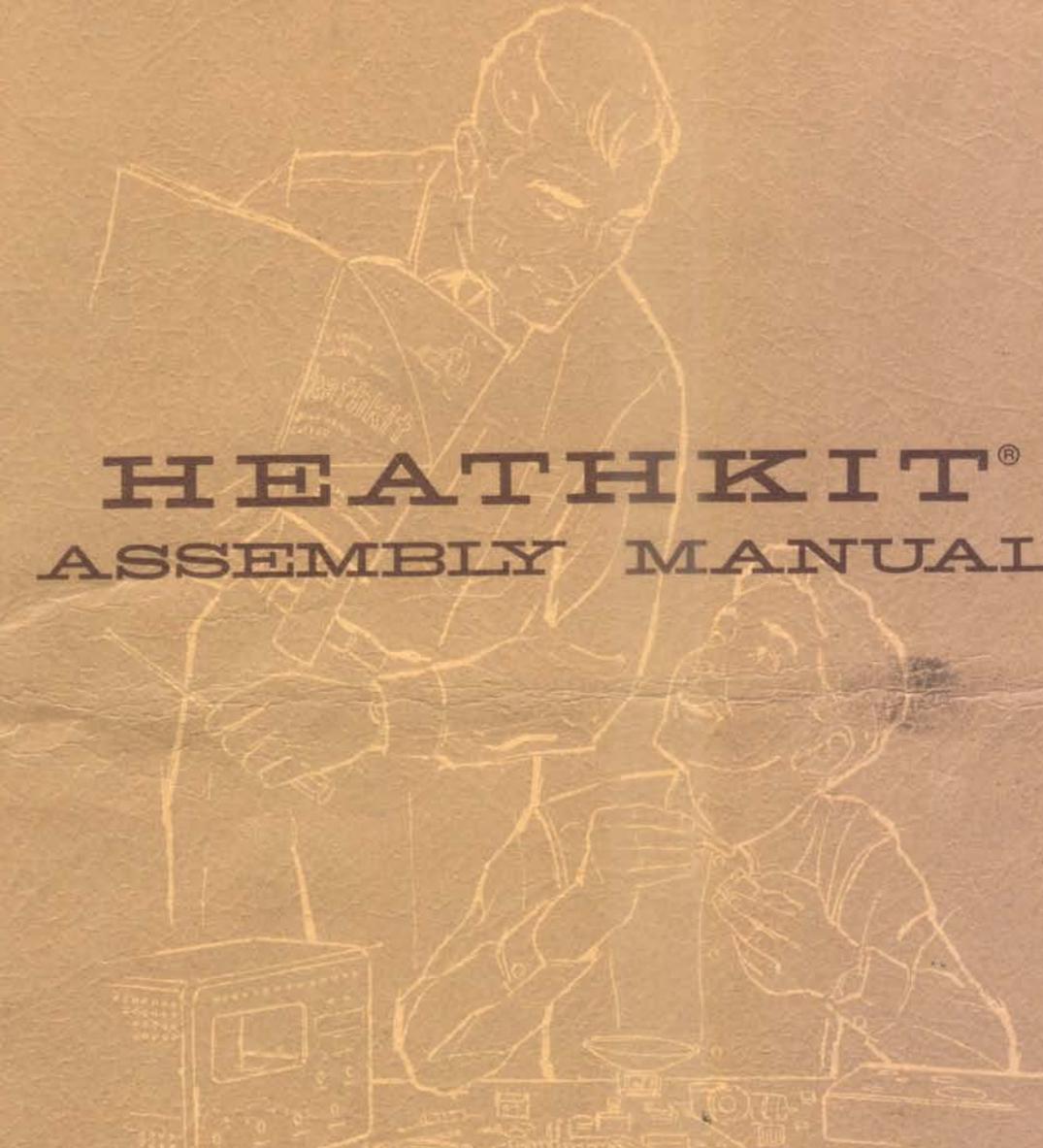
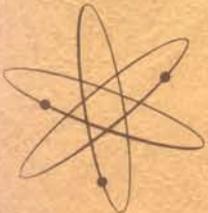


HEATH COMPANY BENTON HARBOR MICHIGAN



HEATHKIT[®]
ASSEMBLY MANUAL



**TRANSISTORIZED
IGNITION SYSTEM**

MODEL GD-212

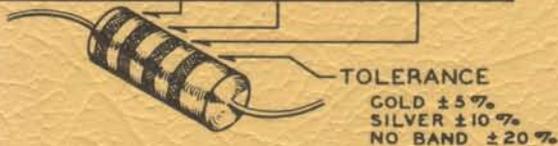
RESISTORS

The colored bands around the body of a color coded resistor represent its value in ohms. These colored bands are grouped toward one end of the resistor body. Starting with this end of the resistor, the first band represents the first digit of the resistance value; the second band represents the second digit; the third band represents the number by which the first two digits are multiplied. A fourth band of gold or silver represents a tolerance of $\pm 5\%$ or $\pm 10\%$ respectively. The absence of a fourth band indicates a tolerance of $\pm 20\%$.

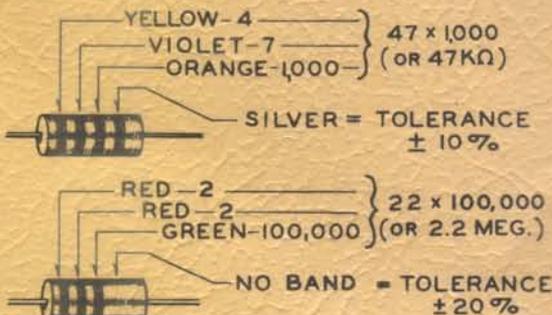
The physical size of a composition resistor is related to its wattage rating. Size increases progressively as the wattage rating is increased. The diameters of 1/2 watt, 1 watt and 2 watt resistors are approximately 1/8", 1/4" and 5/16", respectively.

The color code chart and examples which follow provide the information required to identify color coded resistors.

COLOR	CODE			MULTIPLIER
	1ST DIGIT	2ND DIGIT		
BLACK	0	0		1
BROWN	1	1		10
RED	2	2		100
ORANGE	3	3		1,000
YELLOW	4	4		10,000
GREEN	5	5		100,000
BLUE	6	6		1,000,000
VIOLET	7	7		10,000,000
GRAY	8	8		100,000,000
WHITE	9	9		1,000,000,000
GOLD	-	-		.1
SILVER	-	-		.01



EXAMPLES



CAPACITORS

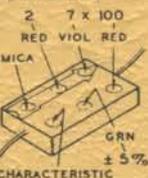
Generally, only mica and tubular ceramic capacitors, used in modern equipment, are color coded. The color codes differ somewhat among capacitor manufacturers, however the codes

shown below apply to practically all of the mica and tubular ceramic capacitors that are in common use. These codes comply with EIA (Electronics Industries Association) Standards.

MICA

COLOR	CODE			TOLER. %
	1ST DIGIT	2ND DIGIT	MULTIPLIER	
BLACK	0	0	1	±20
BROWN	1	1	10	±20
RED	2	2	100	±2
ORANGE	3	3	1,000	±3
YELLOW	4	4	10,000	±5
GREEN	5	5	---	---
BLUE	6	6	---	---
VIOLET	7	7	---	---
GRAY	8	8	---	---
WHITE	9	9	---	---
GOLD	-	-	.1	---
SILVER	-	-	.01	±10

EXAMPLE

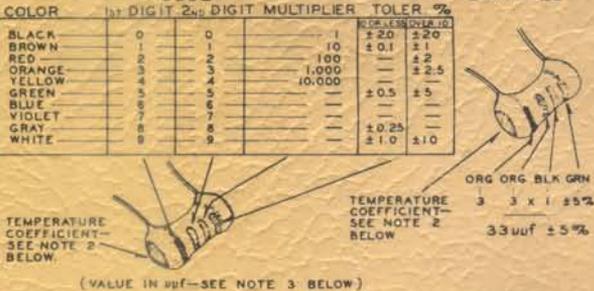


TUBULAR CERAMIC

Place the group of rings or dots to the left and read from left to right.

COLOR	CODE			TOLER. %	
	1ST DIGIT	2ND DIGIT	MULTIPLIER	TEMPERATURE COEFFICIENT	INSULATION RES.
BLACK	0	0	1	±20	±20
BROWN	1	1	10	±0.1	±1
RED	2	2	100	---	±2
ORANGE	3	3	1,000	---	±2.5
YELLOW	4	4	10,000	---	---
GREEN	5	5	---	±0.5	±5
BLUE	6	6	---	---	---
VIOLET	7	7	---	---	---
GRAY	8	8	---	±0.25	---
WHITE	9	9	---	±1.0	±10

EXAMPLE



NOTES:

1. The characteristic of a mica capacitor is the temperature coefficient, drift capacitance and insulation resistance. This information is not usually needed to identify a capacitor but, if desired, it can be obtained by referring to EIA Standard, RS-153 (a Standard of Electronic Industries Association).

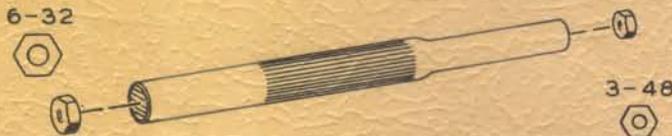
expressed in parts per million per degree centigrade. Refer to EIA Standard, RS-198 (a Standard of Electronic Industries Association.)

2. The temperature coefficient of a capacitor is the predictable change in capacitance with temperature change and is

3. The farad is the basic unit of capacitance, however capacitor values are generally expressed in terms of μfd (microfarad, .000001 farad) and $\mu\mu\text{f}$ (micro-micro-farad, .000001 μfd); therefore, 1,000 $\mu\mu\text{f}$ = .001 μfd , 1,000,000 $\mu\mu\text{f}$ = 1 μfd .

USING A PLASTIC NUT STARTER

A plastic nut starter offers a convenient method of starting the most used sizes: 3/16" and 1/4" (3-48 and 6-32). When the correct end is pushed down over a nut, the pliable tool conforms to the shape of the nut and the nut is gently held while it is being picked up and started on the screw. The tool should only be used to start the nut.

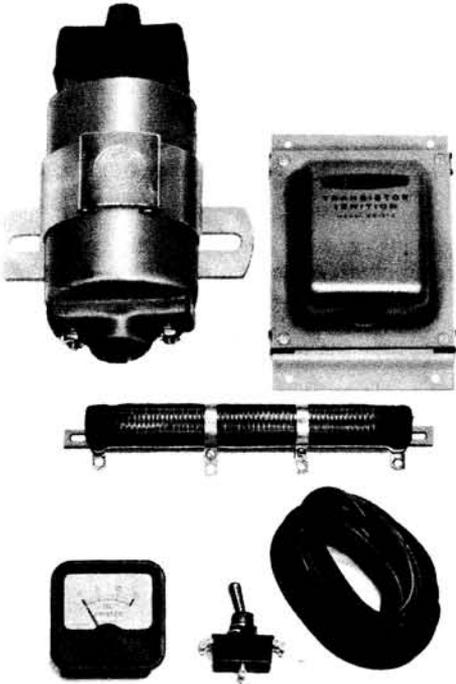


Assembly
and
Operation
of the



**TRANSISTORIZED
IGNITION SYSTEM**

MODEL GD-212



HEATH COMPANY,
BENTON HARBOR,
MICHIGAN

DAYSTROM, INCORPORATED
a subsidiary of

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Heath Company

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All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.



SPECIFICATIONS

Transistors.	Two high-current switching type.
Diodes.	Two Zener, 56 volt, 1 watt.
Ballast Resistor.	Adjustable 0 to 1 Ω (temperature insensitive).
Ignition Coil.	Special high turns ratio.
Meter.	0 to 15 amperes.
Voltage Requirements.	12 volt, negative-grounded system.
Chassis Size.	3-3/4" wide x 5-13/16" long x 1-3/4" high.
Net Weight.	2-3/4 lbs.
Shipping Weight.	4 lbs.

INTRODUCTION

Your Heathkit Transistorized Ignition System has been designed for the automobile hobbyist or experimenter who wishes to replace his present ignition system to gain improved engine performance. (See "Science And Mechanics" magazine, August, 1961, October, 1961, and February, 1962 editions.) Featured in the System is a special high turns ratio ignition coil as well as an adjustable ballast resistor and a meter so you can adjust the current for optimum operation.

A special circuit is used to supply the proper operating current to the transistors and coil

when the battery voltage drops during the engine starting cycle.

Because this is a high performance Ignition System, it is possible that ignition noise interference in radio equipment may increase. The addition of condenser C1 may help to reduce the condition. (See the Schematic.)

NOTE: This Ignition System can be used only in cars having a negative-ground, 12 volt electrical system.

CIRCUIT DESCRIPTION

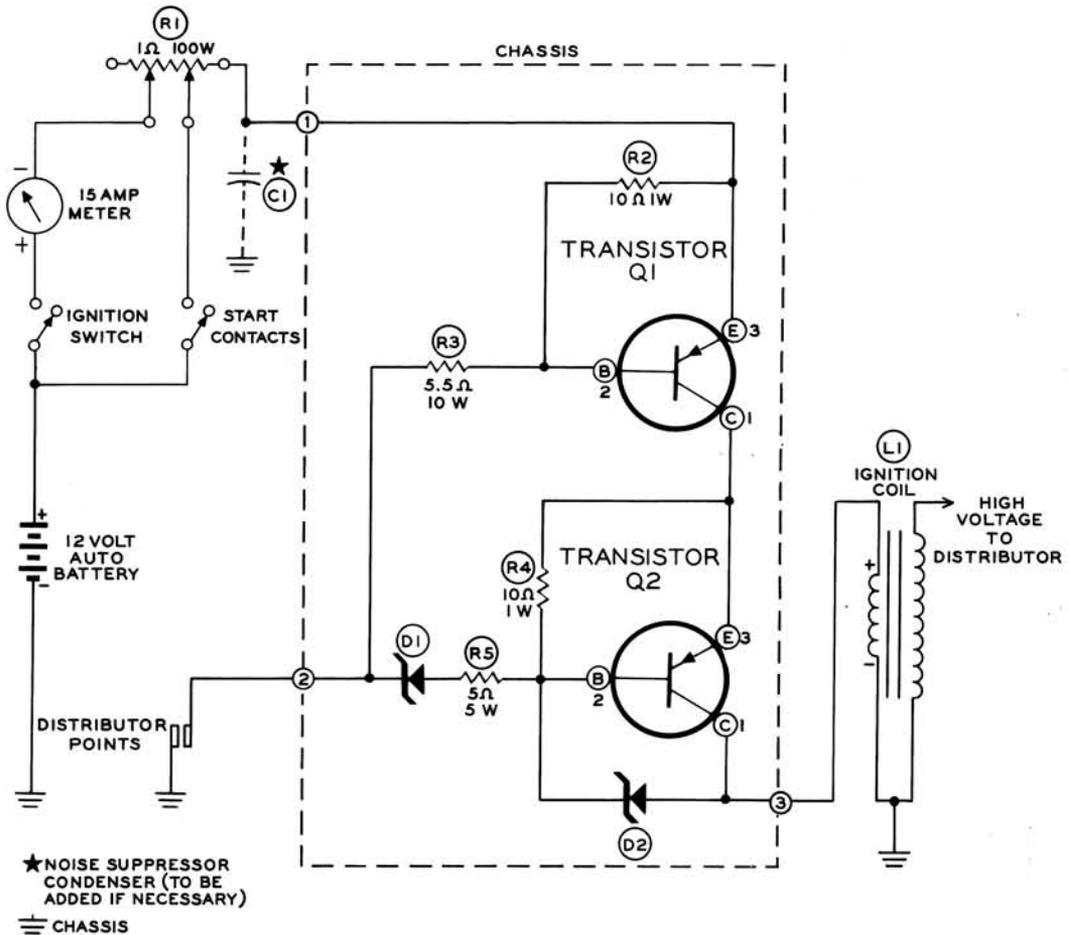
To better understand how the Transistorized Ignition System works, refer to the Schematic Diagram while reading the following Circuit Description.

When the distributor points close, battery current is applied through current-limiting resistors R3 and R5 to the base of transistors Q1 and Q2. This current (forward bias) turns on the transistors and drives them to saturation. When the transistors are turned on, a high current is drawn through the primary winding of ignition coil L1, causing a magnetic field to build up in the coil.

When the distributor points open, transistors Q1 and Q2 are cut off by base-to-emitter resistors R2 and R4. The magnetic field in the coil collapses rapidly, creating a very high voltage pulse in the coil secondary. This pulse is sent through the distributor to a spark plug and causes the plug to "fire."

The cycle of events just described is repeated each time the distributor points close and open.

Ballast resistor R1 has two movable contacts. During normal operation, the proper current, 10 amperes, is supplied to transistors Q1 and



SCHEMATIC DIAGRAM

Q2 by the use of movable contact 3. During the engine starting cycle when the battery voltage is reduced by the large amount of current drawn by the starter, movable contact 2 is used to supply the 10 amperes of current.

The switching between the two movable contacts of the ballast resistor takes place as the igni-

tion switch is turned from the ON to the START position.

Zener diodes D1 and D2 are limiting devices, and protect the transistors from the high voltage in the coil primary that results when the magnetic field in the coil collapses.



CONSTRUCTION NOTES

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. The arrangement shown is the result of extensive experimentation and trial. If followed carefully, the result will be highly stable and dependable performance. We suggest that you retain the manual in your files for future reference, both in the use of the equipment and for its maintenance.

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with the parts. Refer to the information on the inside covers of the manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the Replacements section and sup-

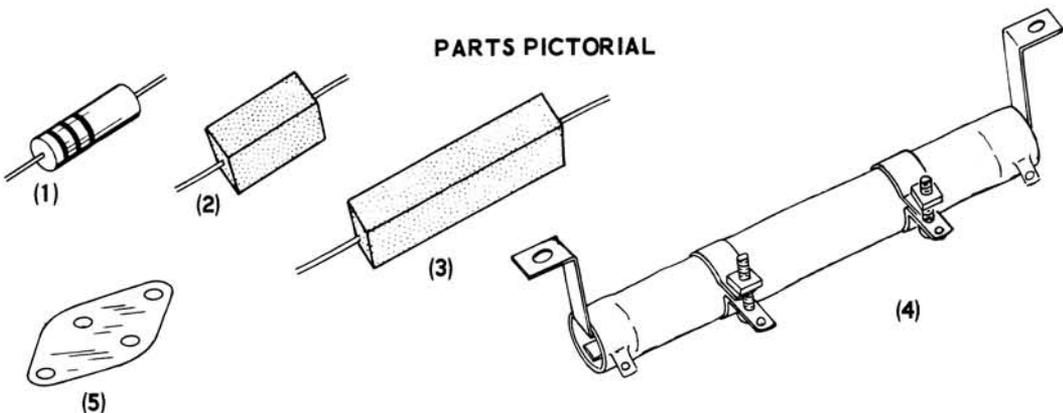
ply the information called for therein. Include all inspection slips in your letter to us.

Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List.

We suggest that you do the following before work is started:

1. Lay out all parts so that they are readily available.
2. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; long-nose pliers; wire cutters, preferably separate diagonal cutters; a penknife or a tool for stripping insulation from wires; a soldering iron (or gun) and rosin core solder.

PARTS PICTORIAL





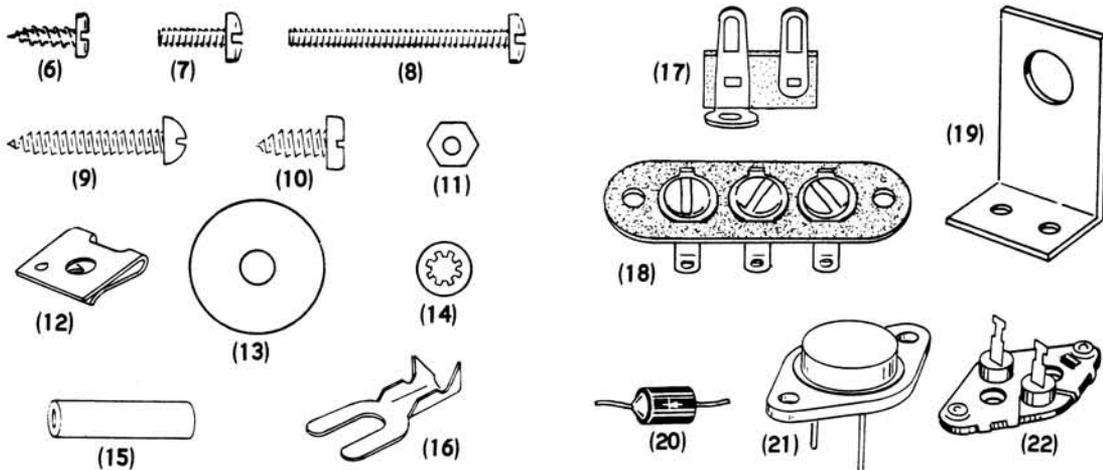
PARTS LIST

Unpack the kit carefully and check each part against the Parts List. The numbers in parentheses

in the Parts List are keyed to the numbers on the Parts Pictorial to aid in parts identification.

PART No.	PARTS Per Kit	DESCRIPTION	PART No.	PARTS Per Kit	DESCRIPTION
Resistors					
(1) 1A-11	2	10 Ω 1 watt (brown-black-black)	Wire		
(2) 3E-20	1	5 Ω 5 watt wire-wound	344-3	1	Length #18 hookup wire (red)
(3) 3J-15	1	5.5 Ω 10 watt wire-wound	344-7	1	Length #14 hookup wire (black)
(4) 3Y-9	1	1 Ω 100 watt wire-wound ballast resistor	Terminal Strips		
			(17) 431-16	1	2-lug terminal strip
			(18) 431-8	1	3-lug screw terminal strip
Insulators					
73-1	1	Grommet	Metal Parts		
73-M24	1	Rubber gasket	200-M375	1	Chassis
(5) 75-44	2	Mica transistor insulator	(19) 204-M89	1	Switch bracket
			206-210F877	1	Chassis cover
Hardware					
(6) 250-8	2	#6 x 3/8" sheet metal screw	Miscellaneous		
(7) 250-89	8	6-32 x 3/8" screw	40-499	1	Ignition coil
(8) 250-79	2	6-32 x 1-1/4" screw	(20) 56-13	2	Zener diode 56 volt 1 watt
(9) 250-35	8	#8 x 7/8" sheet metal screw	61-8	1	DPDT toggle switch
(10) 250-51	8	#10 x 3/8" sheet metal screw	407-11	1	Meter
(11) 252-3	2	6-32 nut	(21) 417-61	2	Transistor
(12) 252-22	4	6-32 speednut	(22) 434-117	2	Transistor socket
(13) 253-19	2	#10 flat steel washer	331-6		Solder
(14) 254-1	2	#6 lockwasher	595-612	1	Manual
(15) 255-5	2	#6 x 3/4" spacer			
(16) 259-16	6	Spade lug			

PARTS PICTORIAL





PROPER SOLDERING TECHNIQUES

Only a small percentage of customers find it necessary to return equipment for factory service. By far the largest portion of malfunctions in this equipment are due to poor or improper soldering.

If terminals are bright and clean and free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Correctly soldered connections are essential if the performance engineered into a kit is to be fully realized. If you are a beginner with no experience in soldering, a half hour's practice with some odd lengths of wire may be a worthwhile investment.

For most wiring, a 25 to 100 watt iron or its equivalent in a soldering gun is very satisfactory. A lower wattage iron than this may not heat the connection enough to flow the solder smoothly. Keep the iron tip clean by wiping it from time to time with a cloth.

CHASSIS WIRING AND SOLDERING

1. Unless otherwise indicated, all wire used is the type with colored insulation (hookup wire). In preparing a length of hookup wire, 1/4" of insulation should be removed from each end unless directed otherwise in the assembly step.
2. Leads on resistors, and similar components are generally much longer than need to be to make the required connections. In these cases, the leads should be cut to proper length before the part is installed. In general, the leads should be just long enough to reach their terminating points.
3. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength. If the lead is too large to allow bending or if

the step states that it is not to be crimped, position it so that a good solder connection can still be made.

4. Position the work, if possible, so that gravity will help to keep the solder where you want it.
5. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.
6. Then place the solder against the connection and it will immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.
7. Remove the solder and then the iron from the completed joint. Use care not to move the leads until the solder is solidified.

A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly. In some cases, it may be necessary to add a little more solder to achieve a smooth, bright appearance.

ROSIN CORE SOLDER HAS BEEN SUPPLIED WITH THIS KIT. THIS TYPE OF SOLDER MUST BE USED FOR ALL SOLDERING IN THIS KIT. ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE EQUIPMENT IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. IF ADDITIONAL SOLDER IS NEEDED, BE SURE TO PURCHASE ROSIN CORE (60:40 or 50:50 TIN-LEAD CONTENT) RADIO TYPE SOLDER.



STEP-BY-STEP PROCEDURE

The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning the specified operation. Also read several steps ahead of the actual step being performed. This will familiarize you with the relationship of the subsequent operations. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omissions, especially if your work is interrupted. Some kit builders have also found it helpful to mark each wire and part in colored pencil on the Pictorial as it is added.

ILLUSTRATIONS

In general, the illustrations in this manual correspond to the actual configuration of the kit; however, in some instances the illustrations may be slightly distorted to facilitate clearly showing all of the parts.

SOLDERING INFORMATION

The abbreviation "NS" indicates that a connection should not be soldered yet as other wires will be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in point before it is soldered. For example, if the instruction reads, "Connect a wire to lug 1 (S-2)," it will be understood that there will be two wires connected to the terminal at the time it is soldered.

GENERAL

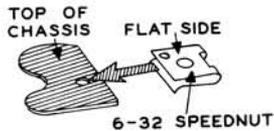
The steps directing the installation of resistors include color codes to help identify the parts. Also, if a part is identified by a letter-number designation (R1, D1, etc.) on the Schematic, its designation will appear at the beginning of the assembly step which directs its installation.

STEP-BY-STEP ASSEMBLY

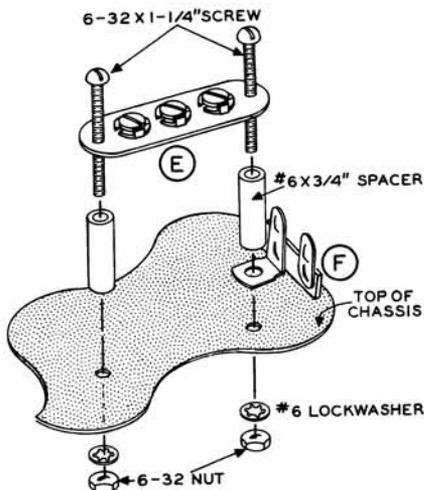
PARTS MOUNTING

Refer to Pictorial 1 for the following steps.

- (✓) Locate the chassis (#200-M375) and position as shown.
- (✓) Referring to Detail 1A, mount 6-32 speednuts at locations A through D. Be sure the flat side of each speednut is up, as shown.



Detail 1A

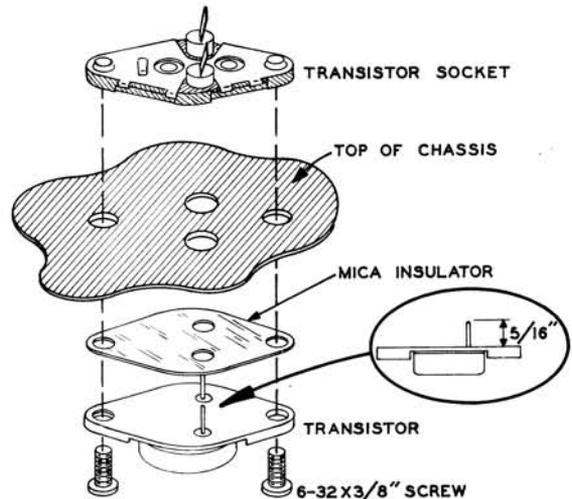


Detail 1B

- (✓) Referring to Detail 1B, mount the 3-lug screw terminal strip at E, and the 2-lug terminal strip at F. Use 6-32 x 1-1/4" screws, #6 x 3/4" spacers, #6 lockwashers, and 6-32 nuts. Position the lugs of the terminal strips as shown.

- (✓) Referring to Detail 1C, cut the transistor pins to 5/16" in length and remove any burrs from the pin ends.

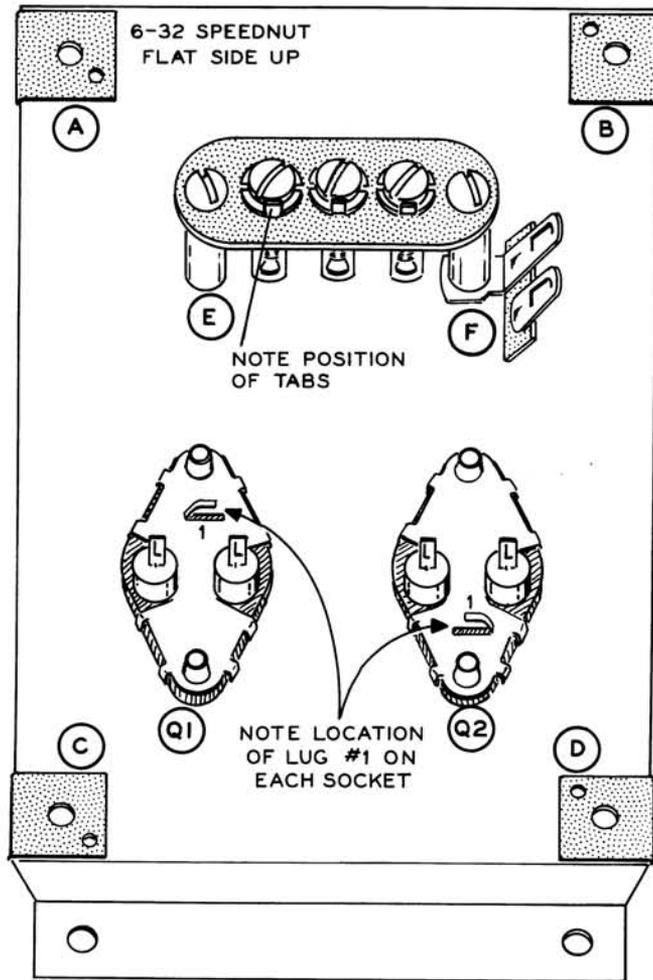
- (✓) Referring to Detail 1C, mount the transistors, mica transistor insulators, and transistor sockets at locations Q1 and Q2. Use 6-32 x 3/8" screws. Be sure the sockets are seated properly before tightening the screws.



Detail 1C

If an ohmmeter is available, check to be sure the case of each transistor is not shorted to the chassis. This can be done by measuring from lug 1 of each socket to the chassis.

If a short exists, make sure a mica insulator is installed between the transistor and the chassis, and that the insulator is not damaged in any way.



Pictorial 1

CHASSIS WIRING

Refer to Pictorial 2 for the following steps.

It is important that the resistors and wires be positioned as shown so the cover will fit onto the chassis properly.

- (✓) R2. Connect a 10 Ω (brown-black-black) 1 watt resistor between lugs 2 (NS) and 3 (NS) of transistor socket Q1.
- (✓) R3. Connect a 5.5 Ω 10 watt resistor from lug 2 of transistor socket Q1 (S-2) to lug 2 of terminal strip E (NS). Position the resistor down on the chassis.
- (✓) R4. Connect a 10 Ω (brown-black-black) 1 watt resistor between lugs 2 (NS) and 3 (NS) of transistor socket Q2.
- (✓) R5. Connect a 5 Ω 5 watt resistor from lug 2 of terminal strip F (NS) to lug 2 of transistor socket Q2 (NS).

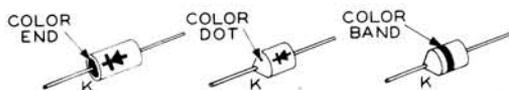
NOTE: Use red hookup wire in the following step. Cut the wire to length, strip 1/4" of insulation from each end of the wire, and tin. "Tin" means to melt a small amount of solder on the exposed wire ends to hold the wire strands together.

- (✓) Connect a 3" wire from lug 1 of terminal strip E (S-1) to lug 3 of transistor socket Q1 (S-2).
- (✓) Connect a 3-1/2" wire from lug 3 of terminal strip E (S-1) to lug 1 of transistor socket Q2 (NS).

- (✓) Connect a 3" wire from lug 1 of transistor socket Q1 (S-1) to lug 3 of transistor socket Q2 (S-2).

- (✓) D1. Referring to Detail 2A, connect the lead at the marked end of a diode to lug 2 of terminal strip E (S-2). Connect the other lead to lug 2 of terminal strip F (S-2). To protect the diode from heat damage, grip the diode lead between the diode body and the connection with a pair of long-nose pliers when soldering. A rubber band around the handle of the pliers, will keep them in place.

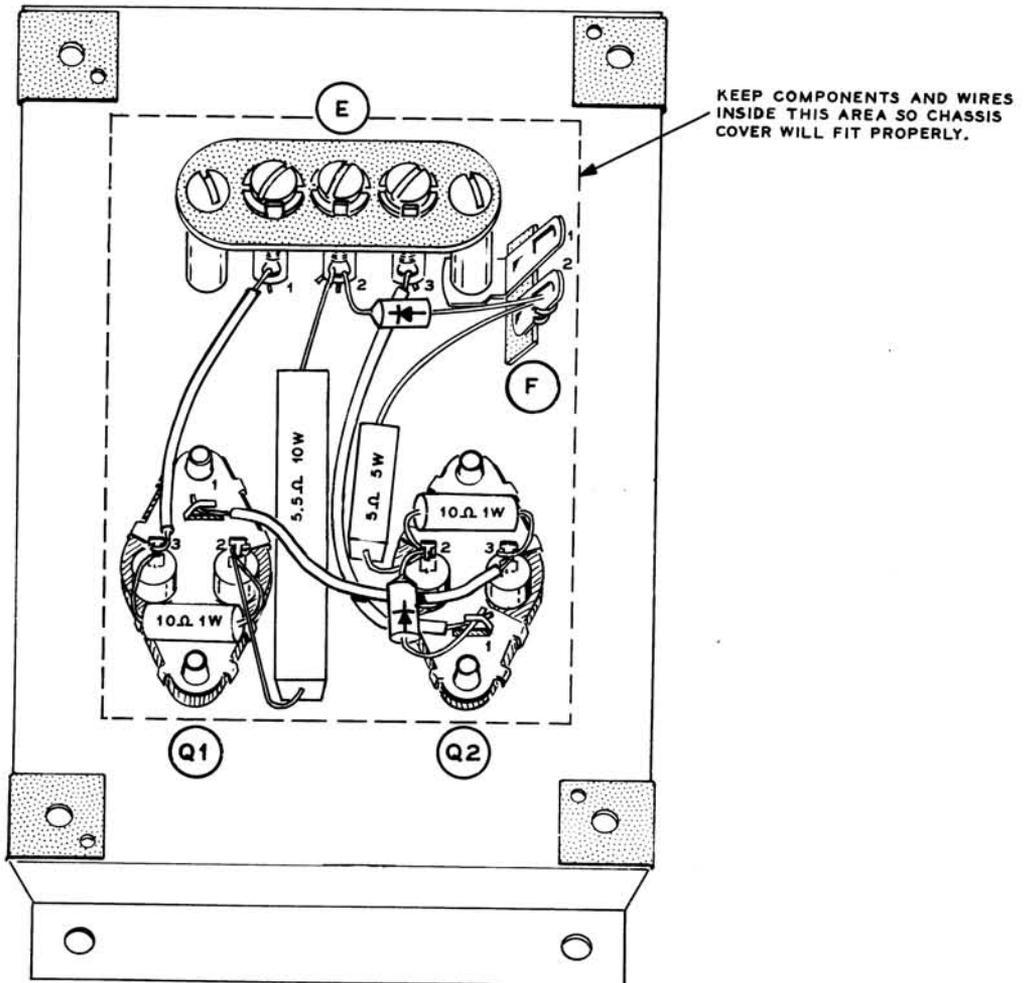
NOTE WHEN INSTALLING SILICON DIODES, THE CATHODE END SHOULD BE PLACED AS DIRECTED THE CATHODE END IS MARKED WITH A COLOR END, COLOR DOT, OR COLOR BAND. IN THE ILLUSTRATION, THE SYMBOL K INDICATES THE CATHODE END.



Detail 2A

- (✓) D2. Connect the lead at the marked end of a diode to lug 2 (S-3) and the other lead to lug 1 (S-2) of transistor socket Q2.

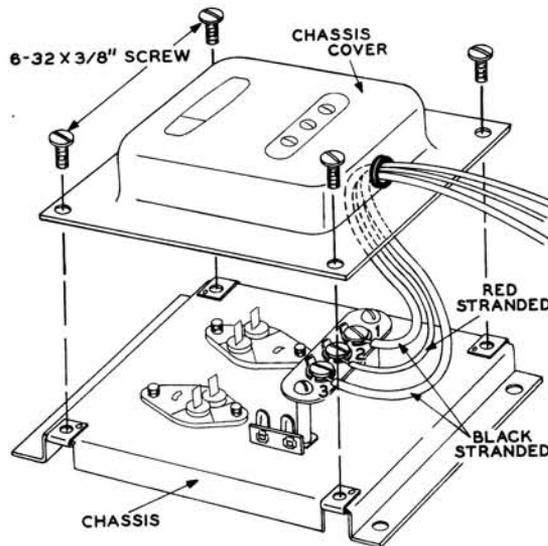
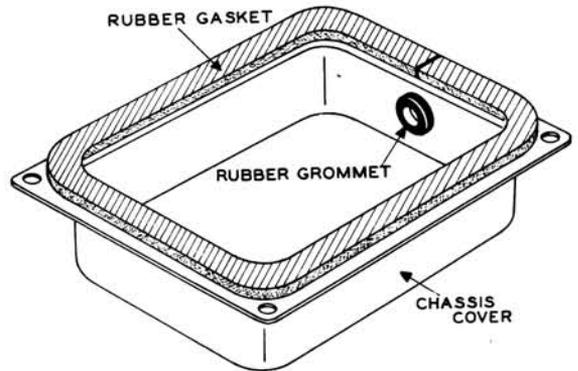
This completes the chassis wiring. Be sure all connections are soldered and that no shorts exist between any connections and the chassis.



Pictorial 2

Refer to Detail 3A for the following steps.

- (✓) Locate the chassis cover (#206-210F877) and install the rubber grommet in the hole as shown.
- (✓) Peel the protective backing from the rubber gasket.
- (✓) Position the gasket around the cover as shown, pressing it down firmly. The seam should be at the same end of the cover as the rubber grommet.
- (✓) Referring to Pictorial 3, temporarily mount the cover on the chassis. Use 6-32 x 3/8" screws through the cover and into the speed-nuts on the chassis. This will hold the gasket in place until its adhesive becomes set.



Pictorial 3



INSTALLATION

Before installing any of the Ignition System components in the car, we suggest that you read the entire Installation and Calibration sections of the manual carefully to understand fully all the requirements of the installation.

The Ignition System can be installed in a number of ways. Figures 1 through 4 show four wiring variations, one of which should be suitable for any installation requirement.

The following discussion will point out the advantages of these systems and aid you in

choosing the one best suited for your automobile.

First and most important is the ballast resistor or resistance wire from the ignition switch to the original coil of cars with 12 volt electrical systems. This ballast resistor or wire is used to drop the voltage to the coil, to a value somewhat less than 12 volts once the engine is started. Because of the low current handling capability of the original ballast resistor or resistance wire, it cannot be used to supply the high current to ballast resistor R1. The black wire supplied must be used for this purpose.

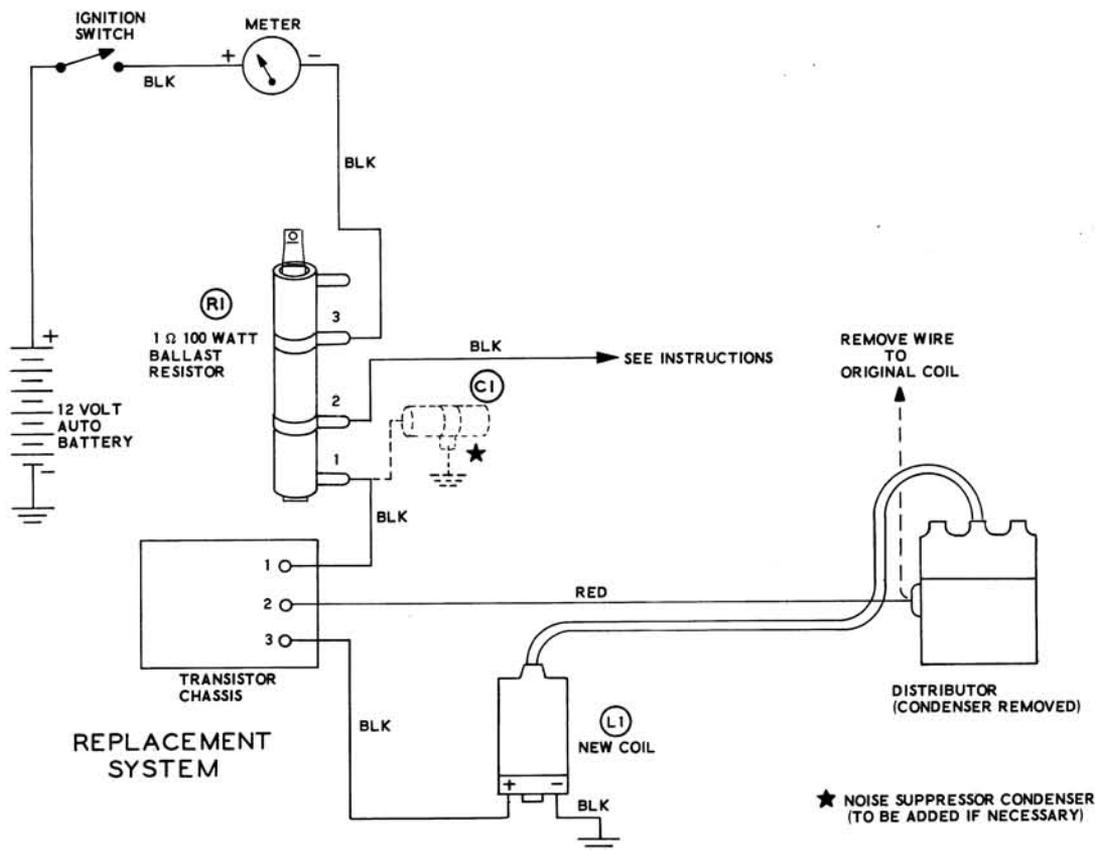


Figure 1

For the installation shown in Figure 2, a black wire should be installed in addition to the original ignition wire.

The circuits shown in Figures 3 and 4 use a relay (Mallory #25947A bypass relay) which should be available from local autoparts stores. The advantage of using the relay is that the major portion of the wiring will be done under the hood. It eliminates the necessity of wiring to the ignition switch (which is difficult to get to) and permits the use of the existing ballast resistor or resistance wire to operate the relay. The relay contacts will handle the full high cur-

rent requirements of the transistor ignition system.

Figures 1 and 3 actually replace the original ignition system of the car, whereas Figures 2 and 4 are substitution systems, thus retaining the original system in reserve in case you desire to switch it back in. In Figures 2 and 4, in order to switch from the transistor system to the original, all that has to be done is to flip the switch and connect the high tension wire from the distributor to the proper coil.

Regardless of which circuit is chosen, the condenser must be removed from the distributor when using the transistorized system.

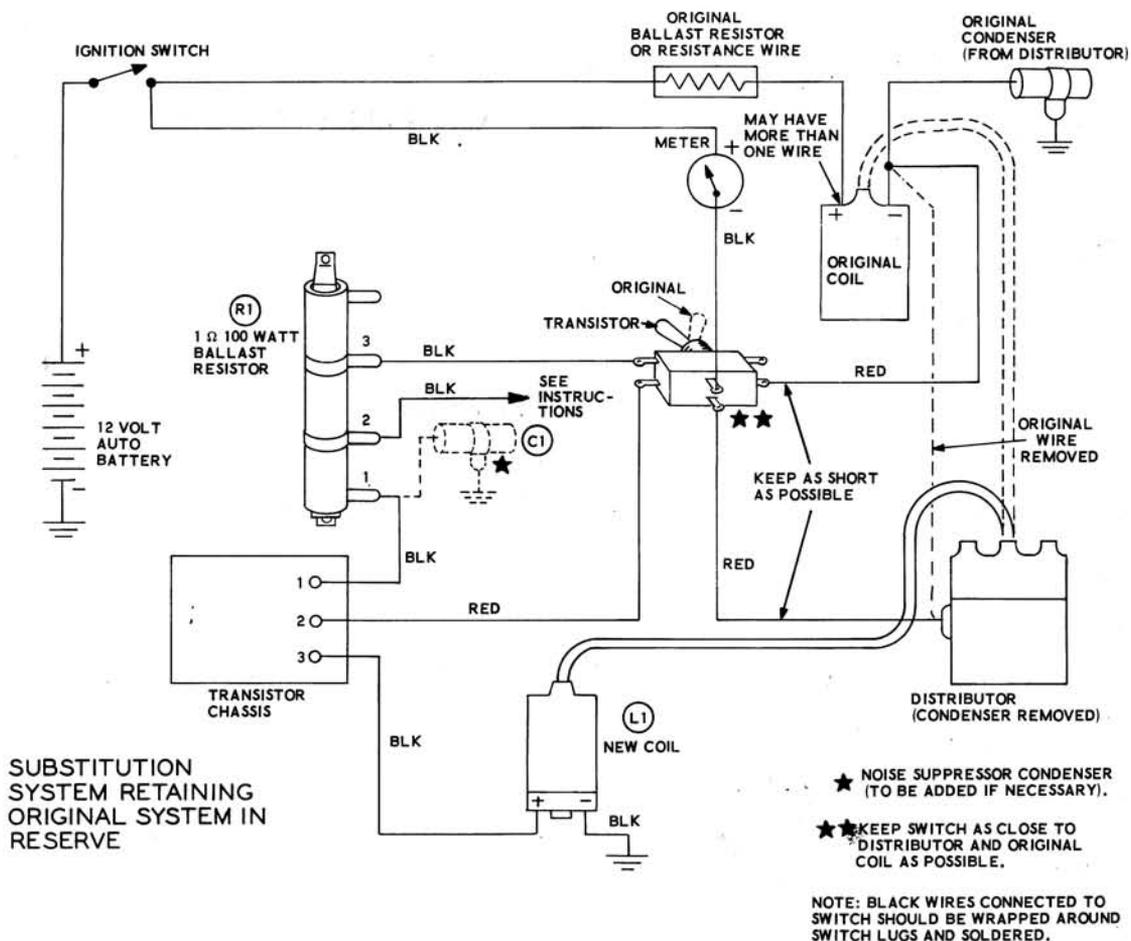


Figure 2



This condenser must be used with the original ignition system by connecting it to the original coil if Figure 2 or 4 is followed.

Also if Figure 2 or 4 is followed, the switch must be mounted as close to the distributor as possible to keep the distributor and original coil wires short, to hold ignition noise (radio interference) down as much as possible.

It is also suggested that new spark plugs and distributor points be installed. If resistance type high voltage ignition wire (all wires from distributor cap) is used on the car, they should be replaced with standard non-resistive type high voltage ignition wire in order to take full advantage of the higher ignition voltage produced by the transistorized system.

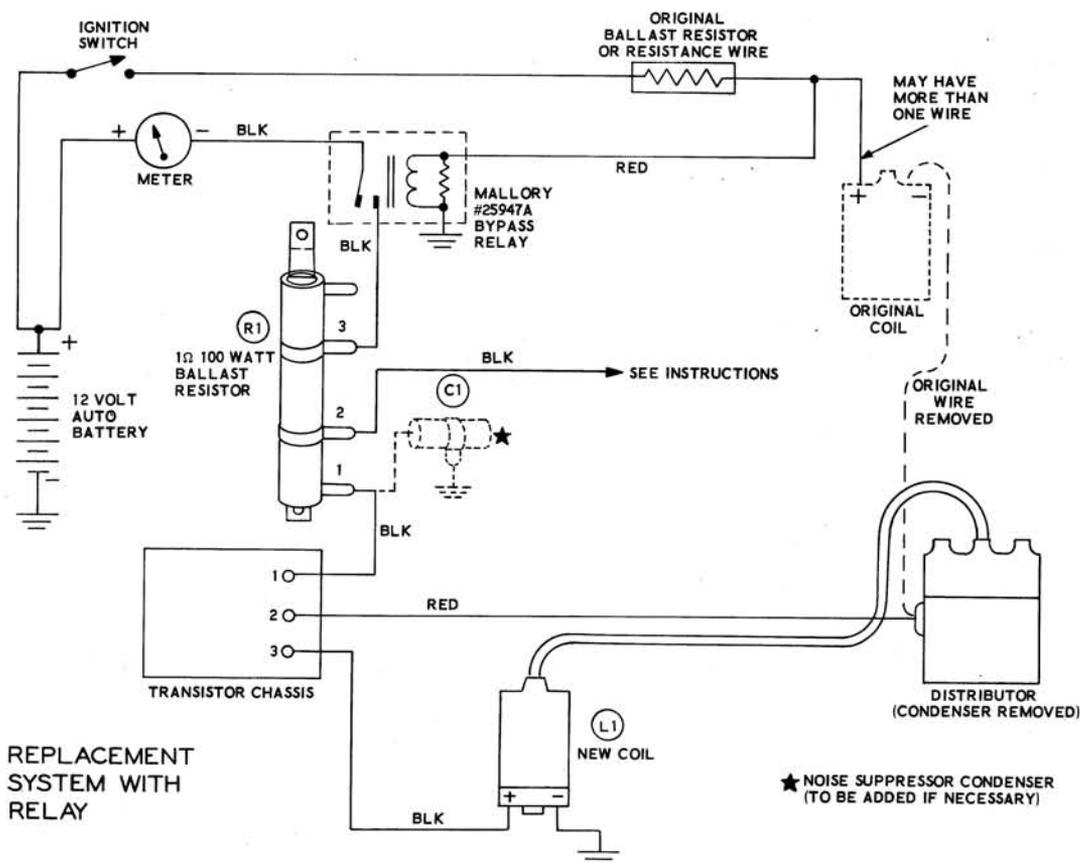


Figure 3

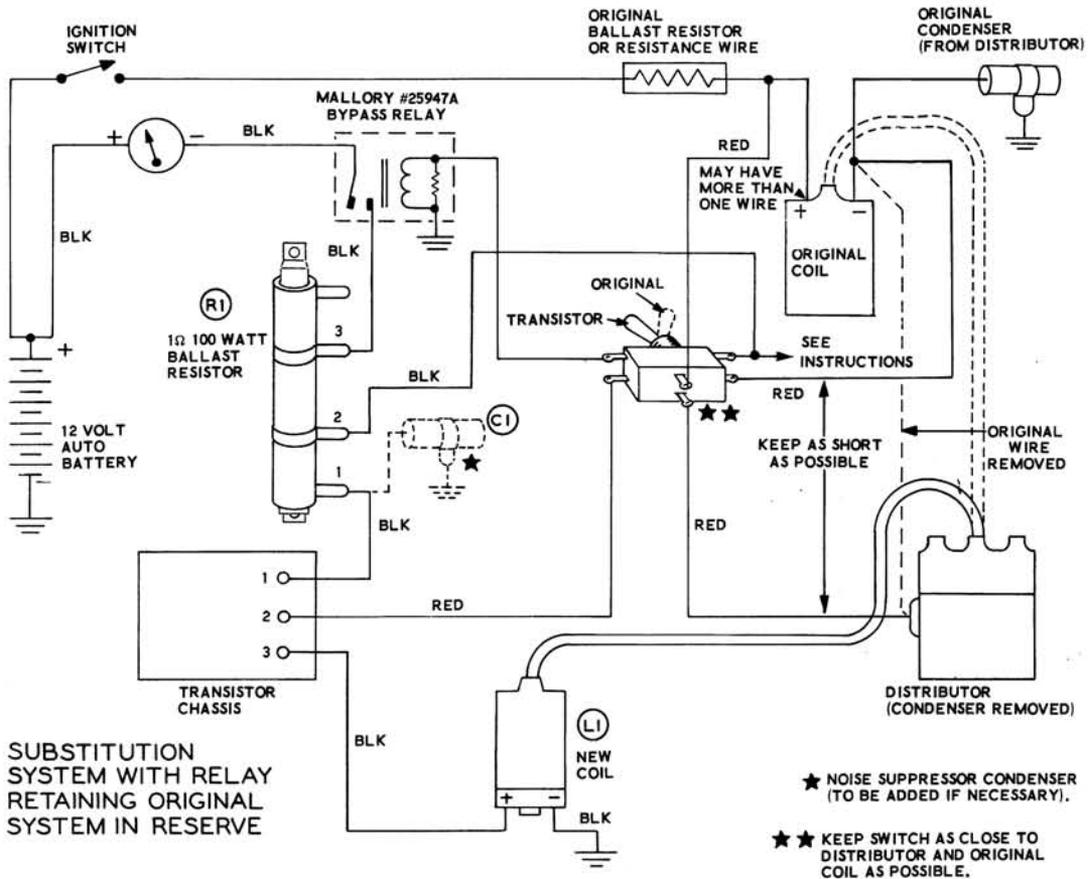


Figure 4

PARTS MOUNTING IN CAR

Either the #8 or #10 sheet metal screws should be used in the following steps. Use 1/8" or 9/64" drilled holes, respectively.

- (✓) L1. Mount the ignition coil close enough to the distributor to use the same length high tension wire (center wire from top of distributor) used in the original system. Use the #10 flat washers when mounting the coil.
- (✓) Mount the transistor chassis in a location that is not affected by heat, such as that from the radiator or engine. If a cool location can not be found in the engine com-

partment, possibly the chassis can be mounted on the inside of a frontfender, just behind the grille, or even in the passenger compartment. However, long leads to the chassis may cause an increase in ignition noise in any radio equipment in the car.

- (✓) R1. Mount the 1 Ω 100 watt ballast resistor in a location where its radiated heat will not affect the chassis unit.
- (✓) Mount the switch and switch bracket, if used. Position the switch as close to the distributor and original coil as possible. Use #6 x 3/8" sheet metal screws into 7/64" drilled holes.



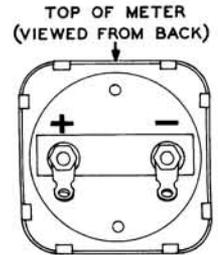
WIRING

The black or red wire should be used in all locations marked on the Figures. If not marked, the original car wiring can be used. The spade lugs can be crimped and soldered to the wire ends for easier hookup, except the wires connected to the terminal strip of the transistor chassis. The ends of these wires should be tinned and bent to form a hook to fit around the screws of the terminal strip.

All connections should be made except to movable contacts 2 and 3 of ballast resistor R1. These wires will be connected after calibration.

- (-) Remove the cover from the transistor chassis.
- (-) Wire the components together, except the black wire to movable contact 2, as shown in the Figure chosen. The black wire to movable contact 2 will be installed later. Refer to Pictorial 3 on Page 12 for proper

positioning of wires through the grommet of the cover, and to the chassis cover for hookup to the transistor chassis. Refer to Detail 3B for meter lug polarity identification.



Detail 3B

- (-) Replace the cover on the chassis, using 6-32 x 3/8" screws. Tighten only enough to slightly compress the gasket.
- (-) Unplug the high tension wire from the original coil and plug it into the new coil. Be sure to use the rubber cap supplied with the new coil.
- (-) Set movable contact 3 of ballast resistor R1 for maximum resistance. (The end opposite where the wire is connected.)
- (-) Check to see that the distributor points are closed. If not, quickly turn the ignition switch to START and then to OFF. Repeat, if necessary, until the points are closed.

CALIBRATION

CAUTION: At no time should the Transistor Ignition System draw more than 10 amperes of current as indicated on the meter, except as directed during calibration.

- (-) Turn the ignition switch ON.
- (-) Momentarily touch the free wire end to movable contact 3 of the ballast resistor and observe the meter reading. Then remove the wire. If the reading is less than 9 amperes, move movable contact 3 on the ballast resistor toward the center. Do not move the contact more than 2 or 3 turns of wire on the resistor at a time. If there is no meter indication check the meter wiring to be sure that it is correct.
- (-) Touch the wire to movable contact 3 again observe the meter reading, and remove the wire.
- (-) Repeat the preceding steps until a meter reading between 9 and 10 amperes is obtained. Turn the ignition switch to the OFF position.

- (-) Tighten movable contact 3 on the ballast resistor.
- (-) Position movable contact 2 about 1" below the bottom of movable contact 3.
- (-) Turn the Ignition switch ON.

NOTE: The following step must be done rapidly. Leave the wire on the contact only long enough for the meter to stabilize at the correct reading, as more than normal current is being drawn and the transistors can be damaged by prolonged operation at high current.

- (-) Touch the free end of the wire used in the preceding steps to movable contact 2, quickly note the meter reading, and remove the wire. If the reading is less than 15 amperes, move contact 2 closer to contact 3. Repeat the above procedure until the meter reads 15 amperes.
- (-) Turn the ignition switch OFF.

- () Tighten movable contact 2 on the ballast resistor.
- () Connect the free end of the wire to movable contact 3 and solder (S-1).

IMPORTANT: READ THE FOLLOWING STEPS CAREFULLY, AND BE SURE TO CONNECT THE WIRES TO THE CORRECT POINTS, AS DESCRIBED.

- () There is a point in the original ignition system where battery voltage is present only when the ignition switch is in the START position. This point is usually located either on the back of the ignition switch or at the starter solenoid contacts (not at both points). There will already be a wire connected to this point. This wire is the one used to bypass the ballast resistor of the original ignition system and apply battery voltage directly to the original ignition coil only during the start cycle. If you use the circuit shown in Figure 4, disconnect this wire from the point just described, and tape up the end.

NOTE: Perform only one of the following two steps, not both.

- () For the circuit shown in Figure 2, 3, or 4, connect a wire from this point in the original

system to movable contact 2 of the ballast resistor, and solder.

- () For the circuit shown in Figure 4, connect a wire from this point in the original system, to the switch. Then connect a wire from the same lug of the switch to movable contact 2 of the ballast resistor, and solder.

NOTE: 15 amperes of current does not flow through the Ignition System under normal operation. This current is drawn only during calibration. By adjusting movable contact 2 for 15 amperes of current at 12 volts, the resistance is set so that when the battery voltage drops during the engine starting cycle, the current through the system will be approximately 10 amperes, or normal current. When the engine is running, the current drawn by the ignition circuit will vary slightly at different engine speeds.

The meter can now be removed from the circuit, or it can be left in to monitor the circuit current at all times, indicating any changes in operating conditions. Furthermore, it is important that the ignition switch not be left in the ON position with the distributor points closed and the engine not running (as is true with the original ignition system), because of possible damage to the system. The meter will indicate current being drawn only when the points are closed.

IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.
2. It is interesting to note that about 90% of the kits that are returned for repair, do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques section of this manual.
3. Check the values of the component parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.
4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.
5. A review of the Circuit Description will prove helpful in indicating where to look for trouble.
6. Transistors are somewhat sensitive to high temperatures and if overheated they may not function properly. If the car will not start, and the transistor chassis cover is very warm to touch, allow it time to cool, then the system should function properly. If this situation occurs very often, the chassis unit should be moved to a cooler location.



SERVICE INFORMATION

SERVICE

If, after applying the information in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, YOU MUST QUALIFY for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under In Case Of Difficulty. Possibly it will not be necessary to write.
2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units, and anything else that might help to isolate the cause of trouble.
3. Report fully on the results obtained when testing the unit initially and when following the suggestions under In Case Of Difficulty. Be as specific as possible and include voltage readings if test equipment is available.
4. Identify the kit model number and date of purchase, if available. Also mention the date of the kit assembly manual. (Date at bottom of Page 1.)

5. Print or type your name and address, preferably in two places on the letter.

With the preceding information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed equipment to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a minimal service fee, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by Authorized HEATHKIT Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service for your HEATHKIT equipment. Although charges for local service are generally somewhat higher than for factory service, the amount of increase is usually offset by the transportation charge you would pay if you elected to return your kit to the Heath Company.

HEATHKIT Service Centers will honor the regular 90 day HEATHKIT Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company; however, it will be necessary that you verify the purchase date of your kit.



Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if the Service Center assists you in locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT dealer in order to be eligible for parts replacement under the terms of the Warranty.

THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.

REPLACEMENTS

Material supplied with HEATHKIT products has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally, improper operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information.

A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.

- B. Identify the type and model number of kit in which it is used.
- C. Mention date of purchase.
- D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. PLEASE DO NOT RETURN THE ORIGINAL COMPONENT UNTIL SPECIFICALLY REQUESTED TO DO SO. Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SHIPPING INSTRUCTIONS

In the event that your instrument must be returned for service, these instructions should be carefully followed.

Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: HEATH COMPANY
Benton Harbor, Michigan

ATTACH A LETTER TO THE OUTSIDE OF THE CARTON BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Also, include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by insured parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in HIS OPINION, the article is inadequately packed for shipment.



WARRANTY

Heath Company warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

NOTE: The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

HEATH COMPANY

TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations

should prove helpful in identifying most parts and reading the schematic diagrams.

<p>RESISTOR</p>	<p>CAPACITOR</p>	<p>TUBE</p>
<p>POTENTIOMETER (CONTROL)</p>	<p>ELECTROLYTIC CAPACITOR</p>	<p>PNP TRANSISTOR</p> <p>NPN TRANSISTOR</p>
<p>TRANSFORMER (IRON CORE)</p>	<p>VARIABLE CAPACITOR</p>	<p>RECTIFIER (DIODE)</p>
<p>TRANSFORMER (ADJUSTABLE POWDERED IRON CORE) ARROW INDICATES DIRECTION OF CORE MOVEMENT TO INCREASE INDUCTANCE</p>	<p>BATTERY</p>	<p>NEON BULB</p>
<p>TRANSFORMER (ADJUSTABLE CORE)</p>	<p>PHONO JACK</p>	<p>ILLUMINATING BULB</p>
<p>POWER TRANSFORMER</p>	<p>PHONE JACK</p>	<p>METER</p>
<p>INDUCTOR (COIL)</p>	<p>RECEPTACLE</p>	<p>SPST SWITCH (TOGGLE)</p> <p>DPDT</p>
<p>PIEZOELECTRIC CRYSTAL</p>	<p>SPEAKER</p>	<p>SWITCH (ROTARY)</p>
<p>BINDING POST</p>	<p>MICROPHONE</p>	<p>FUSE</p>
<p>ANTENNA</p> <p>GENERAL</p> <p>LOOP</p>	<p>EARTH GROUND</p> <p>CHASSIS GROUND</p>	<p>CONDUCTORS</p> <p>NOT CONNECTED</p> <p>CONNECTED</p> <p>SHIELDED</p>

HEATH COMPANY

BENTON HARBOR, MICHIGAN

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DAYSTROM, INCORPORATED

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM