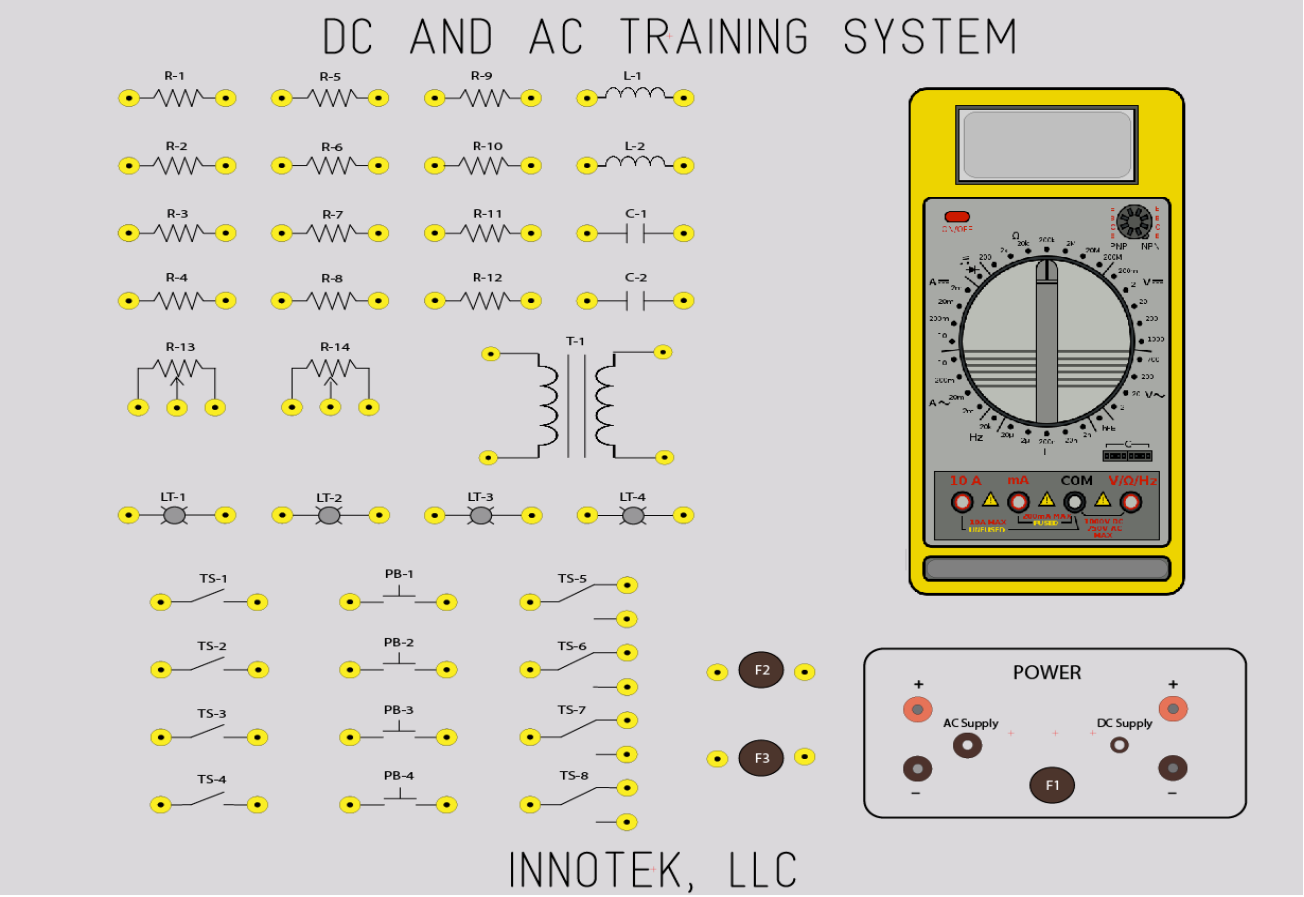
DC and AC TRAINING SYSTEM
Model INT-ACDC-100



Contents:

12- Fixed Resistors
2 – Variable Resistors
2 – Fixed Inductors
2 – Fixed Capacitors
1 – Transformer
4 – Lights
8 – Toggle Switches
4 – Pushbuttons
2 – Fuses for Circuit Protection
1 – AC Supply
1 – DC Supply
1 – Fuse for Trainer Protection
1 – Digital multi-meter
1 – Suitcase
1 – Lab Manual

Topic Coverage:

Resistors
Switches
Ohms Law
Series Circuits
Parallel Circuits
Combination Circuits
Circuit Protection
Inductors
Transformers
Capacitors
Calculations
Multi-Meter Use

All Components are installed permanently in the panel inside suitcase. When the lid is removed, the case can either stand or lie on a table for use by students. Color code charts and component info is included in the lab manual.

Name _____ Date _____

DC Circuits
Lab Exercise
DC Test Equipment (Multi-meter Use)

Discussion: When working with electrical circuits, it is necessary to know what values or quantities of voltage, resistance and current are required and or present to determine if a circuit is operating correctly. This exercise will provide an opportunity to calculate and measure values.

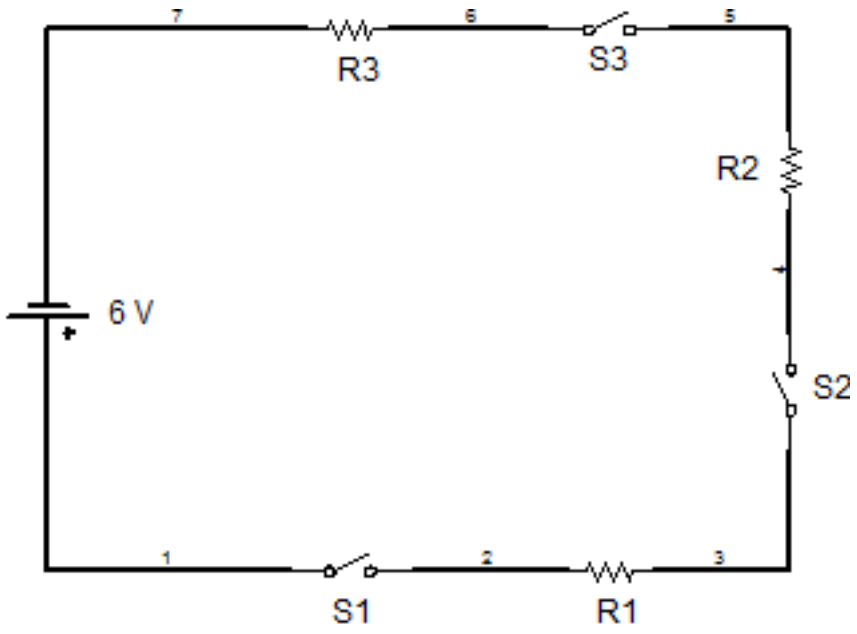
Remember:

- Voltage is measured in parallel across the component or power source.
- Current is measured in series – or breaking the circuit and using the ammeter to complete the path.
- Resistance is measured by placing the meter across the component. Remember to remove power before making your measurements.

PRACTICE EXERCISE 1:

Using the cables provided, connect the circuit shown in the diagram below.

Do Not Apply Power At This Time!!!



You should have (7) total wires when completed. Please have your instructor verify the correct wiring of the circuit before proceeding!

Calculation

This circuit contains resistors R1, R2, and R3, Calculate the value of each resistor using the provided color code chart. Record the values below including the tolerance.

R1 = _____

R2 = _____

R3 = _____

Next, using 6 VDC as the power source value, using Ohm's Law calculate the current flow through the circuit.

Resistors in Series – RT = R1+R2+R3…
Ohm's Law – E = I x R

R_T = _____

I = _____

Open all switches and use the Digital Multi-meter for this portion of the lab.

Hands - On Resistance Measurements

Set the multi-meter to read resistance and measure each resistor. Record the value of each measurement below.

- *Resistance is measured by placing the meter across the component. Remember to remove power before making your measurements*

Note: When making your measurements, place the leads directly into the connectors or the cables.

R1 = _____

R2 = _____

R3 = _____

Compare your measured values with the calculated values. Do the values match exactly? Yes or No

Are the measured values within tolerance based on the previous calculations? Please indicate by writing Yes or No in the blank provided.

R1 = _____

R2 = _____

R3 = _____

Next, add each measured resistor value to obtain the total resistance value

R_T = _____

Resistance of a Switch

Close S2. Now using your multi-meter set to the ohms function, measure the resistance of S2 and record the value below.

R_{S2} = _____

- *The resistance of a closed switch should be near zero ohms.*

Now open S2, measure the resistance across the switch and record the value below.

R_{S2} = _____

- *The resistance of an open switch should be very high or infinity. A reading of OL on a digital meter indicates that the meter is measuring a value above the measurable setting of the meter. For instance, if the meter is set to 1K ohm max and is placed across a 1.2 K ohm load, the meter will indicate OL since in cannot indicate a value larger than 1K.*

Hands - On Voltage Measurements

Set up the DC Power Supply to provide 6 volts. Then use your mulit-meter to check the voltage at the black and red jacks observing correct polarity with your meter. Also make sure all the switches (S1, S2, and S3) are closed.

- *Voltage is measured in parallel across the component or power source.*

Now measure the voltage across R1, R2, and R3 individually and record the values below.

E_{R1} = _____

E_{R2} = _____

E_{R3} = _____

Next measure the total voltage applied to the circuit and record the value below.

E_T = _____

Voltage across a switch

Now measure the voltage across S1 at test points and list the value below.

E_{S1} = _____

- The measurement should be 0V if the switch is closed. A closed switch has no (0Ω) resistance and therefore should have no voltage drop across it.

Now open S1 and measure the voltage across it and list the value below.

E_{S1} = _____

- The measurement should indicate a voltage equal to the applied voltage.

Close S1 and then perform the same procedure on S2 and S3. You should measure very similar values.

E_{S2} = _____ Open

E_{S2} = _____ Closed

E_{S3} = _____ Open

E_{S3} = _____ Closed

Hands - On Current Measurements

Now ensure all switches are closed and the applied power is still 6VDC. In order to make a current measurement with an ammeter, you must break the circuit and install the meter so all the current flows through the meter. The ammeter completes the path for current flow. The total circuit current, which is determined by the voltage applied to the circuit and the resistance of the circuit, will flow through the ammeter. In the following exercise we will measure current be opening the appropriate switch and measuring the current.

- *Current is measured in series – or breaking the circuit and using the ammeter to complete the path.*

Note: When making your measurements, ensure that your meter leads are in the appropriate port, and that the meter is set correctly. Ask your instructor to verify.

Place your meter across S1. You should read a value of 0 amps. Now open S1 and measure the current in the circuit and record the value below.

I = _____

Look back at the calculation part of the lab and record the calculated current below.

I = _____

- Your values should be very close, but likely will not be exact matches.

Close S1 and perform the same measurements on S2 and S3. The values should match what was indicated at S1.

I = _____ S2

I = _____ S3

PRACTICE EXERCISE 2:

Hands - On Voltage Measurements

Return to the Hands – On Voltage exercise, using the controls and analog meter at the top of the unit, adjust your voltmeter to 12VDC and measure and record all your values again. Ensure all the switches are closed to allow current to flow through the circuit.

- *Voltage is measured in parallel across the component or power source.*

E_{R1} = _____

E_{R2} = _____

E_{R3} = _____

E_T = _____

Voltage across a switch

Now measure the voltage across S1 and list the value below.
E_{S1} = _____

Now open S1 and measure the voltage across it and list the value below.

E_{S1} = _____

- Recall what the meter should read across an open and a closed switch.

Hands - On Current Measurements

Make sure you close S1 when making your measurement. Recall in order to have current flow in a circuit; you must have a complete path. If S1 and S2 are open, your ammeter will complete the path for S2 but S1 will stop the current flow in the circuit.

- *Current is measured in series – or breaking the circuit and using the ammeter to complete the path.*

Next open S2 and measure the current again and record your value below.

I = _____

Hands - On Resistance Measurements

Next measure the resistors again and record your values below. Make sure you remove power from the circuit to measure the resistance.

- *Resistance is measured by placing the meter across the component. Remember to remove power before making your measurements.*

R1 = _____

R2 = _____

R3 = _____

Resistance of a Switch

Close S1. Now using your multi-meter measure the resistance of S1 and record the value below.

R_{S1} = _____

- Recall the resistance of a closed switch, good fuse, or closed circuit breaker is 0Ω.

Now open S1, measure the resistance across the switch and record the value below.

R_{S1} = _____

- Recall the resistance of any open is infinity (∞).

If you do not feel comfortable using a meter at this point, change the applied voltage to 6V and 12V and redo the lab. Do not leave the lab until you feel comfortable using the multi-meter. A complete understanding of the multi-meter use will be required for completion of the lab exercises.