A multimeter is a versatile electronic measuring instrument used to measure electrical parameters such as voltage, current, resistance, and sometimes additional properties like continuity, capacitance, or temperature. Let's break down the specifics of the terms and components you've mentioned.

Components of a Multimeter

1. **Probes (Red and Black):**
    - **Red Probe**: Connected to the positive terminal of the multimeter. Typically plugged into the socket labeled **V/Ω/mA** or **10ADC** for measuring voltage, resistance, or current.
    - **Black Probe**: Connected to the common (COM) terminal, which serves as the ground or reference point for measurements.
    - **Types of Probes**:
        - **Standard Probes**: Regular pointed tips for general-purpose measurements.
        - **Crocodile Clips**: For hands-free measurements; clips onto wires or terminals.
        - **Needle Probes**: For piercing insulation and testing wires directly.
        - **Clamp Probes**: Used for measuring current without breaking the circuit (non-contact).
2. **Sockets on the Multimeter:**
    - **COM (Common)**: Always used for the black probe; serves as the reference terminal.
    - **V/Ω/mA**: For measuring voltage, resistance, or small currents (typically less than 200mA).
    - **10ADC**: For measuring high currents (up to 10 amps DC). This socket is separate to avoid overloading the standard mA socket.

Understanding Multimeter Settings and Ranges

Multimeters have rotary switches with various settings for measuring different parameters. Let’s explain the ranges and their meanings:

1. Voltage (V)

- **200m to 600V (AC/DC Voltage Measurement)**:
    - **200m**: The maximum voltage you can measure is 200 millivolts (0.2 volts). Used for low-voltage signals.
    - **600V**: The maximum voltage you can measure is 600 volts. Suitable for high-voltage circuits like mains electricity.
- Voltage ranges often have two settings: **AC (alternating current)** and **DC (direct current)**.

2. Current (A)

- **200u to 10A**:
    - **200uA (microamps)**: For measuring tiny currents, often used in electronics and circuit debugging.
    - **10A (amps)**: For measuring high currents. Use the **10ADC** socket and set the range to **10A**. Most multimeters have a fuse to protect this setting.

3. Resistance (Ω)

- **200 to 2M (Ohms Measurement)**:
    - **200Ω**: Measures resistance up to 200 ohms. Use this for low-resistance components like small resistors.
    - **2MΩ**: Measures resistance up to 2 megaohms (2,000,000 ohms). Useful for testing high-resistance components or checking insulation.

What Do the Settings on the Multimeter Mean?

1. **10ADC**:
    - This is the socket and setting for measuring currents up to 10 amps in DC circuits. It's often unfused or protected with a high-current fuse, so be cautious.
    - Used for high-power circuits, motors, or large loads.
2. **COM (Common)**:
    - This is the shared ground or negative terminal where the black probe connects. It is the reference point for all measurements.
3. **V/Ω/mA**:
    - This socket is used for:
        - Voltage measurements (AC or DC).
        - Resistance measurements (Ohms).
        - Low current measurements (up to 200mA).

What do the 8 holes on the Multimeter Mean?

The **E, C, B, E** labels on your multimeter correspond to testing sockets for **bipolar junction transistors (BJTs)**. These sockets allow you to measure the **gain (hFE)** of a transistor, which indicates how much the transistor amplifies current. Here's a detailed explanation:

E, C, B, E Explanation

- **E**: Emitter
- **C**: Collector
- **B**: Base

These labels represent the three terminals of a BJT transistor. Transistors come in two main types:

1. **NPN**: Current flows from the collector to the emitter when a small current flows into the base.
2. **PNP**: Current flows from the emitter to the collector when a small current flows out of the base.

Your multimeter's **E, C, B** sockets are used to test the transistor's configuration and measure its gain. The second **E** (on the opposite side) is typically redundant to support both legs of the transistor.

How to Use the E, C, B, E Sockets

1. **Locate the Transistor Type**:
    - Identify whether your transistor is NPN or PNP. This is usually marked on the transistor itself or in its datasheet.
2. **Insert the Transistor**:
    - Align the pins (Emitter, Collector, Base) of the transistor with the **E, C, B** sockets.
    - Plug the transistor pins into the appropriate holes.
3. **Set the Multimeter**:
    - Turn the dial to the **hFE** (or transistor test) mode, which is often marked with a symbol resembling a transistor.
4. **Read the hFE** Value:
    - The display will show the **gain (hFE)** of the transistor. This value indicates the current amplification factor of the transistor.

Why Two E Sockets?

The second **E** socket exists to simplify testing for transistors with different pin configurations. For example, some transistors have the **Emitter** on the left side, while others have it on the right. The extra **E** socket accommodates these variations.

Tips for Testing Transistors

- **Polarity**: Ensure you know the correct pinout of your transistor. Misplacing the pins can result in inaccurate readings.
- **hFE Variance**: The hFE (gain) value is not constant and depends on factors like temperature and current levels.
- **Faulty Transistors**: If your multimeter shows no reading or an extremely low hFE, the transistor might be damaged.

How to Use a Multimeter

1. **Measuring Voltage:**
    - Turn the dial to the appropriate voltage range (**DCV or ACV**).
    - Plug the red probe into **V/Ω/mA** and the black probe into **COM**.
    - Touch the probes to the circuit and read the value on the display.
2. **Measuring Current:**
    - For small currents (<200mA), use the **V/Ω/mA** socket. For large currents (<10A), use the **10ADC** socket.
    - Set the dial to the appropriate range (**mA** or **10A**).
    - Insert the multimeter in series with the circuit and read the value.
3. **Measuring Resistance:**
    - Turn the dial to the resistance range (Ω).
    - Plug the red probe into **V/Ω/mA** and the black probe into **COM**.
    - Touch the probes across the component and read the resistance.

Key Safety Tips

- **Voltage Range**: Always start with the highest voltage range to avoid overloading.
- **Current Measurements**: Be careful when measuring currents; always check the range and use the correct socket.
- **Probe Handling**: Never touch the probe tips during measurements, especially in high-voltage or high-current circuits.
- **Circuit Protection**: Check if the multimeter has internal fuses. Replace blown fuses before further use.

Summary

- A multimeter is a critical tool for electrical diagnostics and circuit debugging.
- Settings like **200m to 600V**, **200u to 10A**, and **200 to 2M** define the ranges of measurable parameters for voltage, current, and resistance.
- **Probes** (red and black) are essential for connecting the multimeter to the circuit.
- Be cautious with settings like **10ADC**, as they deal with high currents and may lack robust protection.

How to Use a Multimeter

You Need Test Leads for your Multimeter: Demonstrating the Kaiweets

How To Use A Multimeter: The VERY Basics!

How to use a multimeter like a pro, the ultimate guide

Multimeters - The Complete Guide

Multimeter Buying Guide