**Solar Electric Technician (Level 2)**

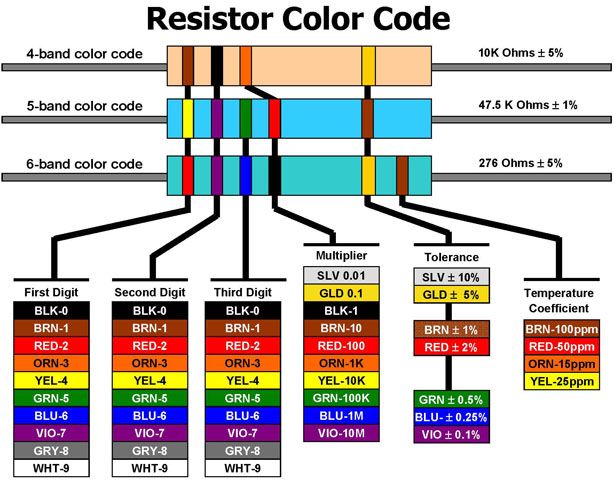
**Module 3: Measurement of electrical and solar parameter**

**E2: Assignment-Measurement of resistance**

|  |  |
| --- | --- |
| **E2: ASSIGNMENT MEMO** | |
| **Date** | …. |
| **To** | Participants |
| **From** | Trainers |
| **Subject** | Measurement of resistance. |
| **What** | Measure the resistance of given resistor using reference load resistor chart. |
| **Why** | The objective of the assignment is to perform the measurement of resistors using resistor color chart code and measure the load resistance of wire and PV modules. |
| **How** | 1. Individual or group work of 2 or 4 2. Interpret the given reference resistor color code chart and perform Task 1. 3. **Read the given task instructions carefully and perform the measurement.** 4. Some tasks are provided with notes to assist participants for tallying the measured value or results 5. After completing the tasks, participants will answer the questions and discuss their results with the class. |
| **Time** | 60’ |

**Task 1: Identify the resistance of the given resistor.**

1. **Reference color code chart**



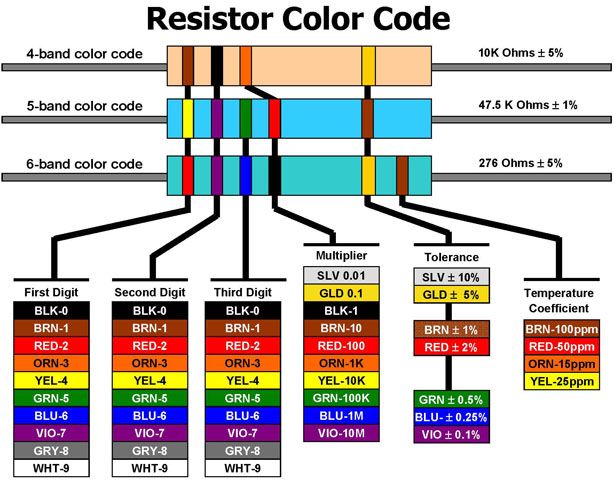


Figure 1: Resistor color code chart

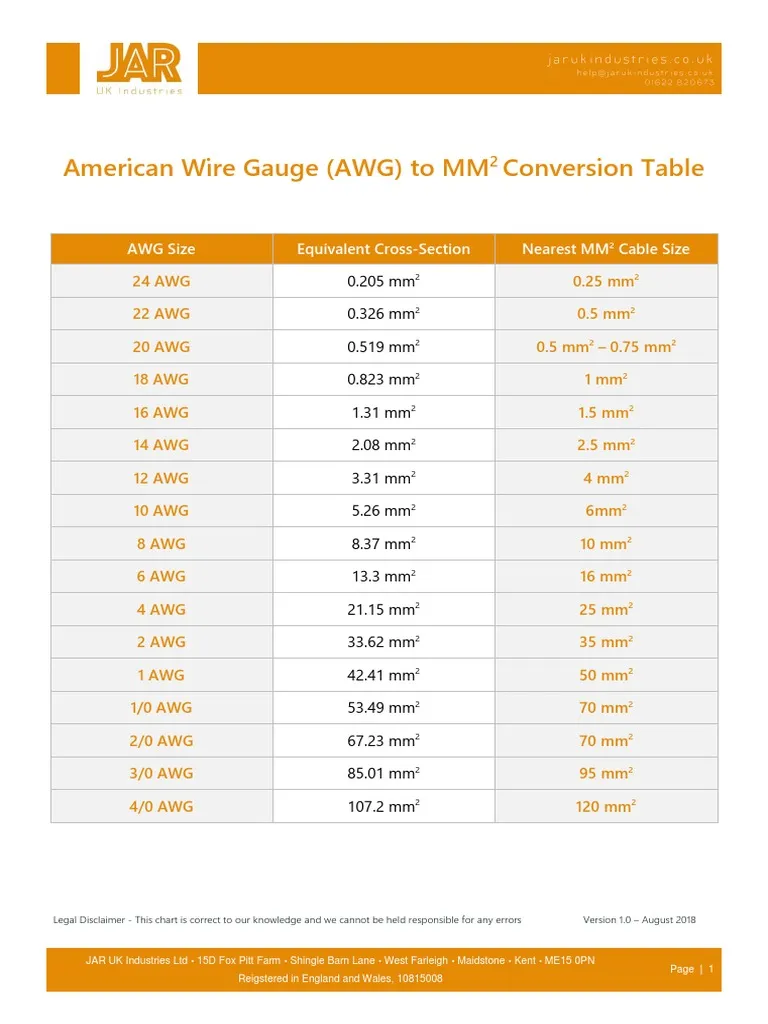
1. **Instructions**

* Set the multimeter to Ohms or Resistance.
* Connect test leads.
* Hold the probes at the end of the test leads together.
* Place the probes across the leads of the resistor. It doesn't matter which probe goes on which lead, as resistance is not polarity-sensitive.
* Measure the resistance of resistors.
* If measuring resistance in a circuit, place the probes across the two points where you want to measure the resistance. Ensure there are no parallel paths that can affect the reading.
* Note down the value.

1. **Measured value:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ω

**Task 2: Identify the resistance of the given wire.**

1. **Reference AWG to MM2 Table**



1. **Instructions**

* Select a standard cable (e.g., 10 AWG, 6 meter long).
* Set the multimeter to the resistance (Ω) setting.
* Measure the resistance between the two ends of the cable.
* Note down the value.

1. **Measured value:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ω
2. **Notes**
   * + The resistance of a 10 AWG copper wire per 1000 feet is approximately 1 ohm.   
       For a 20-foot (6meter) length, the resistance should be close to 0.02 Ohms.

* If the resistance is significantly higher than expected, the cable may be damaged, and you need to check for breaks or loose connections.

**Task 3: Identify the resistance of the solar PV module.**

1. **Instructions**

* Select a solar panel (e.g., 250W, 24V).
* Disconnect the solar panel from the system to ensure there is no current flowing.
* Set the multimeter to the resistance (Ω) mode.
* Measure the resistance between the positive and negative terminals of the solar panel.
* Note down the value.

1. **Measured value:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ω
2. **Notes**

* The resistance between the terminals should be relatively high (typically in the kilohm range).
* A very low resistance (near 0 ohms) might indicate a short circuit, while infinite resistance could mean an open circuit (broken internal connections).
* Compare it with the manufacturer's specification to ensure it’s within the acceptable range.
* If the panel has an abnormal resistance reading, note the potential issue.

**Task 4: Identify the resistance of the solar array grounding system.**

1. **Instructions**

* Set the multimeter to the resistance (Ω) mode.
* Measure the resistance between the solar array's metal frame and the grounding rod or point.
* Note down the value.

1. **Measured value:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ω
2. **Notes**

* The resistance between the array and the ground should be very low (typically less than 5 ohms, depending on the system and local code requirements).
* If the resistance is higher than the acceptable range, it indicates poor grounding, which can cause safety hazards or damage to the equipment.
* If the resistance is too high, check for loose connections or corroded ground wires and repair them as necessary.

**Task 5: Diagnosing a faulty PV string using resistance measurement.**

1. **Scenario:** A PV string (a series of solar panels connected together) in a solar array is not performing as expected, and the voltage output is lower than the other strings.
2. **Instructions**

* Power down the system to ensure no current flows through the string.
* Measure the resistance across the positive and negative terminals of each individual solar panel in the string.
* Measure the resistance between the connections of each panel in the series, checking for loose or corroded connections.

1. **Measured value**

* Panel 1 resistance: \_\_\_\_\_ Ω
* Panel 2 resistance: \_\_\_\_\_ Ω
* Panel 3 resistance: \_\_\_\_\_ Ω
* Suspected faulty panel or connection: \_\_\_\_\_ Ω

1. **Notes**

* Each solar panel should show a similar resistance value. A panel showing either a much higher or lower resistance than others in the string may be faulty.
* Once you’ve identified the faulty panel or connection, repair or replace it and recheck the overall string performance.