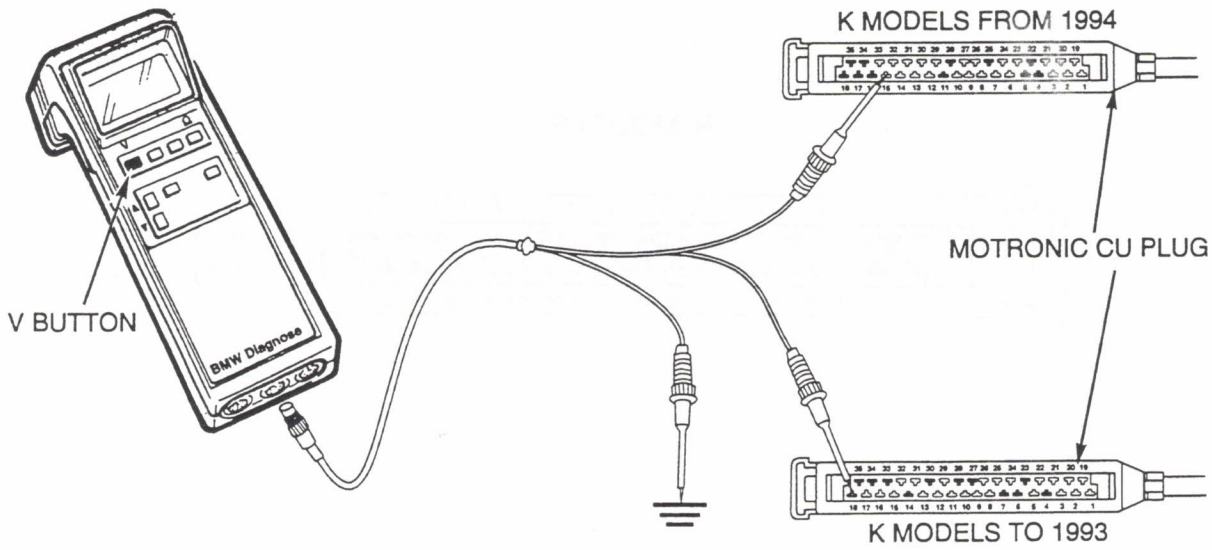
BMW Multi-Tester Display:

Voltage reading should be same as battery voltage.



If display voltage is same as battery voltage, go to page 12. If display voltage differs from battery voltage, check the following:

- ✓ Fuse 5.
- ✓ Battery charge and condition.
- ✓ Ground connection at battery, frame, engine.
- ✓ Pin 15 or 18 of MCU to fuse 5.



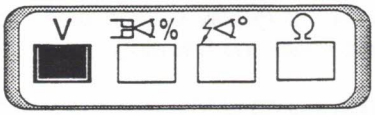
1. Motronic Control Unit Power Supply and Ground (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 33 (K Models from 1994 and R1100) or pin 9 (K Models to 1993) of Motronic MCU to ground - battery voltage

Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to ON position.
3. BMW Multi-Tester V button pressed.

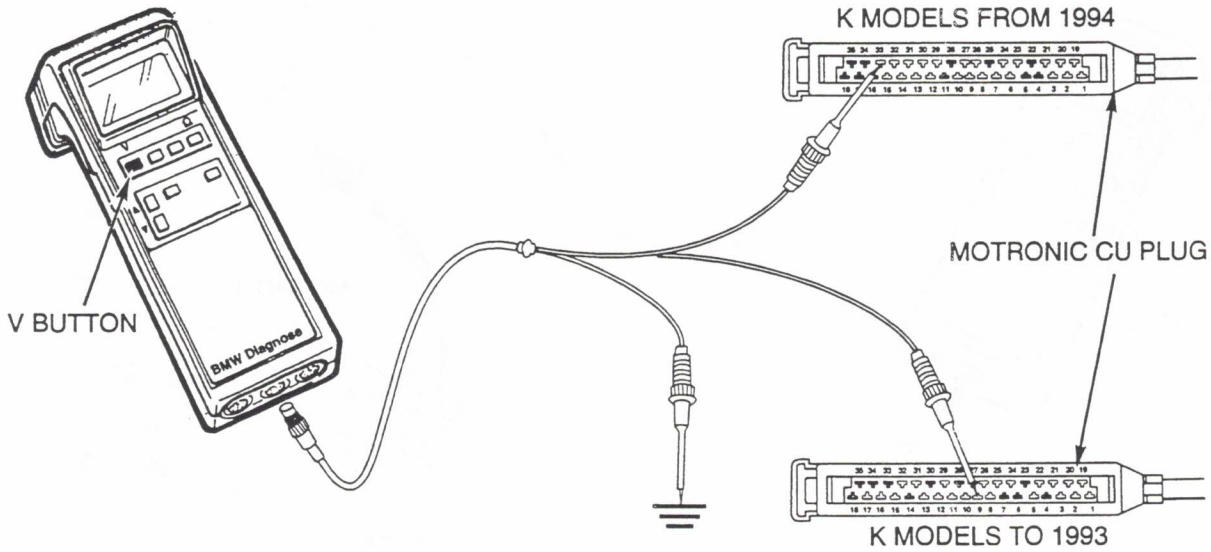


4. Volt/Ohm leads from BMW Multi-Tester connected yellow to pin 33 or 9 of MCU plug and green to frame ground.

BMW Multi-Tester Display:

Voltage reading should be same as battery voltage with key on.

If display voltage is same as battery voltage, go to page 15. If display voltage differs from battery voltage, go to page 13.



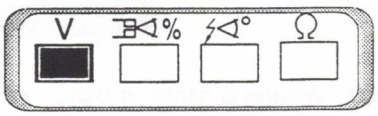
1. Motronic Control Unit Power Supply and Ground (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Terminal 30 of Motronic Relay Socket - battery voltage

Test Conditions:

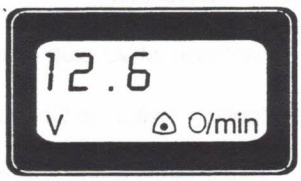
1. Motronic Relay removed.
2. Ignition switch to OFF position.
3. BMW Multi-Tester V button pressed.



4. Volt/Ohm leads from BMW Multi-Tester connected yellow to terminal 30 of Motronic Relay socket and green to frame ground.

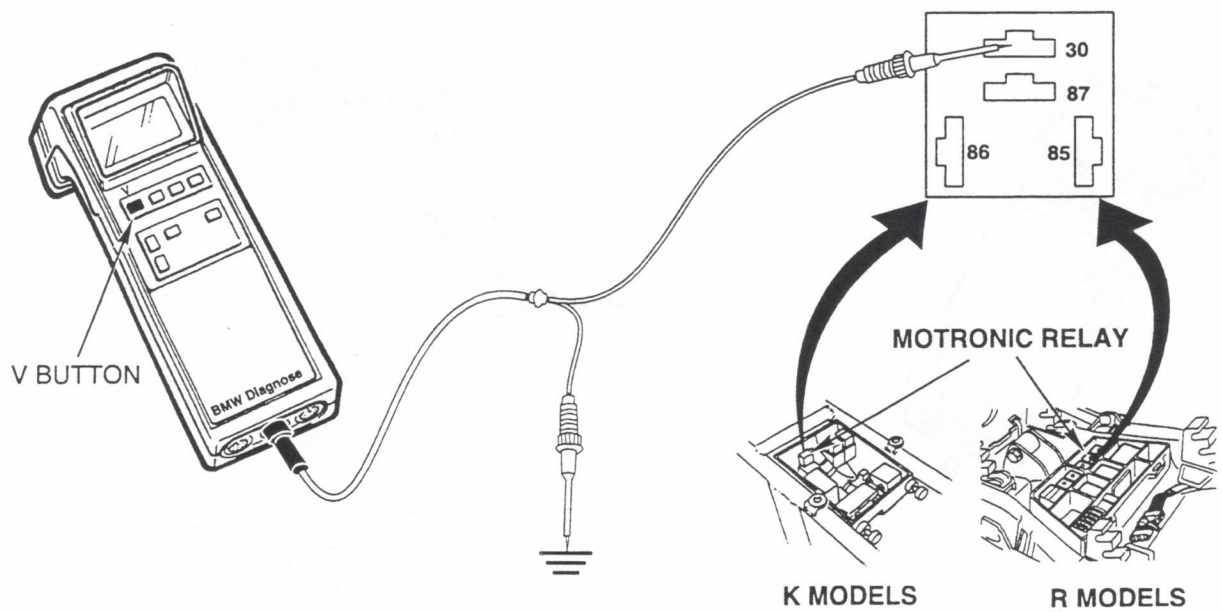
BMW Multi-Tester Display:

Voltage reading should be same as battery voltage.



If display voltage is same as battery voltage, go to page 14. If display voltage differs from battery voltage, check the following:

✓ Terminal 30 of Motronic Relay to fuse 5.



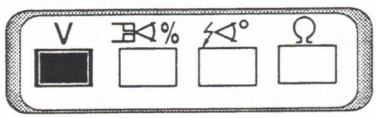
1. Motronic Control Unit Power Supply and Ground (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Terminal 85 to 86 of Motronic Relay Socket - battery voltage

Test Conditions:

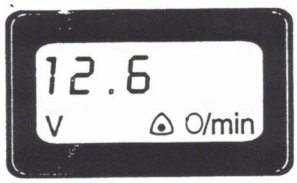
1. Ignition switch to ON position.
2. Motronic Relay removed.
3. BMW Multi-Tester V button pressed.



4. Volt/Ohm leads from BMW Multi-Tester connected yellow to terminal 86 of Motronic Relay socket and green to terminal 85.

BMW Multi-Tester Display:

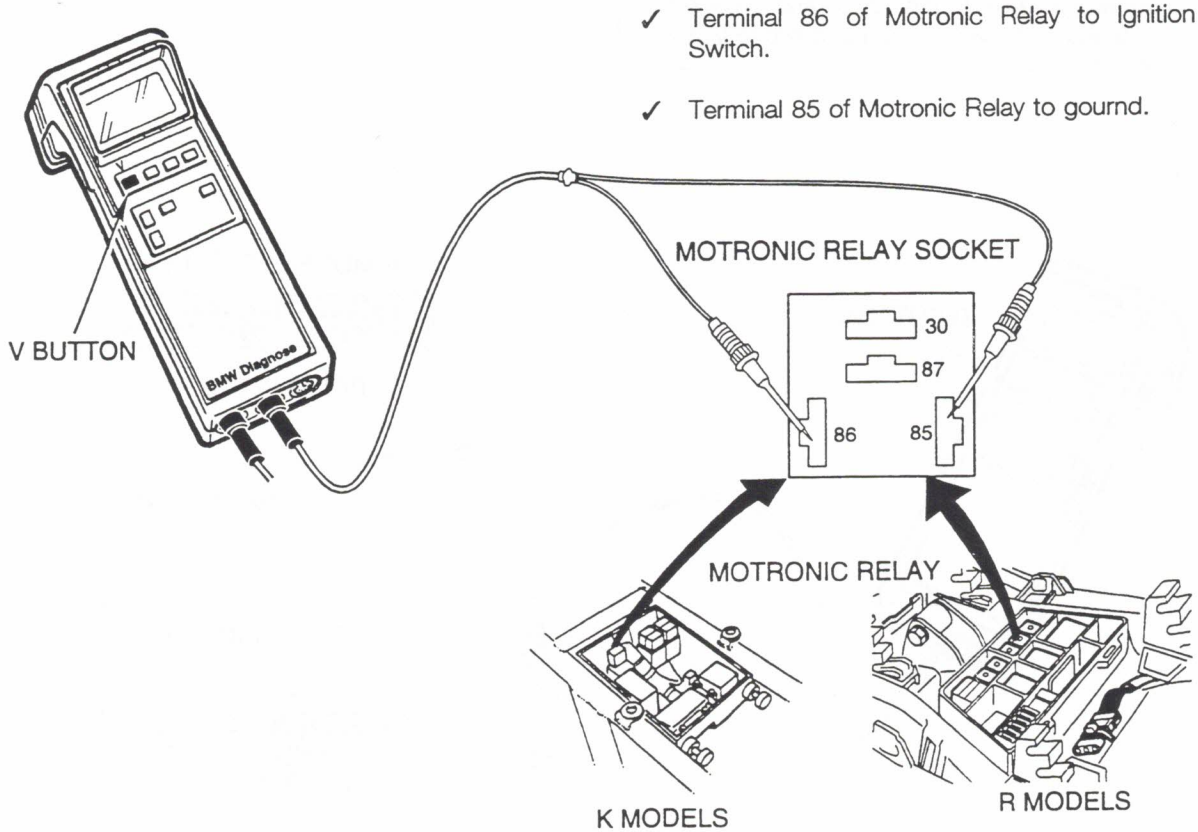
Voltage reading should be same as battery voltage.



If display voltage is same as battery voltage, check continuity of the wire from pin 33 (K Models from 1994 and R1100) or pin 9 (K Models to 1993) of MCU plug to terminal 87 of Motronic Relay. If wire is good, replace Motronic Relay.

If display voltage differs from battery voltage, check the following:

- ✓ Terminal 86 of Motronic Relay to Ignition Switch.
- ✓ Terminal 85 of Motronic Relay to gournd.



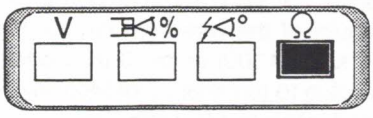
1. Motronic Control Unit Power Supply and Ground (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pins 13, 21 and 26 (K Models from 1994 and R1100) or pins 11, 5 and 19 (K Models to 1993) of Motronic MCU to ground - ground circuit

Test Conditions:

1. Ignition switch to OFF position.
2. Motronic MCU disconnected.
3. BMW Multi-Tester Ω button pressed.



4. Perform zero calibration procedure on the tester.
5. Volt/Ohm leads from BMW Multi-Tester connected yellow to pin 13, 21 and 26 or pin 11, 5 and 19 of MCU plug and green to frame ground.

BMW Multi-Tester Display:

Resistance =

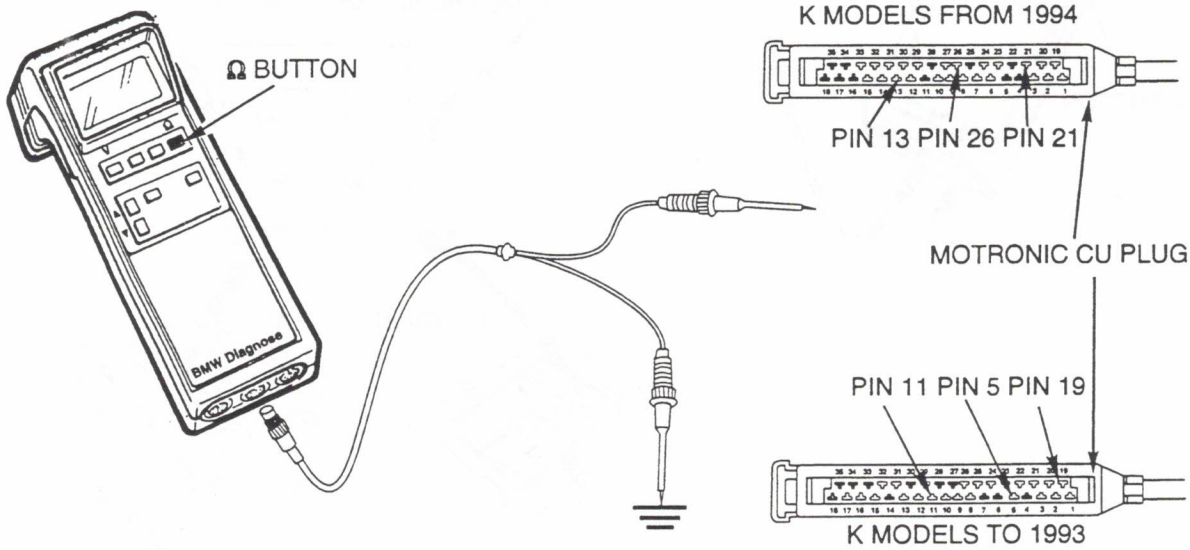
< 0.3Ω

If resistance is > 0.3Ω, check the following:

✓ Pin 13 or 11 of MCU plug to ground II.

✓ Pin 21 or 5 of MCU plug to ground II.

✓ Pin 26 or 19 of MCU plug to ground II.



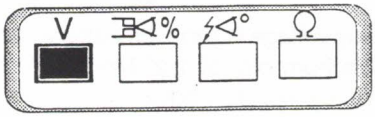
2. Fuel Pump Not Running (Continued on next page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Terminal 30 of Fuel Pump Relay to ground - battery voltage

Test Conditions:

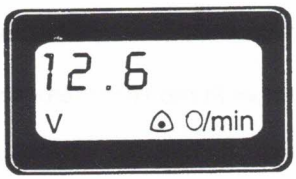
1. Ignition switch to OFF position.
2. Fuel Pump Relay removed.
3. BMW Multi-Tester V button pressed.



4. Volt/Ohm leads from BMW Multi-Tester connected yellow to terminal 30 of Fuel Pump Relay socket and green to frame ground.

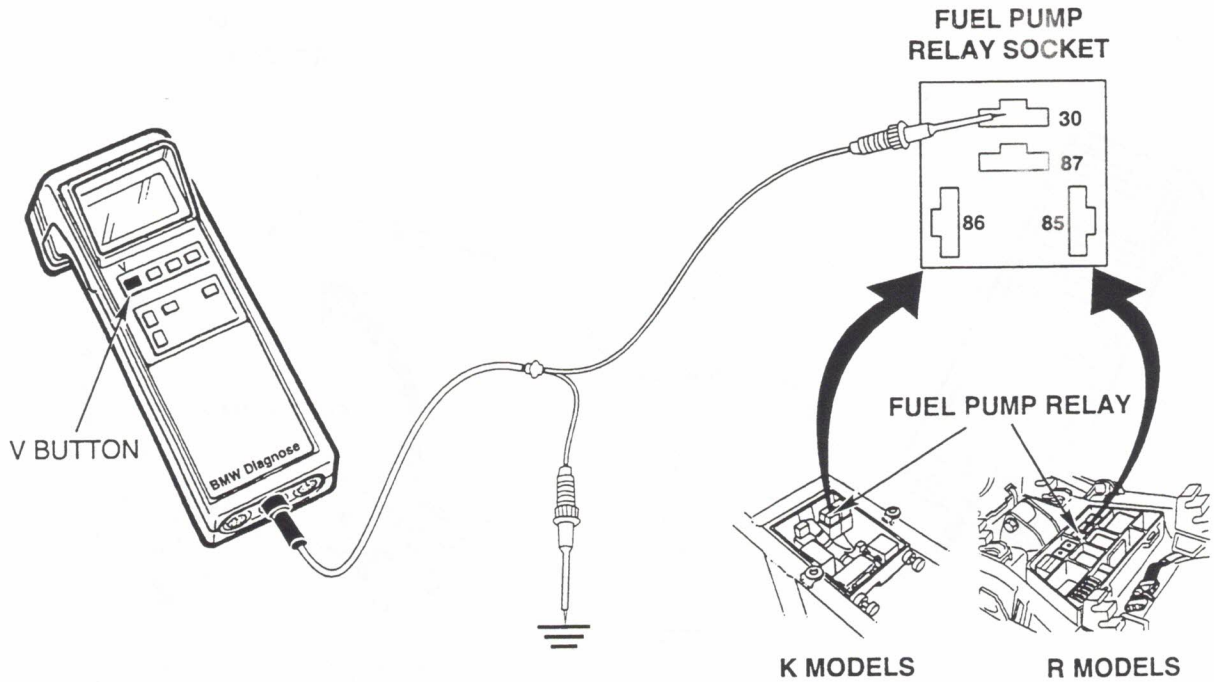
BMW Multi-Tester Display:

Voltage reading should be same as battery voltage.



If voltage reading is same as battery voltage, go to page 17. If voltage reading is not same as battery voltage, check the following:

- ✓ Battery charge and condition.
- ✓ Fuel 6.
- ✓ Wire from terminal 30 of Fuel Pump Relay to Fuse 6.



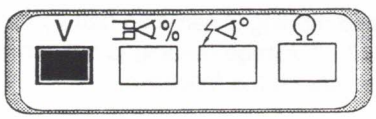
2. Fuel Pump Not Running (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Terminal 86 of Fuel Pump Relay - battery voltage

Test Conditions:

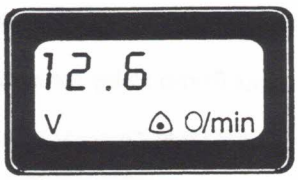
1. Ignition switch to ON position.
2. Fuel Pump Relay removed.
3. BMW Multi-Tester V button pressed.



4. Volt/Ohm leads from BMW Multi-Tester connected yellow to terminal 86 of Fuel Pump Relay socket and green to frame ground.

BMW Multi-Tester Display:

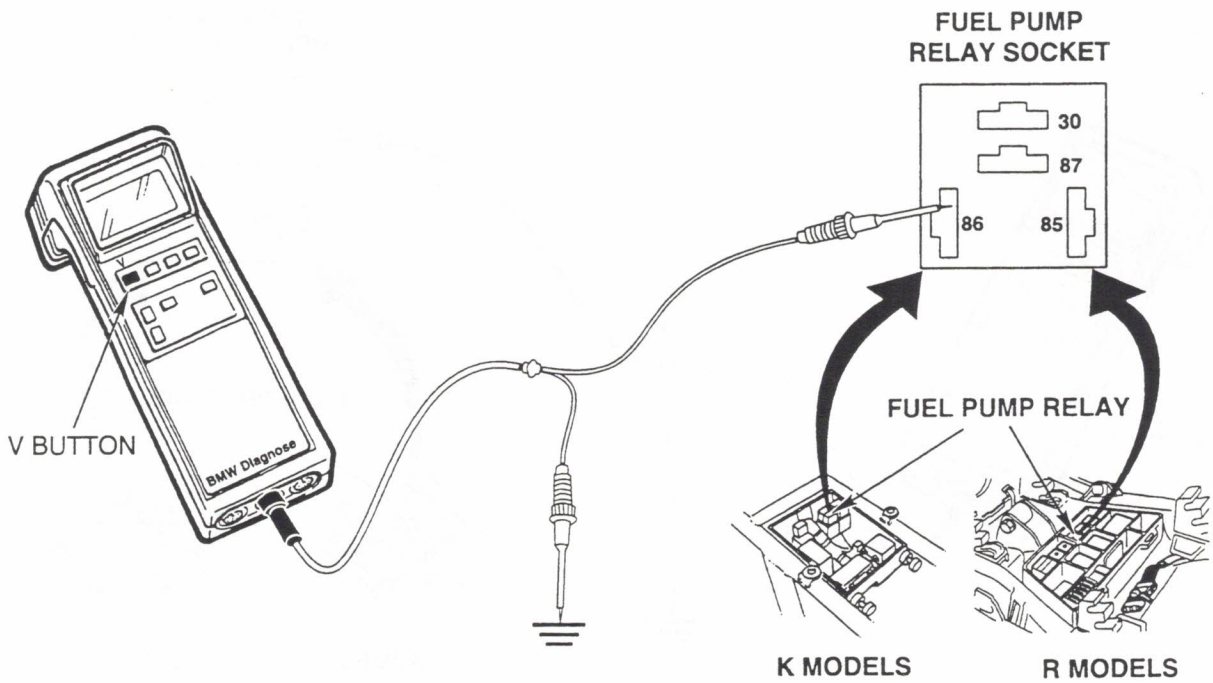
Voltage reading should be same as battery voltage.



If display voltage is same as battery voltage, check the wire from pin of 1 (K Models from 1994 and R1100) or pin 3 (K Models to 1993) an MCU plug to terminal 85 of Fuel Pump Relay.

If display voltage differs from battery voltage, check the following:

✓ Terminal 86 of Fuel Pump Relay to Ignition Switch.



2. Fuel Pump Not Running (Continued from previous page)

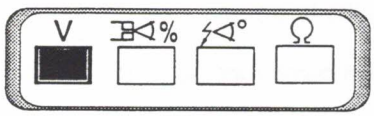
Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pins 1 and 2 of fuel pump plug - battery voltage

NOTE: The fuel pump plug is located on right hand side forward of battery. There should be power there for a few seconds when the ignition switch is turned to ON position.

Test Conditions:

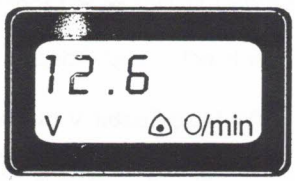
1. Motronic MCU plug connected.
2. Fuel Pump Relay installed.
3. BMW Multi-Tester V button pressed.



4. Volt/Ohm leads from BMW Multi-Tester connected yellow to pin 5 (green / white wire) of fuel pump harness plug and green to pin 1 (brown wire). Turn ignition switch to ON position.

BMW Multi-Tester Display:

Voltage reading should be same as battery voltage.

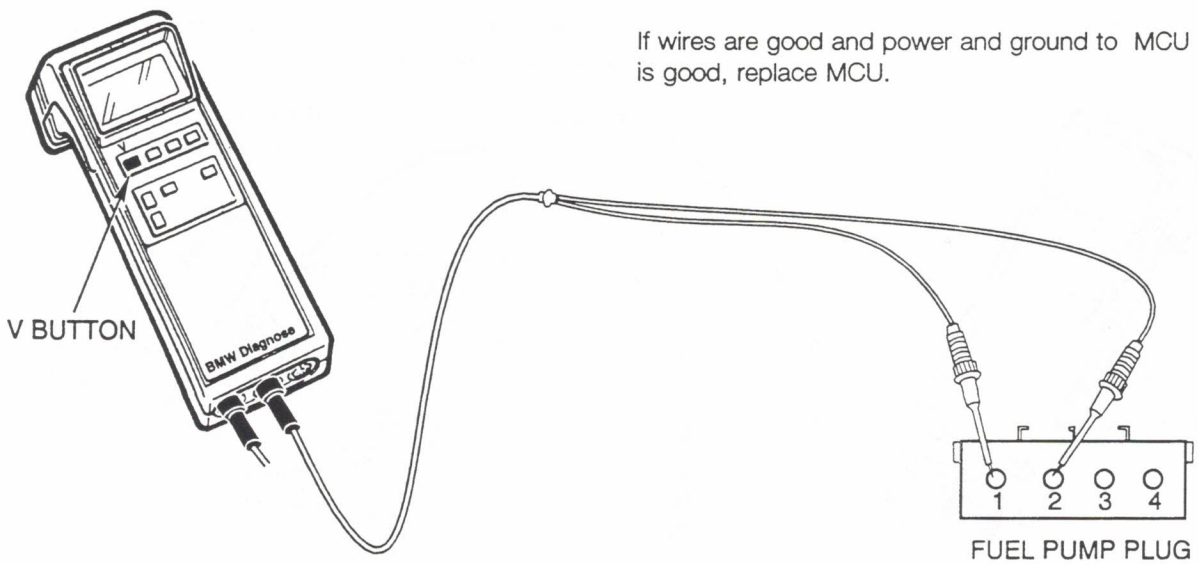


If display voltage is same as battery voltage, check fuel pump and sending unit for open circuit.

If display voltage differs from battery voltage, check the following:

- ✓ Pin 5 of fuel pump plug to terminal 87 of Fuel Pump Relay.
- ✓ Pin 1 of fuel pump plug to ground.
- ✓ Power supply and ground to Motronic MCU, Test 1.

If wires are good and power and ground to MCU is good, replace MCU.



FUEL PUMP PLUG
R1100

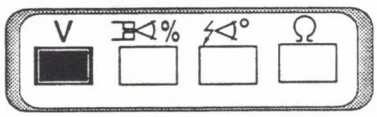
3. Ti Signal Missing

Test Equipment: BMW Multi-Tester, Volt / Ohm Leads and Adapters and Fuel Injector Test Adapter Cable

Tested Pins: Pin 1 of Fuel injector - battery voltage

Test Conditions:

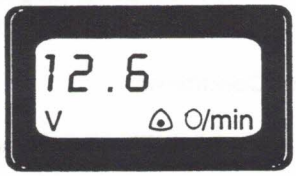
1. Motronic CU plug connected.
2. Ignition switch to ON position.
3. Fuel Injector Test Adapter Cable installed.
4. BMW Multi-Tester V button pressed.



5. Volt/Ohm leads from BMW Multi-Tester connected yellow to yellow banana plug on Fuel Injector Test Adapter Cable and green to frame ground. Actuate starter and measure voltage.

BMW Multi-Tester Display:

Voltage reading should be same as battery voltage.

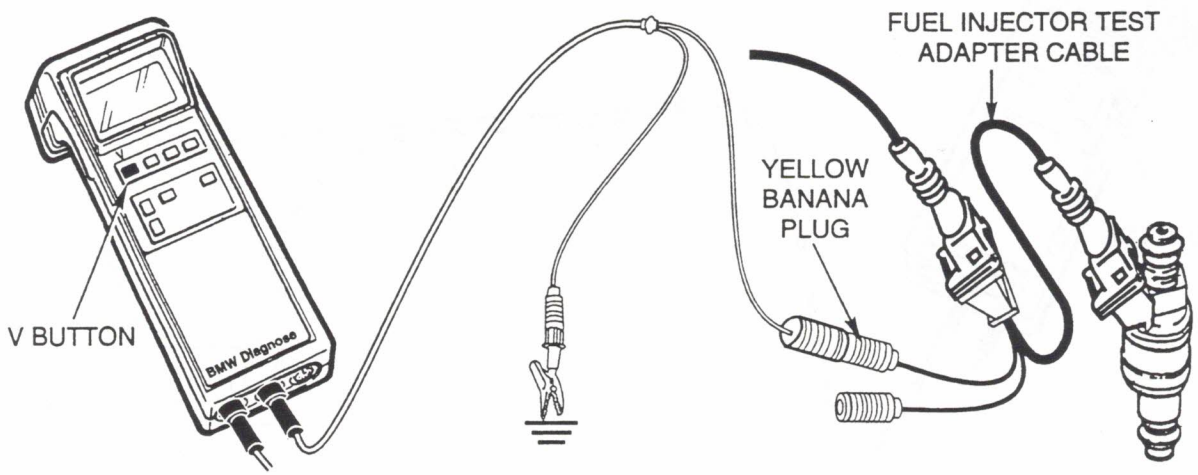


If display voltage is same as battery voltage, check fuel injectors.

If display voltage differs from battery voltage, check the following:

- ✓ Fuel pump running, if not, perform Test 2.
- ✓ Wire from Fuel Pump Relay terminal 87 to fuel injectors.
- ✓ Wire from fuel injectors to pin 27 (K Models from 1994 and R1100) or pin 15 (K Models to 1993) of MCU plug.
- ✓ Power supply and ground to MCU, perform Test 1.

If wires are good and power and ground to MCU are good, replace MCU.



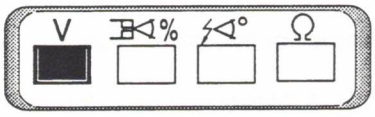
4. Ignition Spark Missing (Continued on next page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Terminal 15 of ignition coil(s) and ground - battery voltage

Test Conditions:

1. Motronic MCU plug connected.
2. Ignition switch to ON position.
3. BMW Multi-Tester V button pressed.

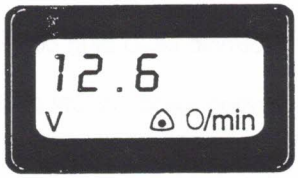


4. Volt/Ohm leads from BMW Multi-Tester connected yellow to terminal 15 of ignition coil(s) and green to frame ground.

NOTE: Wires to ignition coil are same color at terminals 15 and 1. Be sure to check terminal markings on coil.

BMW Multi-Tester Display:

Voltage reading should be same as battery voltage.

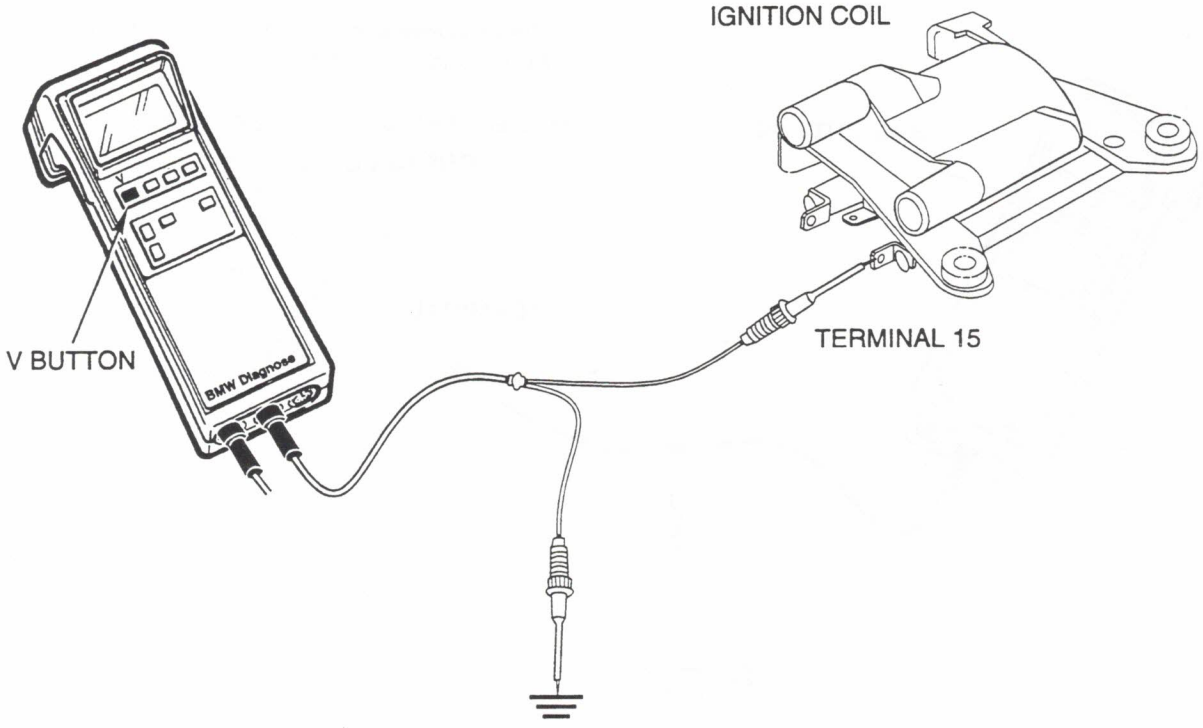


If display voltage is same as battery voltage, go to page 21.

If display voltage differs from battery voltage, check the following:

✓ Wire from terminal 15 of ignition coil(s) to ignition switch.

✓ Ignition switch.



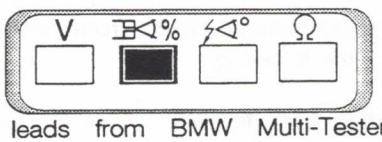
4. Ignition Spark Missing (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Terminal 1 of ignition coil(s) and ground - sensing ratio %

Test Conditions:

1. Motronic MCU plug connected.
2. Ignition switch to ON position.
3. Ignition coils connected.
3. BMW Multi-Tester ⊣◁% button pressed.

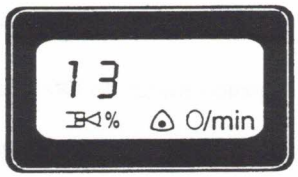


4. Volt/Ohm leads from BMW Multi-Tester connected green to terminal 1 of ignition coil(s) plug and yellow to positive battery terminal. Actuate starter. Engine does not have to fire at this point.

BMW Multi-Tester Display:

Sensing ratio =

14 to 15%

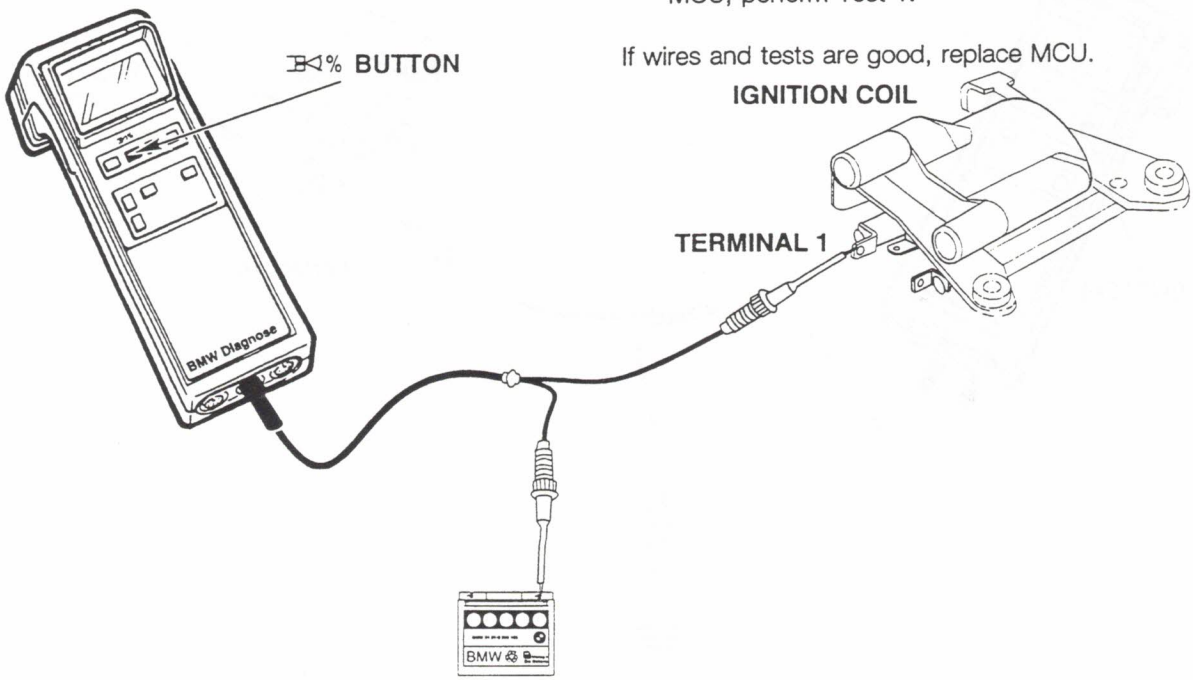


If display is correct, go to page 22.

On M2.1, if display is not correct, go to page 23.
On M2.2, if display is not correct, check the following:

- ✓ Wire from terminal 1 of ignition coils to pin 19 (ignition coil 1) and pin 20 (ignition coil 2) of MCU plug.
- ✓ If wires are good, perform Tests 6 and 7.
- ✓ Check power supply and ground to Motronic MCU, perform Test 1.

If wires and tests are good, replace MCU.



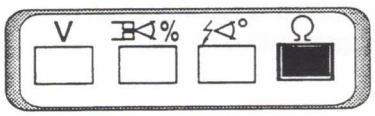
4. Ignition Spark Missing (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Terminal 1 of ignition coil(s) to 15a; terminal 4a to 4b - resistance

Test Conditions:

1. Motronic MCU plug connected.
2. Ignition switch to OFF position.
3. Ignition coils disconnected.
4. BMW Multi-Tester Ω button pressed.



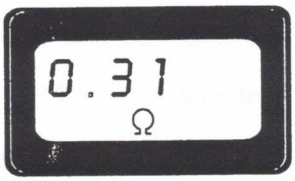
5. Perform zero calibration procedure on the tester.
6. Volt/Ohm leads from BMW Multi-Tester connected green to terminal 1 of ignition coil(s) and yellow to terminal 15a; green to terminal 4a and yellow to terminal 4b.

BMW Multi-Tester Display:

Resistance =

1 to 15a =≈ 0.5Ω

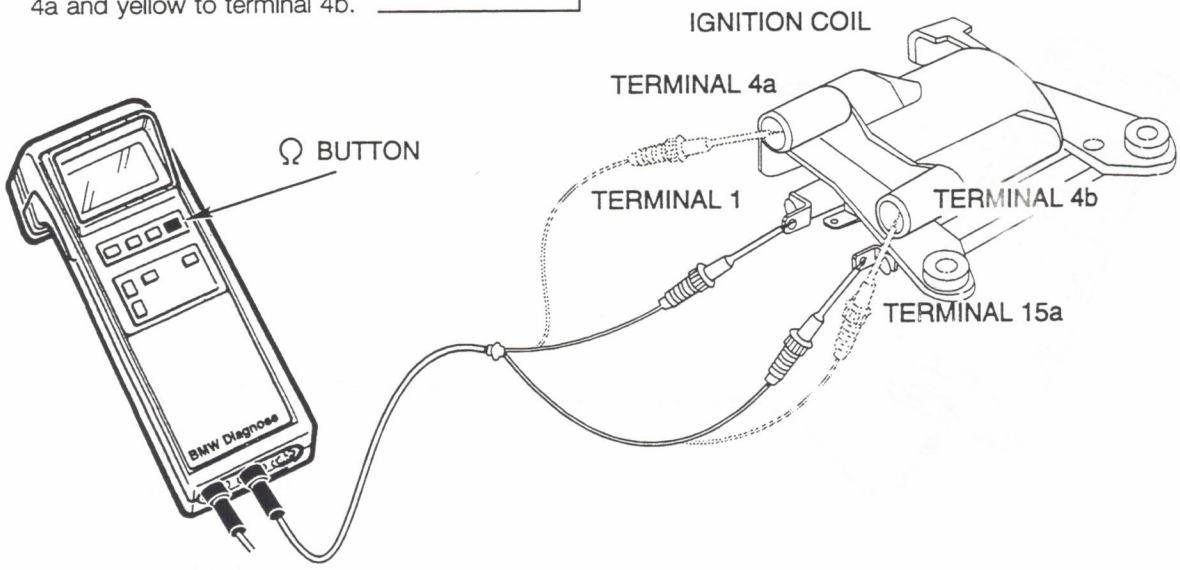
4a to 4b =≈ 13kΩ



If resistance readings are not correct, replace ignition coil.

If resistance readings are correct, check the following:

- ✓ Ignition wires.
- ✓ Spark plug connectors.
- ✓ Spark plugs and gap.



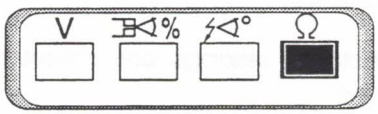
4. Ignition Spark Missing - M2.1 (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 4 of Ignition Output Stage plug to ground - ground circuit

Test Conditions:

1. Motronic MCU plug connected.
2. Ignition switch to OFF position.
3. Ignition Output Stage plug disconnected.
4. BMW Multi-Tester Ω button pressed.

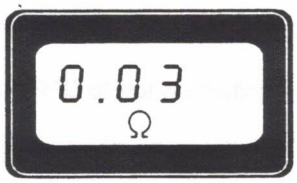


5. Volt/Ohm leads from BMW Multi-Tester connected yellow to pin 4 of Ignition Output Stage plug and green to frame ground.

BMW Multi-Tester Display:

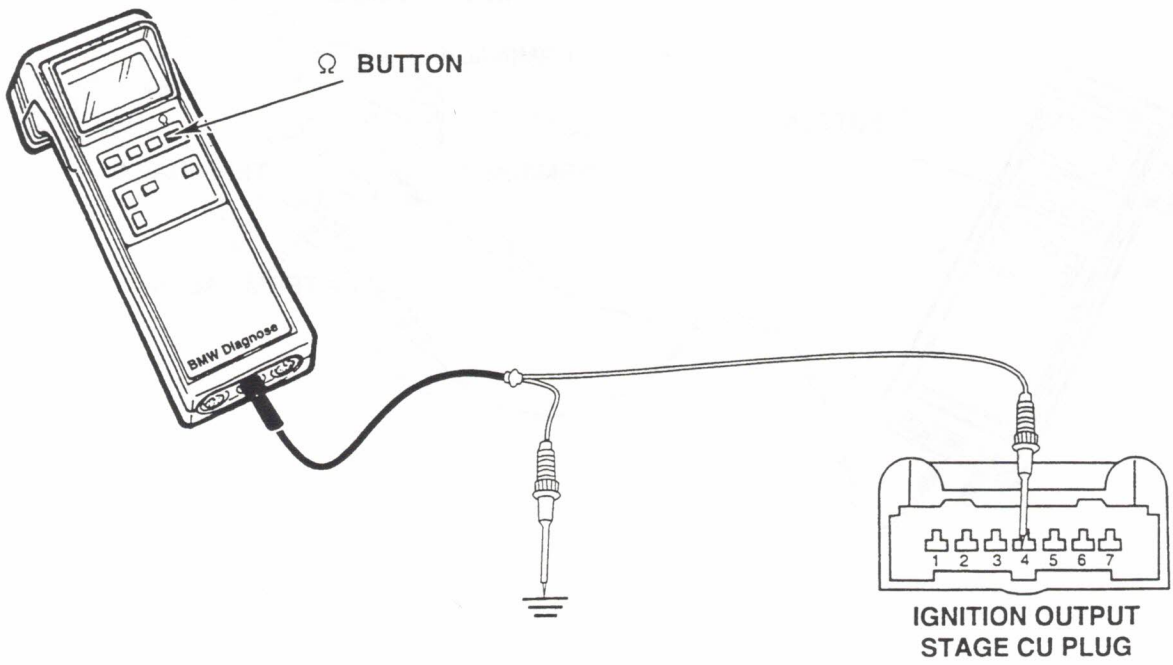
Resistance =

< 0.3Ω



If ground circuit is indicated, go to page 24.

If ground circuit is not indicated, check wire from pin 4 of Ignition Output Stage plug to ground.



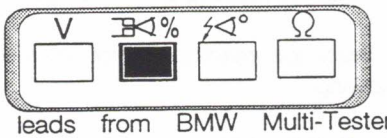
4. Ignition Spark Missing (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Terminal 2 and 7 of Ignition Output Stage CU and battery positive terrminal - sensing ratio %

Test Conditions:

1. Motronic MCU plug connected.
2. Ignition switch to ON position.
3. Ignition coils connected.
3. BMW Multi-Tester %| button pressed.

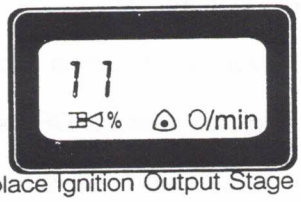


4. Volt/Ohm leads from BMW Multi-Tester connected green to terminal 2 and 7 of Ignition Output Stage CU plug and yellow to positive battery terminal. Actuate starter. Engine does not have to fire at this point.

BMW Multi-Tester Display:

Sensing ratio =

≃11%

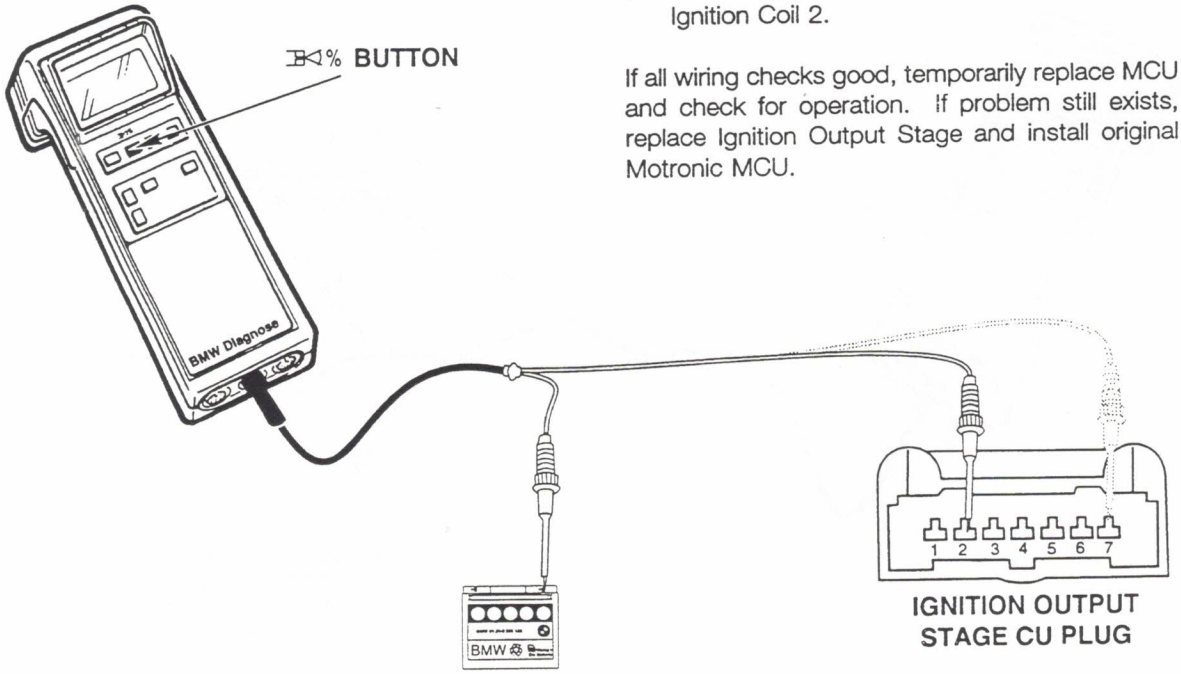


If display is correct, replace Ignition Output Stage CU.

If display is not correct, check the following:

- ✓ Pin 7 of Ignition Output Stage plug to pin 2 of MCU plug.
- ✓ Pin 2 of Ignition Output Stage plug to pin 1 of MCU plug.
- ✓ Pin 1 of Ignition Output Stage plug to pin 1 of Ignition Coil 1.
- ✓ Pin 6 of Ignition Output Stage plug to pin 1 of Ignition Coil 2.

If all wiring checks good, temporarily replace MCU and check for operation. If problem still exists, replace Ignition Output Stage and install original Motronic MCU.



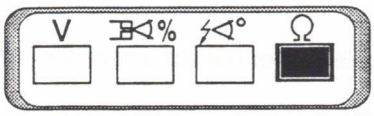
5. Fault Code 1 1 1 1 - CO Potentiometer (Continued on next page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 12 to pin 14 (K Models from 1994 and R1100) or pin 25 to 32 (K Models to 1993) of Motronic MCU plug - resistance

Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. BMW Multi-Tester Ω button pressed.

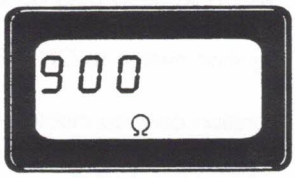


4. Perform zero calibration procedure on the tester.
5. Volt/Ohm leads from BMW Multi-Tester connected green to pin 12 or 25 of MCU plug and yellow pin 14 or 32.

BMW Multi-Tester Display:

Resistance =

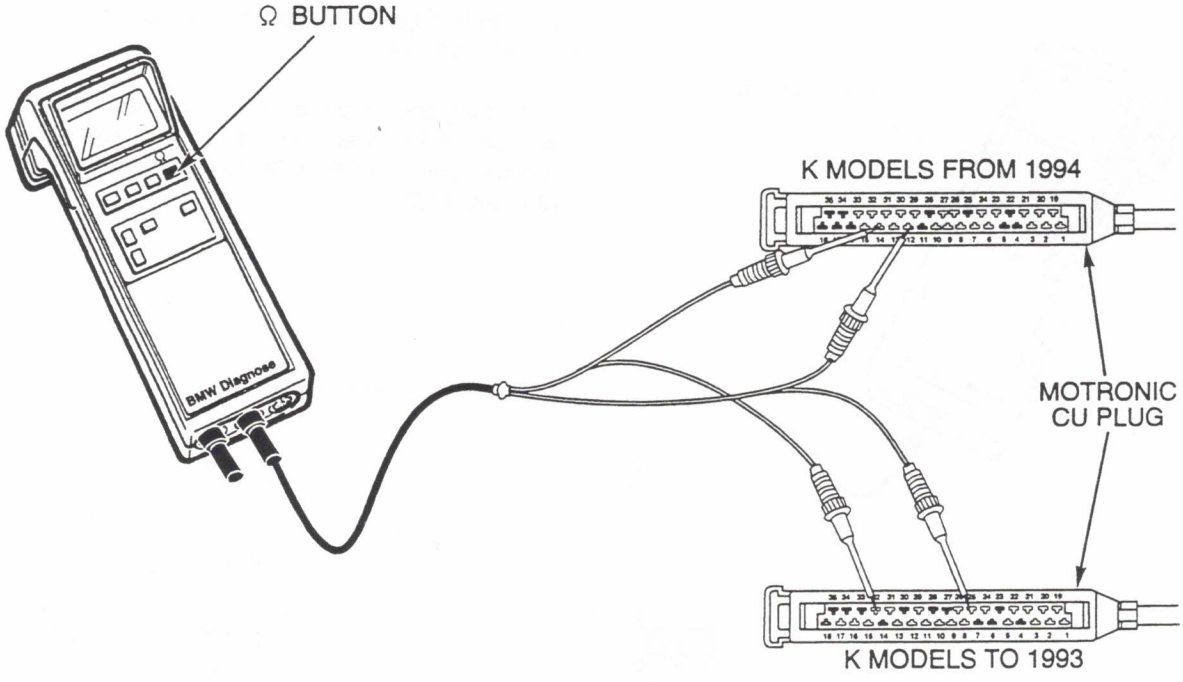
900 to 1100Ω



If resistance reading is correct, go to page 26.

If resistance reading is not correct, check the following:

✓ Pin 12 or 25 of MCU plug to pin 3 of CO Potentiometer plug.



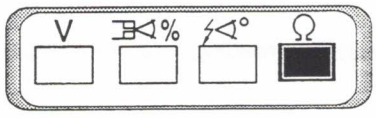
5. Fault Code 1 1 1 1 CO Potentiometer (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 12 (K Models from 1994 and R1100) or pin 25 (K Models to 1993) of Motronic MCU plug to pin 28 - resistance

Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. BMW Multi-Tester Ω button pressed.

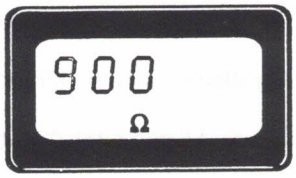


4. Perform zero calibration procedure on the tester.
5. Volt/Ohm leads from BMW Multi-Tester connected green to pin 12 or 25 of MCU plug and yellow pin 28.

BMW Multi-Tester Display:

Resistance =

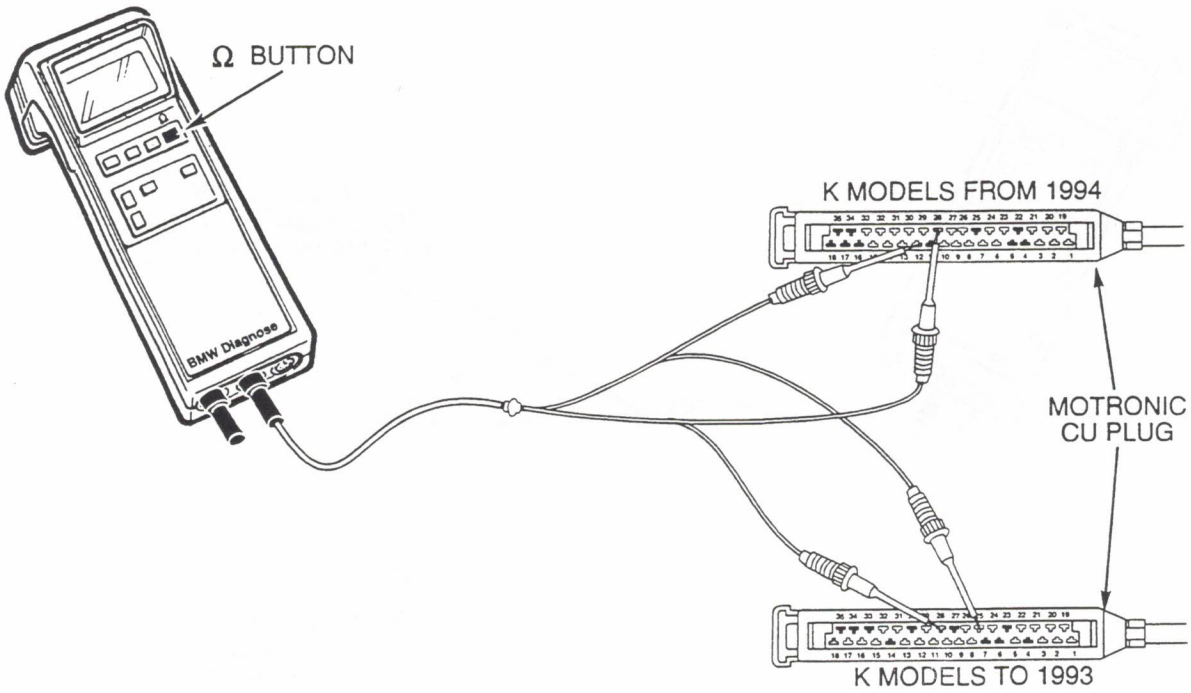
0 to 1100Ω



If resistance reading is correct, go to page 27.

If resistance reading is not correct, check the following:

✓ Pin 28 of MCU plug to pin 2 of CO Potentiometer plug.



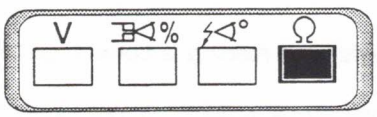
5. Fault Code 1 1 1 1 CO Potentiometer (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 14 (K Models from 1994 and R1100) or pin 32 (K Models to 1993) of Motronic MCU plug to pin 28 - resistance

Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. BMW Multi-Tester Ω button pressed.

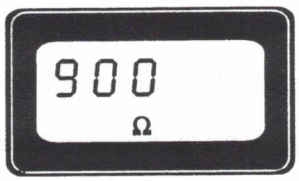


4. Perform zero calibration procedure on the tester.
5. Volt/Ohm leads from BMW Multi-Tester connected green to pin 14 or 32 of MCU plug and yellow pin 28.

BMW Multi-Tester Display:

Resistance =

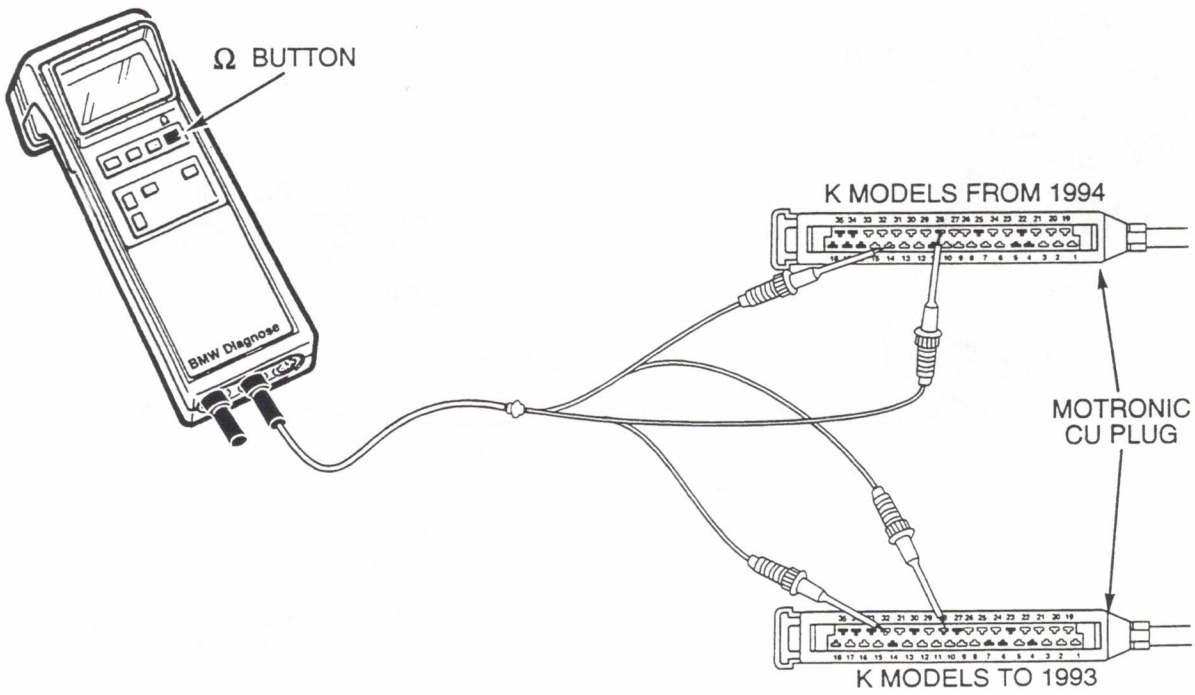
0 to 1100Ω



If resistance reading is correct, replace Motronic MCU.

If resistance reading is not correct, check the following:

✓ Pin 14 or 32 of MCU plug to pin 1 of CO Potentiometer plug.



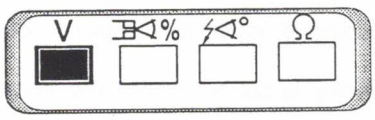
6. Fault Codes 1 1 2 2 and 1 1 3 3 Hall Signal Missing (Continued on next page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 3 of Hall Sensor plug to pin 4 (R Model) or pin 29 to pin 5 of Hall sensor Plug (K Model) - voltage

Test Conditions:

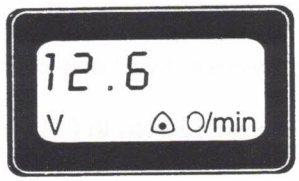
1. Motronic MCU plug connected.
2. Ignition switch to ON position.
3. Hall Sensor plug connected.
4. BMW Multi-Tester V button pressed.



5. Volt/Ohm leads from BMW Multi-Tester connected yellow to pin 4 (R Model, red wire) or pin 29 (K Model, red wire) of Hall Sensor plug and green to pin 3 (R Model, brown wire) or pin 5 (K Model, black wire).

BMW Multi-Tester Display:

Voltage reading should be same as battery voltage.



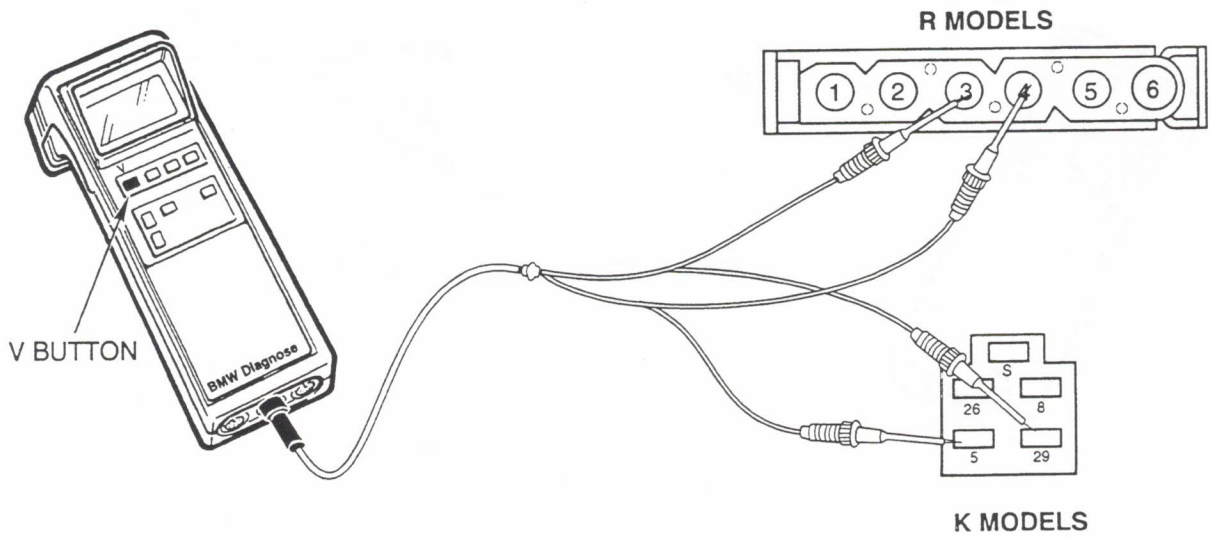
If voltage reading is correct, go to page 29.

If voltage reading is not correct, check the following:

✓ Red wire of Hall Sensor plug to MCU plug.

✓ Brown wire (R1100 Model) or black wire (K Model) of Hall Sensor plug to MCU plug.

If wires are good, check power supply and ground to MCU, perform Test 1. If power supply and ground is good, replace Motronic MCU.



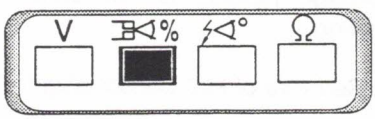
6. Fault Codes 1 1 2 2 and 1 1 3 3 - Hall Signal Missing (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 5 and pin 2 (R Model) or pin 8 and pin 26 (K Model) of Hall Sensor plug to ground - pulse duty %

Test Conditions:

1. Motronic MCU plug connected.
2. Ignition switch to ON position.
3. Hall Sensor plug connected.
4. BMW Multi-Tester %| button pressed.

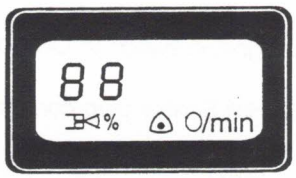


5. Volt/Ohm leads from BMW Multi-Tester green to frame ground and yellow to pin 5 (R Model) or pin 8 (K Model); green to frame ground and yellow to pin 2 (R Model) or pin 26 (K Model); green to frame ground.
6. Operate starter, engine should not start at this point. Check reading.

BMW Multi-Tester Display:

Pulse duty =

≈ 88%

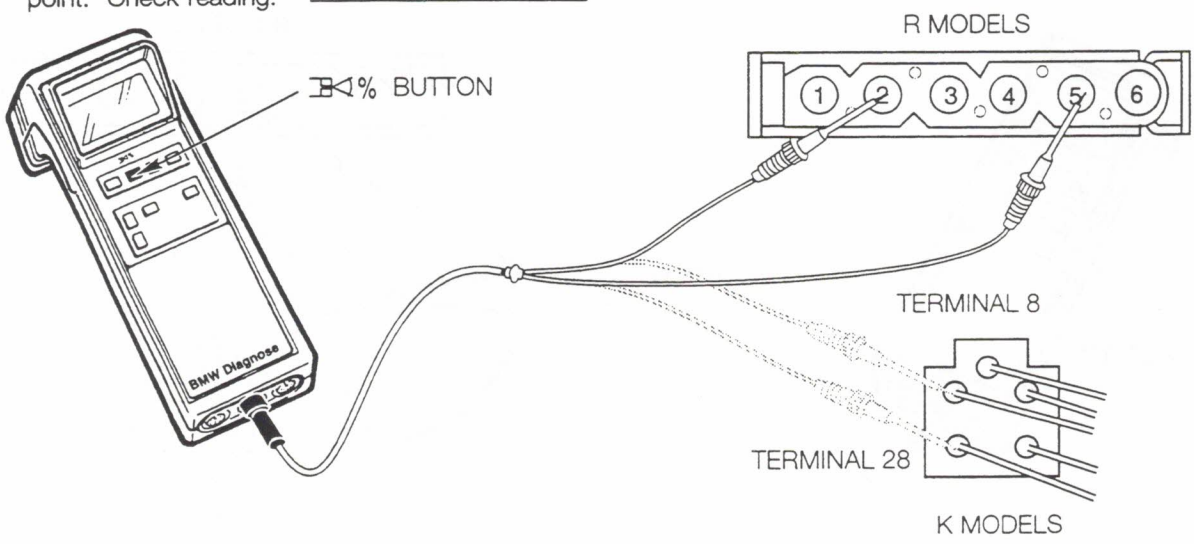


If reading is not correct, replace Hall Sensor.

If reading is correct, check the following:

- ✓ Plug connections to Hall Sensor and MCU and harness for corrosion.
- ✓ Wires from Hall Sensor plug to MCU plug for continuity.

If wiring is good, check power supply and ground to MCU, perform Test 1. If power supply and ground are good, replace MCU.



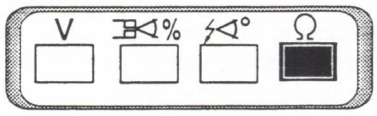
7. Fault Code 1 2 2 3 - Engine Temperature Sensor

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 7 of Motronic MCU plug to pin 14 (K Models from 1994 and R1100) ; pin 21 to pin 32 (K Models to 1993) - resistance

Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. BMW Multi-Tester Ω button pressed.

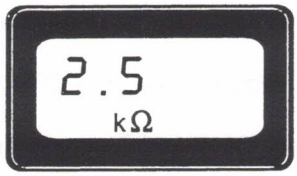


4. Perform zero calibration procedure on the tester.
5. Volt/Ohm leads from BMW Multi-Tester yellow to pin 7 or 21 of Motronic MCU plug, green to pin 14 or 32.

BMW Multi-Tester Display:

Resistance =

≈ 2.5KΩ @ 20°C

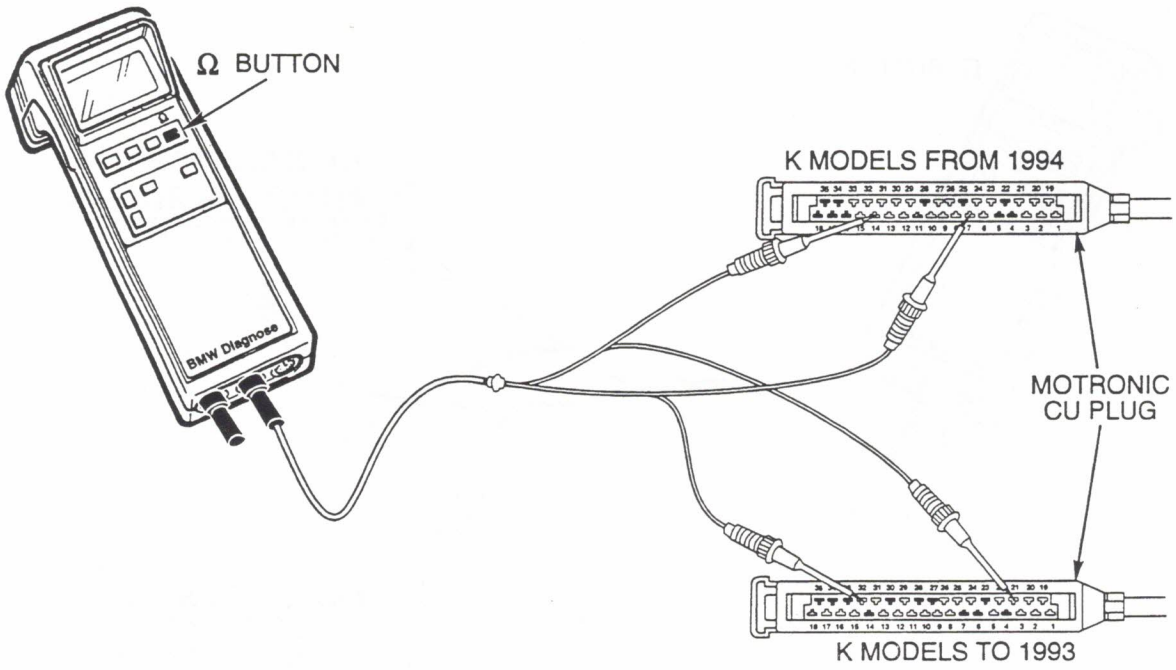


If reading is correct, clear fault code, test drive motorcycle and check for fault code. If fault code is displayed, replace MCU

If reading is not correct, check the following:

✓ Wires from Water/Oil Temperature Sensor to MCU plug for opens or shorts to ground.

If wiring is good, replace Water/Oil Temperature Sensor.



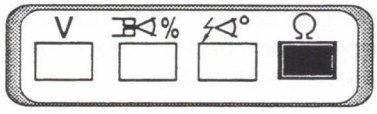
8. Fault Code 1 2 2 4 - Air Temperature Sensor

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 24 of Motronic MCU plug to pin 14 (K Models from 1994 and R1100; pin 22 to pin 32 (K Models to 1993) - resistance

Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. BMW Multi-Tester Ω button pressed.

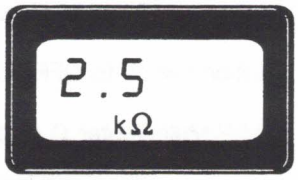


4. Perform zero calibration procedure on the tester.
5. Volt/Ohm leads from BMW Multi-Tester yellow to pin 24 or 22 of Motronic MCU plug, green to pin 14 or 32.

BMW Multi-Tester Display:

Resistance =

≈ 2.5KΩ @ 20°C

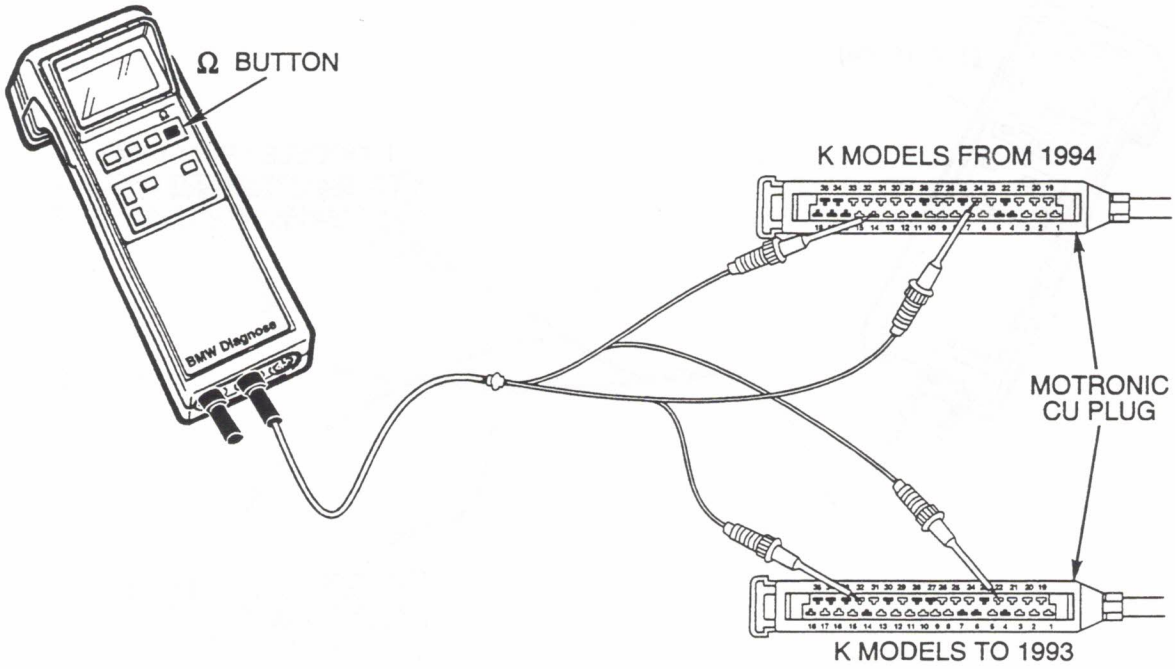


If reading is correct, clear fault code, test drive motorcycle and check for fault code. If fault code is displayed, replace MCU

If reading is not correct, check the following:

✓ Wires from Air Temperature Sensor to MCU plug for opens or shorts to ground.

If wiring is good, replace Air Temperature Sensor.



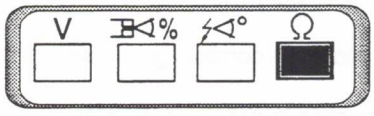
9. Fault Code 1 2 1 5 - Throttle Potentiometer (Continued on next page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 31 of Motronic MCU plug to pin 12 (K Models from 1994 and R1100); pin 31 to pin 25 (K Models to 1993) - resistance

Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. BMW Multi-Tester Ω button pressed.

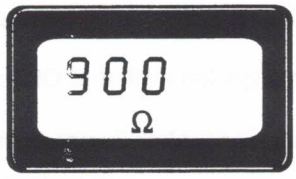


4. Perform zero calibration procedure on the tester.
5. Volt/Ohm leads from BMW Multi-Tester yellow to pin 31 of MCU plug, green to pin 12 or 25.

BMW Multi-Tester Display:

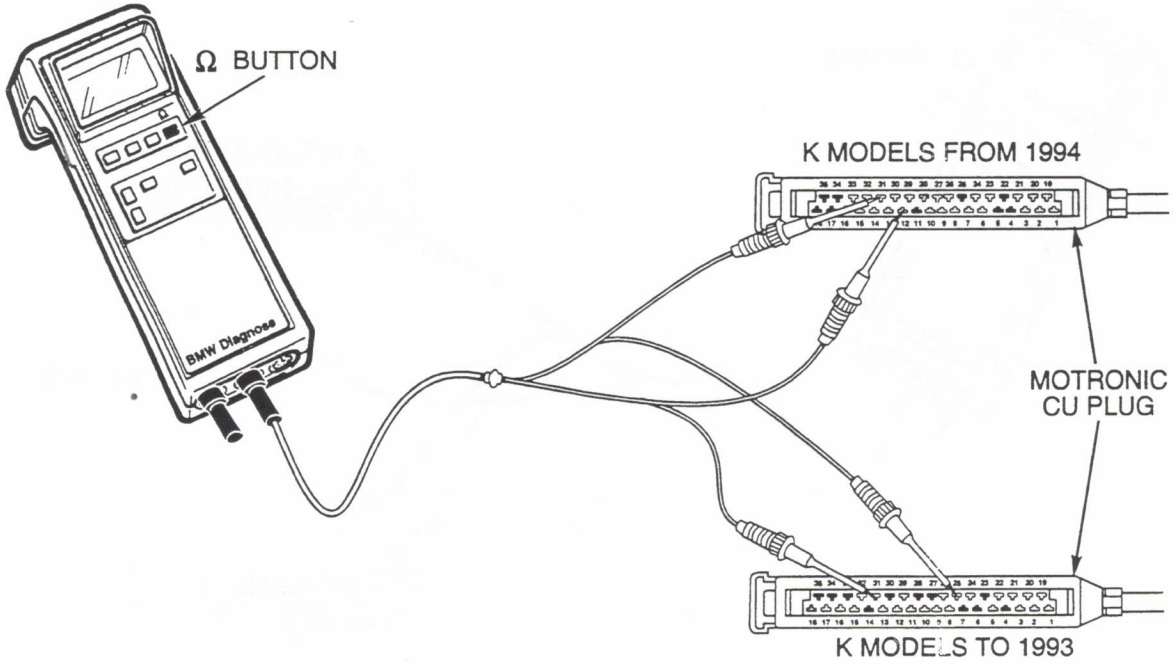
Resistance =

500 to 1000 Ω



If reading is correct, go to page 33.
If reading is not correct, check the following:

- ✓ Wire from pin 31 of MCU plug to pin 4 of Throttle Potentiometer plug.
- ✓ Wire from pin 12 or 25 of MCU plug to pin 2 of Throttle Potentiometer plug.
- ✓ Check and if necessary, adjust throttle potentiometer as directed on page 43.



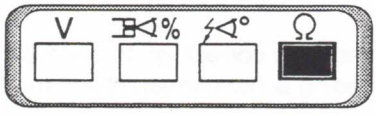
9. Fault Code 1 2 1 5 - Throttle Potentiometer (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 31 of Motronic MCU plug to pin 9 (K Models from 1994 and R1100); pin 31 to pin 13 (K Models to 1993) - resistance

Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. BMW Multi-Tester Ω button pressed.



4. Volt/Ohm leads from BMW Multi-Tester yellow to pin 31 of MCU plug, green to pin 9 or 13. Take reading at both idle and full throttle positions of the Throttle Potentiometer.

BMW Multi-Tester Display:

Resistance =

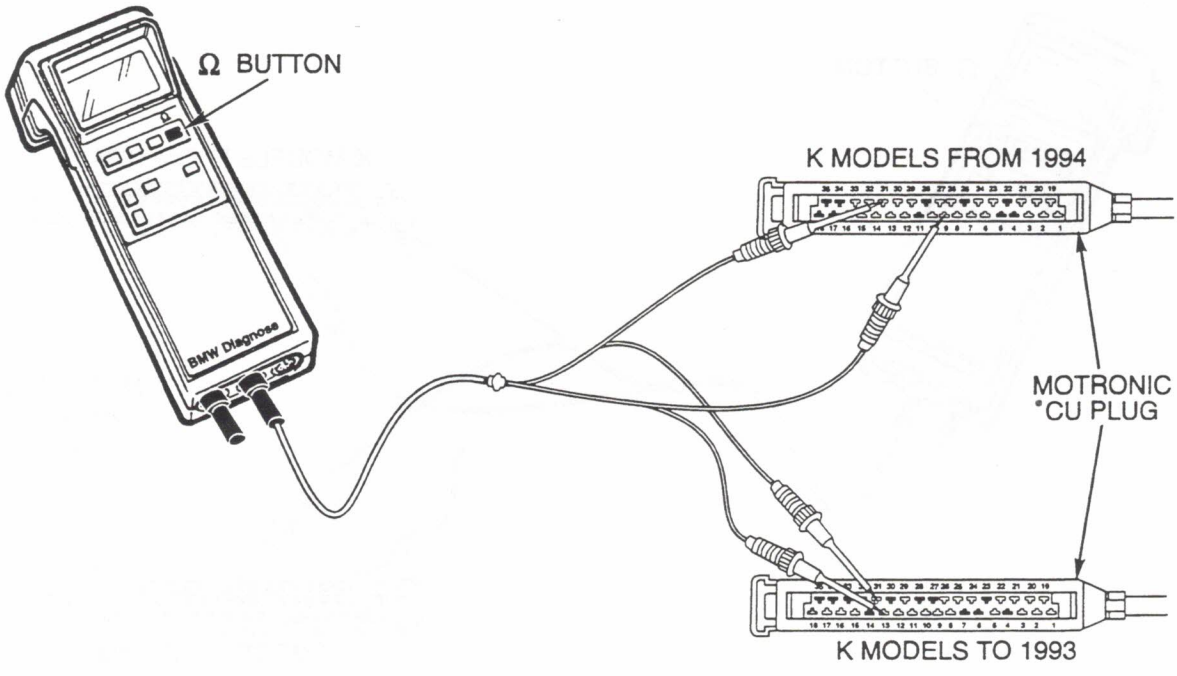
600 to 2400Ω @ idle

≈1.72KΩ
@ full throttle

If reading is correct, go to page 34.

If reading is not correct, check the following:

✓ Wire from pin 9 or 13 of MCU plug to pin 1 of Throttle Potentiometer plug.



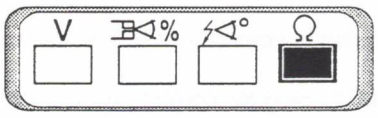
9. Fault Code 1 2 1 5 - Throttle Potentiometer (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 31 of Motronic MCU plug to pin 8 (K Models from 1994 and R11000); pin 31 to pin 10 (K Models to 1993) - resistance

Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. BMW Multi-Tester Ω button pressed.



4. Volt/Ohm leads from BMW Multi-Tester yellow to pin 31 of MCU plug, green to pin 8 or 10. Take readings at both idle and full throttle position of the Throttle Potentiometer

BMW Multi-Tester Display:

Resistance =

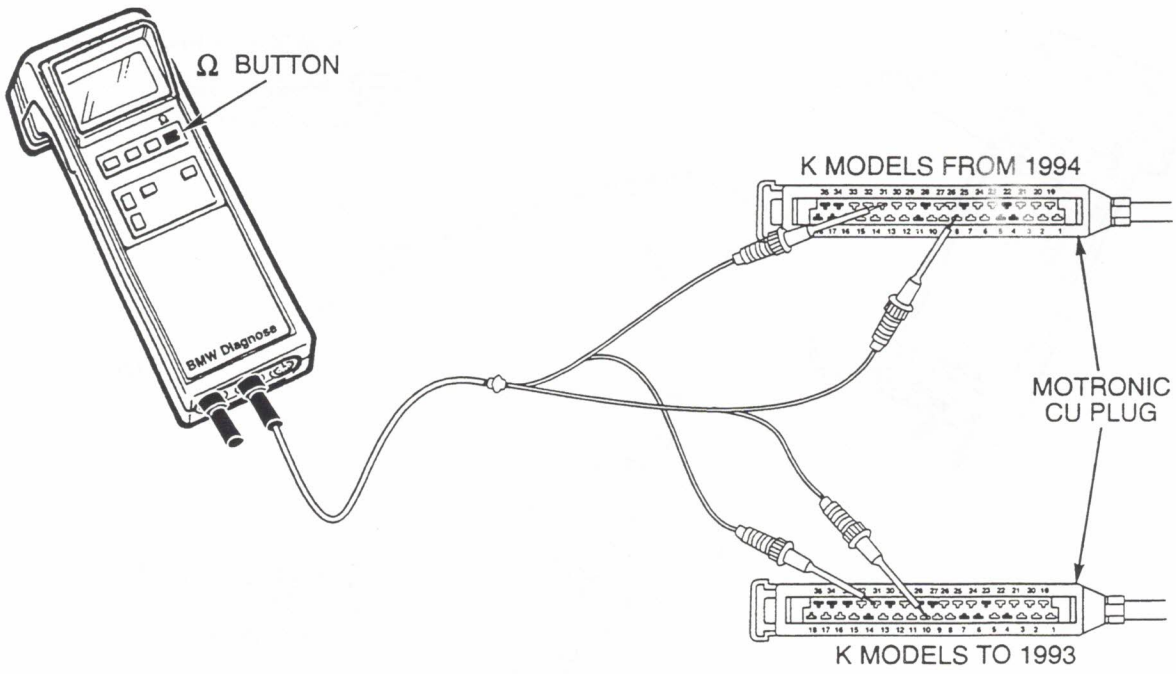
600 to 2400Ω @ idle
≈2.03KΩ @ full throttle

If reading is correct, clear fault code, test drive motorcycle and check for fault code. If fault code is indicated, replace MCU.

If reading is not correct, check the following:

✓ Wire from pin 8 or 10 of MCU plug to pin 3 of Throttle Potentiometer plug.

If wiring is good, replace Throttle Potentiometer.



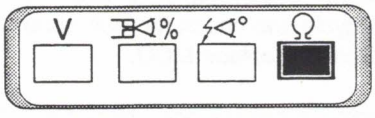
10. Fault Code 2 3 4 2 - O_2 Signal Un-realistic

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 30 (K Models from 1994 and R1100) or pin 24 (K Models to 1993) of Motronic MCU plug to pin 2 of O_2 Sensor harness plug - continuity

Test Conditions:

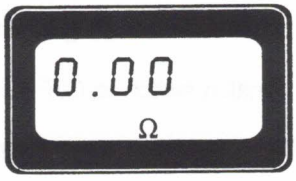
1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. O_2 Sensor plug disconnected.
4. BMW Multi-Tester Ω button pressed.



5. Perform zero calibration procedure on the tester.
6. Volt/Ohm leads from BMW Multi-Tester yellow to pin 30 or pin 24 of MCU plug, green to pin 2 of O_2 Sensor harness plug.

BMW Multi-Tester Display:

Continuity

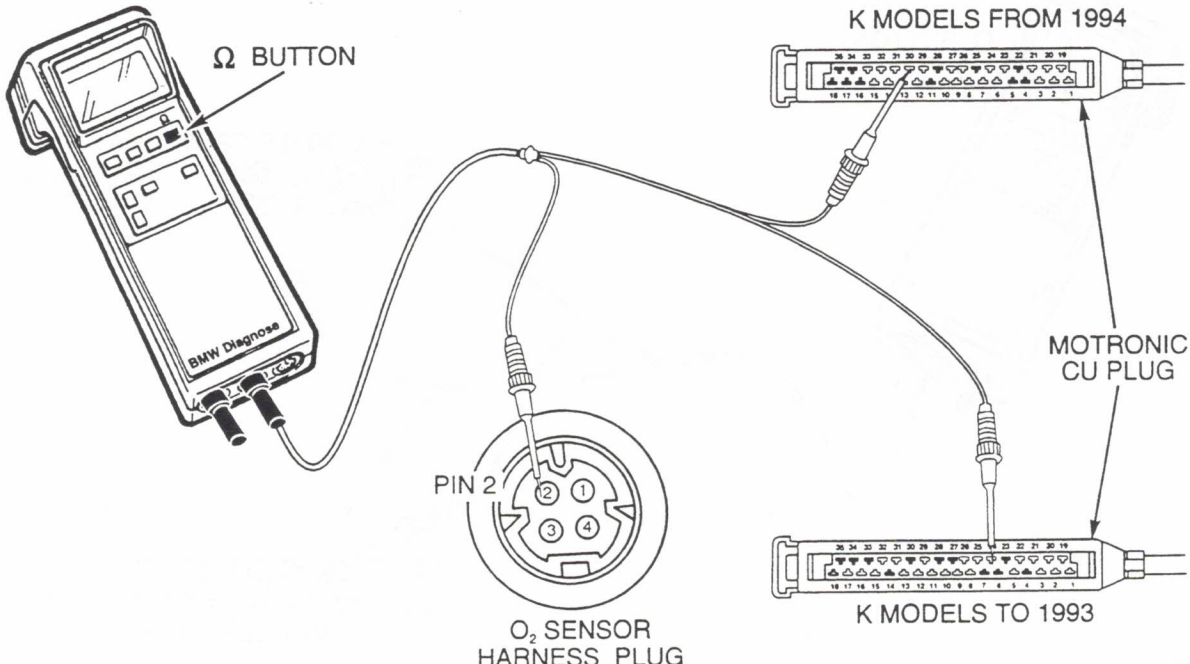


If reading is correct, check the following:

✓ MCU plug for correct seating and contact.

✓ O_2 Sensor plug for correct seating and contact.

If wiring and plug seating and contact are good, replace O_2 Sensor.



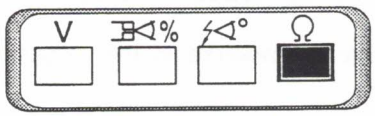
11. Fault Code 2 3 4 4 - Short to (-), O_2 Sensor Signal

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 30 (K Models from 1994 and R1100) or pin 24 (K Models to 1993) of Motronic MCU plug to ground - open circuit

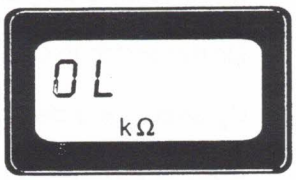
Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. O_2 Sensor plug connected.
4. BMW Multi-Tester Ω button pressed.



5. Perform zero calibration procedure on the tester.
6. Volt/Ohm leads from BMW Multi-Tester yellow to pin 30 or pin 24 of MCU plug, green to frame ground.

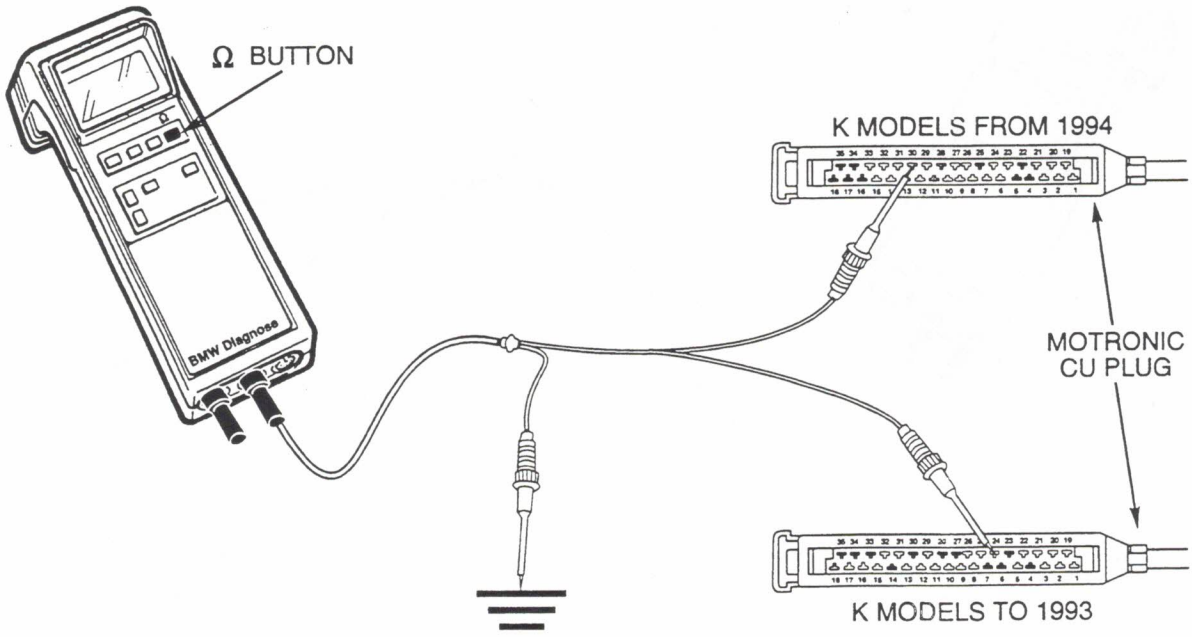
BMW Multi-Tester Display:



If reading is correct, check the following:

- ✓ Wire from pin 30 or 24 of MCU plug to pin 2 of O_2 Sensor plug.
- ✓ Wire at O_2 Sensor plug for proper contacts.
- ✓ Intake air system for leaks.

If intake air system and wiring are good, replace O_2 Sensor.



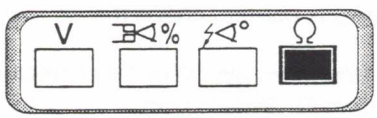
11. Fault Code 2 3 4 5 - Short to (+), O_2 Sensor Signal (Continued on next page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 2 to pin 4 of O_2 Sensor plug - Infinity

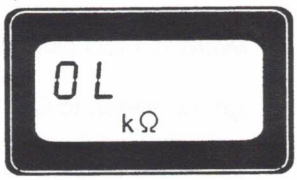
Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch to OFF position.
3. O_2 Sensor plug disconnected.
4. BMW Multi-Tester Ω button pressed.



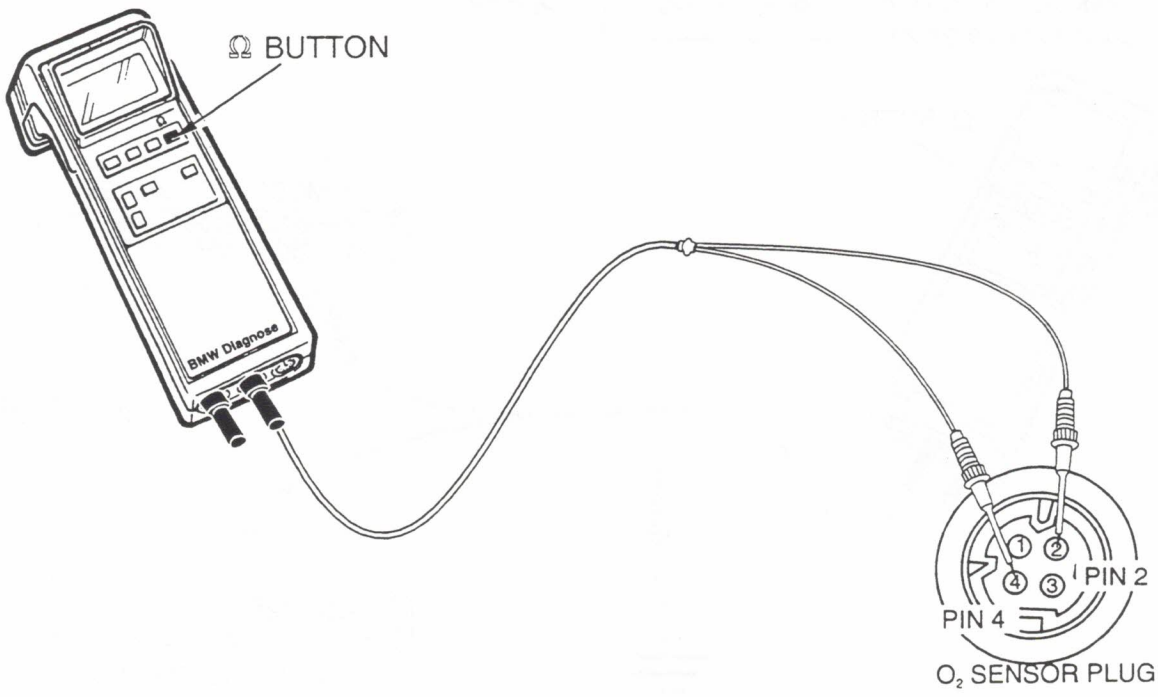
5. Perform zero calibration procedure on the tester.
6. Volt/Ohm leads from BMW Multi-Tester yellow to pin 4 and green to pin 2 of O_2 Sensor plug.

BMW Multi-Tester Display:



If reading is correct, go to page 38. If reading is not correct, replace O_2 Sensor.

Check for moisture in the oxygen sensor plug area.



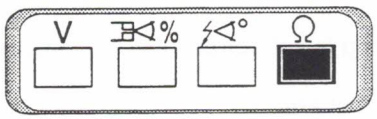
11. Fault Code 2 3 4 5 - Short to (+), O_2 Sensor Signal (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Pin 2 of O_2 Sensor harness plug to ground - resistance

Test Conditions:

1. Motronic MCU plug connected.
2. Ignition switch to OFF position.
3. O_2 Sensor plug disconnected.
4. BMW Multi-Tester Ω button pressed.

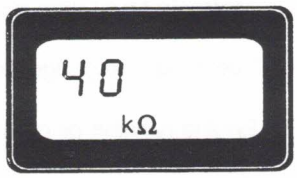


5. Perform zero calibration procedure on the tester.
6. Volt/Ohm leads from BMW Multi-Tester yellow to pin 2 of O_2 Sensor plug, harness side, green to frame ground.

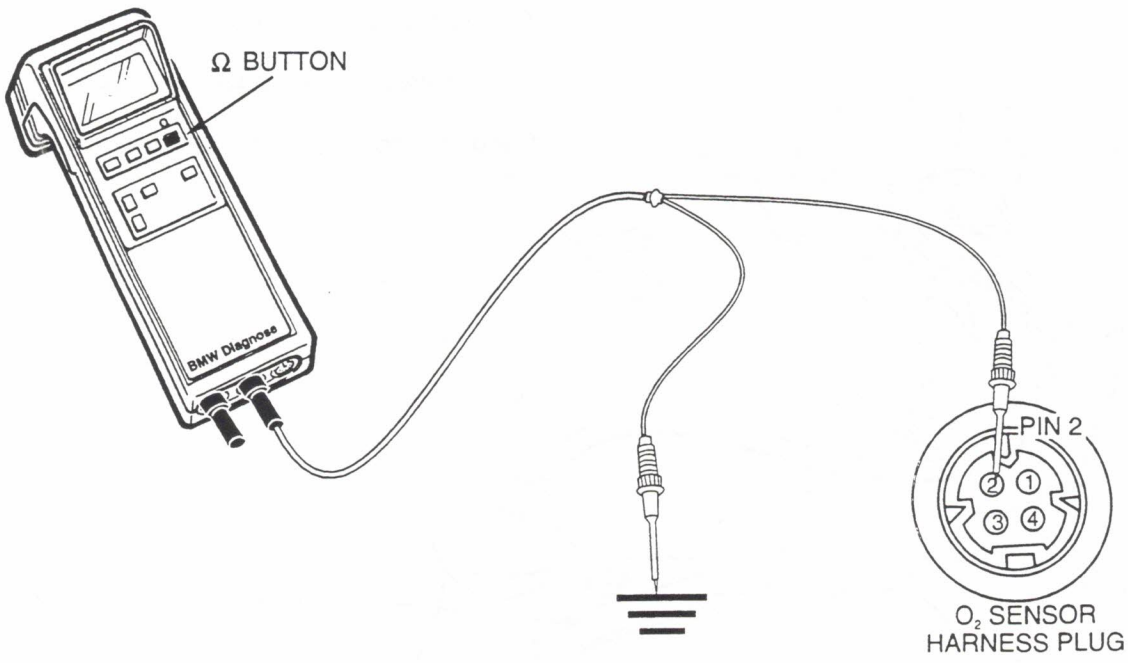
BMW Multi-Tester Display:

Resistance =

>40kΩ



If reading is not correct, check wiring harness for damage.



12. Fault Codes 2 3 4 1 and 2 3 4 3 - O_2 Sensor Control Limit Reached - Mixture Adjustment Limit Ranched

Test Equipment: Fuel pressure gauge

Tested Pins: None

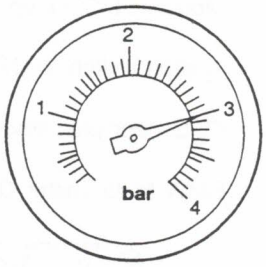
Test Conditions:

1. Motronic MCU plug connected.
2. Fuel pressure gauge connected to fuel rail.
3. Engine running or cranking.
4. Operate engine and check fuel pressure at idle.

BMW Pressure Gauge Display:

K Models =
2.5 ± .05 bar

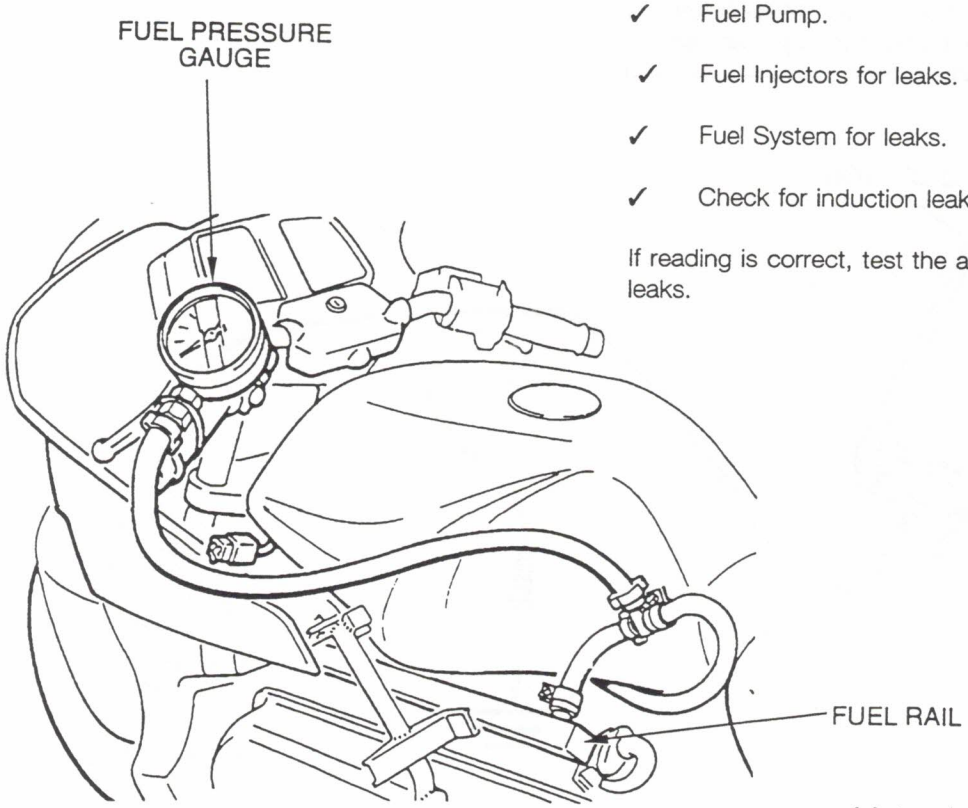
R1100 =
3.0 ± .05 bar



If reading is not correct, check the following:

- ✓ Fuel Filter
- ✓ Fuel Pressure Regulator.
- ✓ Fuel Pump.
- ✓ Fuel Injectors for leaks.
- ✓ Fuel System for leaks.
- ✓ Check for induction leaks (air leaks).

If reading is correct, test the air intake system for leaks.



13. Engine Coolant Fan Does Not Operate - K Models Only (Continued on next page)

Test Equipment: BMW Motorcycle Electrical System Analyzer and one jumper wire

Tested Pins: Pin 2 (K Models from 1994) or pin 16 (K Models to 1993) of Motronic MCU plug to ground

Test Conditions:

1. Motronic MCU plug disconnected.
2. Ignition switch in ON position.
3. Electrical System Analyzer inductive AMP pickup connected to battery + terminal. Voltage wires from this tester conected to battery + and frame ground.
4. Jump pin 2 (K Models from 1994 or pin 16 (K Models to 1993) of the MCU plug to ground.
5. Check that coolant fan runs. With ignition switch ON, check that ampmeter reads as follows:
   - ≈ 8.8 amps with key on
   - ≈ 16.0 with key on and start up of fan
   - ≈ 12.8 with key on and fan operating

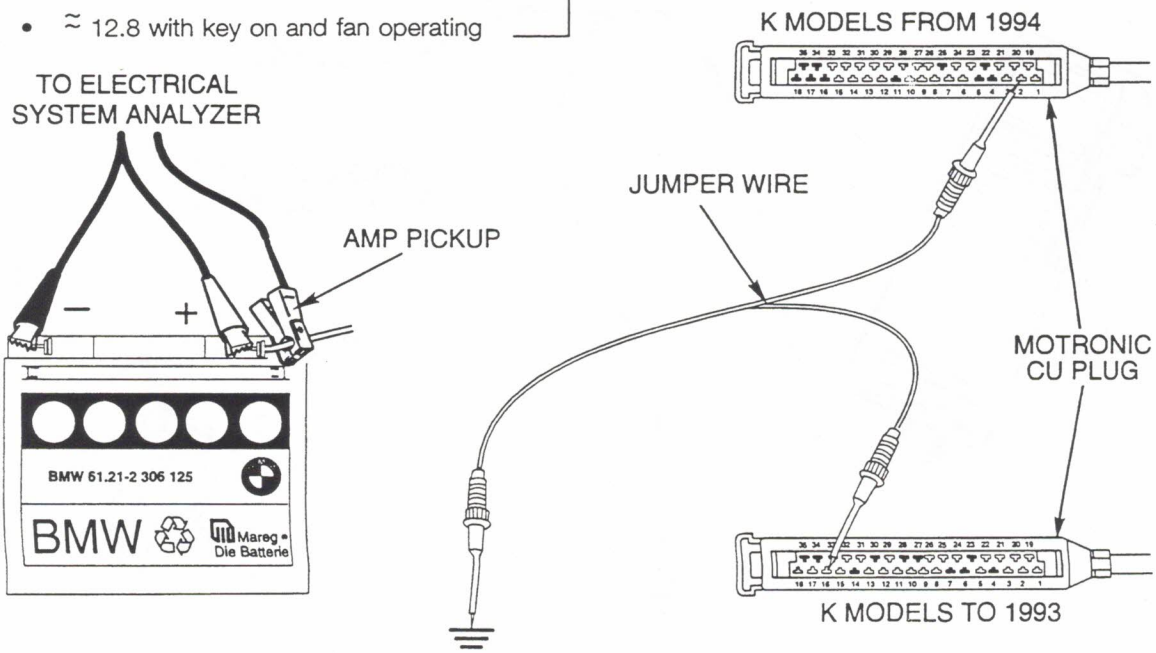
BMW Multi-Tester Display

If fan does not operate, go to page 41.

If fan operates in this test but not durning "Erasing Fault Code", replace Motronic Control Unit.

If fan runs, and current is greater than 10 amps, replace fan motor.

NOTE: Normal fan current draw is 4 to 6 amps.



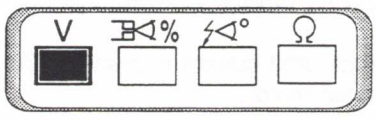
13. Engine Coolant Fan Does Not Operate - K Models Only (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Terminal 86 and 30 of Coolant Fan Relay and ground - battery voltage

Test Conditions:

1. Motronic MCU plug connected.
2. Ignition switch in ON position.
3. Coolant Fan Relay removed.
4. BMW Multi-Tester V button pressed.



5. Volt/Ohm leads from BMW Multi-Tester yellow to terminal 86 and 30 of Coolant Fan Relay socket; green lead to frame ground.

BMW Multi-Tester Display

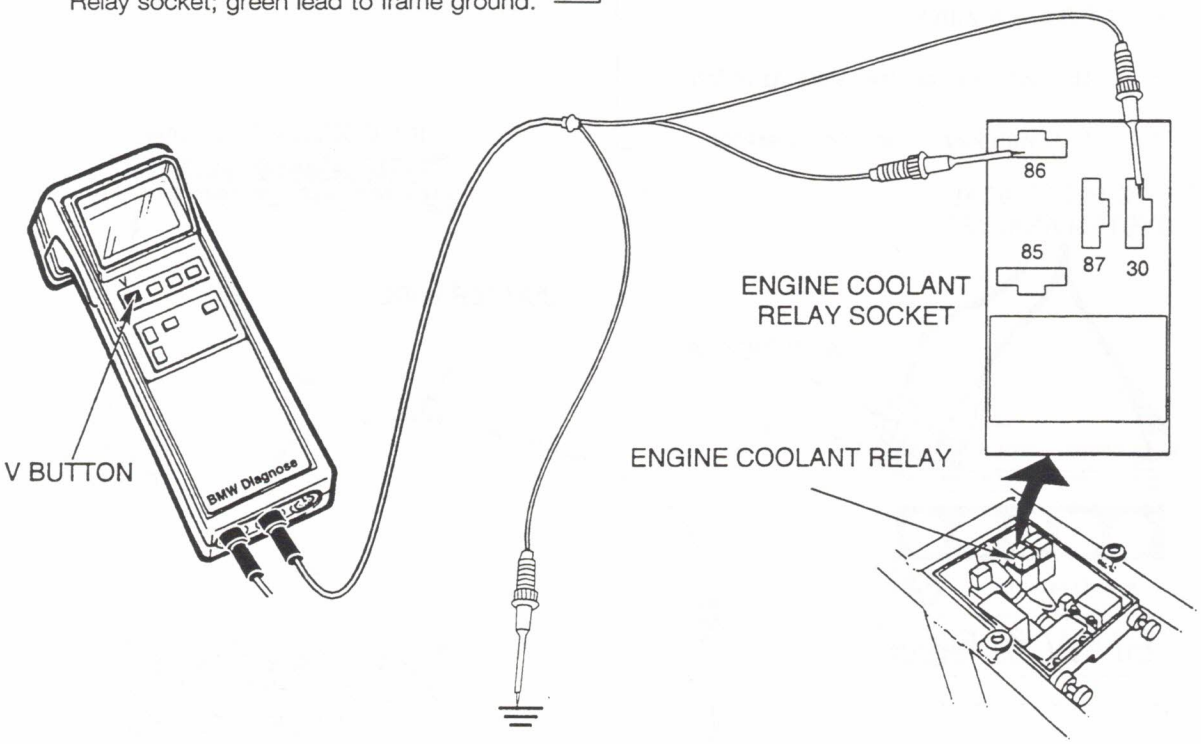
Voltage reading should be same as battery voltage.

If reading is correct, go to page 42.

If reading is not correct, check the following:

✓ Fuse 7.

✓ Wires from terminals 86 and 30 of Coolant Fan Relay to fuse 7.



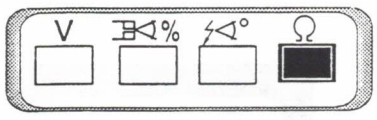
13. Engine Coolant Fan Does Not Operate - K Models Only (Continued from previous page)

Test Equipment: BMW Multi-Tester and Volt / Ohm Leads and Adapters

Tested Pins: Terminal 87 of Coolant Fan Relay socket to ground - resistance

Test Conditions:

1. Motronic MCU plug connected.
2. Ignition switch in OFF position.
3. Coolant Fan Relay removed.
4. BMW Multi-Tester Ω button pressed.

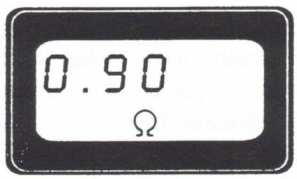


5. Perform zero calibration procedure on the tester.
6. Volt/Ohm leads from BMW Multi-Tester yellow to terminal 87 of Coolant Fan Relay socket, green to frame ground.

BMW Multi-Tester Display

Resistance =

≃0.90Ω



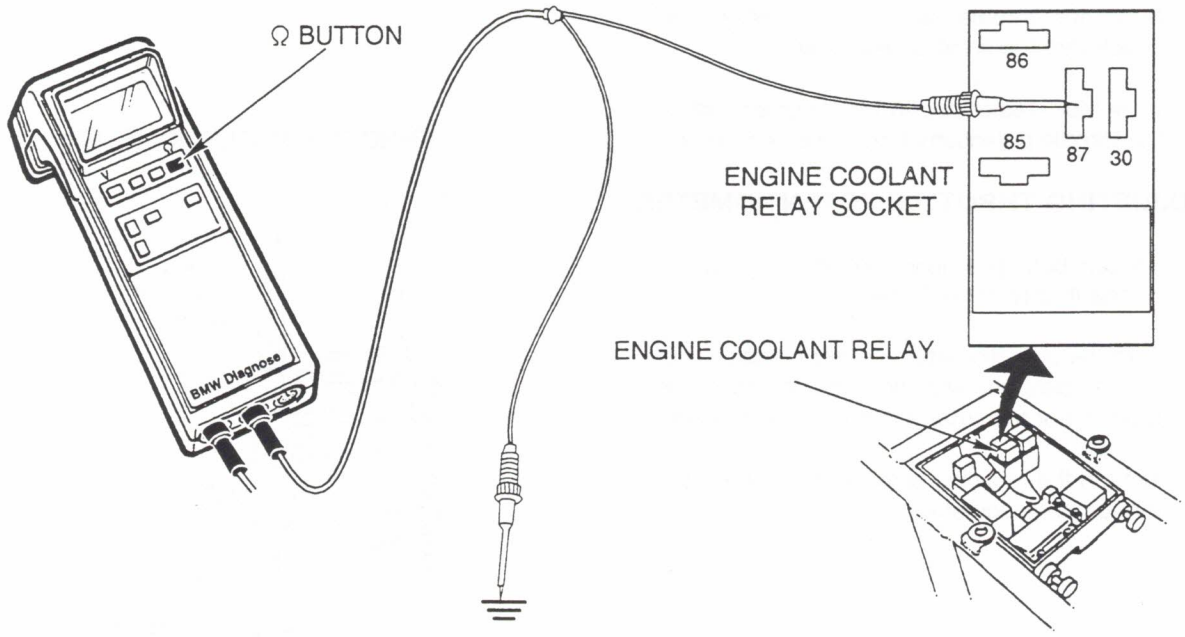
If reading is correct, replace Coolant Fan Relay.

If reading is not correct, check the following:

✓ Wire from terminal 87 of Coolant Fan Relay socket to Coolant Fan Motor plug.

✓ Wire from Coolant Fan Motor plug to ground.

If wires are good, replace Coolant Fan Motor.



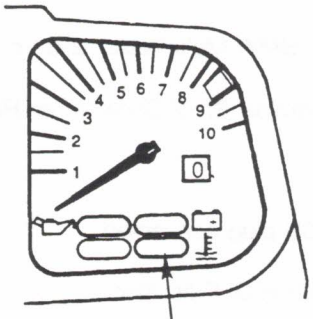
CHECKING AND ADJUSTING THROTTLE POTENTIOMETER

CHECKING THROTTLE POTENTIOMETER - K MODELS

1. Connect the BMW Multi-Tester and KTE-201 as directed on page Motronic Diagnosis - 4.

2. Press the Stimulation Switch on the KTE-201 to the resistance position. Turn the ignition switch to ON.

3. Check the temperature warning light in the instrument cluster. If the light does not come on, adjust the throttle potentiometer as directed below.



TEMPERATURE WARINING LIGHT

CHECKING THROTTLE POTENTIOMETER - R MODELS

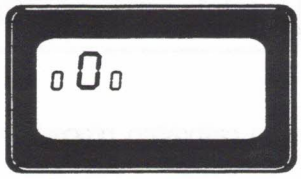
1. Connect the BMW Multi-Tester and KTE-201 as directed on page Motronic Diagnosis - 4.

2. Set the System Select Switch on the KTE-201 to position 2. Press the Stimulation Switch to the resistance position. Turn the ignition switch to ON.

3. Check that the Multi-Tester display is as shown with the small o blinking.

4. Move the throttle off the idle position and check that the small o disappear.

5. If the Multi-Tester display is not correct, adjust the throttle potentiometer as directed below.



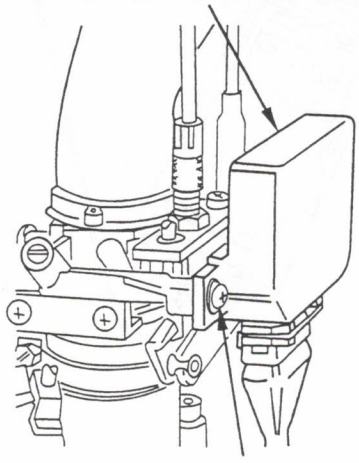
ADJUSTING THROTTLE POTENTIOMETER

1. Loosen both potentiometer retaining screws on the throttle butterfly rail.

2. Turn the potentiometer in either direction until the temperature warning light comes on (K Models) or the small o is blinking (R Models).

3. Tighten the retaining screws and recheck the throttle potentiometer.

THROTTLE POTENTIOMETER



RETAINING SCREW

MOTRONIC CONTROL SYSTEM

TEST DRIVE

1. Turn ignition switch OFF and then ON.

2. Operate motorcycle through all conditions from idle to normal operating conditions. road test for 14 to 16 miles.

3. Operate motorcycle until operating temperature is reached. On K Models, check that coolant fan comes on.

4. Stop motorcycle and turn ignition switch to OFF position. Perform "Accessing Fault Codes, page Motronic Diagnosis - 4.

5. Perform procedures necessary to clear all fault codes.