

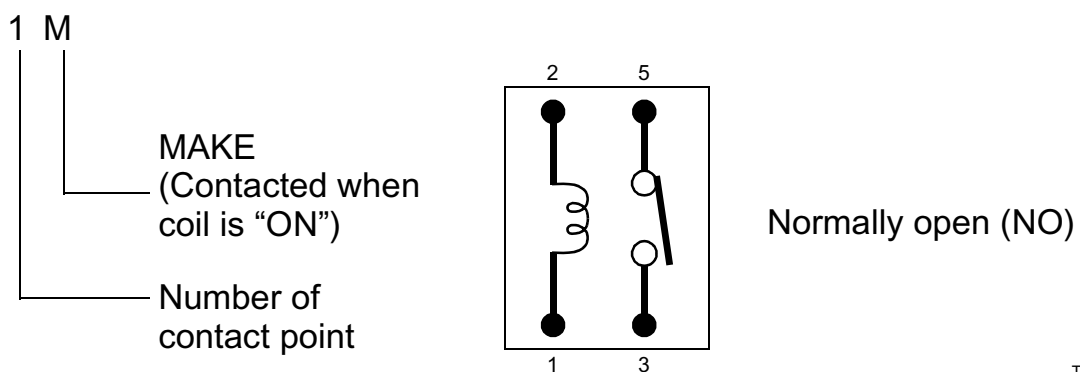
## Relay

### 1. The roles of relays

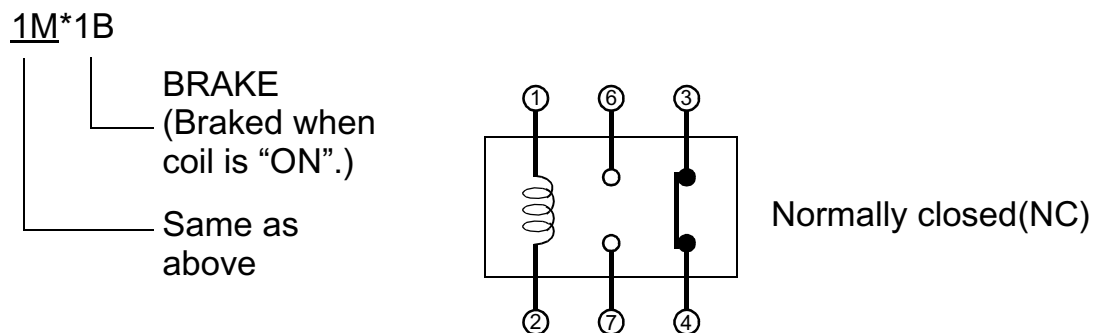
#### 1-1. The roles of relays are as follows.

- A large electric circuit that protects a switch, an electric wire, and electrical systems which use a moderate amount of the electronic current.
- Simplification for the electric wiring for a large electric circuit.
- Automation for operation of electrical systems.
- Remote operation for each system.

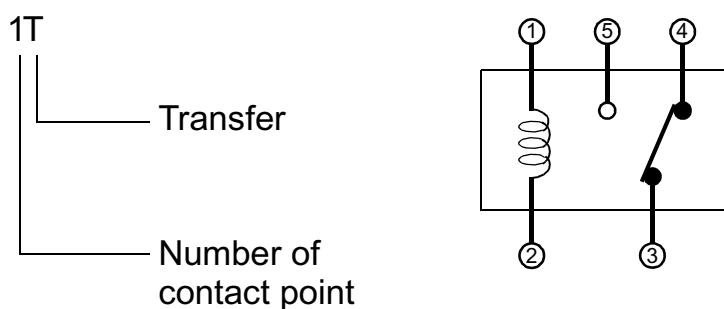
#### 1-2. Various kinds of Relays and terminal Symbols



TGI013



TGI014

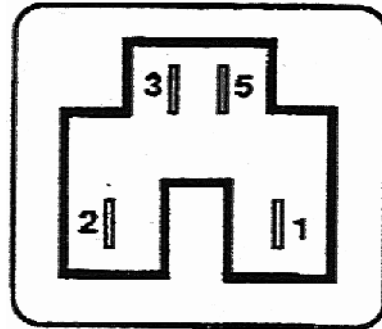


TGI015



On the top of the relay is a small diagram that shows the terminal numbers for both the coil control circuit and the contact point circuit.

TGI016



On the bottom side of the relay, next each electrical terminal, is the terminal number.

TGI017

For example, an IM relay (one-make relay) with wire terminals #1 and #2, and a low current magnetic coil: COIL CONTROL CIRCUIT.

This high current CONTACT POINT CIRCUIT operates the circuit LOAD.

The following indicates kinds of relay used for the Nissan's vehicles.

| Type  | Outer view | Circuit | Connector symbol and connection | Case color |
|-------|------------|---------|---------------------------------|------------|
| 1T    |            |         |                                 | BLACK      |
| 2M    |            |         |                                 | BROWN      |
| 1M-1B |            |         |                                 | GRAY       |
| 1M    |            |         |                                 | BLUE       |

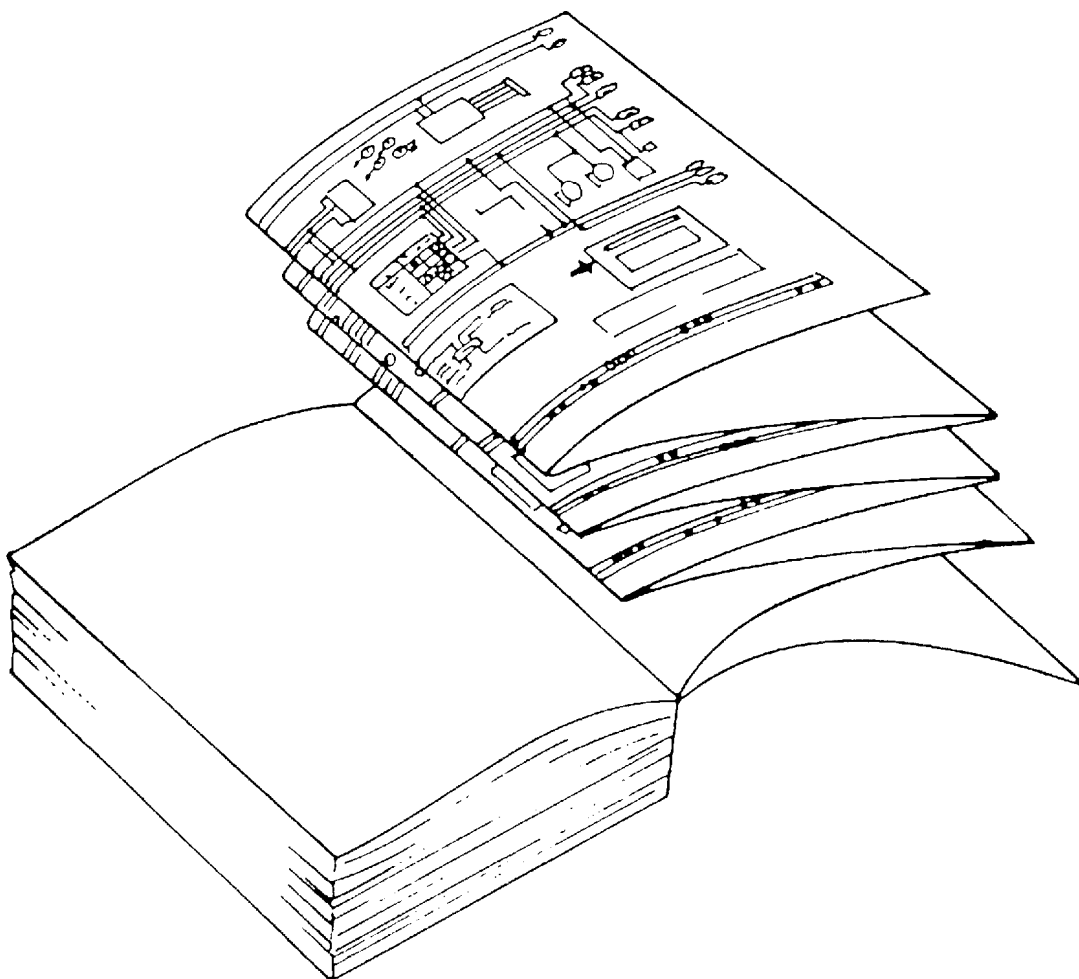
The arrangement of terminal numbers on the actual relays may differ from those shown above.

TGI018

### 3) FOLDOUT CIRCUIT DIAGRAMS

The foldout circuit diagrams at the back of the Service Manual are schematic diagrams of the entire vehicle, drawn in levels to spread out the circuits. This helps to eliminate the clutter of wires, components and connectors. This type of diagram separates the electrical system into three levels. Each level is designed with POWER voltage at the top, circuit LOAD in the middle, and GROUND at the bottom.

The foldout diagrams have important application during circuit diagnosis. Because the wiring diagrams only show wiring for a single system, there may be times when the problem in the system is caused by components that are part of another system, but interconnected to the system. You can use the foldout circuit diagram to find out what components of other circuits interconnect with the circuit you are tracing. This sample foldout diagram is an example of what you'll find in the service manual. Here's a brief description of some of the symbols found on the layout diagrams.

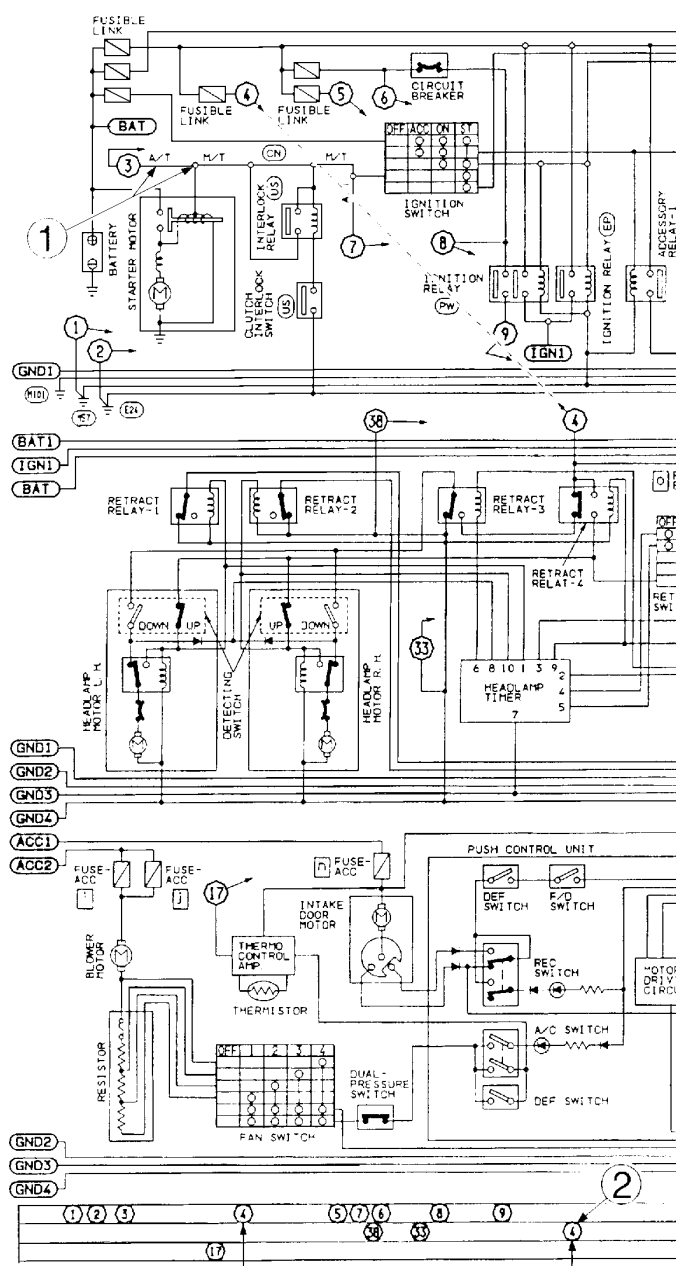


TGI019

Symbol 1 shows branch circuits, depending on equipment variations. These symbols are identified on the diagram, and are the same as used on wiring diagrams.

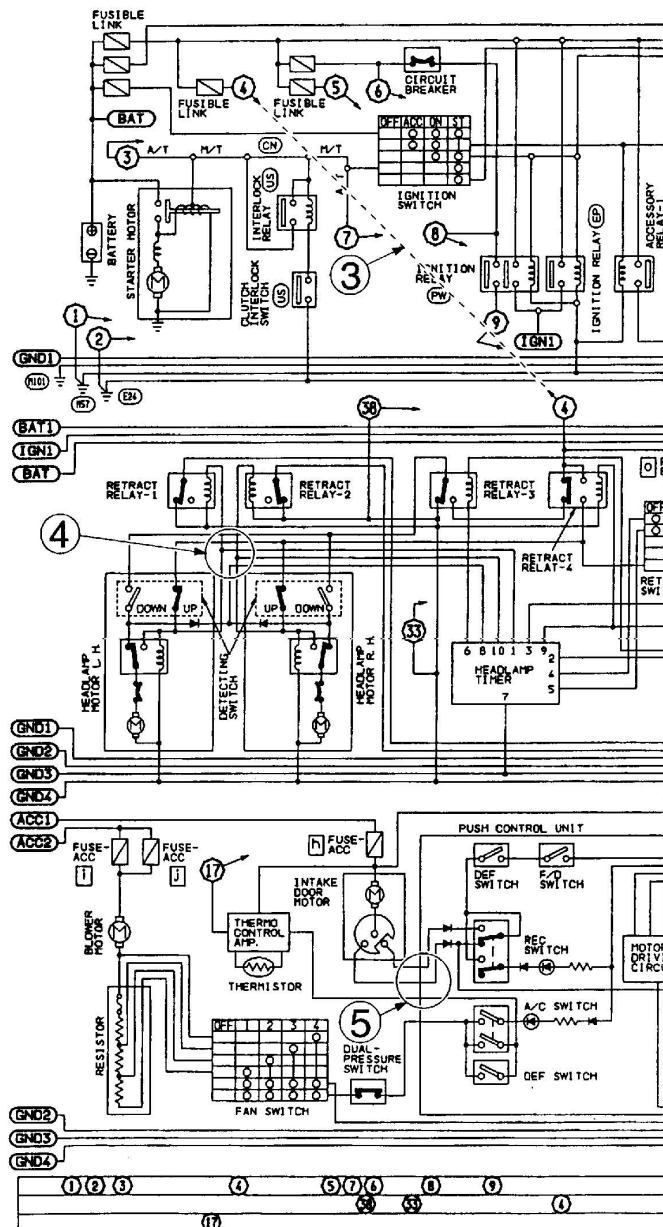
Symbol 2 shows three horizontal columns. Each column represents one of the three diagram levels. The letters and numbers in the horizontal columns align with and match the connection numbers in the diagram. For example, the arrow is pointing to number (4), which is found in the middle column. Following straight up to the middle diagram level, number (4) is found to indicate a connection.

## CIRCUIT DIAGRAM



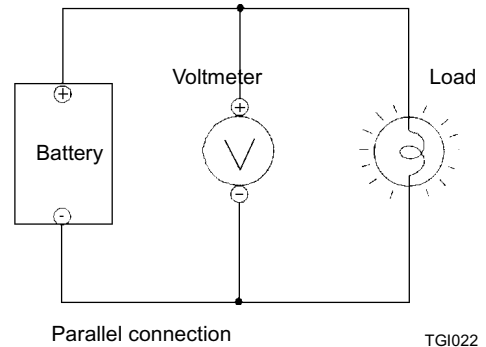
Symbol 3 shows how the different levels are connected. The dotted line connects the circled numbers (4). Notice that the arrows point to each other. The dotted line does NOT appear on the foldout diagram. Use a straight edge to follow the arrows on the diagram. To follow this wiring, use the bottom of the diagram. There are two circled as shown. Each is on a different level, indicating the level on which each connection is made. By moving straight up from each of the circled numbers, you'll find the connection points. Symbol 4 shows wires crossing each other. Only the wires with dots at the intersections indicate wire connections. These symbols are the same as those found on wiring diagrams. Symbol 5 shows wires crossing over each other (with NO dots). These are NOT connections.

### CIRCUIT DIAGRAM



#### 4) HOW TO USE CIRCUIT TESTER MEASURING DC VOLTAGE AS A VOLTMETER

1. Set the selector switch to the DCV position.
2. Connect the test lead (red) to the positive side of the circuit.
3. Connect the test lead (black) to the negative side of the circuit.

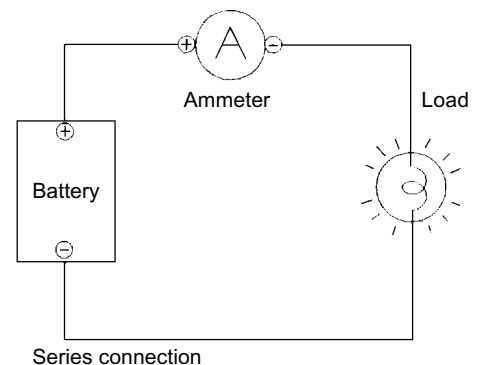


#### HOW TO READ THE NEEDLE INDICATION

| Range             | 3 [V]           | 12 [V]          | 30 [V]         |
|-------------------|-----------------|-----------------|----------------|
| Needle indication |                 |                 |                |
| Reading           | Approx. 1.3 [V] | Approx. 9.5 [V] | Approx. 13 [V] |

#### MEASURING DC CURRENT AS AN AMMETER

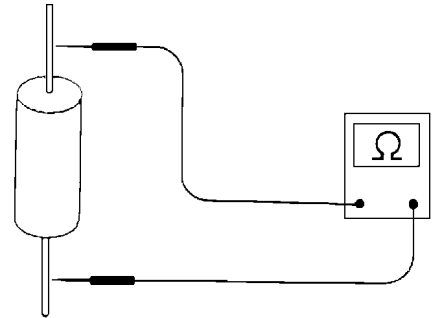
Connect the test leads as shown in the figure. Unlike voltage measurement, an ammeter must be connected in series with the load in the circuit. In general, the DC [A] range of the circuit tester is small, and it cannot be used for measuring relatively large electric currents, such as those in the head light circuit and the charging circuit. (The circuit tester introduced here can measure up to 0.3 [A] = 300 [mA])



## MEASURING RESISTANCE AND TESTING CONTINUITY AS AN OHMMETER

When measuring resistance or checking for continuity, be sure to disconnect the vehicle battery negative (-) terminal so no external voltage will be applied to the circuit being measured.

- Connect the test leads to the resistor in the same way as for voltage measurement.
- Set the selector switch to the RXI position.
- Short out red and black test leads firmly together.
- Turn the zero-ohm adjuster until the needle aligns with the zero-ohms position.
- Connect the test probes to the circuit in which the continuity or resistance is to be measured. Polarity is not important when applying the test probes to the measuring points.
- Read the meter indication.

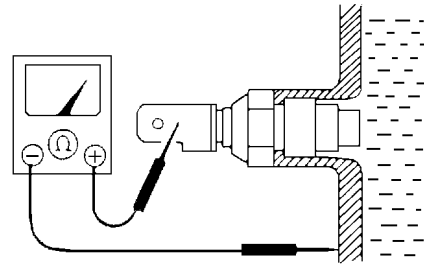


TGI025

### (1) MEASURING RESISTANCE

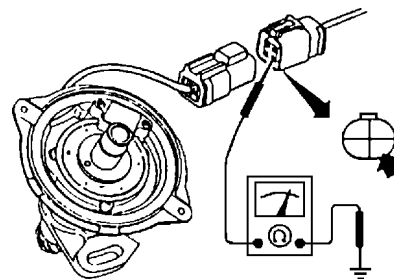
Selector switch RX1:  
The meter directly indicates resistance value.  
[Ex: Meter reading: 7 ... Resistance 7 ohms]  
Selector switch RX100:  
Multiply the meter: reading by 100  
[Ex: Meter reading: 9 ... 9 x 100 = 900 ohms]

### (2) TESTING CONTINUITY



TGI026

|                         |                                 |
|-------------------------|---------------------------------|
| Meter reading: 0 ohm    | Continuity exists               |
| Meter reading: Infinity | No continuity<br>(Open circuit) |



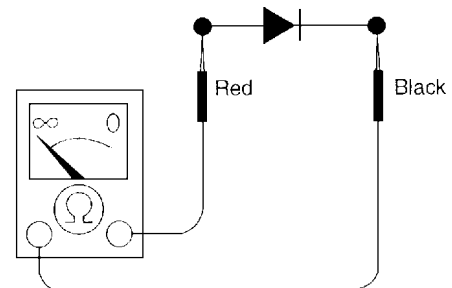
TGI027

## PRECAUTIONS FOR USING THE CIRCUIT TESTER

- Before use, check to see if the meter needle is set at the zero position. If necessary, zero-adjust the meter by turning the needle zero adjuster.
- When reading the meter indication, always view the needle from directly above. A reading error will result if it is not read in this way.
- When measuring high resistance, be careful not to touch the test probe. This will result in a major error in measurement.
- When measuring an unknown voltage, first set the meter to the maximum voltage range to know its approximate value, then set the selector switch to a suitable range for accurate measurement.
- When changing the selector switch position, be sure to disconnect one of the test probes from the measuring point. This precaution is especially essential when using the tester as an ammeter.
- Set the selector switch to a blank or "volt" position when the tester is not in use.
- The battery must be replaced with a new one if On adjustment cannot be made.

### Q: Is the polarity of this diode wrong?

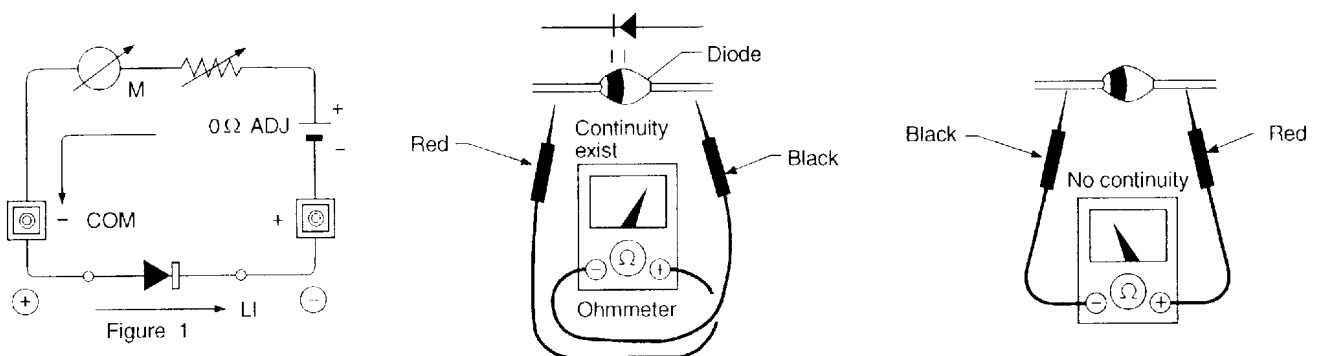
I checked the polarity of a diode connecting a circuit tester as shown in the figure at right, but the needle did not deflect. Is the polarity mark of the diode wrong?



TGI028

### A: The polarity of the diode is correct.

A battery is included in the resistance measuring circuit of a circuit tester as shown in Figure 1. Accordingly, the polarity of the circuit tester output voltage is the opposite of that used for measuring voltage and current.



TGI029







## ELECTRICAL TEST EQUIPMENT

The most common meter for automotive testing actually functions as three meters all in one. It is called a DIGITAL VOLT OHMMETER or DIGITAL MULTIMETER.

The three meters of a multimeter are:

- Ohmmeter
- Voltmeter
- Ammeter

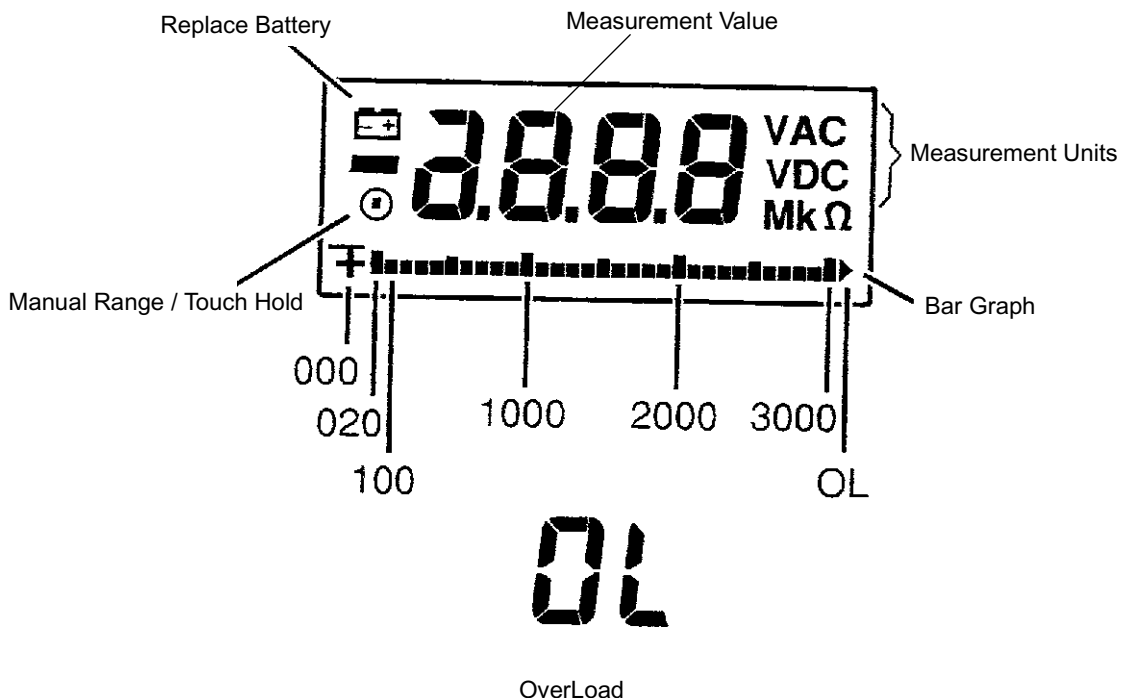
There are two types of test meters available for automotive electrical testing, Analog and Digital.

This section will provide you with an introduction to the DIGITAL MULTIMETER.

### DIGITAL METERS

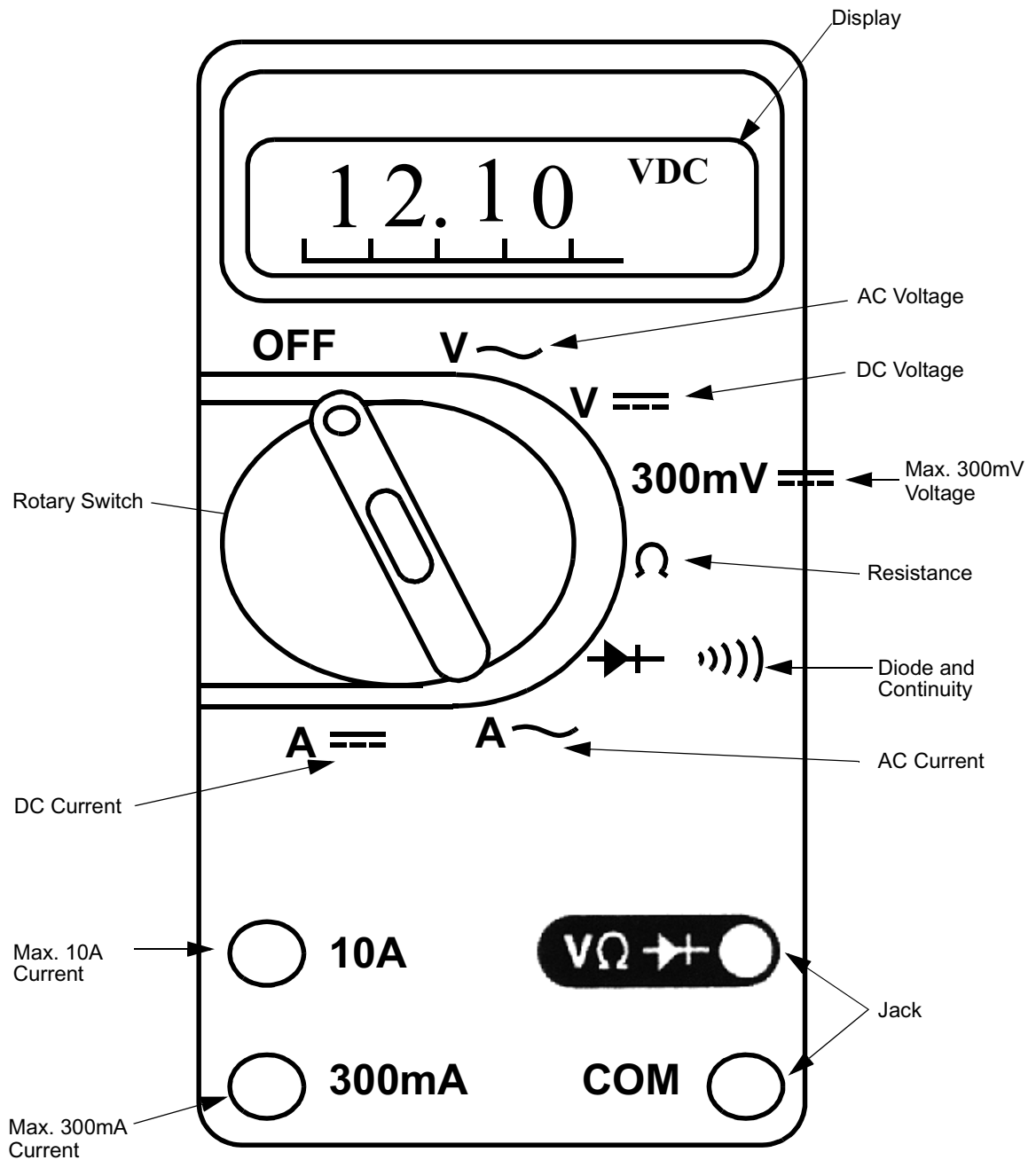
Digital meters provide an electronic digital display of the measurement being made. This display shows actual numbers.

### DETAIL OF DISPLAY



TGI031

## DIGITAL MULTIMETER



TGI032

## MEASURING RESISTANCE

An ohmmeter has two important functions:

- Measure circuit or component resistance
- Check for continuity in a circuit or component

Never use an ohmmeter on a circuit with power. Doing so will damage the meter.

To use an ohmmeter:

**Step 1:** Connect test lead wire to:

Red test lead:  Jack

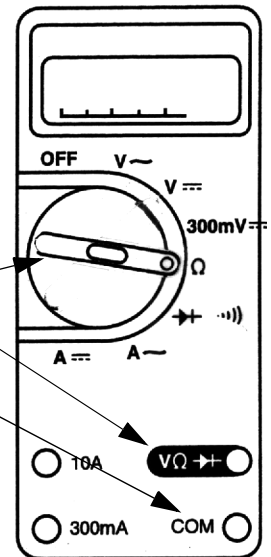
TGI033

Black test lead:  Jack

TGI034

**Step 2:** Turn rotary switch to  $\Omega$

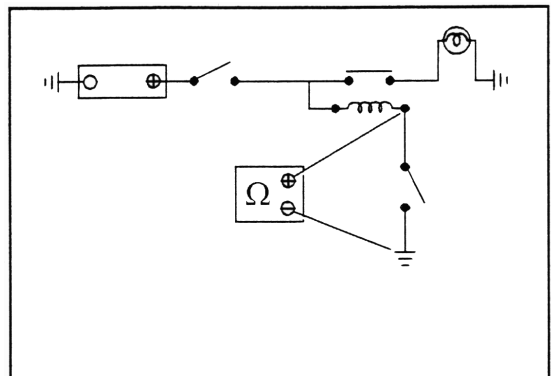
**Note:** Before measuring the resistance, turn off power to the circuit, and then discharge all capacitors.



TGI035

**Step 3:** Touch the test lead to the circuit.

**Note:** Be sure you have a good contact between the probes and the circuit. Dirt, oil, solder, or other foreign matter seriously affects the resistance. Never touch the circuit with your finger.

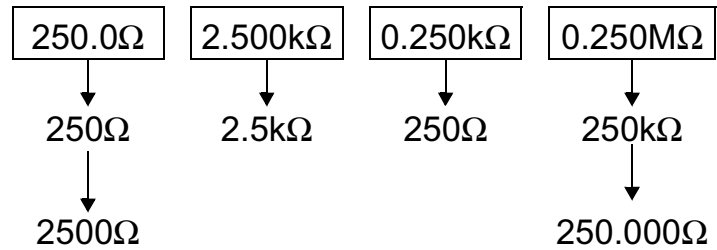


TGI036

**Step 4:** Read out the resistance from the display.

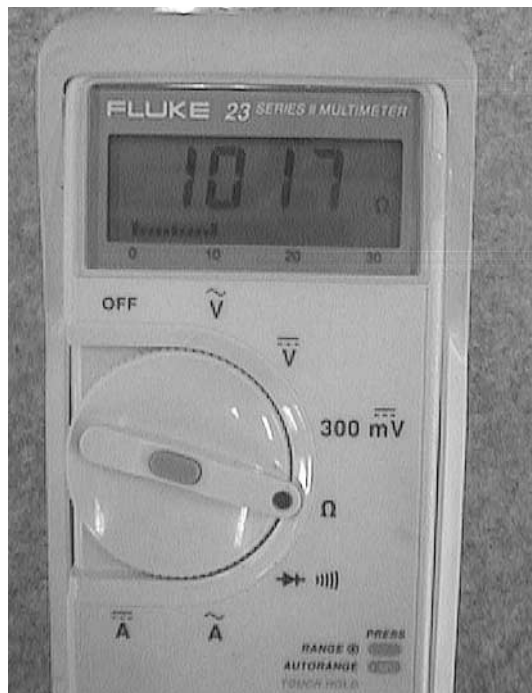
**Note:** The number varies in accordance with the selected unit on some meters.

**For example:**



1 kΩ = 1,000 Ω

1 MΩ = 1,000 kΩ



TGI037



## MEASURING DC VOLTAGE

A voltmeter is used for almost all automotive electrical tests.

A voltmeter has two functions:

- Measure circuit voltage
- Measure voltage drops


This section will provide you with an introduction to measuring circuit voltage.

To measure voltage:

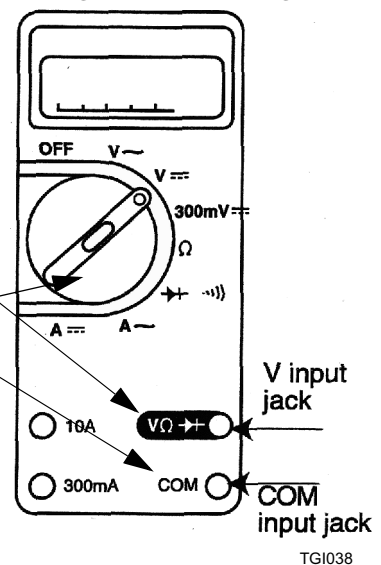
**Step 1:** Connect test lead wire to:

Red test lead:  Jack TGI033

Black test lead:  Jack TGI034

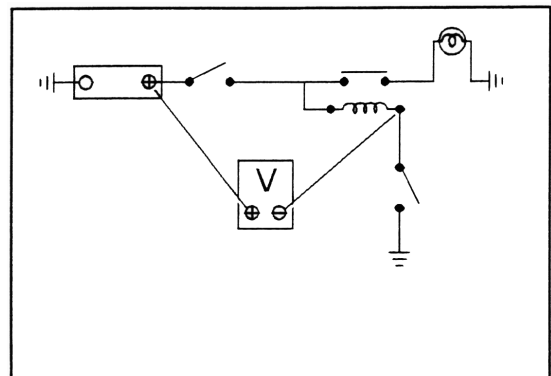
**Step 2:** Turn rotary switch to  TGI039

**Note:** For DC voltage below 300 mV, use the mV function to get the best resolution.

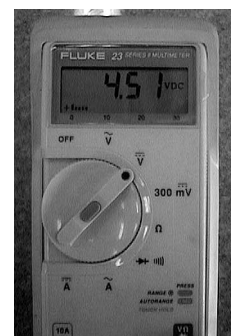


**Step 3:** Connect the voltage probes in parallel across the circuit or part of the circuit being measured.

**Note:** Be sure polarity of the circuit.  
Red probe should be positive.  
Black probe should be negative.



**Step 4:** Read out voltage from display.





## MEASURING DC AMMETER

An ammeter is used for measuring the current flow in a circuit.

To use the ammeter:

**Step 1:** Connect test lead wire to:

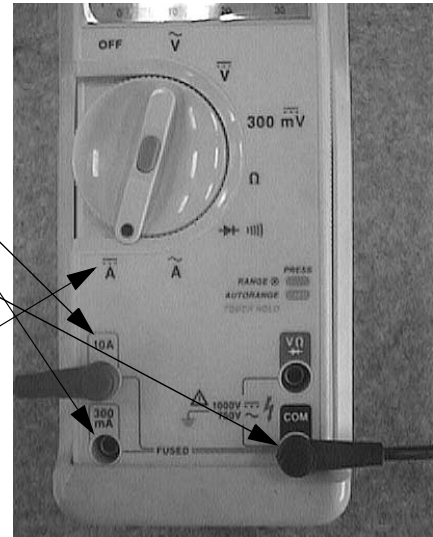
Red test lead: 10A or 300mA Jack

Black test lead: **COM** Jack

**Note:** To avoid blowing an input fuse, use the 10A Jack until you are sure that the current is less than 300mA.

**Step 2:** Turn rotary switch to **A**

TGI042



TGI043

**Step 3:** Connect an ammeter in series with the circuit.

**Note:** Be sure the positive probe of the ammeter is inserted into the PLUS (+) terminal and the negative probe into the ground or negative (–) side of the circuit.

**Step 4:** Read out Amperage from display.

- Note:**
- 1) Specification for amperage is usually not available in the Service Manual.
  - 2) Measuring with an inductive current probe is also possible. (See the next illustration.)



TGI044