

# *knight-kit*

ASSEMBLY  
MANUAL



LC-1 CODE  
OSCILLATOR

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## Thank You . . .

for your interest in Knight-Kits.

This Assembly Manual represents our many decades of experience in developing electronic kits which bring you outstanding performance at dollar-saving prices . . . and with maximum ease of construction.

*As you go through the pages of this brochure, note how carefully each stage of construction is explained—how each diagram is magnified so that you almost have the feeling a good instructor is working at your side!*

Knight-Kit's "do and check" method of kit-building insures accurate and simple assembly. Although your final product may represent a very complicated piece of electronic equipment, you will proceed with ease and assurance, step-by-step . . . and enjoy enormous satisfaction in your completed working unit.

We know you will find the building of this Knight-Kit a most rewarding experience.

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# KNIGHT-KIT MODEL LC-1

## CODE PRACTICE OSCILLATOR

**Advanced-Design, 2-Transistor Circuitry  
Economy, "C" Size Flashlight Cell Power  
Built-In Loudspeaker; Code Flasher Light  
Use With Any High-Impedance Headphones  
Smooth-Acting Hand Key Is Adjustable  
Powerful Volume For Group Practice**

The LC-1 Code Practice Oscillator is specially designed to lend a helping hand to aspiring Amateurs, Scouts, students, hobbyists, and shortwave listeners in learning the International Morse Code, which is used around the world for radio communication.

You may practice code on the oscillator either by listening to the audible tone, or by watching the code flasher. There's plenty of volume for group practice as well, with the built-in loudspeaker. A conveniently located phone jack allows the use of any high-impedance type set of headphones.

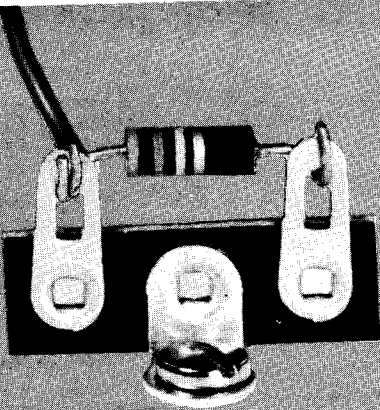
A compact, powerful two-transistor circuit is used in the oscillator. Carefully engineered for best possible performance and economy, the modern circuitry utilizes a readily available "C" size flashlight cell for power. Under normal use, you'll find that one battery will operate your set for several months.

The professional-type adjustable key included with your code practice oscillator helps you get the "feel" of actual "on-the-air" operation. Practice will soon enable you to send and receive code in a jiffy. Since the oscillator is completely portable, you can take it to meetings or group practice.

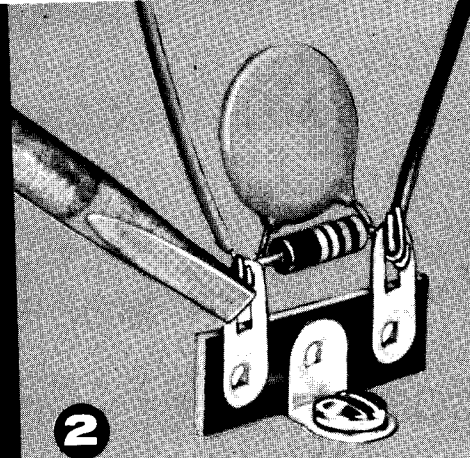
*You can always look to Knight-Kit for leadership in the field of electronic kits. You can always depend on Knight-Kits for unsurpassed value and performance.*

**THIS  
KIT  
MUST BE  
PROPERLY  
SOLDERED!**

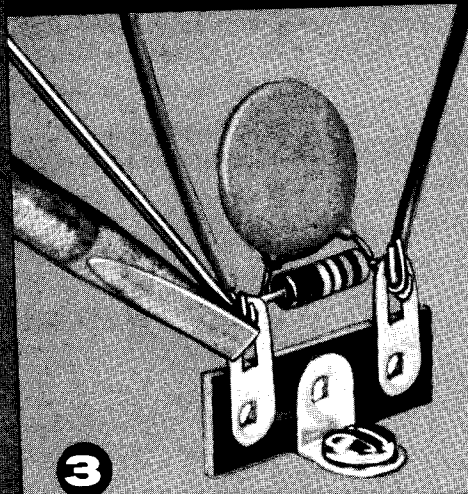
**1**



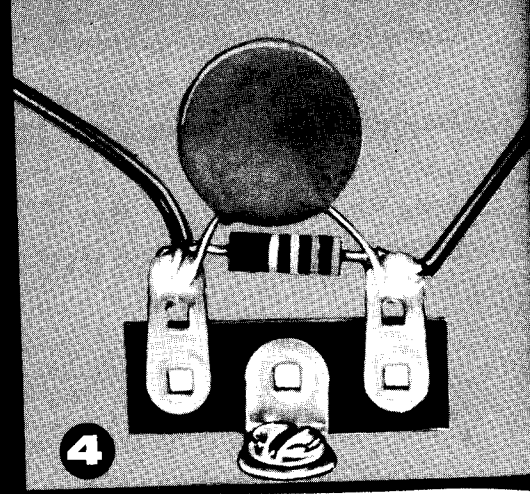
**2**



**3**



**4**



## USE ENOUGH HEAT

This is the main idea of good soldering. Apply enough heat to the metal surfaces you are joining to make the solder spread freely, until the contour (shape) of the connection shows under the solder.

**AN ELECTRONIC UNIT WILL NOT WORK . . .** unless it is properly soldered. Read these instructions carefully to understand the basic ideas of good soldering.

**Enough heat** must be used so the solder can actually penetrate the metal surfaces, making an unbroken path over which electricity can travel. You are not using enough heat if the solder barely melts and forms a rounded ball of rough, flaky solder.

## Use the Right Soldering Tool

A soldering iron in the 27-40 watt range is recommended. Any


iron in this range with a clean, chisel-shaped tip will supply the correct amount of heat to make a good solder connection. You may also use a solder gun but make sure the tip reaches full heat before you solder.


Keep the iron or gun tip brightly coated with solder. When necessary, wipe the hot tip clean with a cloth. If you are using an old tip, clean it before you start soldering.


## Use Only Rosin Core Solder

We supply the right kind of solder (*rosin core solder*). Do not use any other kind of solder! **Use of Acid Core Solder, Paste, or Irons Cleaned on a Sal Ammoniac Block will ruin any Electronic Unit and will Void the Guarantee.**


## HERE'S HOW TO DO IT...

 Join bare metal to bare metal; insulation must be removed. Make good mechanical connections and keep resistor and capacitor leads as short as possible, unless otherwise specified.

 Coat the tip of a hot iron with solder. Then **Firmly Press the Flat Side of the Tip** against the parts to be soldered together. Keep the iron there while you . . .

 Apply the solder between the metal to be soldered and the iron tip. Use only enough solder to flow over all surfaces of the connection, and all wires in the connection. Remove the iron.

**Do Not Move Parts Until the Solder Hardens.** If you accidentally move the wires as the solder is hardening, apply your iron and reheat.

 Compare your soldering with the pictures on this page. You have a good connection if your solder has flowed over all surfaces to be connected, following the shape of the surfaces. It should appear smooth and bright and all wires in the connection should be well-soldered.

**You Have Not Used Enough Heat:** If your connection is rough and flaky-looking, or if the solder has formed a round ball instead of spreading.

The difference between good soldering (enough heat) and poor soldering (not enough heat) is just a few extra seconds with a hot iron firmly applied.

**Remember, larger metal surfaces take a longer time to heat.**

## CONSTRUCTION

Follow the step-by-step instructions exactly. Read through the entire step before beginning, because several parts may be mounted with the same hardware. For your convenience a box is provided for you to check off each step as it is completed.

- Check each part against the parts list. Use FIGURE 1, to help you identify the parts.

### SEE FIGURE 1.

- Sub-panel. Position as shown.

NOTE: all of the parts, except the speaker grille, are mounted on the side of the panel facing you. Screws used to mount the parts are inserted from the other side of the panel.

- Rubber grommet. Press into place.
- Lamp socket. Press into the rubber grommet, even with the front of the sub-panel. Position the terminals as shown.
- Jack and large lockwasher. Place the lockwasher on the threaded portion of the jack. Insert the jack through the sub-panel and fasten with the large nut.

- Switch and TS-1, 4 terminal strip. Position the switch with the color dot as shown. Fasten the end nearest the color dot with a flathead screw, lockwasher and nut. Position TS-1 on the mounting foot at the other end of the switch and fasten with another flathead screw, lockwasher, and nut.
- TS-2, 2-screw terminal strip. Mount with two flathead screws, lockwashers, and nuts.
- Speaker. Be careful not to tear the speaker on the mounting tabs of the sub-panel. Mount with the terminals positioned as shown and carefully bend the tabs to hold the speaker in place.
- Battery clip. Bend the two tabs protruding from the sides even with the body of the clip. This will protect the speaker from damage.
- Speaker grille and battery holder. Place a rounded-head screw through the grille. Insert this screw from the front of the panel, through the hole next to the speaker. Place the battery holder on this screw from the rear of the panel. Position the + (plus) end as shown. Place the battery clip on this screw and fasten with a lockwasher and nut.
- Go back and check your work against Figure 1 to be sure that all of the parts are correctly mounted.

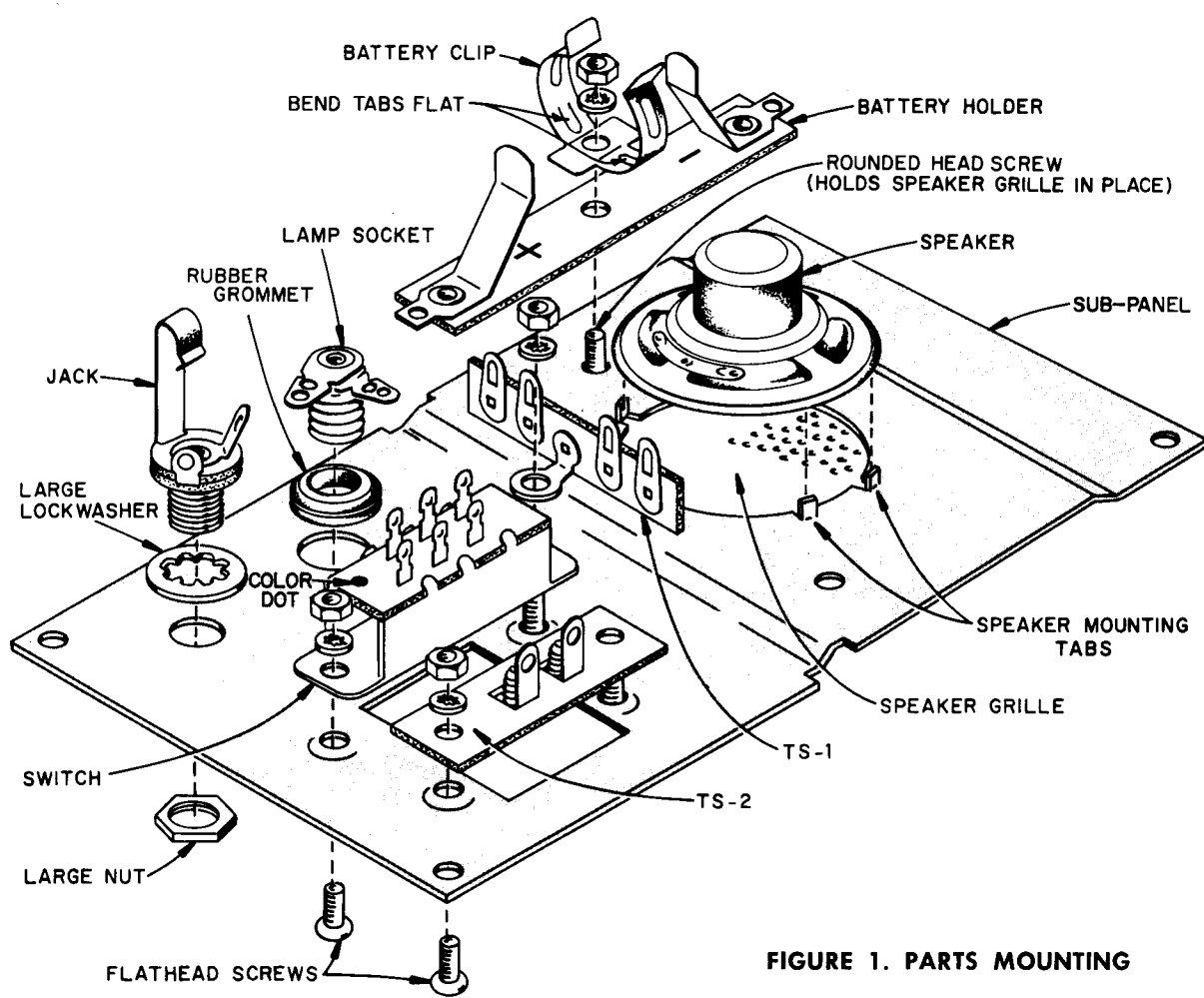


FIGURE 1. PARTS MOUNTING

## FIRST WIRING

### IMPORTANT INSTRUCTIONS

**CONNECT** means: Connect the wire or lead to the given point, **BUT DO NOT SOLDER AT THIS TIME**. Later additional wires or leads will be connected to this same point.

**SOLDER** means: Connect the wire or lead to the given point and then **SOLDER THE CONNECTION AND ALL WIRES IN IT**. The number of wires will be given if there is more than one wire in the connection.

**NOTE:** Be sure to read the soldering section in this manual very carefully. Good soldering will assure proper operation of your code practice oscillator.

### SEE FIGURE 2.

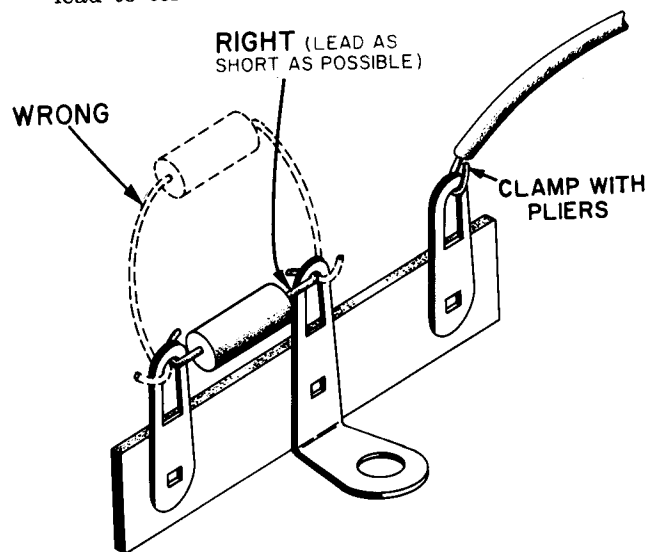
- Slightly bend the two speaker terminals away from the speaker cone.
- Yellow wire. Solder one end to terminal 1 of the speaker. Solder the other end to terminal 6 of the switch.

**NOTE:** Use only the color wire called for in each step. Use solid wire unless stranded is called for.

- Orange wire. Solder one end to terminal 2 of the speaker. Connect the other end to terminal 1 of TS-2.
- Blue wire. Solder one end to terminal 1 of TS-2, (2 wires). Solder the other end to the minus (—) terminal of the battery holder.

To mount a resistor or capacitor, pull the leads through the terminals so that the part is tightly mounted. Bend each lead around the terminal and cut off the excess wire. Keep the leads as short as possible.

- R-1, 100K resistor, (100,000 ohms, marked with brown, black, and yellow color bands). Connect one lead to terminal 3 of TS-1. Connect the other lead to terminal 1 of TS-1.



CONNECTING A COMPONENT



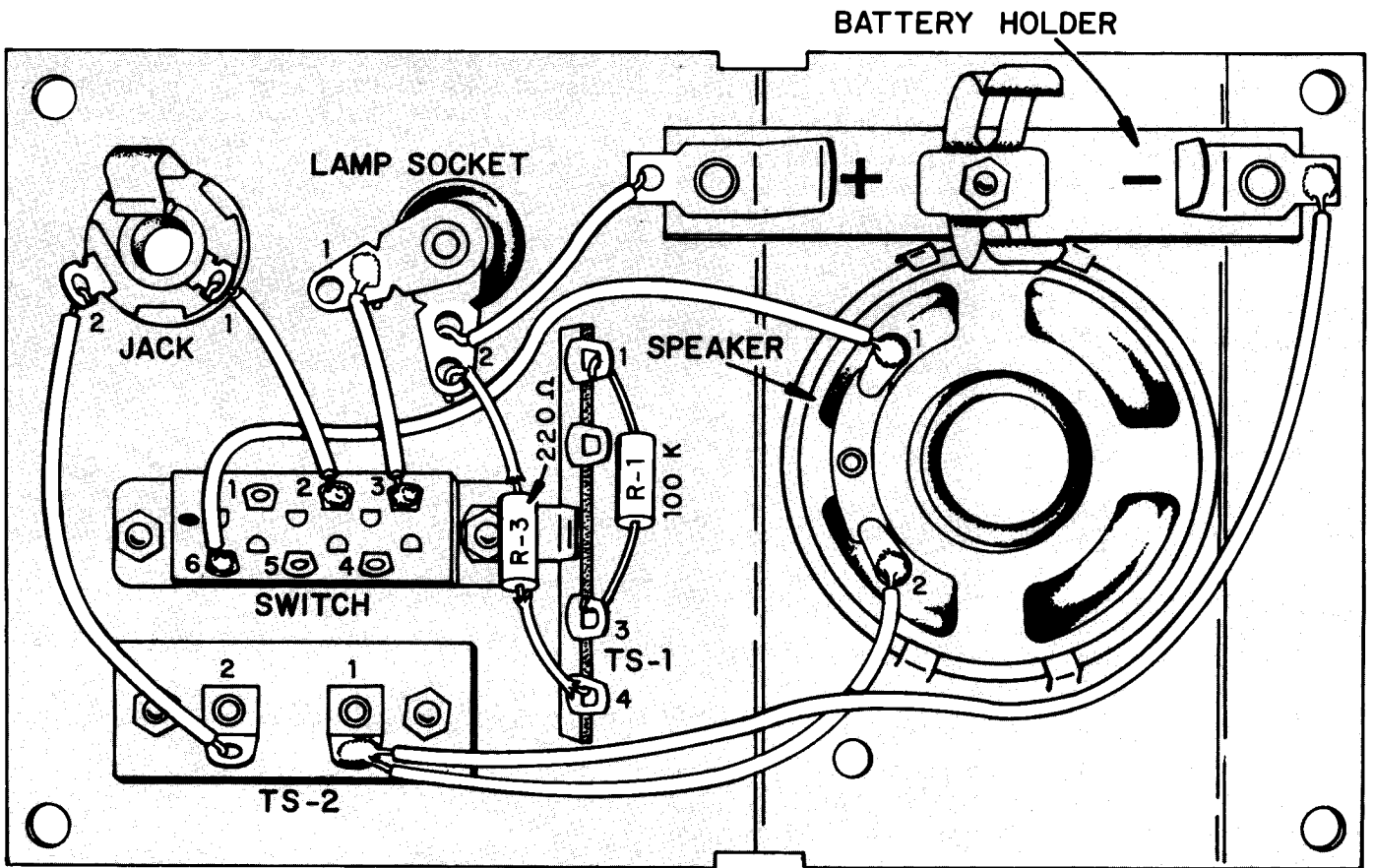


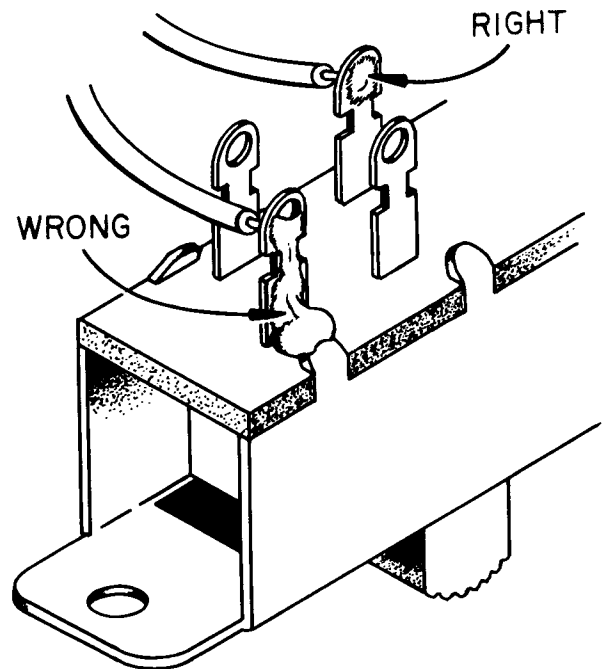
FIGURE 2. FIRST WIRING

## FIRST WIRING (Continued)

### SEE FIGURE 2.

- R-3, 220 $\Omega$  resistor (red, red, brown). Cut two  $\frac{5}{8}$ " pieces of tubing from the length supplied; slip one over each resistor lead. Connect one lead to terminal 2 of the lamp socket. Connect the other lead to terminal 4 of TS-1.
- Red wire. Connect one end to the plus (+) terminal of the battery holder. Connect the other end to terminal 2 of the lamp socket.
- Red wire. Solder one end to terminal 1 of the lamp socket. Solder the other end to terminal 3 of the switch.
- Red wire. Solder one end to terminal 2 of the switch. Connect the other end to terminal 1 of the jack.
- Orange wire. Connect one end to terminal 2 of the jack. Connect the other end to terminal 2 of TS-2.
- Carefully check the wiring completed on this page to be sure that it is correct. Compare your soldered connections with those shown in the soldering instructions.

- Examine the illustration in this column. Two switch terminals are shown with wires soldered to them. One of these terminals is properly soldered, the other is shorted directly to the switch frame by excess solder. Go back and check your work. Be sure that you have not used too much solder.



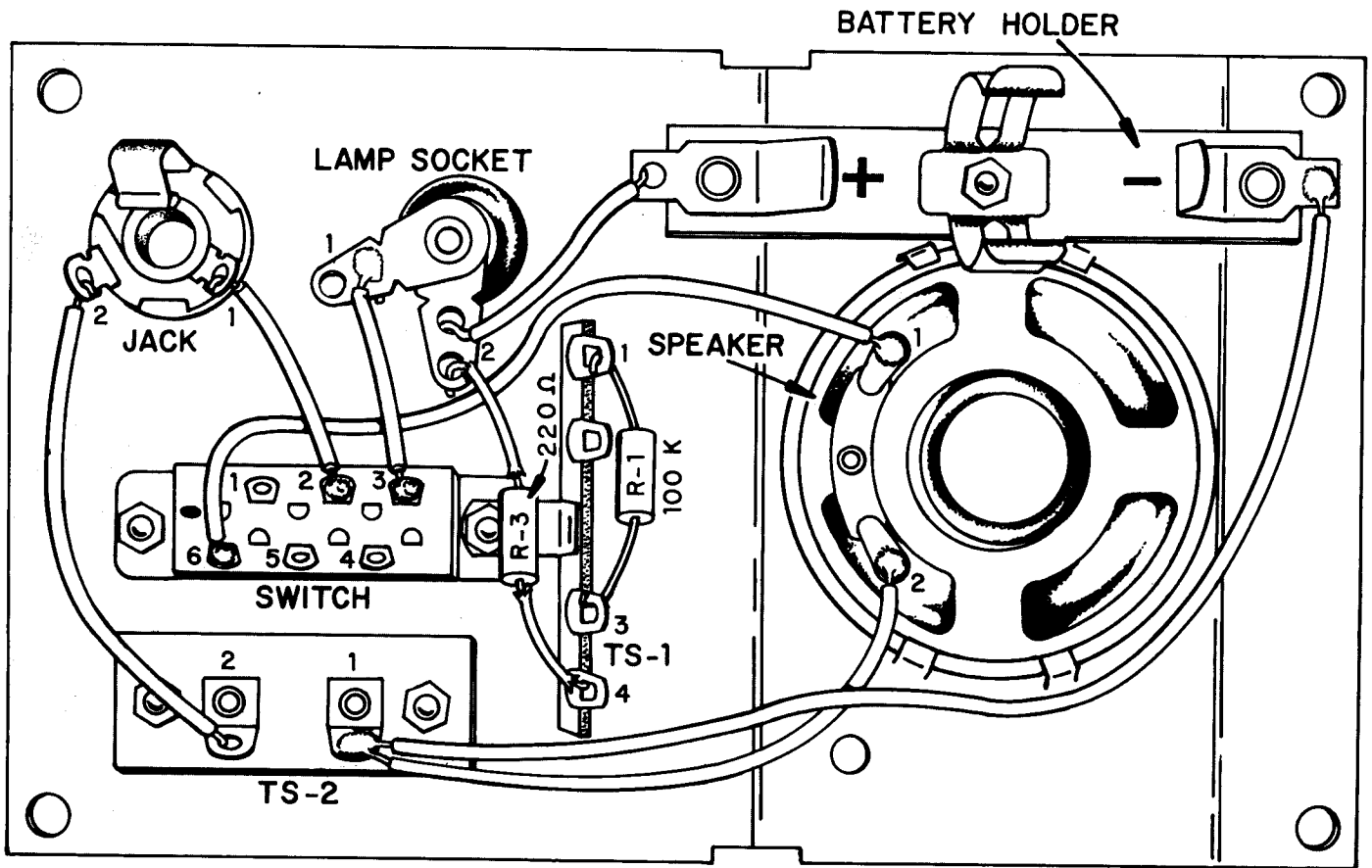


FIGURE 2. FIRST WIRING (Continued)

- Orange stranded wire. Solder one end to the + terminal of the battery holder (2 wires). Solder the other end to the pin connector on pin E of TR-2.
  - Battery. Install the battery in the holder so that the + end of the battery (raised end) is facing the + end of the battery holder. This is very important; your code practice oscillator will not work if the battery is reversed.
  - Long red stranded wires. Remove  $\frac{1}{2}$ " insulation from the ends of both wires, twist the strands together and coat lightly with solder. Twist the wires together and connect one end of each to the screw terminals of TS-2 on the front of the sub-panel. Connect the remaining end of each wire to a terminal of the key.
  - Lamp. Screw the lamp into the lamp socket.
  - The wiring of your kit is now complete. Go back and check your work. Make sure that all of the wiring is correct. Your soldered connections should look like the examples on the soldering page. All bare wires that do not go to the same terminal must not touch each other or any part of the sub-panel.
- 
- Clean the key contacts by passing a piece of paper between them while maintaining pressure on the key.
  - Place the switch in the OFF-LIGHT position. Press the key and notice that the lamp lights.

- Set R-4, the tone-stability control to about the halfway position.
- Place the switch in the SPEAKER position.
- Press the key; a tone should be heard. R-4 should now be set for the best stability and most desirable tone.

NOTE: The unit may not operate over the entire range of R-4. This condition is normal, due to slight transistor variations.

- Place the switch in the PHONES position. Plug any high-impedance set of headphones into the jack. Press the key while listening to the headphones; the tone should be heard.
- Place the completed sub-panel assembly into the case.
- Disconnect the long red wires from TS-2.
- Front panel. Install the front panel over the sub-panel with 4 rounded-head screws. Do not tighten the screws until all 4 have been started.
- Re-connect the long red wires to TS-2.
- International Morse Code label. Remove the paper backing and press the adhesive side of the label firmly to the top of the oscillator case.

When the unit will not be used for long periods, place the switch in the OFF-LIGHT position. This will eliminate a small current drain through the transistors, and thus prolong battery life. Be sure that the key is not held in the operated position, or its terminals shorted when the unit is stored.

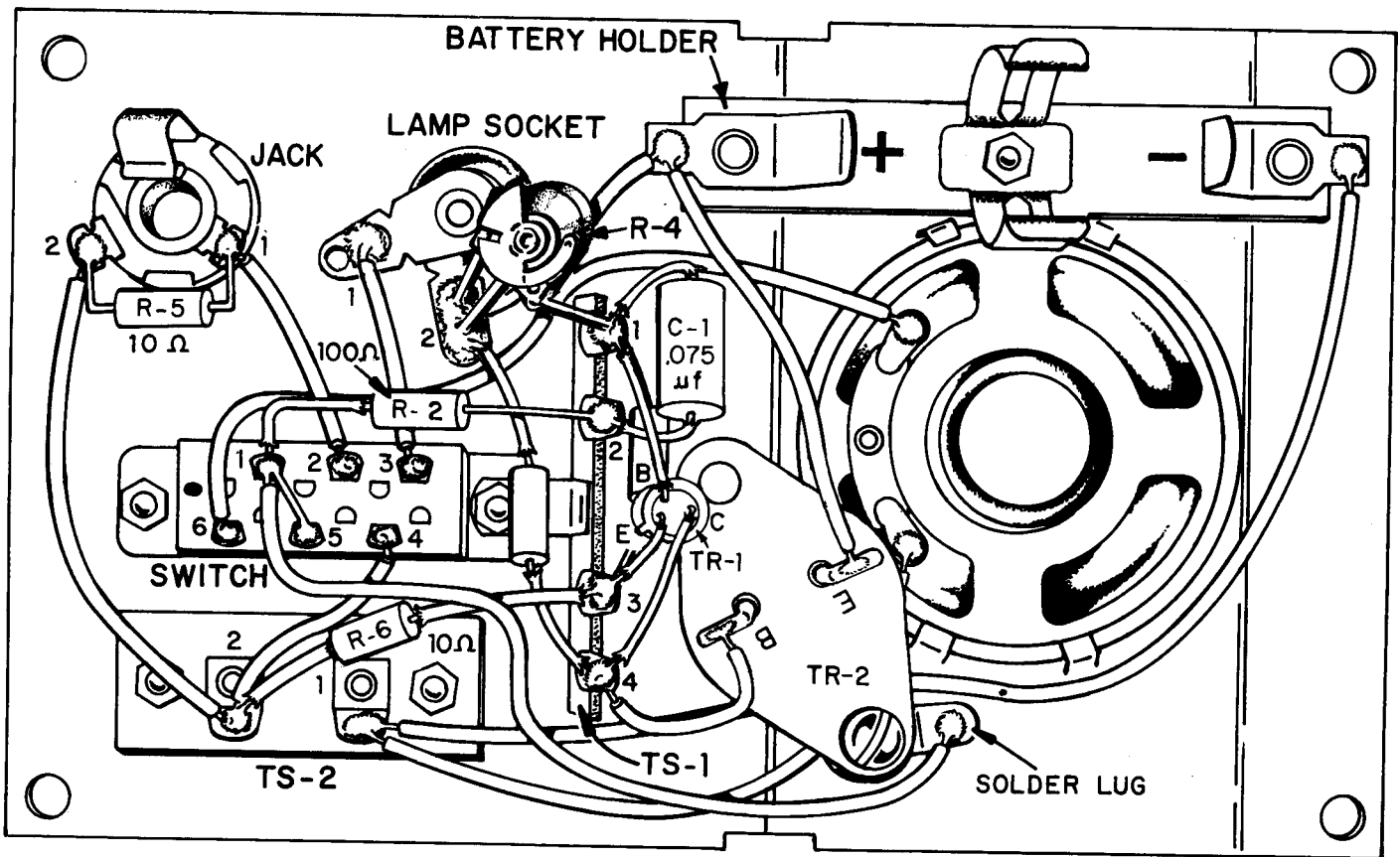


FIGURE 3. FINAL WIRING (Continued)

## SERVICE HINTS

Wiring errors and poorly soldered connections are the most frequent cause of difficulty. Carefully recheck your work.

Check the following items if the unit seems "dead." Place the switch in the LIGHT position and press the key. If the lamp lights brightly it may be assumed that the battery is not "dead". Be sure that the battery is correctly installed in the battery holder. The + (plus) terminal of the battery must face the + terminal of the battery holder.

Place the switch in the SPEAKER position. Press the key and a tone should be heard. If this tone is not heard check the pin connectors on the leads of TR-2. They must not be pushed all of the way down on the transistor pins. Also check the leads of TR-1; they must be connected correctly for the unit to operate. Check the mounting screw of TR-2. If the spacers on this screw are not properly positioned the collector of TR-2 will be shorted to the sub-panel.

Periodically clean the key contacts in the following manner. Place a strip of clean white paper between the contacts and press the key. Withdraw this strip of paper while maintaining a slight pressure on the key. Clean the key contacts whenever you notice any change of tone while keying the unit.

Normally a slight change in tone will be heard when the sub-panel is removed from the case. The tone may also change when the unit is subjected to extremes of temperature. Any change of tone can be corrected by the tone-stability control, R-4.

## CIRCUIT DESCRIPTION

The LC-1 operates as a two-transistor oscillator. When the key is pressed a voltage is applied to the base of TR-1. This voltage is supplied by the battery through the biasing network composed of R-1 and R-4. When this voltage is applied to TR-1 a signal is passed from the emitter to the collector and to the base of TR-2.

This voltage at the base of TR-2 causes it to conduct also. The signal passes from the emitter to the collector of TR-2, through the speaker coil, and to the negative terminal of the battery. A portion of this signal from TR-2 is also fed back to the base of TR-1 through the feedback network composed of C-1 and R-2. This signal causes TR-1 to stop conducting. When TR-1 stops conducting the circuit returns to its original state. Holding the key down repeats this cycle of operation at the rate of several hundred times per second, generating an audible tone.

When the unit is switched to the light position the circuit is changed. The lamp, battery, and key are now connected in series. When the key is pressed in this mode of operation, current flows from the battery, through the key, and through the lamp. This completes the circuit and the lamp lights.

With the switch in the PHONES position, the LC-1 operates in the same manner as it did in the SPEAKER position. The signal does not pass through the speaker coil in this mode of operation, but passes through R-5. This resistor provides a voltage drop to supply the phones with a small operating current. This is the only circuit change from speaker operation.

# KNIGHT-KIT SERVICE FACILITIES

## TECHNICAL CONSULTING SERVICE

If, after following the instructions and suggestions given in this manual you are still unable to obtain proper performance from your kit, we invite you to contact our Technical Consulting Service for further assistance. Please be as accurate and thorough as possible because the effectiveness of our advice depends entirely on the information you supply.

Use the following as a guide for your correspondence:

1. Have you checked all the suggestions under Service Hints? Careful consideration of these points may solve your problem without writing.
2. Be sure to give the kit model number, the date of purchase and the serial numbers on the label pasted on the chassis and the back cover of the manual.
3. Have you made a thorough check of all wiring and soldering? Each solder connection should have a shiny metallic finish. Reheat any connection that appears doubtful and add a little solder if needed. Be sure there are no parts accidentally touching each other, the chassis or nearby terminals.
4. If the kit is of the type that requires calibration or alignment, double check these procedures. Be as specific as possible in your report. Outline adjustments made and the alignment procedure employed.
5. When you write be sure to describe all associated equipment. Specifically note the switch positions. Define as clearly as possible the symptoms as noted and mention any particular circumstance under which the problem occurs (after unit has been on for some time, only when jarred or moved, only when used for a particular purpose, etc.).
6. If you have completed the recommended service hints, be sure to outline the results and note any measurements taken which are out of tolerance.

### KNIGHT-KIT PARTS WARRANTY

Knight Electronics guarantees that only premium-quality parts are selected for use in Knight-Kits. Every Knight-Kit part is fully warranted for a period of one year from date of purchase against defects in material and workmanship. Prompt No-Charge replacements of defective parts will be made.

You may return your completed Knight-Kit for inspection and repair within **one year from purchase** for a service charge of **\$2.50** for this particular kit. An additional charge will be made for parts damaged in construction.

Kits not completely wired or which require extensive re-work will incur an additional labor charge. You will be notified of these charges prior to our repairing your kit.

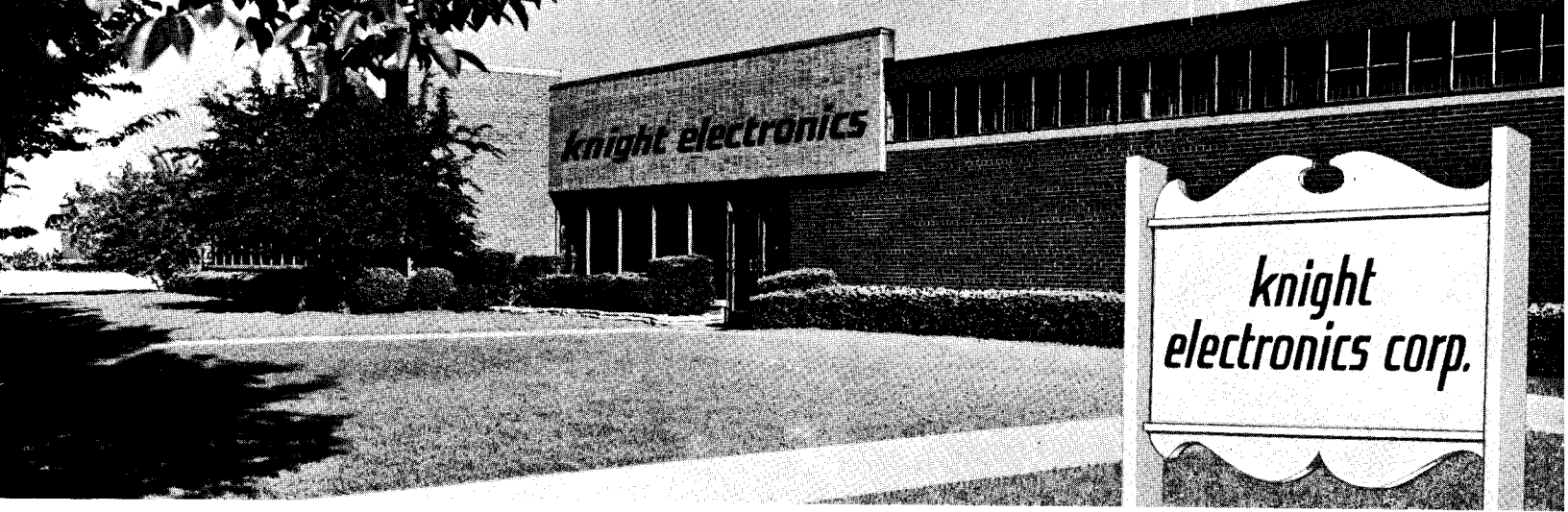
No service charge will be made for a **period of 90 days from date of purchase**, if malfunctioning of the completed kit is due to a defective part. Service charges for kits returned **after the one year period** will be on a time and materials basis.

Should you find it necessary to return your Knight-Kit, be sure to pack it carefully. The original carton should be used, if available. If not, a sound carton of similar size may be used. **TO PREVENT COSTLY DAMAGE IN TRANSIT**, cushion your Knight-Kit tightly using plenty of packing material. Mark: **FRAGILE—DELICATE ELECTRONIC EQUIPMENT**.

Ship your unit by **Parcel Post Insured**. Please include remittance to cover repair costs plus return postage and insurance. Postage and insurance may be estimated by referring to the "how to order page" in our catalog. This will save you costly COD fees; any excess remittance will be refunded.

**KNIGHT ELECTRONICS CORP. • Knight-Kit Service Department**  
2100 Maywood Drive • Maywood, Illinois





This is the ultra-modern Knight Electronics plant in Maywood, Illinois, a nearby suburb of Chicago. This extensive facility is devoted completely to the research, engineering, and manufacturing of quality electronic equipment in kit form. Knight pioneers in creating better electronic products at lower cost for hobbyists, experimenters, laboratories, schools, and industry.

***knight electronics***

A SUBSIDIARY OF ALLIED RADIO

STEREO HI-FI • HOBBY • AMATEUR • CITIZENS BAND • INSTRUMENTS • AUTOMOTIVE • INTERCOMS • EDUCATIONAL



**KNIGHT-KITS ARE YOUR BEST BUY.** They represent the finest electronic equipment in kit form. Truly creative engineering and the use of premium quality parts assure superior performance.

**KNIGHT-KITS ARE "CONVENIENCE ENGINEERED".** Every detail is planned for easy construction. Resistors are card-mounted and identified; wire is pre-cut; small parts are packaged in transparent plastic bags. Superb step-by-step "show how" manuals make KNIGHT-KITS easiest to build.

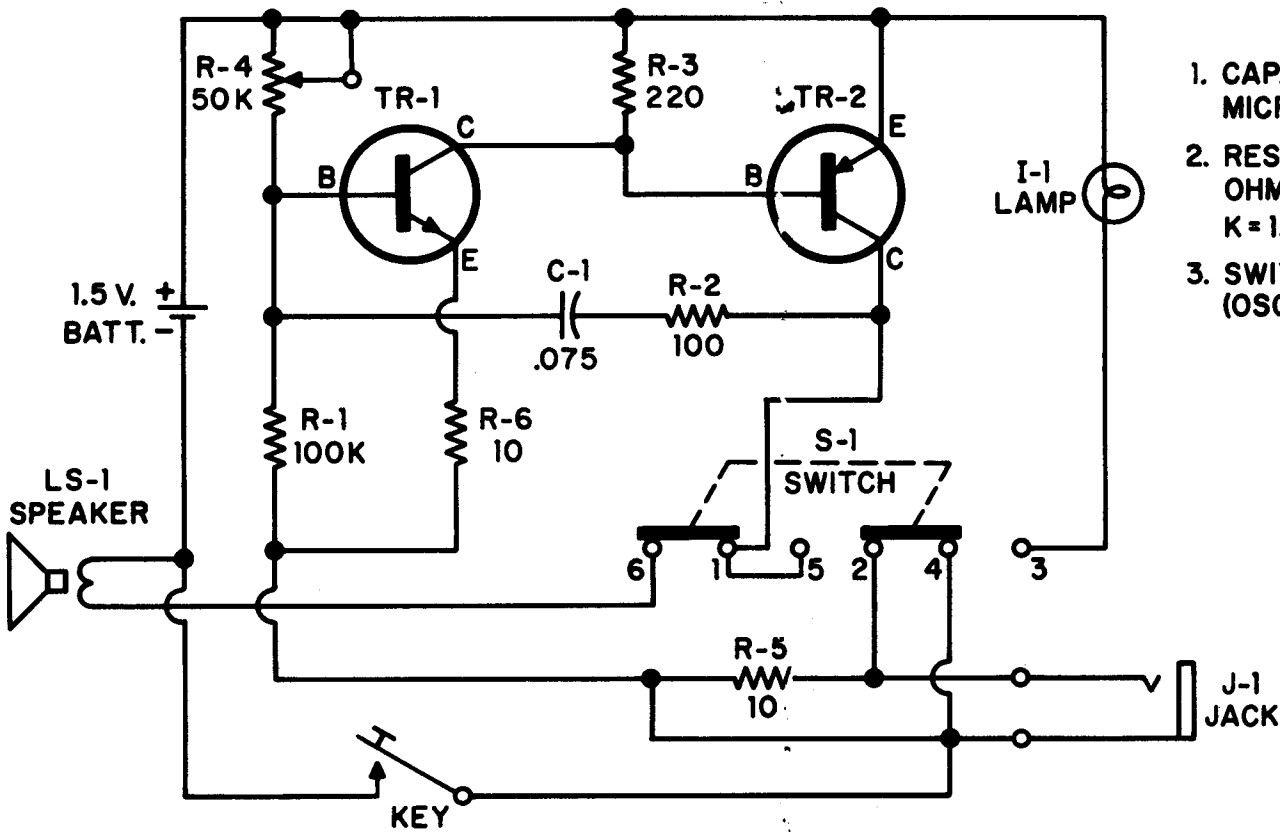
**KNIGHT-KITS ARE THE FIRST CHOICE** of exacting builders of electronic equipment . . . this has been true since the early 20's. There is an outstanding KNIGHT-KIT for every requirement. Each is a rewarding experience in kit construction. You will be proud to build and own a KNIGHT-KIT.

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Subsidiary of **ALLIED RADIO**

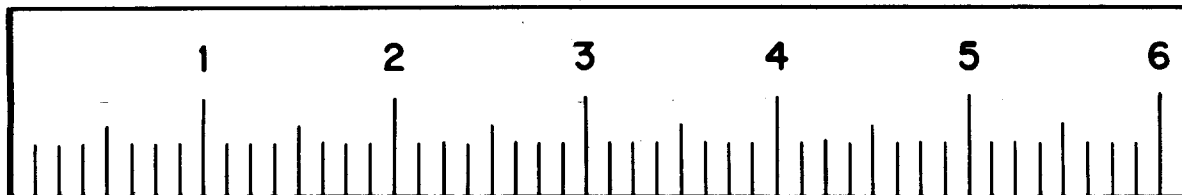
**2200 MAYWOOD DRIVE, MAYWOOD, ILLINOIS**

# SCHEMATIC DIAGRAM



## NOTES

1. CAPACITOR INDICATED IN MICROFARADS.
2. RESISTORS INDICATED IN OHMS.  
K=1,000 OHMS.
3. SWITCH S-1 SHOWN IN (OSCILLATOR) POSITION.



## PARTS LIST

CAPACITORS and RESISTORS		
Sym.	Description	Part No.
C-1	.075 tubular capacitor	293-016
R-1	100K resistor	301-104
R-2	100Ω resistor	301-101
R-3	220Ω resistor	301-221
R-4	50K control	420-157
R-5	10Ω resistor	301-100
R-6	10Ω resistor	301-100

TRANSISTORS		
Sym.	Description	Part No.
TR-1	Signal NPN	660-073
TR-2	Power PNP	660-069

MISCELLANEOUS		
Description	Qty.	Part No.
Battery, "C" type	1	450-011
Battery clamp	1	534-002
Battery holder	1	534-001
Case	1	701-005
Front panel	1	463-524
Jack	1	502-221
Key	1	134-054
Label	1	725-054
Lamp	1	644-556
Lamp socket	1	509-066
Pin connectors	2	502-244
Rubber grommet	1	830-600
Spacer	1	940-044
Speaker	1	734-059
Speaker grille	1	870-156
Sub panel	1	463-523
Switch	1	437-099
Terminal strip, 4 terminal	1	440-402
Terminal strip, screw type	1	442-972

HARDWARE, WIRE, SOLDER		
Description	Qty.	Part No.
Fiber washer	1	590-300
Lockwasher, large, 3/8"	1	582-700
Lockwasher, small, #6	7	582-300
Nut, large, 3/8"	1	570-840
Nut, small, #6	5	570-340
Screw, flathead, #6	4	563-373
Screw, rounded head, #6	7	560-342
Solder	1	930-001
Solder lug	1	553-005
Red wire	4	801-002
Orange wire	2	801-003
Yellow wire	1	801-004
Green wire	1	801-005
Blue wire	1	801-006
Stranded wire, short red	1	809-002
Stranded wire, orange	1	809-003
Stranded wire, long red	2	809-011
Bare wire	1	806-002
Tubing	1	813-163