<table>
<thead>
<tr>
<th>Qty.</th>
<th>Symbol</th>
<th>Value</th>
<th>Description</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R5</td>
<td>10Ω 5% 1/4W</td>
<td>brown-black-gold</td>
<td>121000</td>
</tr>
<tr>
<td>1</td>
<td>R1</td>
<td>68kΩ 5% 1/4W</td>
<td>blue-gray-brown-gold</td>
<td>136800</td>
</tr>
<tr>
<td>1</td>
<td>R3</td>
<td>5.6kΩ 5% 1/4W</td>
<td>green-blue-red-gold</td>
<td>145600</td>
</tr>
<tr>
<td>1</td>
<td>R4</td>
<td>10kΩ 5% 1/4W</td>
<td>brown-black-orange-gold</td>
<td>151000</td>
</tr>
<tr>
<td>1</td>
<td>R2</td>
<td>18kΩ 5% 1/4W</td>
<td>brown-gray-orange-gold</td>
<td>151800</td>
</tr>
<tr>
<td>1</td>
<td>R6/S3</td>
<td>Potentiometer 50kΩ &amp; switch w/ nut &amp; washer</td>
<td>192522</td>
<td></td>
</tr>
</tbody>
</table>

### RESISTORS

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Symbol</th>
<th>Value</th>
<th>Description</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C6</td>
<td>33μF</td>
<td>Discap (33)</td>
<td>213317</td>
</tr>
<tr>
<td>1</td>
<td>C7</td>
<td>82μF</td>
<td>Discap (82)</td>
<td>218210</td>
</tr>
<tr>
<td>1</td>
<td>C10</td>
<td>180μF</td>
<td>Discap (181 or 180)</td>
<td>221810</td>
</tr>
<tr>
<td>1</td>
<td>C5</td>
<td>220μF</td>
<td>Discap (221 or 220)</td>
<td>222210</td>
</tr>
<tr>
<td>1</td>
<td>C8</td>
<td>330μF</td>
<td>Discap (331 or 330)</td>
<td>223317</td>
</tr>
<tr>
<td>1</td>
<td>C4</td>
<td>470μF</td>
<td>Discap (471 or 470)</td>
<td>224717</td>
</tr>
<tr>
<td>1</td>
<td>C13</td>
<td>680μF</td>
<td>Discap (681 or 680)</td>
<td>226880</td>
</tr>
<tr>
<td>1</td>
<td>C23</td>
<td>1500μF</td>
<td>Discap (152)</td>
<td>231516</td>
</tr>
<tr>
<td>1</td>
<td>C11, C12</td>
<td>3300μF</td>
<td>Discap (332)</td>
<td>233310</td>
</tr>
<tr>
<td>1</td>
<td>C15</td>
<td>0.033μF</td>
<td>Discap (333)</td>
<td>243318</td>
</tr>
<tr>
<td>1</td>
<td>C19</td>
<td>0.047μF</td>
<td>Discap (473)</td>
<td>244730</td>
</tr>
<tr>
<td>6</td>
<td>C3, C9, C14, C16, C17, C18</td>
<td>0.1μF</td>
<td>Discap (104)</td>
<td>251010</td>
</tr>
<tr>
<td>1</td>
<td>C21, C22</td>
<td>10μF</td>
<td>Electrolytic radial</td>
<td>271044</td>
</tr>
<tr>
<td>1</td>
<td>C20</td>
<td>22μF</td>
<td>Electrolytic radial</td>
<td>272244</td>
</tr>
<tr>
<td>1</td>
<td>C1</td>
<td>100μF</td>
<td>Electrolytic radial</td>
<td>281044</td>
</tr>
<tr>
<td>2</td>
<td>C2, C18</td>
<td>220μF</td>
<td>Electrolytic radial</td>
<td>282244</td>
</tr>
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</table>

### CAPACITORS

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Symbol</th>
<th>Value</th>
<th>Description</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L2</td>
<td>Coil 4-turn</td>
<td></td>
<td>430150</td>
</tr>
<tr>
<td>1</td>
<td>L1</td>
<td>Coil 6-turn</td>
<td></td>
<td>430160</td>
</tr>
</tbody>
</table>

### SEMICONDUCTORS

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Symbol</th>
<th>Value</th>
<th>Description</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D1</td>
<td>BB909/BB910</td>
<td>Varactor</td>
<td>310909</td>
</tr>
<tr>
<td>1</td>
<td>D2</td>
<td>1N4001</td>
<td>Semiconductor silicon diode</td>
<td>314001</td>
</tr>
<tr>
<td>1</td>
<td>D3</td>
<td>Red LED 3mm</td>
<td>Low voltage audio power amplifier</td>
<td>350003</td>
</tr>
<tr>
<td>1</td>
<td>U2</td>
<td>LM-386 or identical</td>
<td>Low voltage audio power amplifier</td>
<td>330386</td>
</tr>
<tr>
<td>1</td>
<td>U1</td>
<td>TDA7088T or identical</td>
<td>FM receiver SM installed on PC board</td>
<td></td>
</tr>
</tbody>
</table>

### MISCELLANEOUS

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Description</th>
<th>Part #</th>
<th>Qty.</th>
<th>Description</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Antenna FM</td>
<td>484005</td>
<td>1</td>
<td>Screw M1.8 x 7.5mm</td>
<td>641100</td>
</tr>
<tr>
<td>1</td>
<td>PC board w/ installed U1 (TDA7088T)</td>
<td>517038</td>
<td>1</td>
<td>Antenna screw M2 x 5mm</td>
<td>643148</td>
</tr>
<tr>
<td>2</td>
<td>Push button switch 12mm</td>
<td>540005</td>
<td>1</td>
<td>Nut M1.8</td>
<td>644210</td>
</tr>
<tr>
<td>1</td>
<td>Battery holder</td>
<td>590996</td>
<td>1</td>
<td>Socket IC 8-pin</td>
<td>664008</td>
</tr>
<tr>
<td>1</td>
<td>Speaker BD</td>
<td>590102</td>
<td>1</td>
<td>Speaker pad</td>
<td>780128</td>
</tr>
<tr>
<td>1</td>
<td>Cap push button switch yellow</td>
<td>622001</td>
<td>3</td>
<td>Wire 22 ga. solid</td>
<td>834012</td>
</tr>
<tr>
<td>1</td>
<td>Cap push button switch red</td>
<td>622007</td>
<td>1</td>
<td>Solder Lead-free</td>
<td>9LF99</td>
</tr>
<tr>
<td>1</td>
<td>Knob pot / switch</td>
<td>622050</td>
<td>1</td>
<td>-</td>
<td>-5-</td>
</tr>
</tbody>
</table>

Glossary (Continued):

- **RF**: Radio Frequency.
- **Transistor**: A semiconductor component that can be used to amplify signals, or as electronic switches.
- **Sensitivity**: The ability of a receiver to pick up low-amplitude signals.
- **Speaker**: An electronic device that turns electric impulses into sound.
- **Varactor**: A diode optimized to vary its internal capacitance with a change in its reverse bias voltage.
- **Surface-mount Technology**: A method of using special components that are soldered to the PC board’s surface.
- **Voltage**: Electrical potential difference measured in volts.

**QUIZ**

**INSTRUCTIONS**: Complete the following examination, check your answers carefully.

1. The number of cycles produced per second by a source of sound is called the . . .
   - A) amplitude.
   - B) vibration.
   - C) sound wave.
   - D) frequency.

2. The frequency of the modulating signal determines the . . .
   - A) number of times the frequency of the carrier changes per second.
   - B) maximum deviation of the FM carrier.
   - C) maximum frequency swing of the FM carrier.
   - D) amount of amplitude change of the FM carrier.

3. The FM broadcast band is . . .
   - A) 550 – 1,600kHz.
   - B) 20 to 200kHz.
   - C) 0 to 200kHz.
   - D) 98.7 – 118.7MHz.

4. The AFC circuit is used to . . .
   - A) automatically hold the local oscillator on frequency.
   - B) maintain constant gain in the receiver to prevent such things as fading.
   - C) prevent amplitude variations of the FM carrier.
   - D) none of the above.

5. The gain of the LM-386 amplifier can be set in range . . .
   - A) 1 to 20.
   - B) 20 to 200.
   - C) 0 to 200.
   - D) 50 to 100.
1. One of the most frequently occurring problems is poor solder connections.
   - a) Tug slightly on all parts to make sure that they are indeed soldered.
   - b) All solder connections should be shiny. Resolder any that are not.
   - c) Solder should flow into a smooth puddle rather than a round ball. Resolder any connection that has formed into a ball.
   - d) Have any solder bridges formed? A solder bridge may occur if you accidentally touch an adjacent foil by using too much solder or by dragging the soldering iron across adjacent foils. Break the bridge with your soldering iron.

2. Use a fresh 9V battery.

3. Make sure that all of the parts are placed in their correct positions. Check if the IC, diode and electrolytic orientations are correct.

GLOSSARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGC</td>
<td>Automatic Gain Control.</td>
</tr>
<tr>
<td>AF</td>
<td>Audio Frequency</td>
</tr>
<tr>
<td>AM</td>
<td>Amplitude Modulation</td>
</tr>
<tr>
<td>Amplifier</td>
<td>Converts input signal to output.</td>
</tr>
<tr>
<td>Anode</td>
<td>The positive terminal of a diode.</td>
</tr>
<tr>
<td>Antenna</td>
<td>Any device that either radiates a signal or pulls in a signal.</td>
</tr>
<tr>
<td>Baffle</td>
<td>Used to ensure positive airflow.</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>The amount of frequency spectrum, in hertz, utilized by a filter or channel.</td>
</tr>
<tr>
<td>Bypass Capacitor</td>
<td>A capacitor used to shunt AC around a component.</td>
</tr>
<tr>
<td>Capacitor</td>
<td>An electronic component that has ability to store a charge and block DC current.</td>
</tr>
<tr>
<td>Cathode</td>
<td>The negative terminal of a diode.</td>
</tr>
<tr>
<td>Coil</td>
<td>A component with inductive reactance.</td>
</tr>
<tr>
<td>Current</td>
<td>Transport of electrons throughout a conductor and measured in amps.</td>
</tr>
</tbody>
</table>

Detector Circuit: Receiver circuit that recovers the modulated portion of the signal impressed on the RF carrier wave.

Diode: An electronic component that changes alternating current to direct current.

FM: Frequency Modulation.

Frequency: Wave or pulse repetition rate.

Gain: Signal multiplication.

IC: Integrated Circuit.

LED: Light Emitting Diode. A semiconductor device that emits light when voltage and current are passed through it.

PC Board: Printed Circuit Board.

Potentiometer: Three-terminal variable resistor, volume control.

Power Supply: An electronic circuit that produces the necessary power for another circuit.

Resistor: An electronic component that obstructs (resists) the flow of electricity.
You Will Need:
- 9V Battery
- 25 or 30 watt Soldering Iron
- Side Cutters
- Small Phillips and Slotted Screwdrivers
- Long Nose Plier

IDENTIFYING RESISTOR VALUES
Use the following information as a guide in properly identifying the value of resistors.

**Abbreviation** | **Means** | **Multiply Unit By** | **Or**
--- | --- | --- | ---
P | Pico | 0.00000000000001 | 10^-12
n | nano | 0.000000001 | 10^-9
μ | micro | 0.000001 | 10^-6
m | milli | 0.001 | 10^-3
| unit | 1 | 10^0
k | kilo | 1,000 | 10^3
M | mega | 1,000,000 | 10^6

1. 1,000 pico units = 1 nano unit
2. 1,000 nano units = 1 micro unit
3. 1,000 micro units = 1 milli unit
4. 1,000 milli units = 1 unit
5. 1,000 units = 1 kilo unit
6. 1,000 kilo units = 1 mega unit

METRIC UNITS AND CONVERSIONS

**IDENTIFYING CAPACITOR VALUES**

Capacitors will be identified by their capacitance value in pF (picofarads), nF (nanofarads), or μF (microfarads). Most capacitors will have their actual value printed on them. Some capacitors may have their value printed in the following manner. The maximum operating voltage may also be printed on the capacitor.

Electrolytic capacitors have a positive and a negative electrode. The negative lead is indicated on the packaging by a stripe with minus signs and possibly arrowheads.

**Warning:** If the capacitor is connected with incorrect polarity, it may heat up and either leak, or cause the capacitor to explode.

**Abbreviation** | **Means** | **Multiply Unit By** | **Or**
--- | --- | --- | ---
M | mega | 1,000,000 | 10^6
m | milli | 0.001 | 10^-3
μ | micro | 0.000001 | 10^-6
n | nano | 0.000000001 | 10^-9
P | pico | 0.00000000000001 | 10^-12

1. 1,000 kilo units = 1 mega unit
2. 1,000 nano units = 1 micro unit
3. 1,000 micro units = 1 milli unit
4. 1,000 milli units = 1 unit
5. 1,000 units = 1 kilo unit
6. 1,000 pico units = 1 nano unit

**TESTING - SECTION 2**

Voltage reference chart for U1 TDA 7088T (turn radio on and press reset).

**Test**

Verify that FM signals are present in your location by listening to another FM radio placed near the FM-88K.

1. Install fresh 9V battery into holder.
2. Bend the antenna to vertical position and adjust for maximum length.
3. Turn ON power switch (rotate clockwise until a “click” is heard). RED LED should light. Turn the VOLUME CONTROL potentiometer to middle position (comfortable level).
4. Press and release “RESET” (R) button.

Press and release the “SCAN” (S) button once or a couple of times; a station should be heard. Press and release “SCAN” button again; the radio should be automatically searching for other broadcast station. When you press the “SCAN” button in several times, there should be other broadcast stations coming before the HIGH-END frequency (FM106-108MHz).

If test fails:

Make sure that all of the parts are placed in their correct position. Check if the orientation of D1 is correct.

Short pins 2 and 14 of U1 several times using a wire. If you don’t hear tapping from the speaker, check U1, capacitors C22 and C23, resistor R2, and potentiometer R6.

**Alignment**

The first time “SCAN” button is pressed, the radio should start at the bottom end of the FM band (88-90 MHz). You may need to press the SCAN button a couple of times. If it doesn’t tune to the low end, you will need to adjust the coil.

If the radio is receiving station frequencies higher than 87MHz after pressing the “RESET” button (to receive regular FM stations you need to press the “SCAN” button several times), then you will need to adjust the L2 coil to a smaller value (carefully slide a small screwdriver between coils to get the spacing shown in Figure M).

If sound is not clear:

Install capacitor C* onto the copper side of the PC board as shown in Figure N.

If you need more gain (up to 200), install capacitor C21 (10μF) as shown in Figure D.
ASSEMBLE COMPONENTS TO THE PC BOARD

Place a check mark ☑ in the box provided next to each step to indicate that the step is completed.

- C5 - 220μF Discap (221 or 222)
- C4 - 10μF 5% 1/4W Res. (brown-black-orange-gold)
- C6 - 33pF Discap (33)
- C7 - 82μF Discap (82)
- C8 - 330μF Discap (331 or 335)
- C11 - 330μF Discap (332)
- L1 - Coil 6-turn (see Figure K)
- C9 - 0.1μF Discap (104)
- C14 - 0.1μF Discap (104)
- R3 - 5.6kΩ
- C16 - 0.1μF Discap (104)
- C15 - 0.033μF Discap (333)
- L2 - Coil, 4-turn (see Figure I)
- C12 - 330μF Discap (332)
- C10 - 180μF Discap (181 or 180)
- C23 - 1500μF Discap (152)
- R4 - 10kΩ
- C5 - 220μF Discap (221 or 222)
- S1 - Cap red (see Figure J)
- C22 - 10μF Electrolytic (see Figure D)
- S2 - Push button switch
- C1 - Cap yellow (see Figure J)
- S2 - Push button switch
- C2 - Cap red (see Figure J)
- C7 - 82μF Discap (82)
- C16 - 0.1μF Discap (104)
- C20 - 330μF Discap (332)
- C23 - 1500μF Discap (152)

Note: Capacitors C21 and C* are not used.

Figure I
Using a spacer, create three 1/16" gaps in the 4-turn coil as shown. Mount the coil to the PC board as shown. Solder and cut off excess leads.

Figure J
Mount the push button switch flush to the PC board and solder into place. Attach the plastic button cap to the switch by snapping it into place.

Figure K
Mount the 6-turn coil to the PC board as shown. Solder and cut off excess leads.

- Electronic auto-scan FM RADIO FM-88K is a receiver for searching FM stations.
- Operated by two push button switches.
- Frequency range: (88 – 108) MHz.
- High sensitivity.

INTRODUCTION

The FM (Frequency Modulation) band covers 88 – 108 MHz. There are signals from many radio transmitters in the band inducing signal voltages in the area. Below is a block diagram of a basic SUPERHETERODYNE FM radio:

FM RF AMPLIFIER, MIXER, OSCILLATOR

The RF amplifier selects and amplifies a desired station from many. It is adjustable so that the selection frequency can be altered, also known as tuning. The selected frequency and the output of an Oscillator are applied to the mixer, forming a frequency changer circuit. The RF amplifier and the oscillator are the only two resonant circuits that change when the radio is tuned for different stations.

Since a radio station may exist 10.7MHz above the oscillator, a frequency changer circuit is used. The RF amplifier selects and amplifies a desired frequency. The oscillator frequency is stable in spite of temperature, voltage, and other effects changes. If this occurs, the center frequency of 10.7MHz will not be maintained. AFC is used to maintain the 10.7MHz center frequency. When the local oscillator drifts, the radio detector will produce a DC (direct current) "correction" voltage. This signal is fed to a filter network that removes the audio so that pure DC voltage is produced and changes the frequency of oscillation of the local oscillator.

AUDIO AMPLIFIER

The audio amplifier increases the audio power to a level sufficient to drive an 8Ω speaker. To do this, DC from the battery is converted by the amplifier to AC (alternating current) in the speaker. The ratio of the power delivered to the speaker and the power taken from the battery is the efficiency of the amplifier. In a class A amplifier (transistor on over entire cycle), the maximum Theoretical efficiency is 0.5 or 50%.
In this test, you will produce a clicking sound by shorting the bottom volume control pin to ground using your finger.

1. Install a new 9V battery into the battery holder. Turn the power switch on and turn the knob fully clockwise. The LED should light.
   - If LED does not light:
     - Make sure the diode D2 and LED D3, capacitor C2, and U2 are mounted in the correct position as marked on the PC board.
     - Check that resistor R1 is the correct value.
     - Check if the battery is properly installed in the battery holder and that the power switch is operational.
     - Check capacitors C3 and C17.
   - You should hear a clicking sound every time the pins are shorted. If you hear no sound then:
     - Check that U2 and C18 are installed in the correct position as marked on the PC board.
     - Check the potentiometer R6 and the speaker. Make sure the speaker’s wires are soldered correctly and not shorting together.

Voltage reference chart for U2 LM386

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Voltage</th>
<th>Pin #</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.3</td>
<td>5</td>
<td>4.5</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>6</td>
<td>9.0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>7</td>
<td>4.5</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>8</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Voltage Regulator Circuit

1. Voltage across D2 and D3 should be 2.6V
2. Voltage across the LED D3 should be 1.9V.

SCHEMATIC DIAGRAM FM-88K

FM RADIO HIGHLIGHTS

1. The FM broadcast band covers the frequency range from 88MHz to 108MHz.
2. FM signals are usually limited to line a sight.
3. Audio signals up to 15kHz are transmitted on the FM carrier.
4. The amount that the RF carrier changes frequency is determined by the amplitude of the modulating signal.
5. The number of times the carrier frequency changes in a period of time is exactly equal to the audio frequency.
6. The bandwidth assigned for FM is 200kHz.
ASSEMBLE COMPONENTS TO THE PC BOARD

Place a check mark \( \square \) in the box provided next to each step to indicate that the step is completed.

- C1 - 100μF, Electrolytic (see Figure D)
- R2 - 18kΩ 5% 1/4W Res. (brown-gray-orange-gold)
- C13 - 680pF Discap (681 or 680)
- D1 - BB909/BB910 Varactor (see Figure G)
- C17 - 0.1μF Discap (104)

Install speaker

Step 1: If the speaker pad has center and outside pieces, then remove them. Peel the backing off of one side of the speaker pad and stick the pad onto the speaker.

Step 2: Remove the other backing from the speaker pad.

Step 3: Slick the speaker onto the solder side of the PC board.

Step 4: Solder two 1/4" wires from the speaker to the pads +SP and −SP.

Install battery holder

Bend the leads of the battery holder as shown. Fasten the battery holder to the PC board with a M1.8 x 7.5mm screw and M1.8 nut. Solder the leads to the PC board pads as shown.

The Oscillator voltage and signals of all the other FM stations (Fs) from pin 11 are inputted into the Mixer. The output of the mixer is only FM signals whose frequencies are equal to the differences of the oscillator and the original station frequency.

Only a signal whose carrier frequency is equal to IF can reach the "Demodulator". Selectivity (ability to "pick out" one station while rejecting all others) is accomplished by two active filters made from the capacitors connected to pins 6, 7, 8, 9 and 10. The oscillator frequency increases until the condition \( F_o - F_s = 70kHz \) is accomplished. When this happens, the charging of the capacitor is halted by the command that is sent into the "Tuning Search" circuit by two detectors (diode-blocks) located in the "Mute Control" circuit.

In order to hold the frequency, the voltage on pin 16 must not change until the "Scan" switch is pushed again. That is the function of the AFC (Automatic Frequency Control) circuit; controlling the voltage on pin 16. When the switch S2 "R" (Reset) is pushed, the capacitor C14 is discharged, the voltage on pin 16 drops down to zero, and the receiver is set to the low end of the reception bandwidth 88MHz.

Capacitor C23 and resistor R2 filter out the radio frequency component of the signal, leaving a clean audio signal. Capacitor C22 couples the audio signal to the input of the power amplifier. Since the maximum operating DC voltage of the U1 is 5V, the battery voltage must be regulated down.

Our kit uses the standard design for the audio amplifier on base of the integrated circuit (U2) LM-386, or identical. In Figure 3, you can see equivalent schematic and connection diagrams. To make the LM-386 a more versatile amplifier, two pins (1 and 8) are provided for gain control. With pins 1 and 8 open, the 1.35kΩ resistor sets the gain at 20 (see Figure 4a). The gain can be set to any value from 20 to 200 if resistor is placed in series with the capacitor. The amplifier with a gain of 150 is shown in Figure 4c. The amount of gain control is varied by potentiometer R6, which also varies the audio level and, consequently, the volume.
CONSTRUCTION

Introduction
The most important factor in assembling your FM-88K Auto-scan FM Radio Kit is good soldering techniques. Using the proper soldering iron is of prime importance. A small pencil type soldering iron of 25-40 watts is recommended. The tip of the iron must be kept clean at all times and well-tinned.

Solder
For many years leaded solder was the most common type of solder used by the electronics industry, but it is now being replaced by lead-free solder for health reasons. This kit contains lead-free solder, which contains 99.3% Sn, 0.7% copper, and has a rosin-flux core.

Lead-free solder is different from leaded solder: It has a higher melting point than lead solder, so you need higher temperature for the solder to flow properly. Recommended tip temperature is approximately 700°F; higher temperatures improve solder flow but accelerate tip decay. An increase in soldering time may be required to achieve good results. Soldering iron tips wear out faster since lead-free solders are more corrosive and the higher soldering temperatures accelerate corrosion, so proper tip care is important. The solder joint finish will look slightly duller with lead-free solders. Each tip should be cleaned frequently to remove oxidation before it becomes impossible to remove. Use Dry Tip Cleaner (Elenco® #TTC1). If you use a sponge to clean your tip, then use distilled water (tap water has impurities that accelerate corrosion).

Safety Procedures
• Always wear safety glasses or safety goggles to protect your eyes when working with tools or soldering iron, and during all phases of testing.
• Be sure there is adequate ventilation when soldering.
• Locate soldering iron in an area where you do not have to go around heated component and the circuit board foil. Do not hold soldering iron in your mouth.
• Do not use AC core solder!

ASSEMBLE COMPONENTS TO THE PC BOARD

Place a check mark in the box provided next to each step to indicate that the step is completed.

What Good Soldering Looks Like
A good solder connection should be bright, shiny, smooth, and uniformly flowed over all surfaces.

1. Solder all components from the copper foil side only. Push the soldering iron tip against both the lead and the circuit board foil.

2. Apply a small amount of solder to the tip of the iron. This allows the heat to leave the iron and onto the foil. Immediately apply solder to the opposite side of the connection, away from the iron. Allow the heated component and the circuit foil to melt the solder.

3. Allow the solder to flow around the connection. Then, remove the solder and the iron and let the connection cool. The solder should have flowed smoothly and not lump around the wire lead.

4. Here is what a good solder connection looks like.

Types of Poor Soldering Connections

1. Insufficient heat - the solder will not flow onto the lead as shown.

2. Insufficient solder - let the solder flow over the connection until it is covered. Use just enough solder to cover the connection.

3. Excessive solder - could make connections that you did not intend to, between adjacent foil areas or terminals.

4. Solder bridges - occur when solder runs between circuit paths and creates a short circuit. This is usually caused by using too much solder. To correct this, simply drag your soldering iron across the solder bridge as shown.

• Turn off iron when not in use or reduce temperature setting when using a soldering station.
• Tips should be cleaned frequently to remove oxidation before it becomes impossible to remove. Use Dry Tip Cleaner (Elenco® #TTC1). If you use a sponge to clean your tip, then use distilled water (tap water has impurities that accelerate corrosion).

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