Feng Chia University

Electrical Engineering Fundamentals I Lab

Laboratory 1

Resistance, Voltage, and Current Measurements, Ohm's Law

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1. Introduction

* To be familiar with using digital multimeter and oscilloscope

1. Materials

Power Supply, Waveform Generator, Oscilloscope, Digital Multimeter Components

* + Resistors
    1. 330 Ω, 470 Ω, 1 kΩ, 2.2 kΩ
    2. 1.2 kΩ, 2.2 kΩ, 5.6 kΩ, 7.5 kΩ
    3. 1 k Ω
  + Diode
    1. Zener Diode (V Z < 15 V)

1. Circuit diagram

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自動產生的描述

▲ Figure 1. Circuit of Experiment 1.a Series Circuit

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▲ Figure 2. Circuit of Experiment 1.b Parallel Circuit一張含有 行, 圖表, 文字, 螢幕擷取畫面 的圖片

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▲ Figure 3. Circuit of Experiment 1.d The Mystery Component

1. Methods

Use digital multimeter to measure current, voltage, and resistance.

1. Experiment data

Table 1: Results of the Resistor Measurements

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NR | Color Code | kOhm | NOM | DMM | %ERR | TOL |
| R0 | Orange Orange Brown | 0.3263 | 330 | 326.30 | -1.12% | GOLD 5% |
| R1 | Yellow Purple Brown | 0.4672 | 470 | 467.20 | -0.60% | GOLD 5% |
| R2 | Brown Black Red | 0.9816 | 1000 | 981.55 | -1.84% | GOLD 5% |
| R3 | Red Red Red | 2.1750 | 2200 | 2175.00 | -1.14% | GOLD 5% |

Table 2: the total current from the source

|  |  |
| --- | --- |
| Theory(mA) | Measured(mA) |
| 3.75 | 3.8022 |

Table 3: voltages across each resistor

|  |  |  |
| --- | --- | --- |
| NR | Theory(V) | Measured(V) |
| R0 | 1.2375 | 1.2405 |
| R1 | 1.7625 | 1.7750 |
| R2 | 3.7500 | 3.7303 |
| R3 | 8.2500 | 8.2591 |

Table 4: Results of the Resistor Measurements

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NR | Color Code | kOhm | NOM | DMM | %ERR | TOL |
| R0 | Brown Red Red | 1.1965 | 1200 | 1196.50 | -0.29% | GOLD 5% |
| R1 | Red Red Red | 2.1750 | 2200 | 2175.00 | -1.14% | GOLD 5% |
| R2 | Green Blue Red | 5.7773 | 5600 | 5777.30 | 3.17% | GOLD 5% |
| R3 | Purple Green Red | 7.4020 | 7500 | 7402.00 | -1.31% | GOLD 5% |

Table 5: currents from the source and through each resistor

|  |  |  |
| --- | --- | --- |
| NR | Theory(mA) | Measured(mA) |
| Total | 15.9978 | 16.0800 |
| R0 | 8.3333 | 8.4033 |
| R1 | 4.5455 | 4.6040 |
| R2 | 1.7857 | 1.7330 |
| R3 | 1.3333 | 1.3525 |

Table 6: current versus voltage for the unknown component

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Vdc0 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 |
| VMeter0 | -5.18 | -5.18 | -5.18 | -5.18 | -5.17 | -5.17 | -5.17 | -5.16 | -5.16 | -5.15 |
| IMeter0 | -14.99 | -13.90 | -12.91 | -11.90 | -10.89 | -9.87 | -8.87 | -7.86 | -6.81 | -5.83 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Vdc0 | -10 | -9 | -8 | -7 | -6 | -5 | -4 | -3 | -2 | -1 |
| VMeter0 | -5.15 | -5.13 | -5.12 | -5.10 | -4.95 | -4.76 | -3.99 | -3.01 | -2.01 | -1.00 |
| IMeter0 | -4.75 | -3.50 | -2.68 | -1.77 | -0.55 | -0.21 | -0.02 | 0.00 | 0.00 | 0.00 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Vdc0 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| VMeter0 | 0.00 | 0.70 | 0.74 | 0.76 | 0.77 | 0.78 | 0.78 | 0.79 | 0.79 | 0.80 |
| IMeter0 | 0.00 | 0.24 | 1.12 | 2.06 | 3.00 | 4.06 | 5.04 | 6.07 | 7.18 | 8.22 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Vdc0 | 10 | 11 | 12 | 13 | 14 | 15 |
| VMeter0 | 0.80 | 0.80 | 0.81 | 0.81 | 0.81 | 0.81 |
| IMeter0 | 9.15 | 10.20 | 11.24 | 12.30 | 13.29 | 14.30 |

Graph 1: current versus voltage for the unknown component

1. Results

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▲ Figure 4. Measure the total current from the source

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▲ Figure 5. Measure the current across each resistor

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自動產生的描述▲ Figure 6. A period of △-wave with f = 20 Hz and amplitude of 10 Vp-p一張含有 文字, 電子產品, 電子工程, 電子裝置 的圖片

自動產生的描述

▲ Figure 7. Measure current versus voltage for the diode

1. Discussion

Graph 1: current versus voltage for the unknown component

While the voltage is between -4.7~0.7, the current of diode will become 0.

1. Conclusion

With digital multimeter, we can measure current and resistance in series and voltage in parallel.