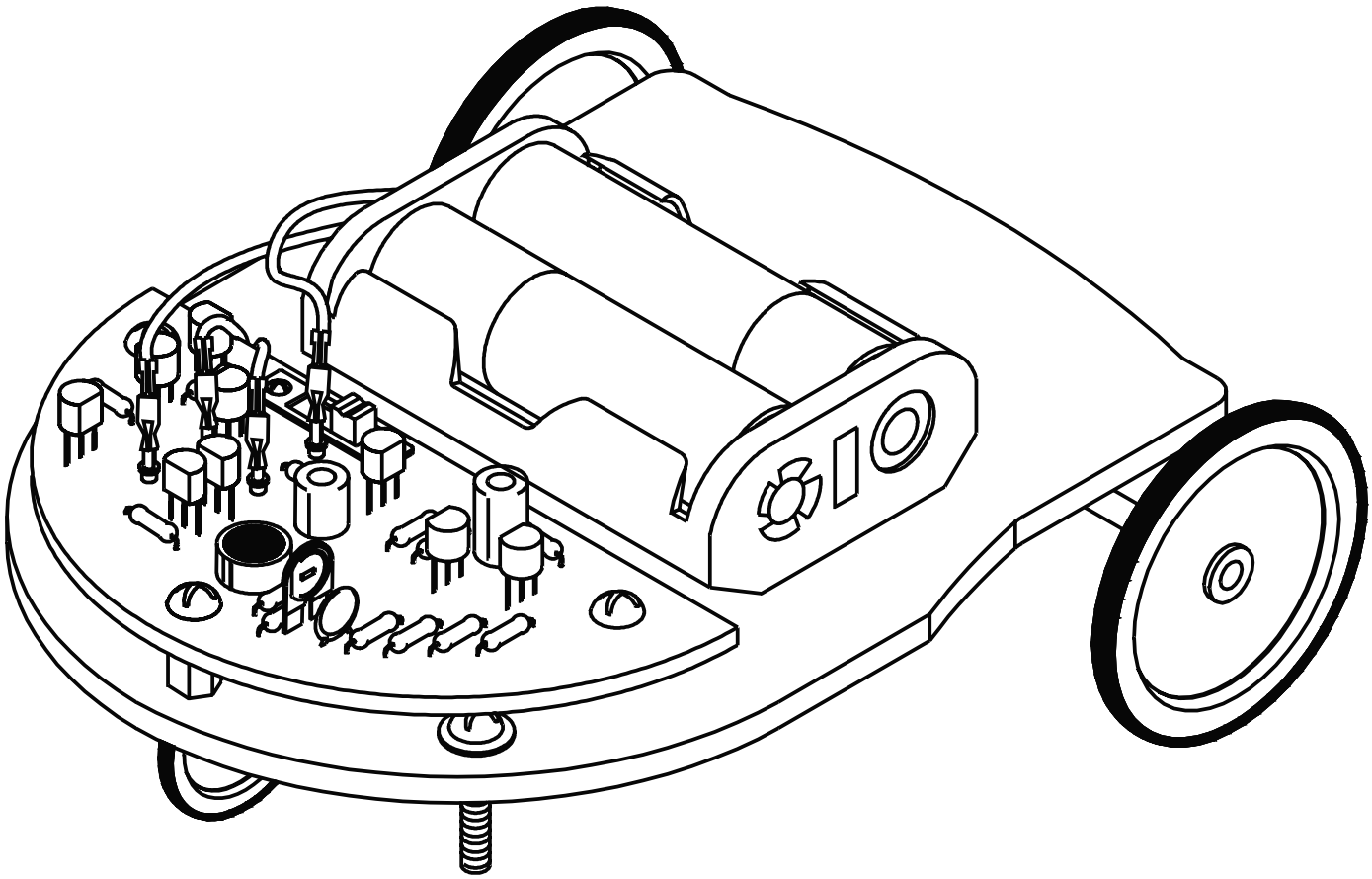
WEmake™

TOOLS FOR MAKERS

Learn to Solder Kit
Build a Robot Car

MODEL WMSK-300	Sound Reversing Car



Assembly and Instruction Manual

ELENCO®
Learn by doing.®

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Wheeling, IL 60090 (847) 541-3800
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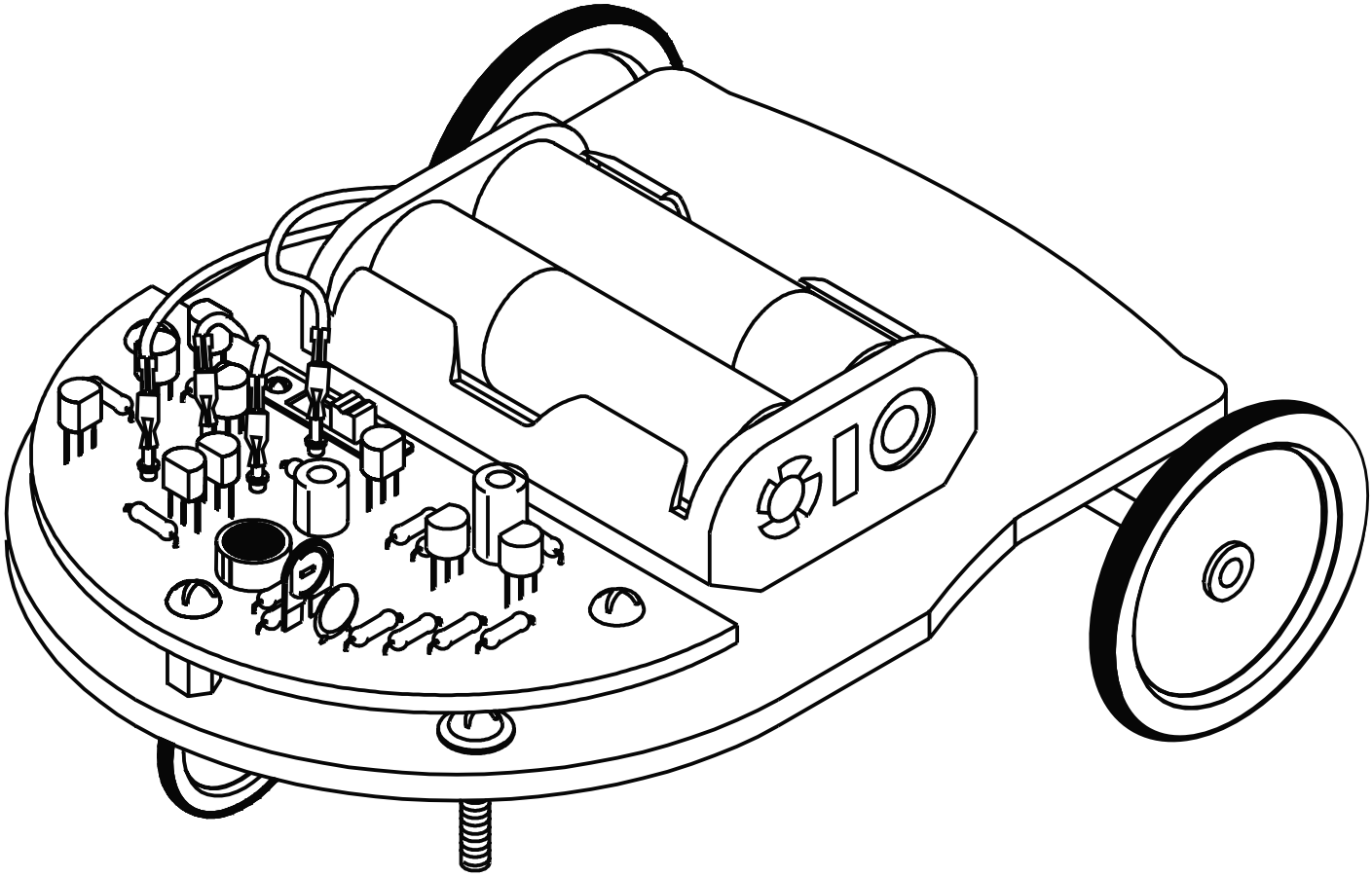
elenco.com

753018

WEmake™ Sound Reversing Car I Introduction

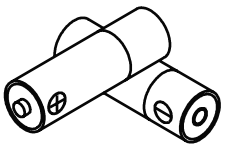


You will find it's fun to learn electronics and mechanisms by building this Sound Reversing Car. It is a simple voice control robot car by using microphones as its detector. It moves forward normally unless the microphone receives a signal like a clap or physical contact.

The car will move forward when you switch on the unit, when the microphone detects noise it will turn back and towards the left side for a few seconds then keep forward moving again until the next signals are received by microphone.

WEmake™ Tools Included

Qty.	Description	Part #
❒1	25W Soldering Iron W/Stand	WMSI200
❒1	Side Cutters 4 1/2" long	WMSC1



Power source required:
1.5V "AA"X2 batteries
(not included)

⚠ Batteries:

- Insert batteries with correct polarity.
- Do not mix old and new batteries. Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
- Remove batteries when they are used up.
- Do not short circuit the battery terminals.
- Never throw batteries in a fire or attempt to open the outer casing.
- Batteries are harmful if swallowed, so keep away from small children.

Parts List

If any parts are missing or damaged, please contact ELENCO® (address/phone/e-mail is at the front of this manual) for additional assistance, if needed. DO NOT contact your place of purchase as they will not be able to help you.

RESISTORS

Qty.	Symbol	Description	Color Code	Part #
❒2	R10,R11	15Ω 5% 1/4W	brown-green-black-gold	121500
❒2	R8, R9	220Ω 5% 1/4W	red-red-brown-gold	132200
❒1	R1	1kΩ 5% 1/4W	brown-black-red-gold	141000
❒1	R2	2.2kΩ 5% 1/4W	red-red-red-gold	142200
❒2	R5, R12	3.3kΩ 5% 1/4W	orange-orange-red-gold	143300
❒1	R6	22kΩ 5% 1/4W	red-red-orange-gold	152200
❒1	R4	47kΩ 5% 1/4W	yellow-violet-orange-gold	154700
❒1	R13	100kΩ 5% 1/4W	brown-black-yellow-gold	161000
❒1	R7	1MΩ 5% 1/4W	brown-black-green-gold	171000
❒1	R3	2.7MΩ 5% 1/4W	red-violet-green-gold	172700
❒1	VR	100kΩ (104) Variable resistor		191604

CAPACITORS

Qty.	Symbol	Description	Part #
❒1	C1 0.022µF (223)	Discap	242217
❒1	C3 1µF	Electrolytic	261047
❒1	C2 47µF	Electrolytic	274744

SEMICONDUCTORS

Qty.	Symbol	Description		Part #
❒5	TR1,TR2,TR5,TR6,TR9	C945 or 1815	Transistor NPN	320945
❒2	TR4, TR8	8050	Transistor NPN	328050
❒2	TR3, TR7	8550	Transistor PNP	328550

MISCELLANEOUS (REFER P.4 FOR PARTS ID CHART)

Qty.	Description	Part #	Qty.	Description	Part #
❒1	Gear Box	P1	❒2	Washer (2.6x6x0.5mm)	P19
❒1	Motor	P2	❒2	Washer (3.2x10x0.5mm)	P20
❒1	Metal Shaft 2x40mm	P3	❒4	Screw (M2x10mm)	P21
❒1	Metal Shaft 3x90mm	P4	❒6	Screw (M3x5mm)	P22
❒1	Pinion Gear 10T	P5	❒3	Screw (M3x18mm)	P23
❒1	Face Gear 36T/14T White	P6	❒1	Screw (M3x20mm)	P24
❒1	Gear 36T/0T White	P7	❒4	Nut M2	P25
❒1	Gear 36T/14T Red	P8	❒4	Nut M3	P26
❒1	Gear 36T/14T Green	P9	❒3	Hex Post (M3x10mm)	P27
❒2	Nylon Pad (5.6x4.8x1.95mm)	P10	❒1	Round Post (Ø3x6mm)	P28
❒2	Rubber Ring (30x3mm)	P11	❒1	Battery Holder	P29
❒1	Rubber Ring (15x2.5mm)	P12	❒4	1.3mm Pin	P30
❒1	Front Wheel (20mm)	P13	❒1	Wire Yellow	P31
❒2	Rear Wheel (32mm)	P14	❒1	Wire Green	P32
❒1	Spring	P15	❒1	Slide Switch	P33
❒1	Front Wheel Bracket	P16	❒1	Microphone	P34
❒2	Nylon Nut	P17	❒1	PC Board	P35
❒1	Round Post (3x2mm)	P18	❒1	Base	P36

PARTS IDENTIFICATION

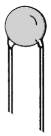
Resistors

5% 1/4W

Variable

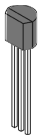
Capacitors

Electrolytic



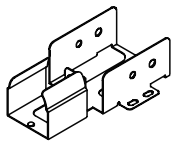
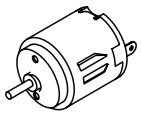
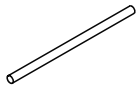
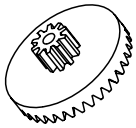
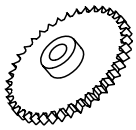
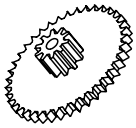
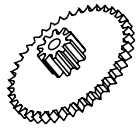
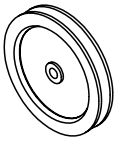
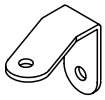
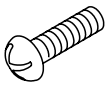
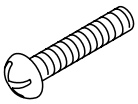
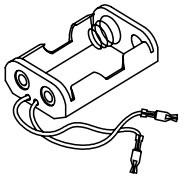
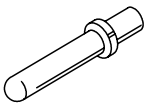
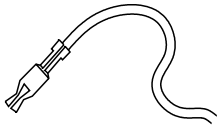
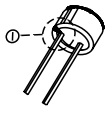
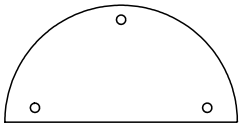
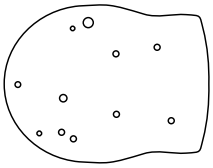
Discap

Semiconductors



Transistor

Parts Identification

				
Gear box	Motor	Metal shaft (2x40mm)	Metal shaft (3x90mm)	Pinion gear 10T
No: P1 1 PC	No: P2 1 PC	No: P3 1 PC	No: P4 1 PC	No: P5 1 PC
				
Face Gear 36T/14T White	Gear 36T/0T White	Gear 36T/14T Red	Gear 36T/14T Green	Nylon pad(5.64 x 4.8 x 1.95)
No: P6 1 PC	No: P7 1 PC	No: P8 1 PC	No: P9 1 PC	No: P9 2 PC
				
Rubber ring (Ø30 x 3mm)	Rubber ring (Ø15 x 2.5mm)	Front wheel (Ø20mm)	Rear wheel (Ø32mm)	Spring
No: P11 2 PC	No: P12 1 PC	No: P13 1 PC	No: P14 2 PC	No: P15 1 PC
				
Front wheel bracket	Nylon nut	Round post (Ø3 x 2mm)	Washer (2.6 x 6 X 0.5mm)	Washer (3.2 x 10 X 0.5mm)
No: P16 1 PC	No: P17 2 PC	No: P18 1 PC	No: P19 2 PCS	No: P20 2 PCS
				
Screw (M2 X 10mm)	Screw (M3 x 5mm)	Screw (M3 x 18mm)	Screw (3 x 20mm)	M2 Nut
No: P21 4 PC	No: P22 6 PC	No: P23 3 PC	No: P4 1 PC	No: P25 4 PC
				
M3 Nut	Hex Post (M3 x 10mm)	Round Post (Ø3 x 6mm)	Battery holder w/ 8cm wires	Pin 1.3mm
No: P26 4 PC	No: P27 3 PC	No: P28 1 PC	No: P29 1 PC	No: P30 4 PC
				
Connector with wire 15cm				
No: P31 Yellow 1PC	Slide Switch	Microphone	Printed circuit board	Base
No: P32 Green 1 PC	No: P33 1 PC	No: P34 1 PC	No: P35 1 PC	No: P36 1 PC

IDENTIFYING RESISTOR VALUES

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

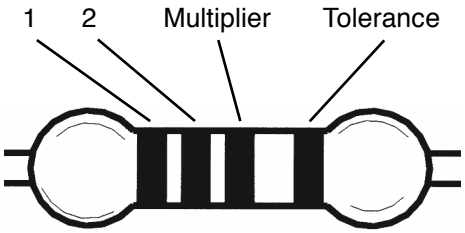
BAND 1 1st Digit	
Color	**Digit**
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

BAND 2 2nd Digit	
Color	**Digit**
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Multiplier	
Color	**Multiplier**
Black	1
Brown	10
Red	100
Orange	1,000
Yellow	10,000
Green	100,000
Blue	1,000,000
Silver	0.01
Gold	0.1

Resistance Tolerance	
Color	**Tolerance**
Silver	±10%
Gold	±5%
Brown	±1%
Red	±2%
Orange	±3%
Green	±0.5%
Blue	±0.25%
Violet	±0.1%

BANDS



IDENTIFYING CAPACITORS VALUES

Capacitors will be identified by their capacitance value in pF (picofarads), nF (nanofarads), or mF (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.

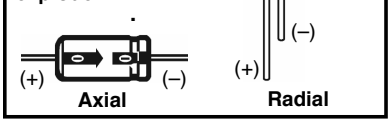
IDENTIFYING RESISTOR VALUES

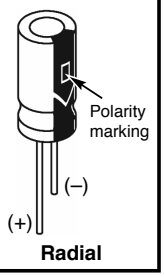
Use the following information as a guide in properly identifying the value of resistors.

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. Also, the negative lead of a radial electrolytic is shorter than the positive one.

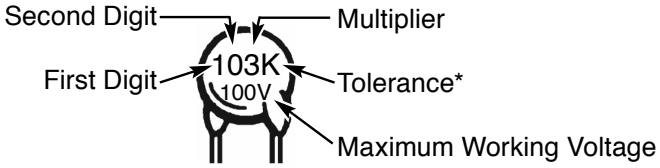
Warning:

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





Multiplier	For the No.	0	1	2	3	4	5	8	9
	Multiply By	1	10	100	1k	10k	100k	.01	0.1



The value is 10 x 1,000 =
10,000pF or .01µF, 10%, 100V

*The letter M indicates a tolerance of ±20%
The letter K indicates a tolerance of ±10%
The letter J indicates a tolerance of ±5%

Note: The letter "R" may be used at times to signify a decimal point; as in 3R3 = 3.3

METRIC UNITS AND CONVERSION

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	.000000000001	10^{-12}
n	nano	.000000001	10^{-9}
µ	micro	.000001	10^{-6}
m	milli	.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

Almost every electronic device today has a printed circuit board. Whether you are assembling a PC board or repairing it, you must understand the basics of working with these boards.

Good soldering requires practice and an understanding of soldering principles. This solder practice project will help you achieve good soldering techniques, help you to become familiar with a variety of electronic components, and provide you with dynamic results. If the circuit has been assembled and soldered properly, two LEDs will alternately flash, and the speaker will produce a wailing sound.

Safety Precautions

Like all electrical devices, the solder station must be handled with care. The soldering iron and tip can reach high temperatures and these simple safety rules should be followed.

- Keep children out of reach of the soldering station.
- To protect your eyes, use safety goggles during all phases of construction.
- Keep flammable material away from the soldering iron.
- DO NOT cool iron by dipping it into any liquid or water.
- Always assume that the tip is hot to avoid burns.
- Work in an area that is well ventilated.
- Be careful that the hot soldering iron tip or the barrel of the iron does not come in contact with any electrical cord.
- Do not hold solder in your mouth. Wash your hands thoroughly after handling solder.
- Locate soldering iron in an area where you do not have to go around it or reach over it.

Solder

Solder is a fusible metal, ideal for forming a metallic joint between two metals. Lead solder is composed of tin and lead, identified by the ratio of tin-to-lead. The most common ratios are 63/37, 60/40, the first number indicates the amount of tin, and the second is lead. It has a melting temperature around 360˚ to 370˚.

For health reasons, lead-free solder is widely used and included in this kit. Lead-free solders contain high percentages of tin, almost always over 94%. The lead-free solder in this kit contains 99.3% tin, 0.5% copper, and has a rosin-flux core. The melting point of lead-free solder is about 40˚F higher than leaded solder.
Tin is a corrosive and active metal and when it mixes with iron (the protective layer on the tip), an inter-metallic compound is formed that wears away more quickly than the iron would either by itself or when used with leaded solder.

When using lead-free solders it is very important that tips are properly maintained, otherwise tip life will be reduced significantly. Tips should be cleaned frequently to remove oxidation before it becomes impossible to remove. The tips should always be tinned when not being used, otherwise oxidation will quickly form on the tip. The iron should be turned off if not used for extended periods of time.

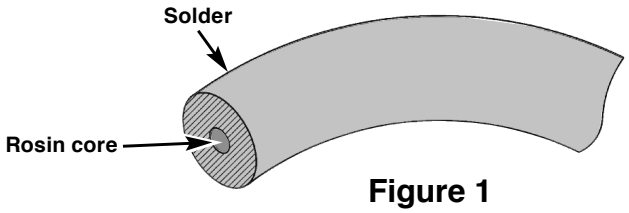


Figure 1

Flux

Most solder contains flux in the hollow core of the solder allowing it to be applied automatically when you heat the solder. The flux will remove any oxide film on the metals soldered creating a good metal-to-metal contact. This is called “wetting the metal”. There are three types of solder fluxes: chloride, organic and rosin. In the electronics industry, only the rosin type is used. Rosin flux comes in two types, pure and active. The most reliable is the pure type, since it doesn’t cause dendrites between tracks on the PC board as the active type does. Due to the highly corrosive and moisture attracting characteristics of the chloride and organic type fluxes, they should not be used in electronics.

Surface Preparation

In order for the solder to adhere to the connection, the metals must be clean and free of nonmetallic materials. Flux in the solder can remove oxides from metal but not other materials like dirt or grease. To remove these, use a small steel brush or fine emery cloth.

Mechanical Connection

When all the surfaces are clean, the metals should have a solid mechanical connection. Wires should be tightly wrapped around each other or to the terminal. This will eliminate large gaps that create weak solder joints. Solder should not be used as a mechanical connection.

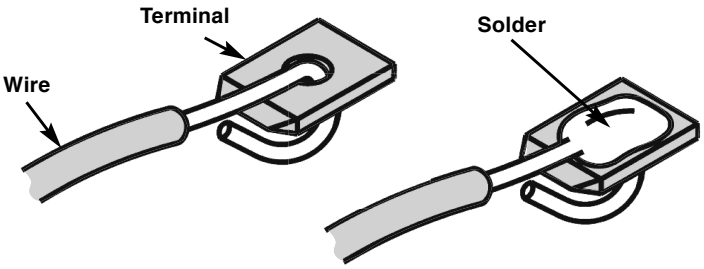


Figure 2

Solder: Tips and Maintenance

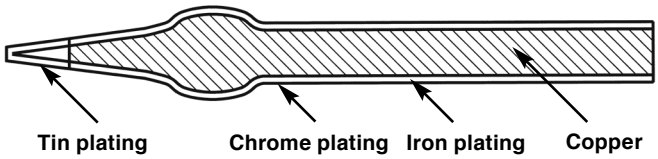
Types of Soldering Devices

A number of different types of soldering devices: irons, guns and stations are available today. Irons are used for light to medium work and guns are for medium to heavy-duty work. The station type can range from light to heavy-duty For working on PC boards, irons ranging from 15 to 40 watts are suitable, or a station with a range of 15 to 40 watts. If you use an iron with a higher wattage rating than 40 watt, you may damage the copper tracks on the PC board. The higher wattage irons are best suited for heavy-duty electrical jobs.

Soldering iron | Soldering gun | Soldering station

Solder Tips

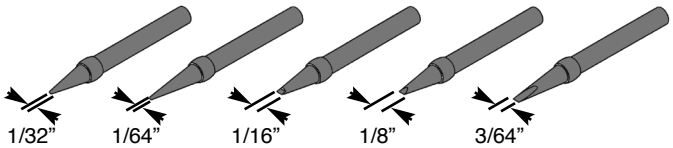
The tip is the very important part of the iron. The material that the tip is made from is an essential factor. The soldering iron tip contains four different metals as shown in Figure 3. The core consists of copper because of its high thermal conductivity. Since the copper is a soft material, it is plated with iron to maintain the shape. Chrome plating is used on the area where no soldering takes place to prevent oxidation. Then the tip is plated with tin, because it can be easily cleaned.



Tin plating | Chrome plating | Iron plating | Copper

Figure 3

Today, tips are manufactured in a variety of different shapes (see figure below). The chisel shape is one of the most common. Having a choice of tip styles allows you to choose the one best suited for your soldering needs. Due to the high heat, removable tips can bond themselves to the heating element if left in place for extended periods of time. Periodic removal of the tip is therefore advisable.



1/32” 1/64” 1/16” 1/8” 3/64”

Tip Cleaning

A good clean solder tip makes soldering much easier. The tip should be tinned by lightly coating it with solder to prevent it from oxidizing. The tip can become pitted (black spots) from normal use. It is important to clean the tip by wiping it with a wet sponge or rag. For tips that need a good cleaning, the tip tinner and cleaner (#TTC1) should be used.

Never use a file or abrasive material to clean the tip. Using such methods will damage the plating and ruin the tip. Do not remove the excess solder from the tip before storing. The excess solder will prevent oxidation.

Clean Connections

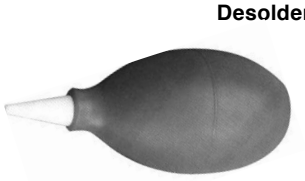
Proper solder adhesion requires that the metal surface to be free of dirt and grease. The flux only removes the oxides so a brush or rag can be used to clean metal. There are contact cleaners in aerosol cans and other solvents available.

Desoldering

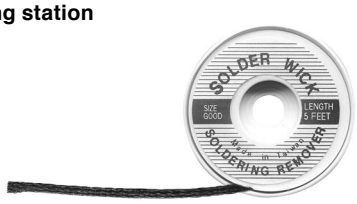
Great care should be taken when repairing or correcting a mistake on a PC board. The metal foil can be easily pulled up or broken from excessive heat. Use the least amount of heat as possible. You can use a desoldering tool, bulb, wick or a station. These tools will remove the solder enabling you to correct the problem..

When using lead-free solders it is very important that tips are properly maintained, otherwise tip life will be reduced significantly. Tips should be cleaned frequently to remove oxidation before it becomes impossible to remove. The tips should always be tinned when not being used, otherwise oxidation will quickly form on the tip. The iron should be turned off if not used for extended periods of time.

Desoldering station



Bulb



Solder wick

Desoldering pump

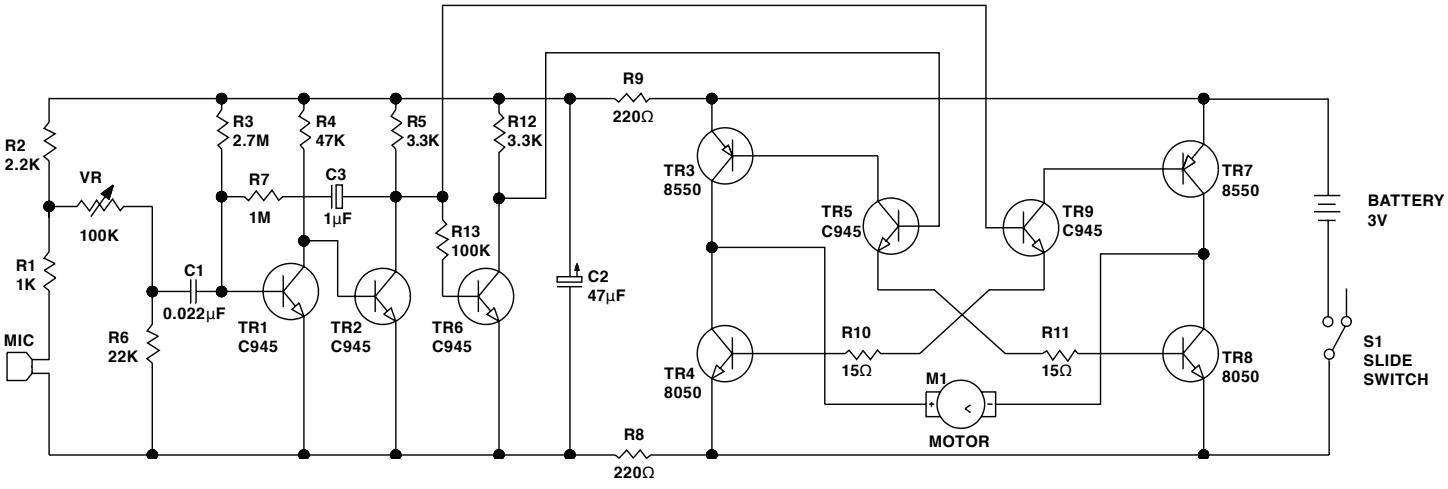
Theory of Operation

The kit is a simple sound controlled car which uses a microphone as its detector. The car moves forward when the switch is first turned on. When the microphone detects noise like clap or physical contact, it turns back to the left for few seconds then moves forward again until the next signal is received by microphone.

When the switch is turned on transistors TR1 and TR6 are on and TR2 off. When you apply 0.7V from base to emitter you will turn the transistor on and allow a current to flow from collector to emitter. Turning TR5 and TR9 on or off controls direction the car moves. In the forward direction TR5 is off and TR9 is on. In the backwards direction TR5 is on and TR9 is off. The base voltage of transistors TR5 and TR9 are controlled by the sound detection section. When the switch is turned on the base of TR6 is high and the collector low so the motor drives forwards. Transistors TR4 and TR7 are on and TR3 and TR8 off. The positive side of the battery connected to the motor through TR7 and the negative side through TR4.

When the microphone detects sound the base voltage of TR1 goes low turning the transistor off. Capacitor C3 then discharges through TR2 turning it on which turns TR6 off. The base of TR6 now goes low and the collector high turning transistors TR4 and TR7 off and TR3 and TR8 on This reverses the voltage on the motor so it car drives backwards. When the capacitor C3 voltage drops below .7 volts TR6 turns on again and the car drives forward. The potentiometer VR is used to adjust the sound sensitivity.

Schematic Diagram



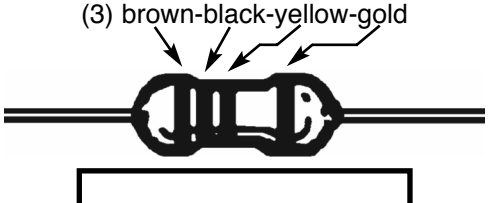
WEmake™ Resistor Reading Exercise

Before starting assembly of your project, you should be thoroughly familiar with the 4-band color code system. Many of the resistor values will be identified by color bands and it is easy to mistake their value if you read the colors incorrectly or read the value from the wrong end. Do the following exercise in resistor values. Place your answer in the box beneath the resistor. Answers are on the bottom of this page.

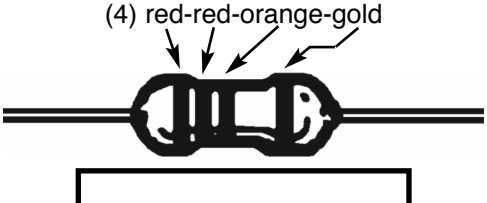
(1) brown-green-red-gold

(2) brown-black-orange-gold

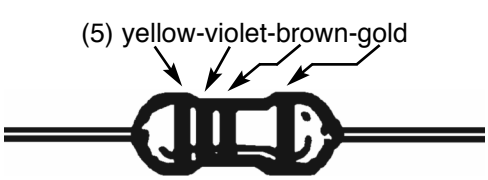
(3) brown-black-yellow-gold



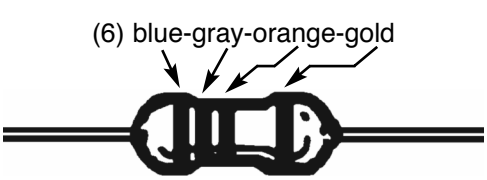
(4) red-red-orange-gold



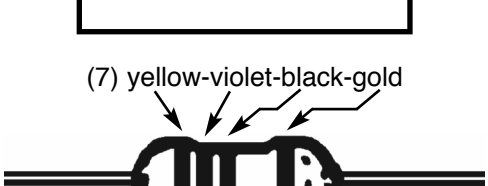
(5) yellow-violet-brown-gold



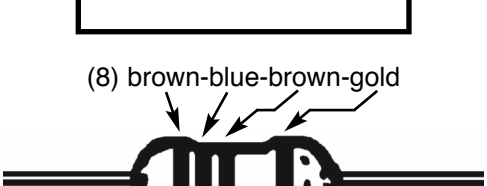
(6) blue-gray-orange-gold



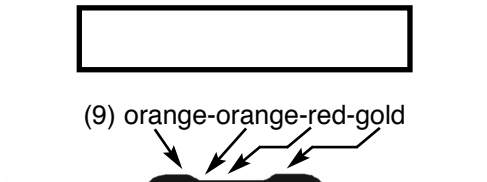
(7) yellow-violet-black-gold



(8) brown-blue-brown-gold

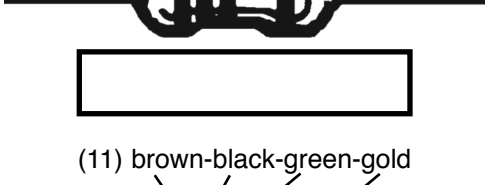


(9) orange-orange-red-gold

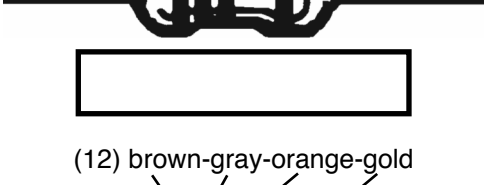


(10) green-brown-red-gold

(11) brown-black-green-gold



(12) brown-gray-orange-gold



Answers to Resistor Reading Exercise: 1) 1.5kW+5%; 2) 10kW+5%; 3) 100kW+5%; 4) 22kW+5%; 5) 470W+5%; 6) 68kW+5%; 7) 47W+5%; 8) 160W+5%; 9) 3.3kW+5%; 10) 5.1kW+5%; 11) 1MW+5%; 12) 18kW+5%

Construction

Introduction

The most important factor in assembling your WMSK-300 Kit is good soldering techniques. Using the proper soldering iron is of prime importance. A small pencil type soldering iron of 25 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% tin, 0.7% copper, and has a rosin-flux core.

Lead-free solder is different from lead 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.

Use these procedures to increase the life of your soldering iron tip when using lead-free solder:

- Keep the iron tinned at all times.
- Use the correct tip size for best heat transfer. The conical tip is the most commonly used.
- 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® #SH-1025) or 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 it or reach over it. Keep it in a safe area away from the reach of children.**
- **Do not hold solder in your mouth. Solder is a toxic substance. Wash hands thoroughly after handling solder.**

Assemble Components

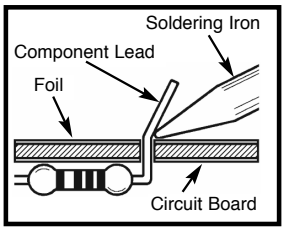
In all of the following assembly steps, the components must be installed on the top side of the PC board unless otherwise indicated. The top legend shows where each component goes. The leads pass through the corresponding holes in the board and are soldered on the foil side. Use only rosin core solder.

DO NOT USE ACID CORE SOLDER!

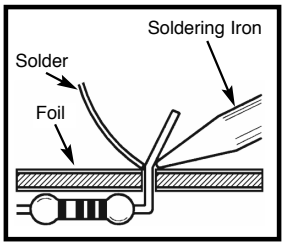
What Good Soldering Looks Like

A good solder connection should be bright, shiny, smooth, and uniformly flowed over all surfaces.

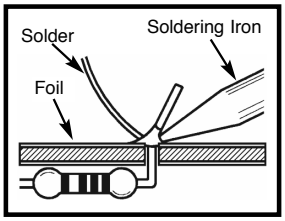
1. Solder all components from the copper foil side only. Push the soldering iron tip against both the lead and the circuit board foil.



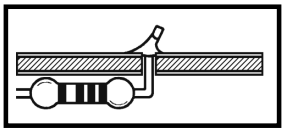
2. Apply a small amount of solder to the iron tip. This allows the heat to leave the iron and onto the foil. Immediately apply solder to the opposite side of the connection, away from the iron. Allow the heated component and the circuit foil to melt the solder.



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.

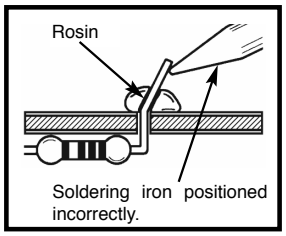


4. Here is what a good solder connection looks like.

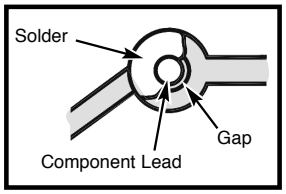


Types of Poor Soldering Connections

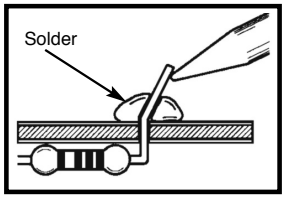
1. **Insufficient heat** - the solder will not flow onto the lead as shown.



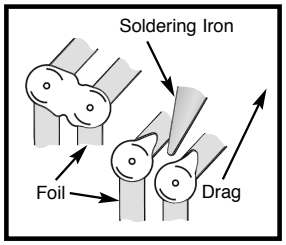
2. **Insufficient solder** - let the solder flow over the connection until it is covered. Use just enough solder to cover the connection.



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.

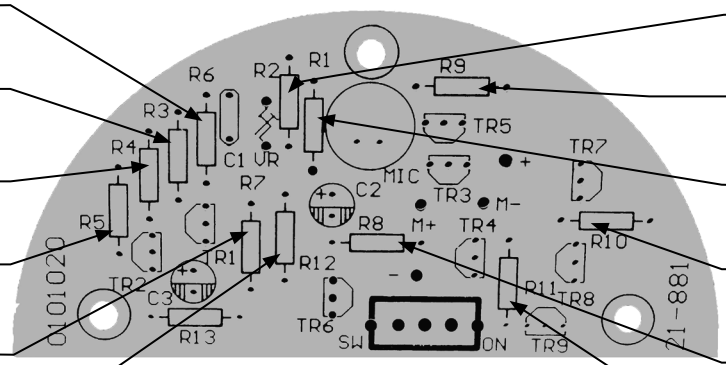


PC Board Assembly

NOTE: Before beginning assembly, please refer to page 6 for the resistor reading exercise. This will familiarize you with the resistor color band coding.

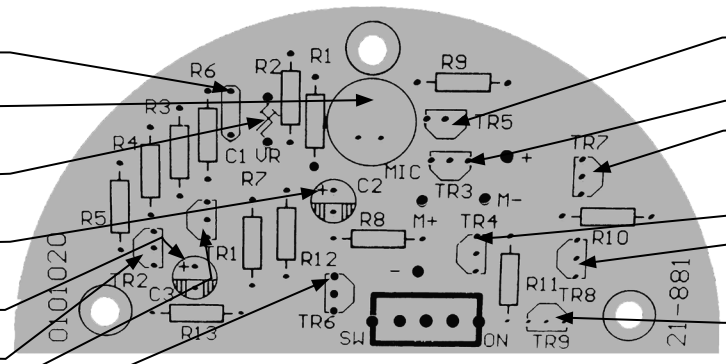
Solder the following parts to the PC board.

- ☐ R6 - 22kΩ 5% ¼W Resistor (red-red-orange-gold) (see Figure C)
- ☐ R3 - 2.7MΩ 5% ¼W Resistor (red-violet-green-gold) (see Figure C)
- ☐ R4 - 47kΩ 5% ¼W Resistor (yellow-violet-orange-gold) (see Figure C)
- ☐ R5 - 3.3kΩ 5% ¼W Resistor (orange-orange-red-gold) (see Figure C)
- ☐ R7 -1MΩ 5% ¼W Resistor (brown-black-green-gold) (see Figure C)
- ☐ R12 -3.3kΩ 5% ¼W Resistor (orange-orange-red-gold) (see Figure C)

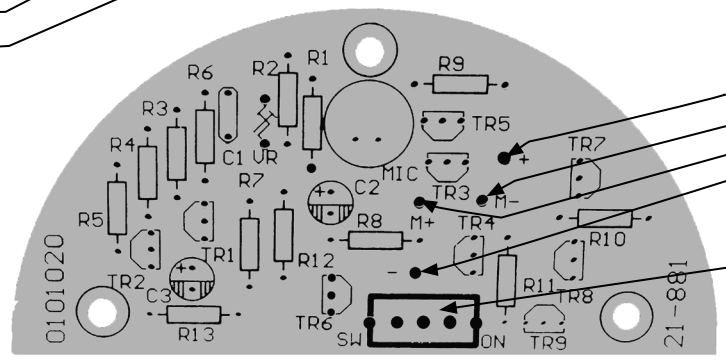


- ☐ R2 - 2.2kΩ 5% ¼W Resistor (red-red-red-gold) (see Figure C)
- ☐ R9 - 220Ω 5% ¼W Resistor (red-red-brown-gold) (see Figure C)
- ☐ R1 - 1kΩ 5% ¼W Resistor (brown-black-red-gold) (see Figure C)
- ☐ R10 - 15Ω 5% ¼W Resistor (brown-green-black-gold) (see Figure C)
- ☐ R8 - 220Ω 5% ¼W Resistor (red-red-brown-gold) (see Figure C)
- ☐ R11 - 15Ω 5% ¼W Resistor (brown-green-black-gold) (see Figure C)

- ☐ C1 0.022µF (223) Discap
- ☐ MIC - Microphone (see Figure A)
- ☐ VR -100kΩ Variable Resistor (see Figure E)
- ☐ C2 47µF Electrolytic (see Figure B)
- ☐ C3 1µF Electrolytic (see Figure B)
- ☐ TR2 - C945 Transistor NPN
- ☐ TR1 - C945 Transistor NPN
- ☐ TR6 - C945 Transistor NPN (see Figure F)



- ☐ TR5 - C945 Transistor NPN (see Figure F)
- ☐ TR3 - 8550 Transistor PNP
- ☐ TR7 - 8550 Transistor PNP (see Figure F)
- ☐ TR4 - 8050 Transistor NPN
- ☐ TR8 - 8050 Transistor NPN (see Figure F)
- ☐ TR9 - C945 Transistor NPN (see Figure F)



- ☐ + 1.3mm Pin
- ☐ M– 1.3mm Pin
- ☐ M+ 1.3mm Pin
- ☐ – 1.3mm Pin (see Figure D)
- ☐ Slide Switch

Figure A
Mount the microphone with the leads in the correct holes on the PC board.

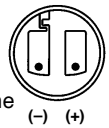
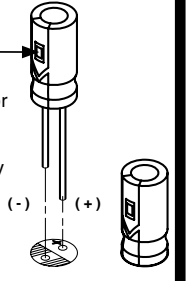


Figure B
Be sure that the negative (short) lead is in the correct hole on the PC board.



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

Figure C
Mount the resistor flat against the PC board as shown.

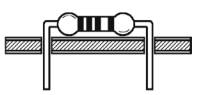


Figure D
Mount the pin flat against the PC board as shown.

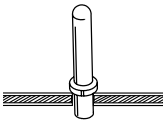
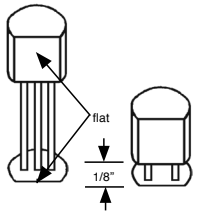
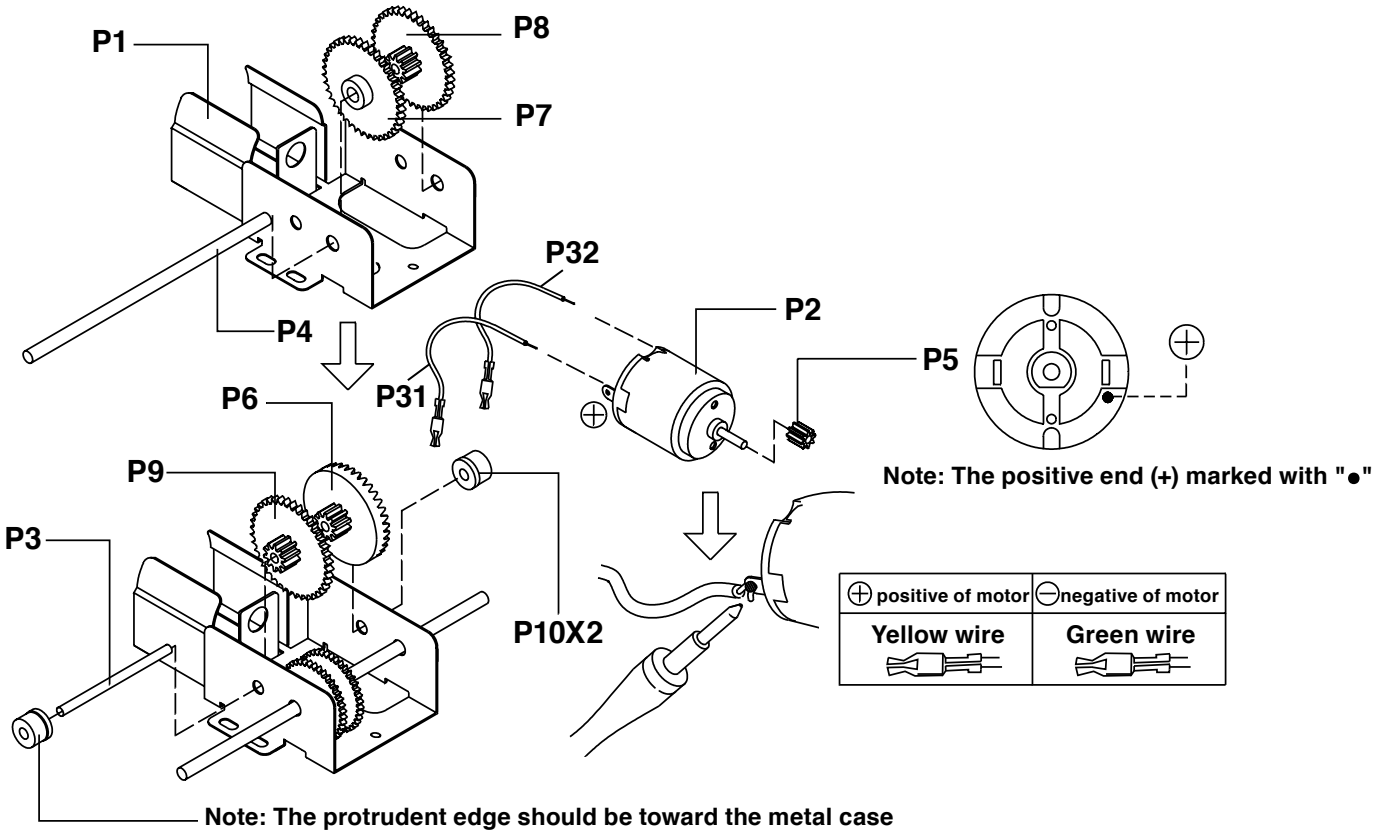


Figure E
Mount the VR flat against the PC board as shown.

Figure F
Mount the transistor with the flat side in the same direction as marked on the PC board. Leave about 1/8" of space between the transistor and the PC board as shown below. Solder and cut off the excess leads.

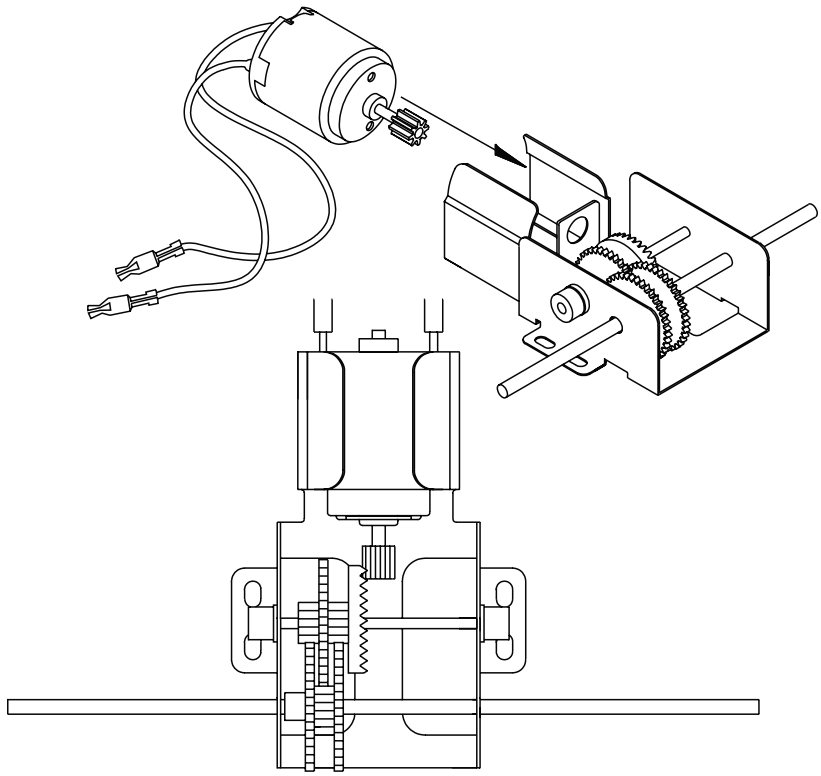


Gear Box Assembly

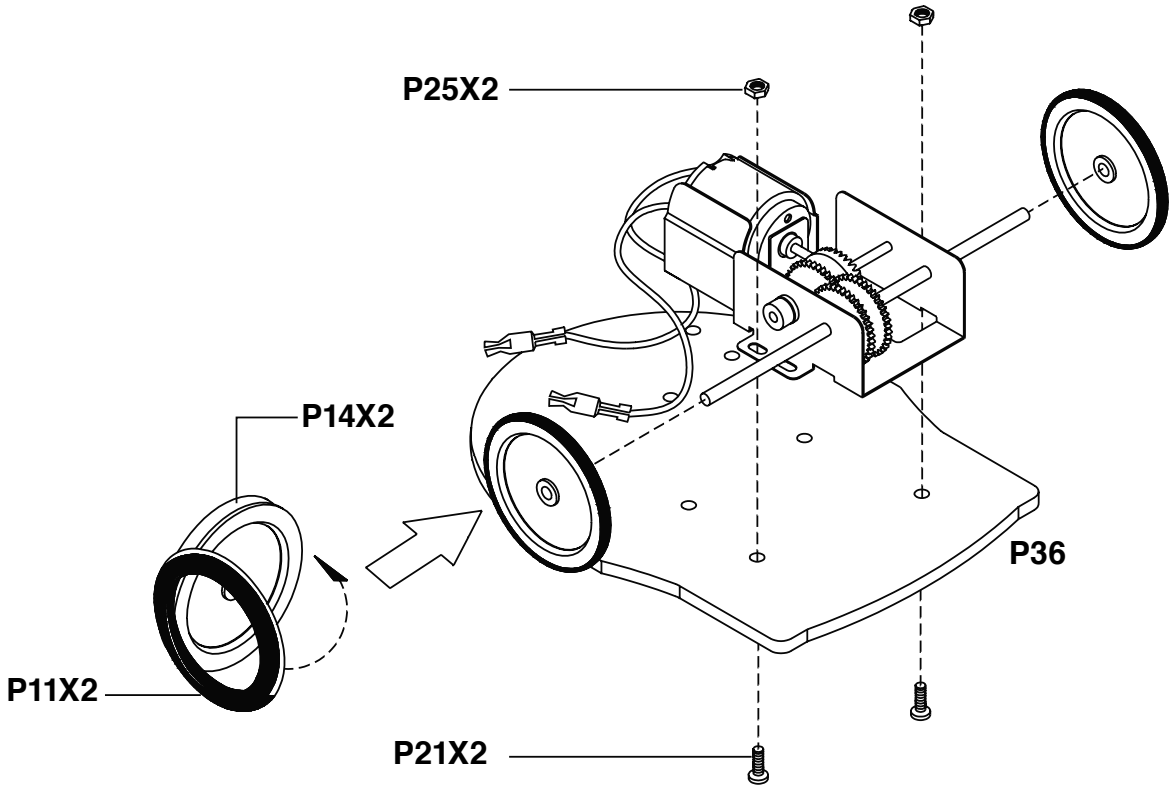


WEmake™

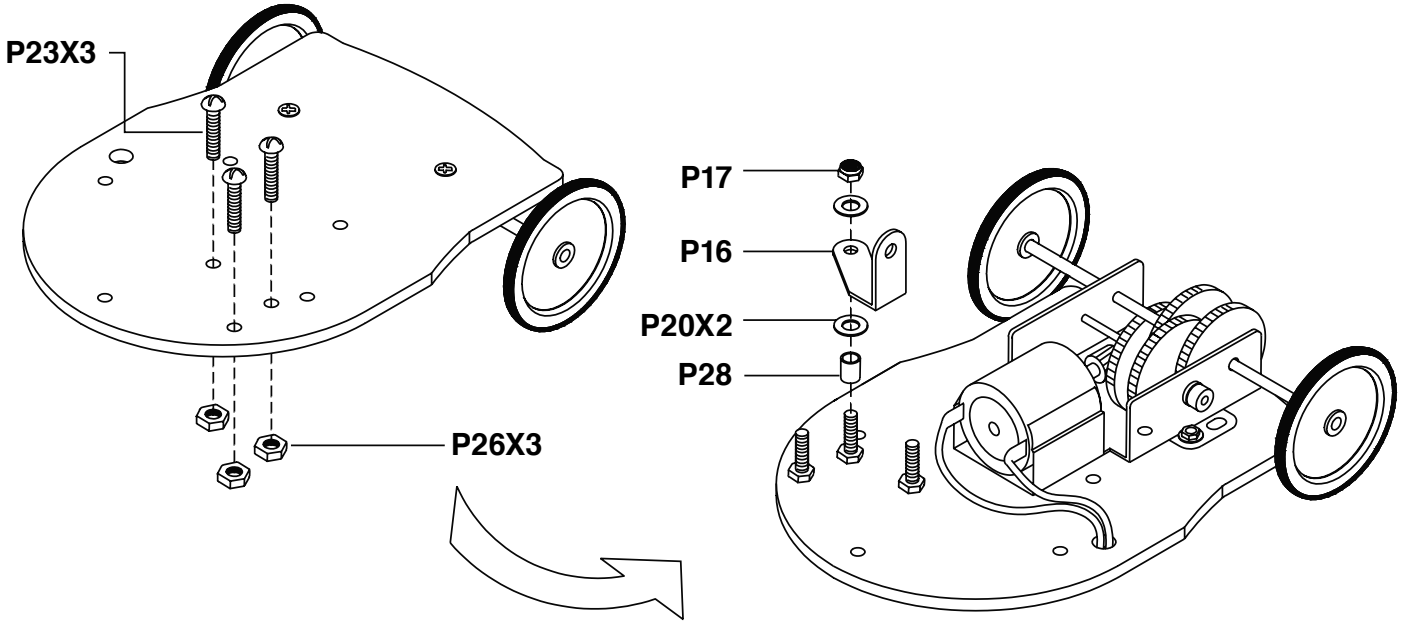
Gear Box Assembly



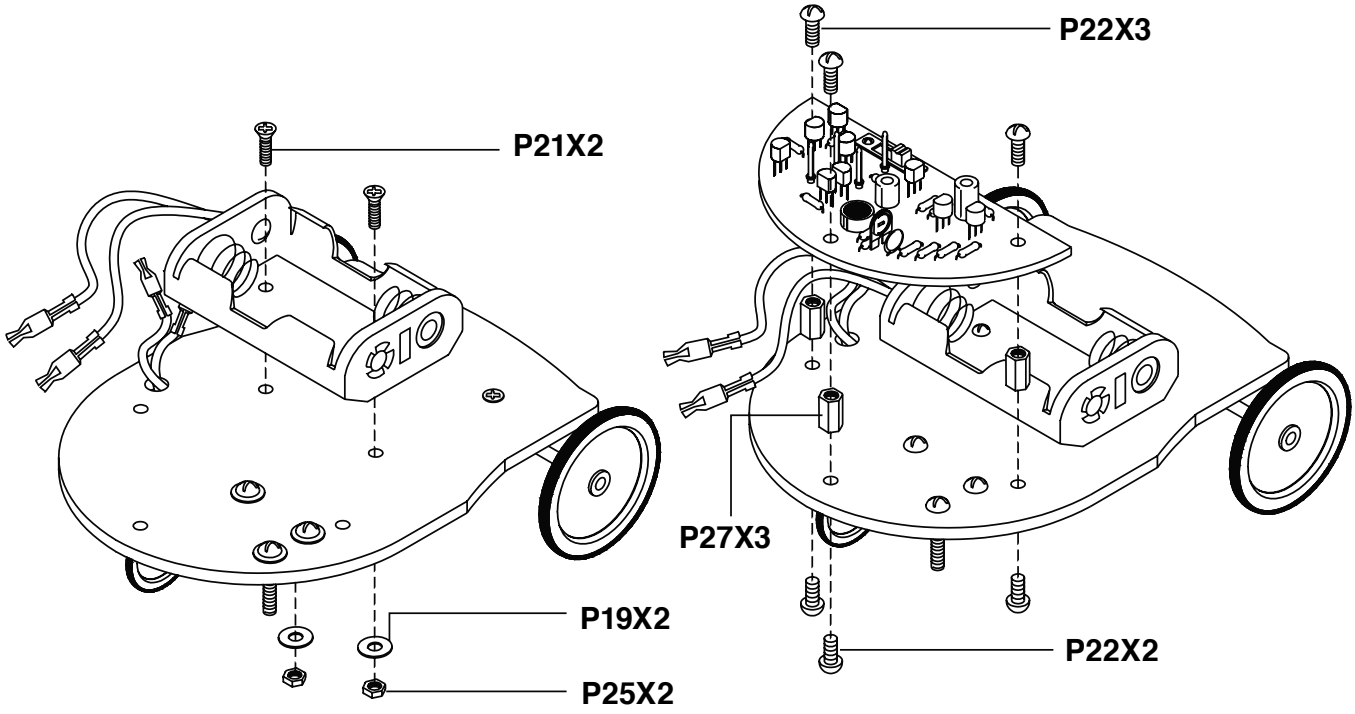
WEmake™ Gear Box & Rear Wheels Assembly



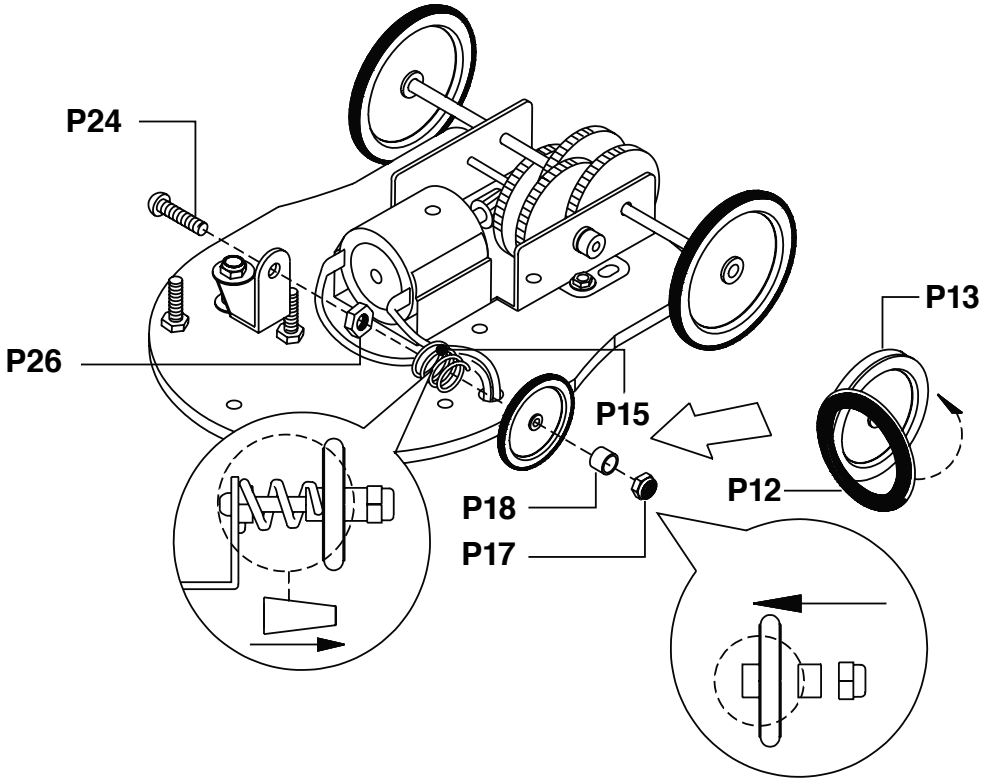
WEmake™ Front Wheel Bracket Assembly



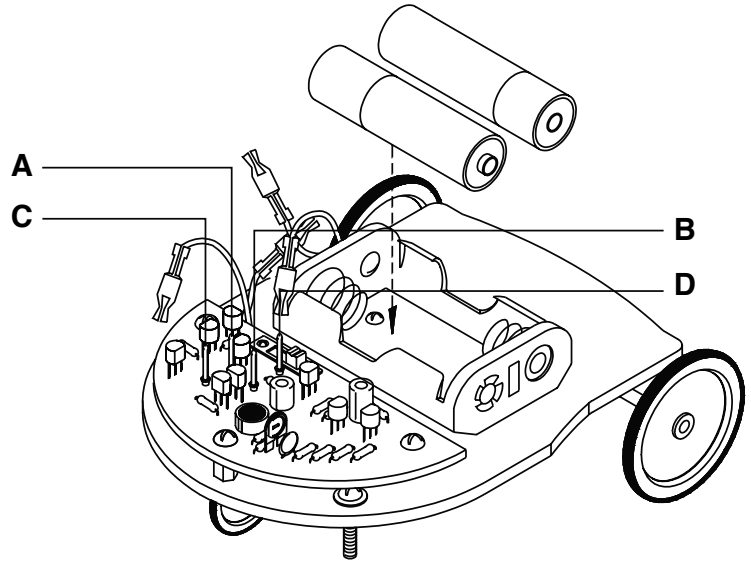
WEmake™ PCB & Battery Holder Assembly

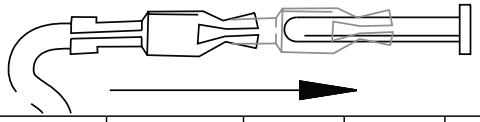


WEmake™ Front Wheel Assembly



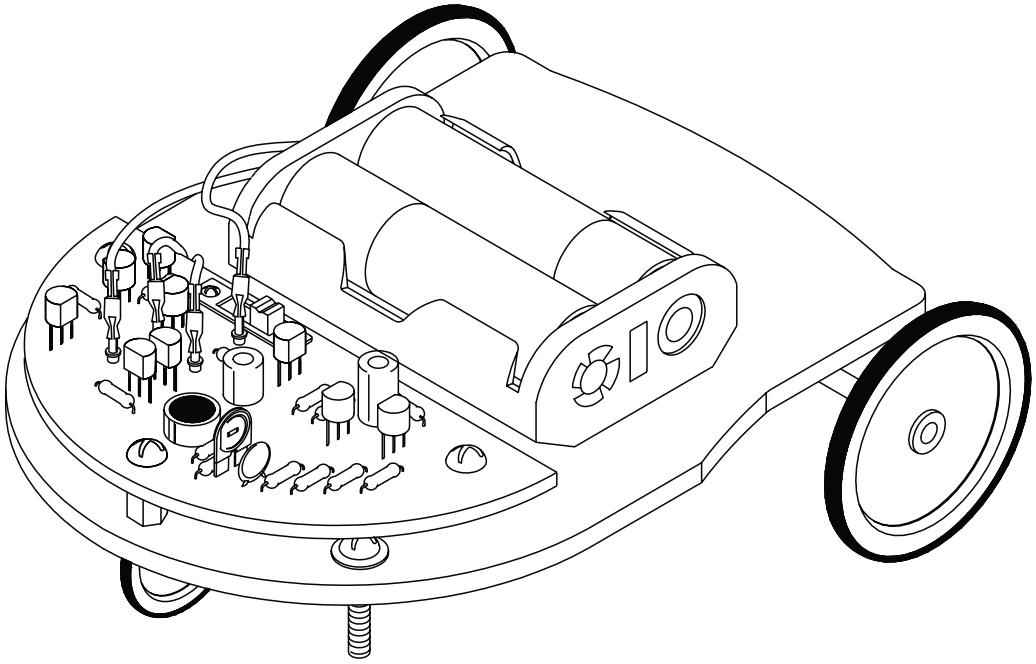
WEmake™ Wiring





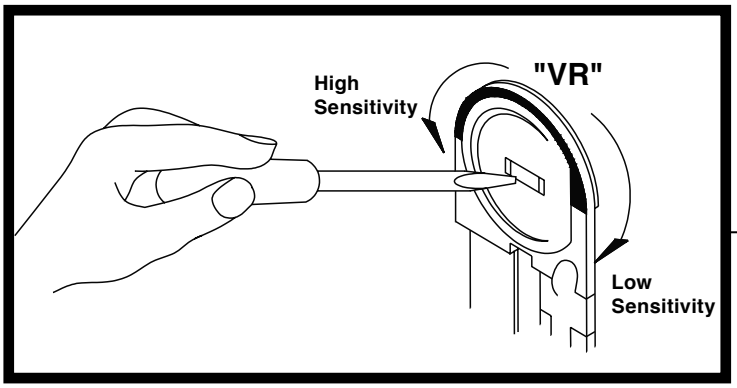
	A	B	C	D
	M–	M+	+	–
	Green	Yellow	Red	Black

WEmake™ Finished Assembly

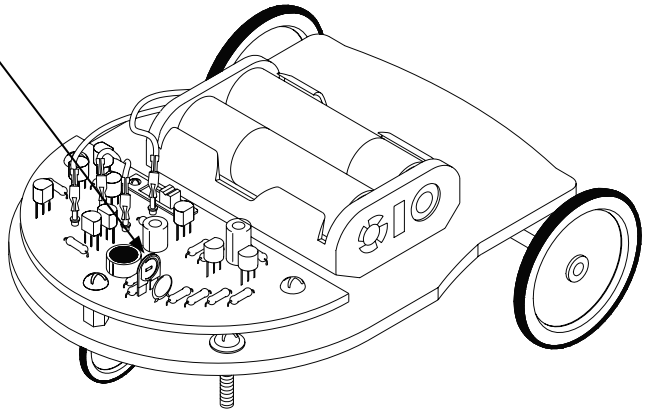


Operation I How It Works

After completing the assembly of the kit, double back to see that the soldering looks good and all of the components are in their proper place.



1. Switch the unit to "ON" position
2. Put it on to ground and see if it goes forward smoothly.
3. Clap your hand and see if it turns back and left side, then go forward again.
4. Adjust "VR" to change microphone's sensitivity.



NOTE: Refer to the Troubleshooting Section if your circuit does not work.

Troubleshooting

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 AA batteries

3. Make sure that all of the components on PCB placed in their correct positions.
   Check the polarity of electrolytics, transistors and microphone.

4. Check all the wiring connections are the same as wiring diagram.

5. If noise from the gearbox interferes with the microphone to receive signal, place a small amount of grease between face gear (P6) and 2mm shaft (P3) will reduce the noise.

6. If the car keeps going left, tighten the nut (P17) on front wheel (P13) until it goes straight.

Note: DO NOT to put any grease between 3mm shaft (P4) and gears (P7 & P8).

Word Glossary

Capacitor An electrical component that can store electrical pressure (voltage) for periods of time.

Cold Solder Joint Occurs because insufficient heat was applied or the connection was moved before the solder had set. Connection looks crystalline, crumbly, or dull.

Flux A substance that is used to cleanse the surface of oxide before it is soldered. Always used in electronics work. Most of the solder used in electronics has flux built right into it.

Heat Sinking A process of keeping the component from becoming overheated during soldering. Any metal object that can be clamped to the component lead will work as an effective heat sink. An alligator clip or pliers work well.

Integrated Circuit (IC) A type of circuit in which transistors, diodes, resistors, and capacitors are all constructed on a semiconductor base.

Microphone A device which converts soundwaves into electrical energy.

NPN Negative-Positive-Negative, a type of transistor construction.

Ohm, (Ω) The unit of measure for resistance.

Oxidation Most metals, when exposed to air, form an oxide on their surface which prevents solder from adhering to the metal.

PNP Positive -Negative - Positive, a type of transistor construction.

Polarity The division of two opposing forces or properties.

Printed Circuit Board A board used for mounting electrical components. Components are connected using metal traces “printed” on the board instead of wires.

Resistor Component used to control the flow of electricity in a circuit. It is made of carbon.

Rosin Core Solder The most common type of solder used in electronics generally referred to as 63/37 rosin core solder

Schematic A drawing of an electrical circuit that uses symbols for all the components.

Solder A tin/copper alloy that melts at a very low temperature, used to join other metals together. It produces excellent electrical connections.

Solder Bridge An unwanted solder connection between two points that are close together.

Solder Melting Point The temperature at which a tin/copper alloy (solder) melts. The common solder used in electronics (63% tin / 37% lead) has a melting point of 370OF.

Solder Wick Braided wire coated with flux to effectively remove solder from a connection.

Soldering The process of joining two or more metals by applying solder to them.

Switch A device to connect (“closed” or “on”) or disconnect (“open” or “off”) wires in an electric circuit.

Tack Soldering A connection where the lead or wire does not have any mechanical support.

Tinning the Tip A process of coating the soldering iron tip with solder to minimize the formation of oxide on the tip, which would reduce the amount of heat transfer.

Transistor An electronic device that uses a small amount of current to control a large amount of current.

Wire Gauge Refers to the size of the wire. The bigger the number, the smaller the diameter of the wire. 18 gauge to 24 gauge is generally used for hook-up in electronics.

Quiz

1. Which component detects sound in the circuit?
☐ A. Resistor
☐ B. Transistor
☐ C. Microphone
☐ D. Capacitor

2. What type of flux should be used in electronics?
☐ A. Chloride
☐ B. Organic
☐ C. Rosin
☐ D. Corrosive

3. When working on PC boards, what wattage range of iron is ideal?
☐ A. 15-40 watts
☐ B. 50-100 watts
☐ C. 1-10 watts
☐ D. 100-200 watts

4. Tinning the soldering tip will prevent it from . .
☐ A. heating.
☐ B. melting.
☐ C. soldering.
☐ D. oxidizing.

5. Proper solder adhesion requires that the metal surface to be . . .
☐ A. solder free.
☐ B. clean.
☐ C. greasy.
☐ D. cold.

6. Solder wick is used to . . .
☐ A. remove solder.
☐ B. solder in small parts.
☐ C. cleaning the soldering iron tip.
☐ D. removing flux.

7. A cold solder joint is caused by . . .
☐ A. a solder bridge.
☐ B. using 60/40 solder.
☐ C. insufficient heat.
☐ D. acid core solder.

8. When two adjacent foils accidentally touch, it is called . . .
☐ A. a jumper.
☐ B. a blob.
☐ C. a solder hole.
☐ D. a solder bridge.

9. What ratio has the greatest amount of tin?
☐ A. 20/80
☐ B. 40/60
☐ C. 50/50
☐ D. 60/40

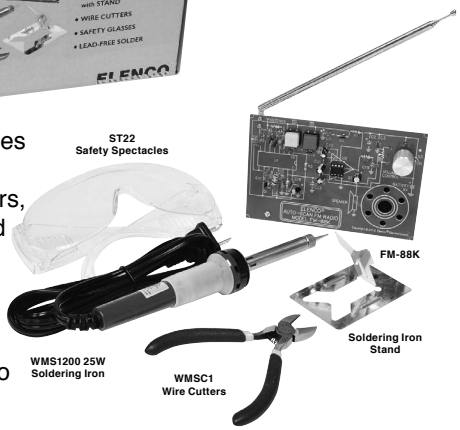
10. The variable resistor is used to adjust the . . .
☐ A. forward speed.
☐ B. sound sensitivity.
☐ C. battery voltage.
☐ D. reverse speed.

ANSWERS: 1. C, 2. C, 3. A, 4. D, 5. B, 6. A, 7. C, 8. D, 9. D, 10. B.

Experience Other WEmake™ Kits

Two IC FM Radio Kit W/Tools
Model MSK200

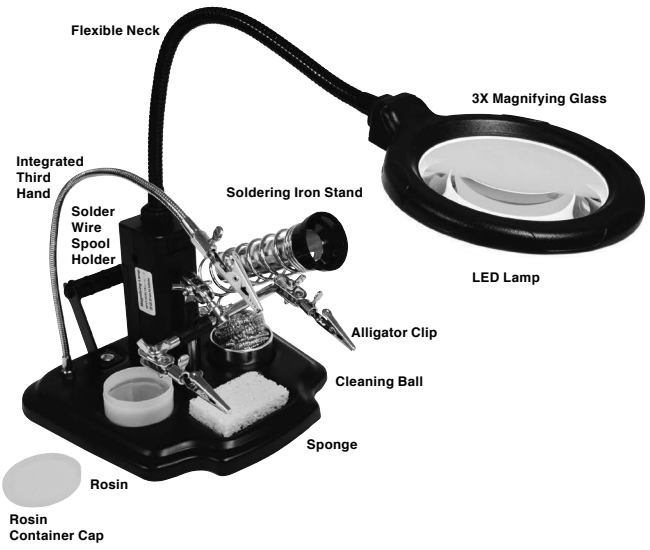
The WMSK200 includes a 25W soldering iron with stand, side cutters, safety spectacles, and an FM-88K Two IC (integrated circuit) Radio soldering kit. This kit includes everything you need to build a functional FM radio receiver.



Flashing European Siren
Model AK-100

This kit is a must for the beginner. After practicing your soldering techniques on the special area of the board, you'll be ready to assemble this European siren with flashing LEDs. This kit also includes a soldering iron and wire cutters. Requires one (1) 9V battery.

WEmake
TOOLS FOR MAKERS™



LED Magnifying lamp with third hand
Model: ZD-10Y
This multi-purpose tool offers an excellent all around solution, ideal for working on small PC boards, components, soldering, etc

Helping Hand with Magnifying Glass
Model: HH-55
For soldering or making fine adjustments. Adjustable arms can hold objects in any position.

Soldering Iron Stand
Model: SH-1
Heavy-duty holder with sponge.

Safety Goggles
Model: WSMG 20
Contours to head • Safety Approved

25W Soldering Iron
Model: WMS 1200
25W Pencil Iron • Stand Included

Wire Stripper
Model: WMS30
7 in 1 Multi-purpose•Strips AWG 18-26

Long Nose Pliers
Model: WMLNP2
5" Long • Drop Forged Carbon Steel

Side Cutters
Model: WMSC1
4 1/2" Long • Drop Forged Carbon Steel

Lead-Free Solder • 1LB Roll
Model: WM1LB
Rosin core • 0.031" diameter 99.3% tin • 0.7% Copper

Lead-Free Solder
Model: WMLF993
Rosin core • 0.031" diameter 99.3% tin • 0.7% Copper

Silver Solder
Model: WMSIL3
Rosin core • 0.031" diameter 96% tin • 4% Silver

Anti-Static Desoldering Pump
Model: WMSP4
High Vacuum Pump • Anti-Static Tip

WMSK300201710V4