Circuit Drawings and Wiring Diagrams

Description
Successfully performing electrical work requires the ability to read and interpret many different types of drawings and diagrams. Understanding circuit symbols and components is another one of the basic building blocks needed to become an electrician. If an electrician misinterprets a drawing or diagram when wiring a house, devices could be incorrectly installed or even missed altogether. Knowing how to properly take information from an electrical drawing or diagram and apply it to the real world is essential for electricians.

Lesson Outcomes
The student will be able to:

- Know the difference between a circuit drawing and a wiring diagram
- Understand some basic symbols for schematic drawings and wiring diagrams
- Produce a wiring diagram
- Understand the difference between different types of diagrams
- Know how to draw a basic floor plan with electrical symbols

Assumptions
Students will have been introduced to electrical equipment and terminology. In addition, they will understand:

- Basic electrical circuits and theory
- Branch circuit wiring
- A basic top view floor plan

Terminology
Block diagram: a diagram of a system in which the principal parts or functions are represented by blocks connected by lines that show the relationships of the blocks.

![Figure 1—Block diagram](image-url)
Circuit drawing (diagram): a simplified conventional graphical representation of an electrical circuit.

Line diagram: a one-line diagram or single-line diagram is a simplified notation for representing an electrical system. The one-line diagram is similar to a block diagram except that electrical elements such as switches, circuit breakers, transformers, and capacitors are shown by standardized schematic symbols.
**Pictorial diagram**: a diagram that represents the elements of a system using abstract, graphic drawings or realistic pictures.

**Schematic diagram**: a diagram that uses lines to represent the wires and symbols to represent components. It is used to show how the circuit functions.

![Schematic diagram](image)

**Figure 4**—Schematic diagram

**Wiring diagram (or pictorial)**: a simplified conventional pictorial representation of an electrical circuit. It shows the components of the circuit as simplified shapes, and how to make the connections between the devices. A wiring diagram usually gives more information about the relative position and arrangement of devices and terminals on the devices.

![Wiring diagram](image)

**Figure 5**—Wiring diagram
**Estimated Time**
2–3 hours

**Recommended Number of Students**
20, based on *BC Technology Educators' Best Practice Guide*

**Facilities**
Classroom, or technology education shop

**Tools**
Pencils, rulers, erasers

**Materials**
Blank paper, photocopies of standard floor plans

**Optional**
Drafting table, T square, 90° triangle

**Resources**
Attached drawing and wiring diagram
Activity 1: Drawing Circuits

1. Using the basic electrical floor plan and the symbol chart on the following pages, explain the electrical symbols to the students.

2. Give students a standard photocopy of a floor plan (see the end of this Activity Plan) that includes a kitchen and have them draw one or two 12-device circuits using electrical symbols and paths for circuits as shown in the floor plan drawing (Figure 5).
   
   **Note:** Page 59 in the *Electrical Code Simplified Book* will help students to understand how many devices are permitted per circuit and their electrical symbols.

3. Have students draw two outlets that require separate circuits for a fridge and a dishwasher that go directly back to panel (homerun shown as a short line directed toward the panel with an arrow on it).

4. Have students draw a legend of symbols for their drawing.
A split-switched duplex receptacle is to be installed at this location. The symbol for the receptacle includes a circle that is partly shaded. This indicates half of the receptacle is controlled by a wall switch. The symbol for the switch looks like a dollar sign and is connected to the receptacle with a line.

The light fixtures in the hall are controlled by these switches. The small number "3" beside the switch symbol indicates a three-way switch, which means that the hallway lights can be controlled from two different locations.

This symbol, the circle with four lines protruding from each pole, is usually used to represent a ceiling-mounted incandescent fixture. The note “A13” indicates the fixture is supplied by panel A, circuit breaker number 13.

The line drawn between the two fixtures represents the conduit that connects the two lights. The four slashes tell you that there are four conductor wires inside the conduit.

A weatherproof receptacle is to be installed on the balcony 600 mm above the finished floor. The note “A7” indicates the receptacle is to be supplied by panel A, circuit breaker number 7.

A duplex receptacle and a cable outlet are to be installed here for television reception.

A telephone outlet is to be installed at this location in the living room. A second telephone outlet is installed in the bedroom. On this drawing the symbol for a telephone outlet is a small black triangle.

The line drawn between the two fixtures represents the conduit that connects the two lights. The four slashes tell you that there are four conductor wires inside the conduit.

This symbol, the circle with four lines protruding from each pole, is usually used to represent a ceiling-mounted incandescent fixture. The note “A13” indicates the fixture is supplied by panel A, circuit breaker number 13.

Panel box A, which supplies power for the suite, is installed in this location.

This symbol is used to show a homerun. It indicates that a wire is to run back to panel A from this point in order to complete the circuit. The three slashes and the note (#8) indicate a three-conductor, number 8 wire is to be used for the homerun.

Figure 6—Floor plan of a typical suite showing power and lighting details
<table>
<thead>
<tr>
<th>General Outlets</th>
<th>Switch Symbols</th>
<th>Auxiliary Symbols</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>lighting outlet</td>
<td>single-pole switch</td>
<td>electric door opener</td>
<td>lighting panel</td>
</tr>
<tr>
<td>blanked outlet</td>
<td>double-pole switch</td>
<td>push button</td>
<td>power panel</td>
</tr>
<tr>
<td>drop cord</td>
<td>three-way switch</td>
<td>buzzer</td>
<td>branch circuit in ceiling or wall</td>
</tr>
<tr>
<td>fan outlet</td>
<td>four-way switch</td>
<td>bell</td>
<td>branch circuit in floor</td>
</tr>
<tr>
<td>junction box</td>
<td>automatic door switch</td>
<td>annunciator</td>
<td>exposed branch circuit</td>
</tr>
<tr>
<td>lampholder</td>
<td>switch and pilot lamp</td>
<td>smoke detector</td>
<td>homerun to panelboard</td>
</tr>
<tr>
<td>lampholder with pull switch</td>
<td></td>
<td>thermostat</td>
<td>(number of circuits indicated by number of arrows)</td>
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<tr>
<td>pull switch</td>
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<tr>
<td>clock outlet</td>
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<td>fluorescent fixture</td>
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<td>floodlight</td>
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<tr>
<td><strong>Convenience Outlets</strong></td>
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<tr>
<td>duplex receptacle</td>
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<tr>
<td>single triplex receptacle</td>
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<tr>
<td>split-switched-duplex receptacle</td>
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<td>three-conductor split-duplex receptacle</td>
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<td>three-conductor split-switched-</td>
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<tr>
<td>duplex receptacle</td>
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<tr>
<td>weatherproof receptacle</td>
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<td>range receptacle</td>
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<td>switch and receptacle</td>
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<tr>
<td>special purpose outlet undesignated</td>
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<td><strong>Telephone</strong></td>
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<td>interconnecting telephone</td>
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<td>outside telephone</td>
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</table>

**Figure 7**—Common electrical symbols
Activity 2: Basic Wiring Diagram

- Have students produce a basic wiring diagram.
- The wiring diagram will show the circuit students will wire in *Wiring Devices* and *Wiring a Wall Section*.
- The diagram should show incoming power feeding a receptacle.
- From the receptacle the cable feeds a switch.
- From the switch the cable feeds a light.

![Figure 8—Basic Wiring Diagram](image-url)
Wire one duplex outlet and one switch controlling one light, fed from the outlet.

NOTE: use coloured pencils to help clarify the wiring diagram.
GREEN: GROUND WIRE
BLUE: NEUTRAL, WHITE WIRE
BLACK: HOT, BLACK WIRE

Duplex receptacle
Ground wire terminal screw
Brass screw hot terminal (black wire)
Silver screw neutral terminal (white wire)

Single pole toggle switch

Lampholder
Silver screw
Brass screw
Evaluation Guidelines

The student:

• Understands basic types of electrical drawings
• Can produce a floor plan that displays understanding
• Knows the difference between a circuit drawing and a wiring diagram
• Draws and understands a wiring diagram

Extension Activity

Draw more wiring diagrams that include more devices in different configurations.

Example: Wiring from a switch box running two lights. The circuit could be more complicated if the student understands the concepts.
Plan for Main Floor of House

BACK PORCH

KITCHEN

BEDROOM 1

BEDROOM 2

LIVING ROOM

LAUNDRY

DINING ROOM

FRONT PORCH

BATH

HALL

HALL