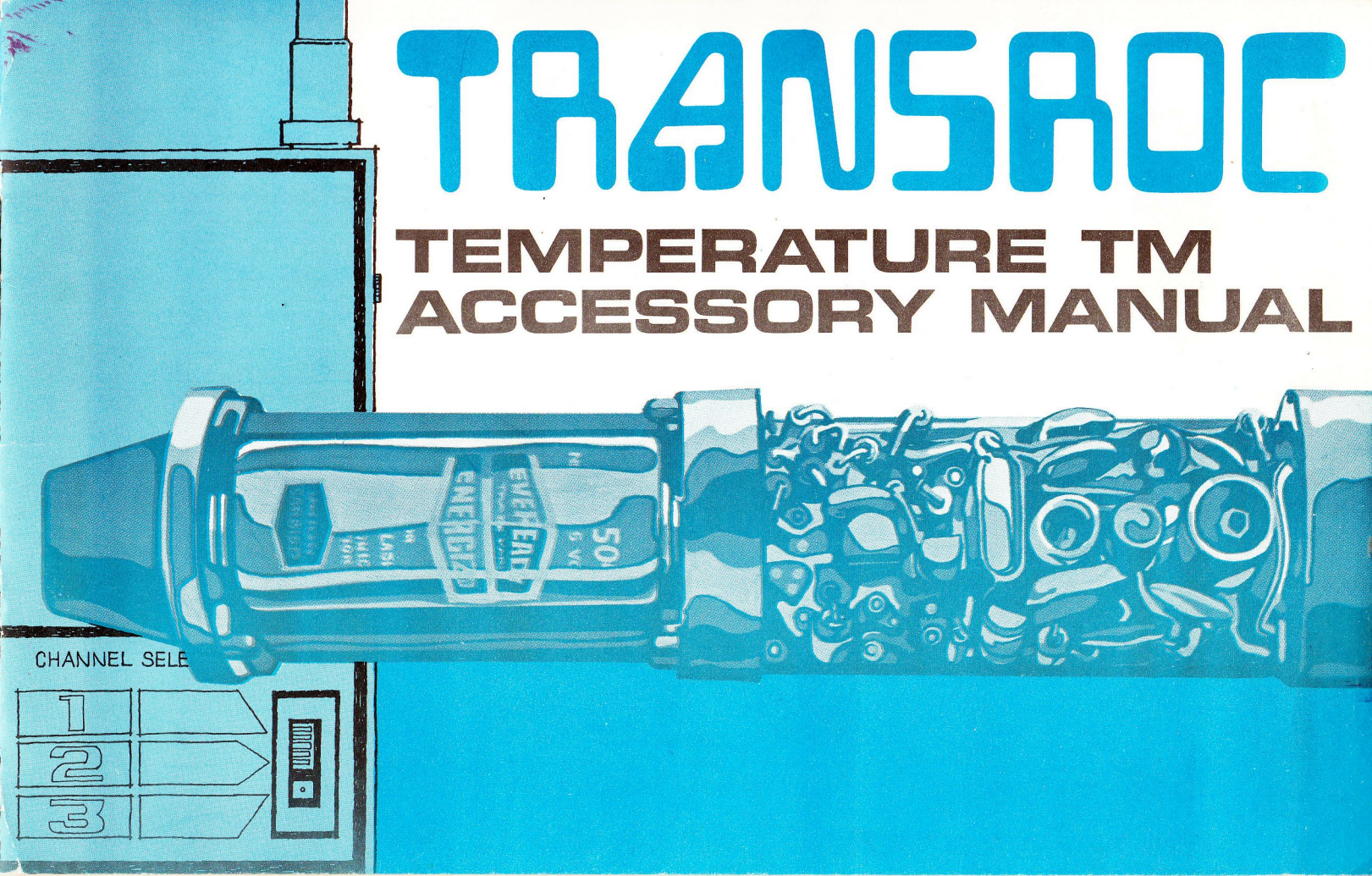
TRANSROC

TEMPERATURE TM ACCESSORY MANUAL



TEMPERATURE TM
ACCESSORY KIT

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

CHAPTER I.

GENERAL:

This manual is a supplement to the "TRANSROC Owner's Manual" and cannot be used alone. It is assumed that the purchaser of a temperature TM accessory kit will make simultaneous use of this supplement, the "TRANSROC Owner's Manual," and the "Electronic Kit Builder's Handbook" as he converts his TRANSROC to the temperature telemetering mode.

CHAPTER II. CONSTRUCTION:

SECTION A. Parts LIST

	Quantity	Stock Number	Description	Price*
( )	1	TXL-3	50 to 110 degrees F thermistor in thermal isolated and shaded mounting	$3.90 each
	or	TXL-4	20 to 60 degrees F thermistor in thermal isolated mounting	3.90 each
( )	1	JT-50C	Stage coupler	.15 each
( )	1	BT-50AE	1 inch section of body tube	.10 each
( )	1	TXC-3	500 picofarad ceramic capacitor, marked 500K	.25 each
( )	1	TXC-13	1.0 microfarad capacitor	1.10 each
( )	1	TXW-4	4'' length of twisted wire	.15 each
( )	1	TXR-10	1/4 watt resistor, 2.2 meg. (red, red, green, silver) or 2.0 meg. (red, black, green, gold)	.20 each
( )	1	TXR-11	4.7 meg., 1/4 watt resistor (yellow, violet, green, gold)	.20 each
( )	1	TXR-12	9.1 meg., 1/4 watt resistor (gray, brown, green, gold)	.20 each

*Prices listed are current as of this printing (July, 1971) and are subject to change without notice.

SECTION B. Assembling The Thermister Mount:

The thermistor mount should be assembled first, in order to allow time for the glue to dry while you perform the other modification steps. Refer to Figure 5.

1. ( ) Assemble the body extension portion of the thermistor mount by gluing the nose block in one end of the one-inch section of body tube (BT-50AE) and the stage coupler in the other end. Press these into position until they butt against each other in the center.

2. ( ) After the glue, applied in Step 1, has dried for a few minutes (so that you can safely handle the assembly), glue the cylindrical outrigger assembly containing the thermistor into position on one side of the body extension section. The contact between the body extension section and the outrigger assembly should be mid-way between the two wires on the sides of the outrigger assembly. Allow plenty of time for this glue to dry thoroughly. You may want to do the PC board modification steps and allow the glue to dry overnight.

3. ( ) Punch or drill two small holes (one on each side of the outrigger) for the wires to pass through. These holes should be approximately 1/32 inch diameter.

4. ( ) Carefully remove the enamel insulation from the ends of the magnet wire leads back to the point where they reach these holes (approximately 1/2 inch). This can be done by sandpapering or by gently scraping with a knife. The insulation must be thoroughly removed at these points before a good soldered connection can be made.

5. ( ) Tin the magnet wires where you have removed the enamel insulation. This tinning is a process of applying a thin coating of rosin core solder to the bare copper and will help to make a good soldered connection. If any of the surface fails to tin properly, check to see that you have removed the enamel insulation from that point and that you have a properly tinned soldering tip. (See instructions for tinning your soldering tip in the "Electronic Kit Builder's Handbook.")

6. ( ) Remove the insulation from approximately 1/2 inch of the ends of the twisted pair of wires. Twist the strands of wire together until they "lay" smoothly.

7. ( ) Tin these bared/twisted wires to form a stiff end which can be punched through the holes.

8. ( ) Punch these wire ends through the holes from the inside.

9. ( ) Wrap the tinned ends of the magnet wires around protruding ends of the twisted pair.

10. ( ) Solder these wires together at the point where the magnet wire wraps around the protruding portions of the twisted pair. Since these solder joints are larger than the holes, they will prevent the wires from pulling back through. Trim off the excess wire at a point just above the solder joints.

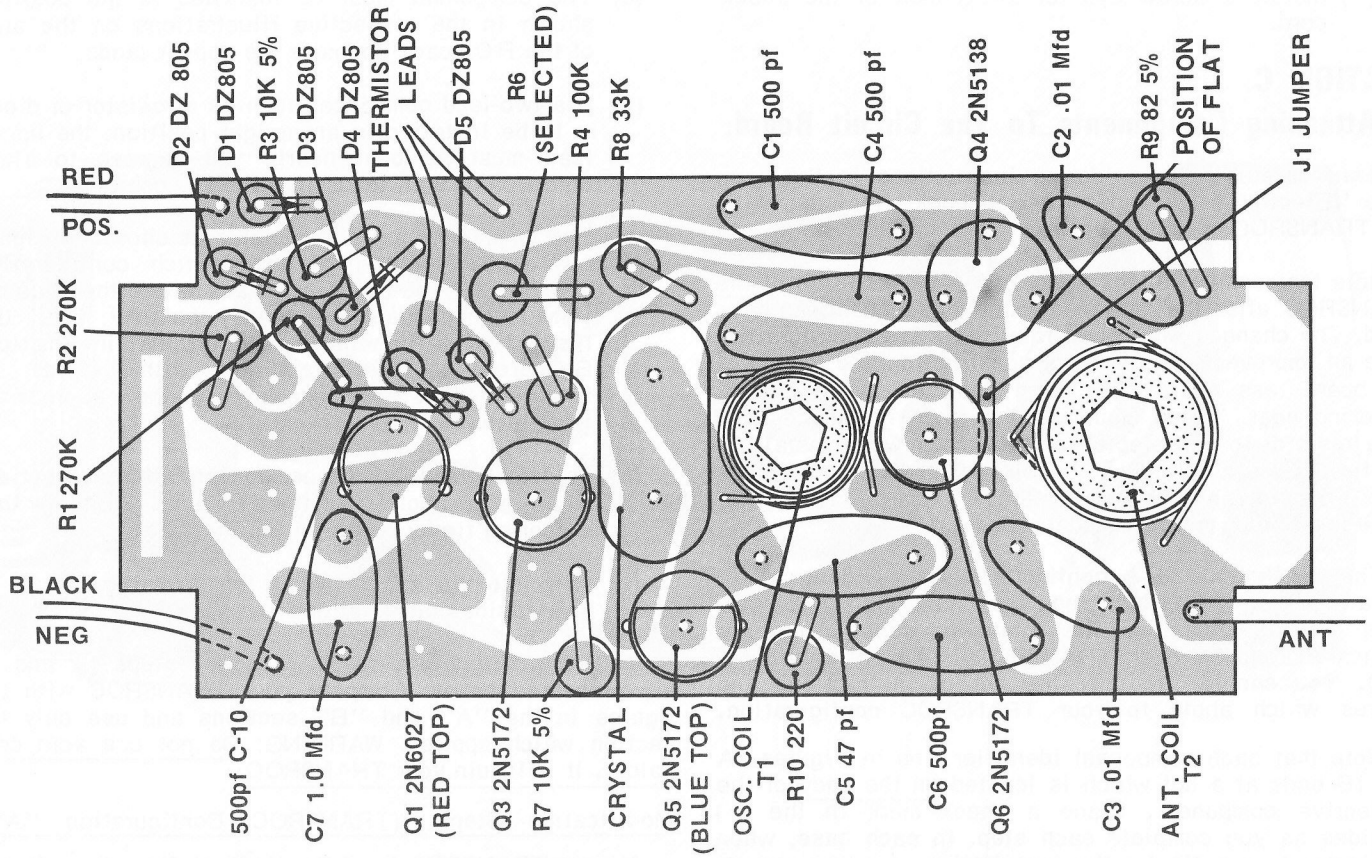


FIG. 1A "A" CONFIG. TRANSROC, TEMP. TM MODE

11. ( ) Install a screw eye for attachment of the shock cord.

SECTION C.

Attaching Components To The Circuit Board:

Read carefully the soldering instructions in the separate "Electronic Kit Builder's Handbook" included with the TRANSROC.

Note that some changes were made in the design of the TRANSROC after the first 1,000 units had been manufactured. The changes which generated the "B" configuration made an improvement in ease of construction and made the PC board less subject to being damaged by excessive soldering heat. These changes also made it unnecessary for a resistor to be selected by the owner when installing his first TM kit. Although the circuit modifications were minor, considerable change to the PC board layout was required in order to accommodate them.

The "A" and "B" configurations are identical in operating characteristics and specifications. Two portions of this manual which relate to construction are duplicated (one for each TRANSROC PC board configuration). You should use only the set of instructions and figures which apply to your TRANSROC configuration.

Note that each component identifier line in Figures 1A and 1B ends at a dot which is located on the body of the respective component. Place a check mark in the ( ) provided as you complete each step. In each case, when the instruction calls for the installation of a component, several additional instructions are implied:

(a) The component must be installed in the position shown in the respective illustrations on the side of the PC board opposite the copper lands.

(b) If a two-lead component such as a resistor or diode is to be installed in an upright position, the upper lead must be bent nearly 180 degrees to allow insertion of both leads into the PC board.

(c) The component must be oriented as shown in Figure 1A or 1B (depending upon which configuration TRANSROC you have). In cases where the illustration is inadequate to identify polarity, etc., the instruction will include the additional information. Be careful to insert transistors with the flat surface oriented as shown in the appropriate illustration.

(d) Solder all leads of the component to the appropriate lands on the bottom of the PC board. Withdraw the soldering tip by running it up the lead.

(e) Clip off the excess lead length using a pair of small, side-cutting pliers.

The two alternate sets of assembly steps (A and B) are presented below. Compare your TRANSROC with the figures in the "A" and "B" sections and use only the section which applies. WARNING: Do not use acid core solder. It will ruin your TRANSROC.

Modification Steps, (TRANSROC Configuration "A"):

If your TRANSROC is of the "A" configuration, it will look like Figures 1A, 2A, and 3A, and the modification

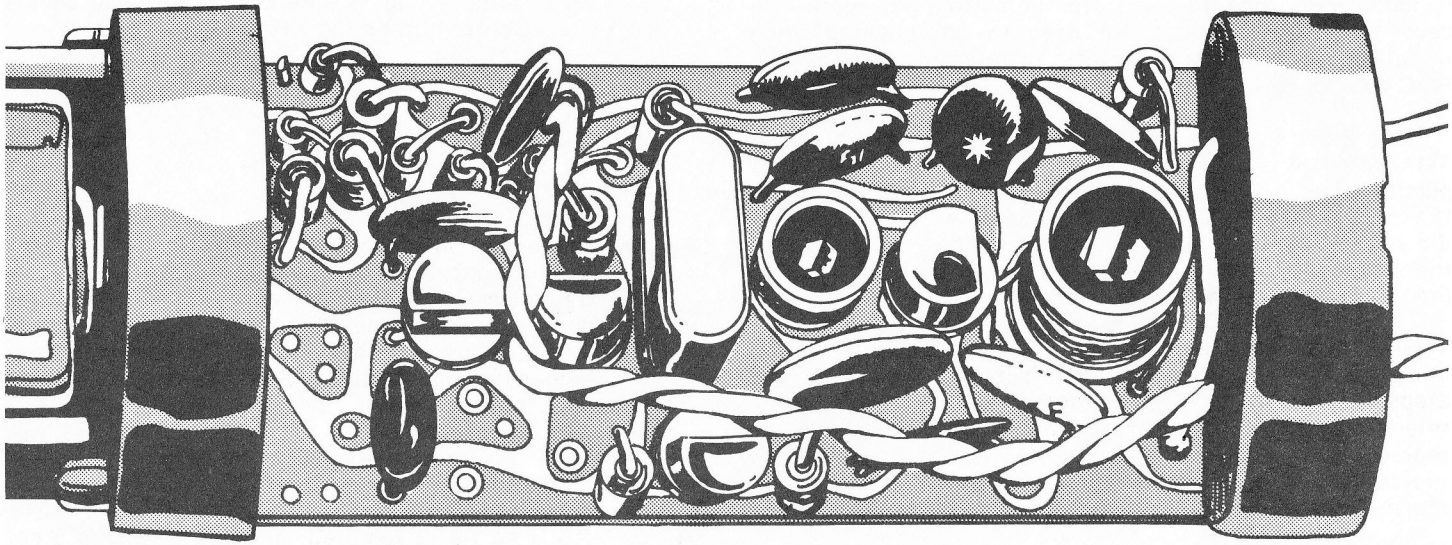


FIG. 2A TOP VIEW, "A" CONFIG, TRANSROC, TEMP. TM MODE

steps will be per the instructions which appear below. You may be able to skip Steps (1A) through (7A) which deal with the selection of the proper value of R6. The objective of these resistor selection steps is to insure that the TRANSROC oscillator will "idle" when powered by the most severely worn battery that could be used in a telemetering mode. Once this resistor selection procedure has been performed, it does not need to be repeated when installing other telemetering kits or returning the TRANSROC to another mode.

Skip Steps (1A) through (7A) if your "A" configuration TRANSROC was assembled at the factory instead of being purchased as a kit and if you have not replaced Q4, or D2. If your factory assembled TRANSROC ("A" configuration) did not have an R6 installed, it means that the results of the tests performed at the factory per Steps (1A) through (4A) indicated that none was needed.

Skip Steps (1A) through (7A) if your "A" configuration TRANSROC was built from a kit but has previously had Steps (1A) through (7A) performed at the time another telemetering kit was being installed and if you have not replaced Q4 or D2 since that time. The absence of an R6 indicates that the results of your tests upon performing Steps (1A) through (4A) showed that none was needed.

1A. ( ) Place your TRANSROC (rocket-finder mode) on your workbench and prepare to power it with a source of 9 volts (to simulate a badly worn 15-volt battery). Any source of 9 volts DC can be used, but a cheap and widely available source is a 9-volt transistor battery like those commonly used in walkie-talkies and pocket size radios (ESTES Cat. #FPB-9 or equivalent). If your walkie-talkie uses a 9-volt battery, you could buy a new battery for it and use it first for this resistor selection and later in the walkie-talkie, when your present walkie-talkie battery wears out. You should, in any case, select for this test a 9-volt battery that is known to be in good condition. Do not turn on the TRANSROC yet.

2A. ( ) Temporarily solder a jumper wire between points "1" and "3" on the bottom of your TRANSROC board. (See Figure 3A.) This tack soldering will be easier if you first tin the tips of the jumper wire.

3A. ( ) Place your walkie-talkie (with antenna collapsed) on the bench beside your TRANSROC, and turn its volume control completely up or until it produces an easily audible background hiss. If your walkie-talkie operates on more than one channel, select the channel that your TRANSROC operates on.

4A. ( ) Turn on the TRANSROC by connecting your external 9-volt power source. If a hiss appears in your walkie-talkie when you turn on the TRANSROC, no R6 is required; and you may skip Steps (5A) through (7A).

5A. ( ) If you detected no increase in the level of hiss coming from your walkie-talkie when you turned on the TRANSROC in Step (4A), you will need to install a selected value of R6. Bend the leads of the 9.1 meg. resistor (gray, brown, green, gold)

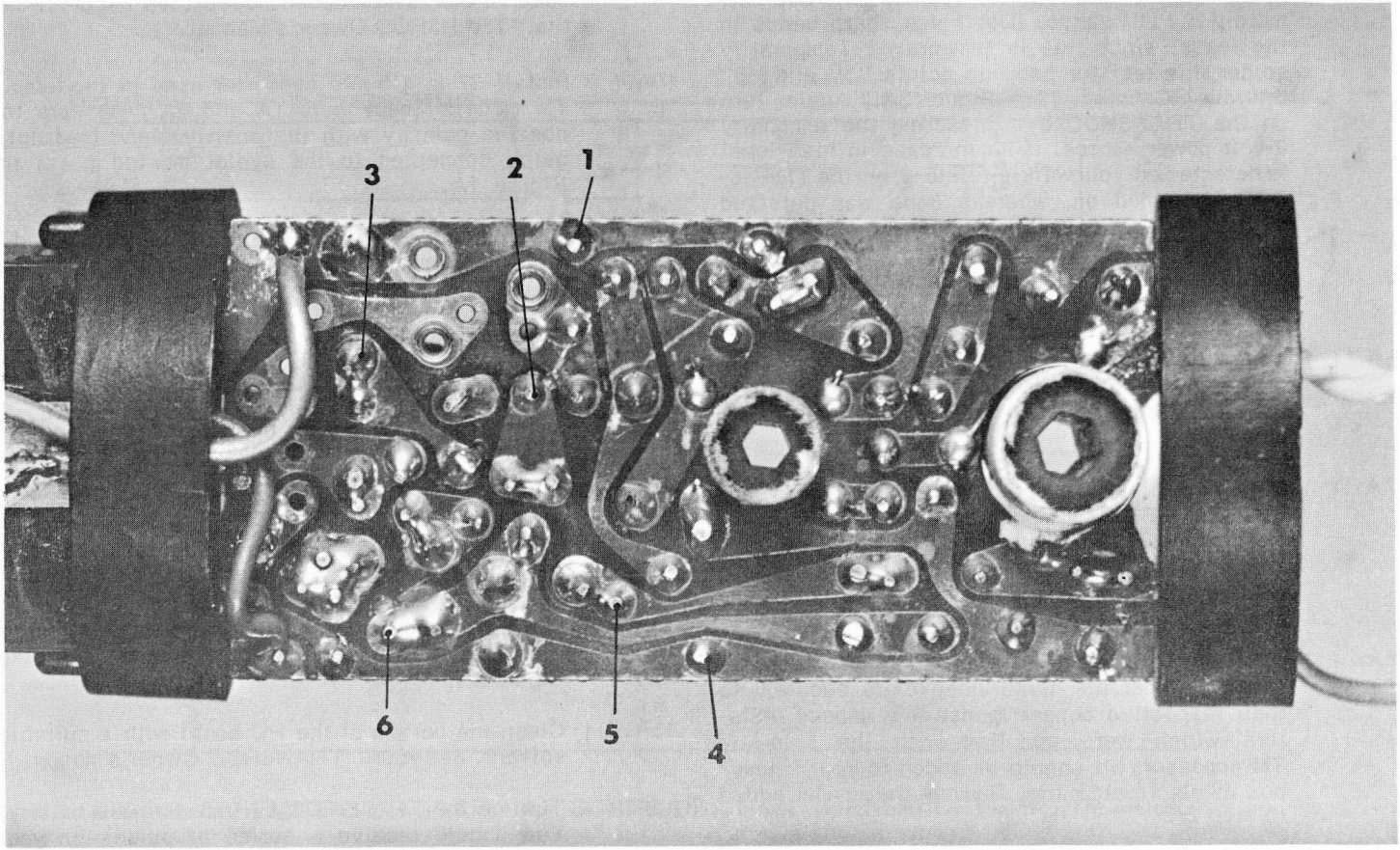


FIG. 3A BOTTOM VIEW, "A" CONFIG. TRANSROC, TEMP. TM MODE

at each end of the resistor body to form approximately a "U" shape. (Don't use sharp bends in the leads, since this is temporary.) Temporarily solder this resistor between points "5" and "6" on your PC board. (See Figure 3A.) Again, turn on the TRANSROC by connecting the temporary 9-volt power source. If an increase in hiss level is detected on your walkie-talkie when the TRANSROC is turned on, whereas none was detected without an R6, install the 9.1 meg. resistor permenently as R6. (See Figures 1A and 2A). Be sure to solder both brass eyelets securely to the copper lands.

6A. ( ) If no idle hiss was detected in Step 4A (no R6) or Step 5A (R6 = 9.1 meg.), repeat Step 5A using the 4.7 meg. resistor (yellow, violet, green, gold).

7A. ( ) If no idle hiss was detected in Step 4A (no R6) Step 5A (R6 - 9.1 meg.), or Step 6A (R6 = 4.7 meg.), repeat Step 5A using a 2.2 meg. (red, red, green, silver) or 2.0 meg. (red, black, green, gold) resistor (whichever was supplied with your accessory kit).

8A. ( ) If you install an R6 in any of these steps, be sure to solder the miniature eyelets securely to their respective copper lands. Any unused resistors which were supplied with the spin-rate TM accessory kit should be added to your "junk" box of electronic parts. Remove the jumper added in step 2A.

9A. ( ) Desolder and remove C7 (a 3.3 tantalum capacitor used in the rocket-finder mode). (See Figure 1 in the "TRANSROC Owner's Manual.")

10A. ( ) Install C7 (a 1.0 mfd capacitor used in the temp. TM mode). (See Figure 1A and 2A.) Be sure to observe polarity with the positive lead (red dot) being connected to the eyelet marked (+) in Figure 1A.

11A. ( ) Desolder and remove R5 (a 270K resistor - red, violet, yellow, silver). (See Figures 1 and 2 in the "TRANSROC Owner's Manual.")

12A. ( ) Pass the twisted leads of the thermistor through the large hole in the bottom mount and connect to the eyelet terminals from which R5 was just removed. Also connect a 500 pf capacitor to these terminals by inserting its leads before soldering.

13A. ( ) Inspect the completed assembly to verify that it looks like Figure 2A. If Q2, C9, R11 and R12 have previously been added for use of the microphone accessory, they do not need to be removed.

14A. ( ) Inspect the bottom of the PC board for poor solder joints, solder bridges, etc. It should look like Figure 3A.

15A. ( ) Clean the bottom of the PC board with a suitable solvent. See your "TRANSROC Owner's Manual."

16A. ( ) Turn on the TRANSROC by inserting the battery. You should receive a series of pulses on your receiver. The frequency of the pulses should

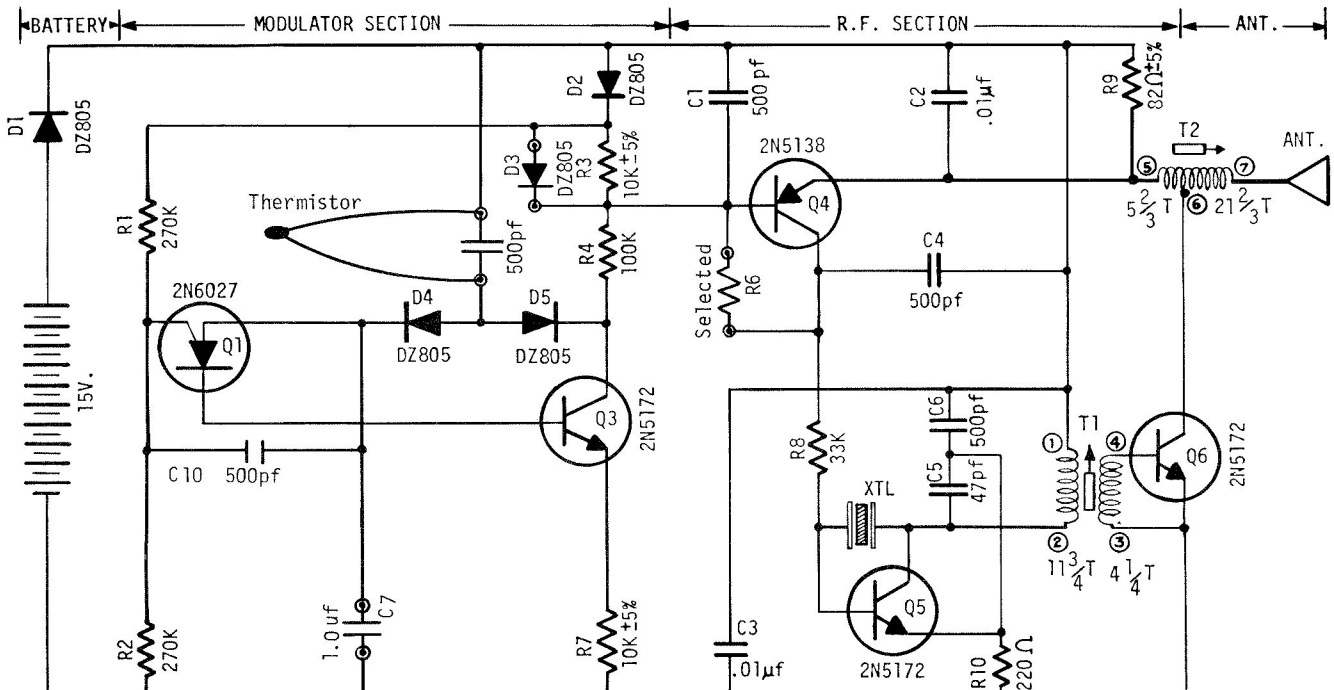


FIG. 4A SCHEMATIC DIAGRAM, "A" CONFIGURATION TRANSROC, TEMP. TM MODE

increase for increasing thermistor temperature and should decrease for decreasing temperatures.

If your TRANSROC does not pass these tests, refer to the troubleshooting section in your "TRANSROC Owner's Manual."

17A. ( ) Install the completed and checked-out assembly in a suitable payload section. Construct this payload section using a BT-50, a PS-50FJ kit, or a PST-50FJ clear plastic body tube. See Figure 6 for a typical installation.

Modification Steps, (TRANSROC Configuration "B"):

If your TRANSROC is of the "B" configuration, it will look like Figures 1B, 2B, and 3B, and the modification steps will be per the instructions which appear below:

1B. ( ) Desolder and remove C7 (a 3.3 mfd tantalum capacitor used in the rocket-finder mode). (See Figure 1 in the "TRANSROC Owner's Manual.")

2B. ( ) Install C7 (a 1.0 mfd capacitor used in the temperature TM mode). Be sure to observe polarity by connecting the capacitor lead with the red dot to the land marked (+) in Figure 1B.

3B. ( ) Desolder and remove R5 (a 270K resistor - red, violet, yellow, silver). (See Figure 1 in the "TRANSROC Owner's Manual.")

4B. ( ) Pass the twisted leads of the thermistor through the large hole in the bottom mount and connect to the eyelet terminals from which R5 was just removed. Also connect a 500 pf capacitor to these terminals by inserting its leads before soldering.

5B. ( ) Inspect the completed assembly to verify that it looks like Figure 2B. If Q2, C9, C11, R11, and R12 have previously been added for use of the microphone accessory, they do not need to be removed. See Figure 23 in your "TRANSROC Owner's Manual."

6B. ( ) Inspect the bottom of the PC board for poor solder joints, solder bridges, etc. It should look like Figure 3B.

7B. ( ) Clean the bottom of the PC board with a suitable solvent. See your "TRANSROC Owner's Manual."

8B. ( ) Turn on the TRANSROC by inserting the battery. You should receive a series of pulses on your receiver. The frequency of the pulses should increase for increasing thermistor temperature and should decrease for decreasing temperatures.

If your TRANSROC does not pass these tests, refer to the trouble-shooting section in your "TRANSROC Owner's Manual."

9B. ( ) Install the completed and checked-out assembly in a suitable payload section. Construct the payload section using a BT-50, a PS-50FJ kit, or a PST-50FJ clear plastic body tube. See Figure 6 for a typical installation.

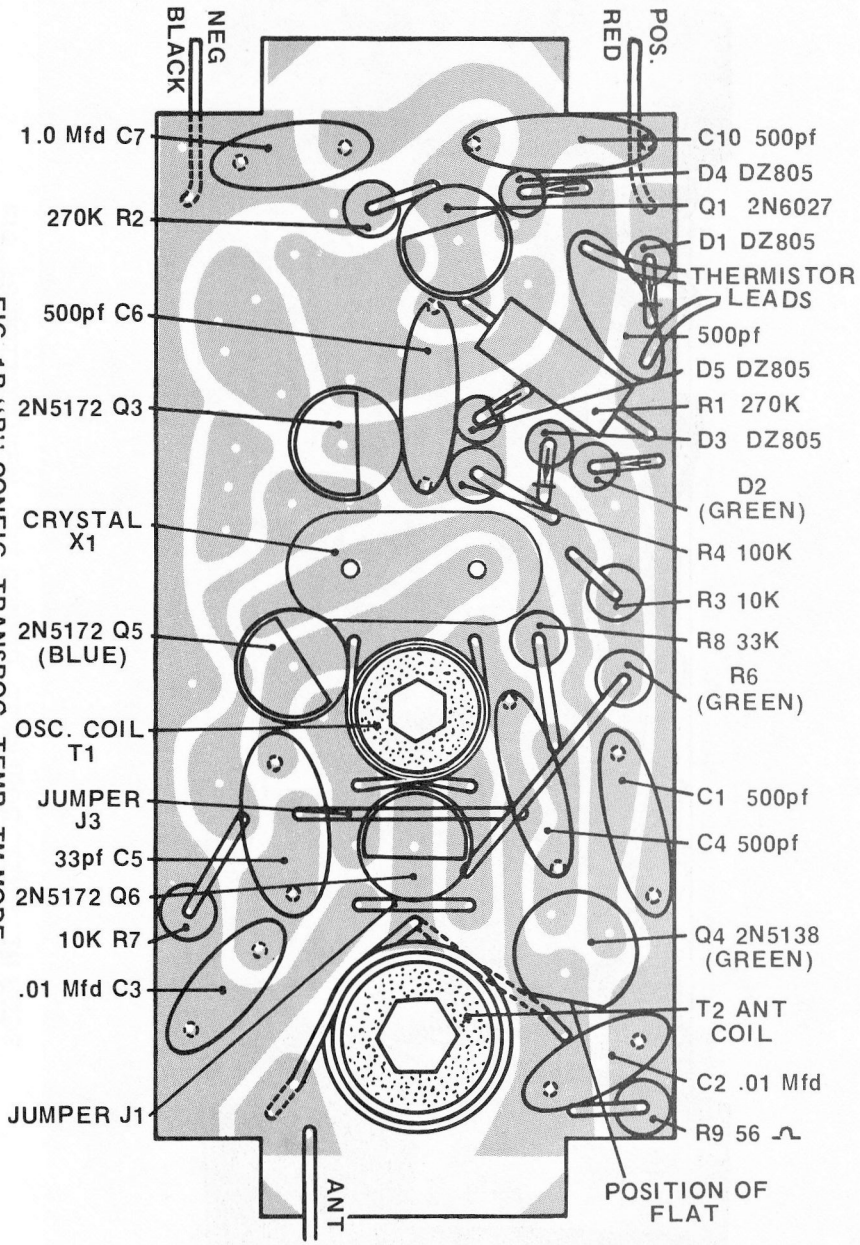


FIG. 1B "B" CONFIG. TRANSROC, TEMP. TM MODE

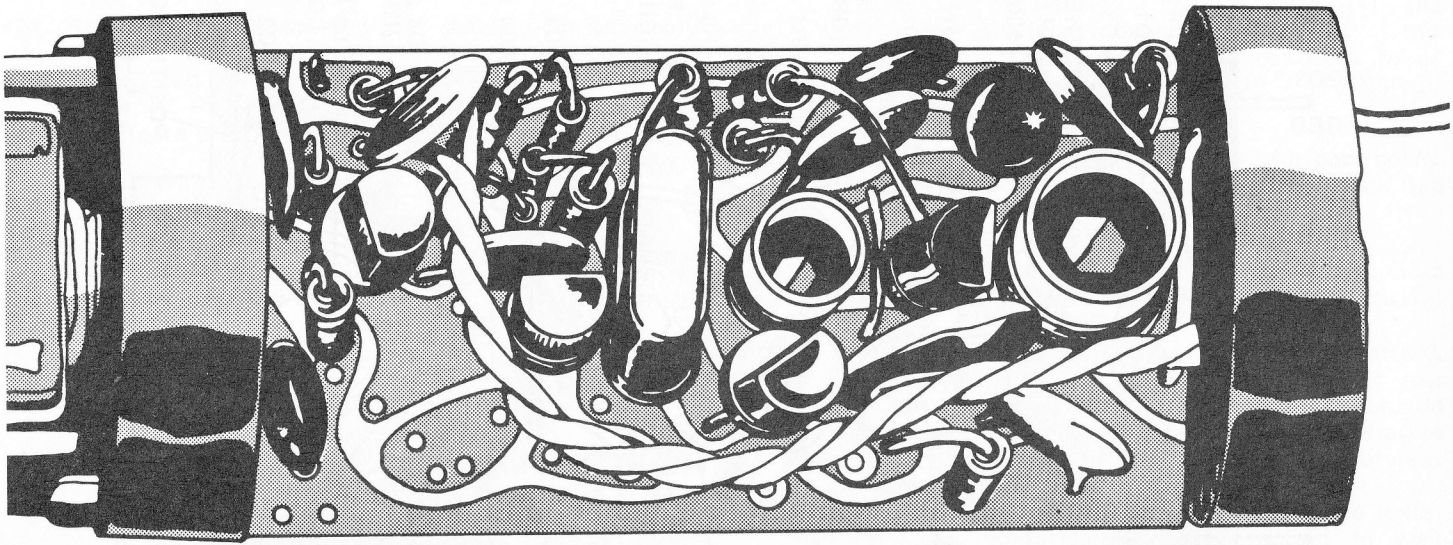


FIG. 2B TOP VIEW, "B" CONFIG. TRANSROC, TEMP. TM MODE

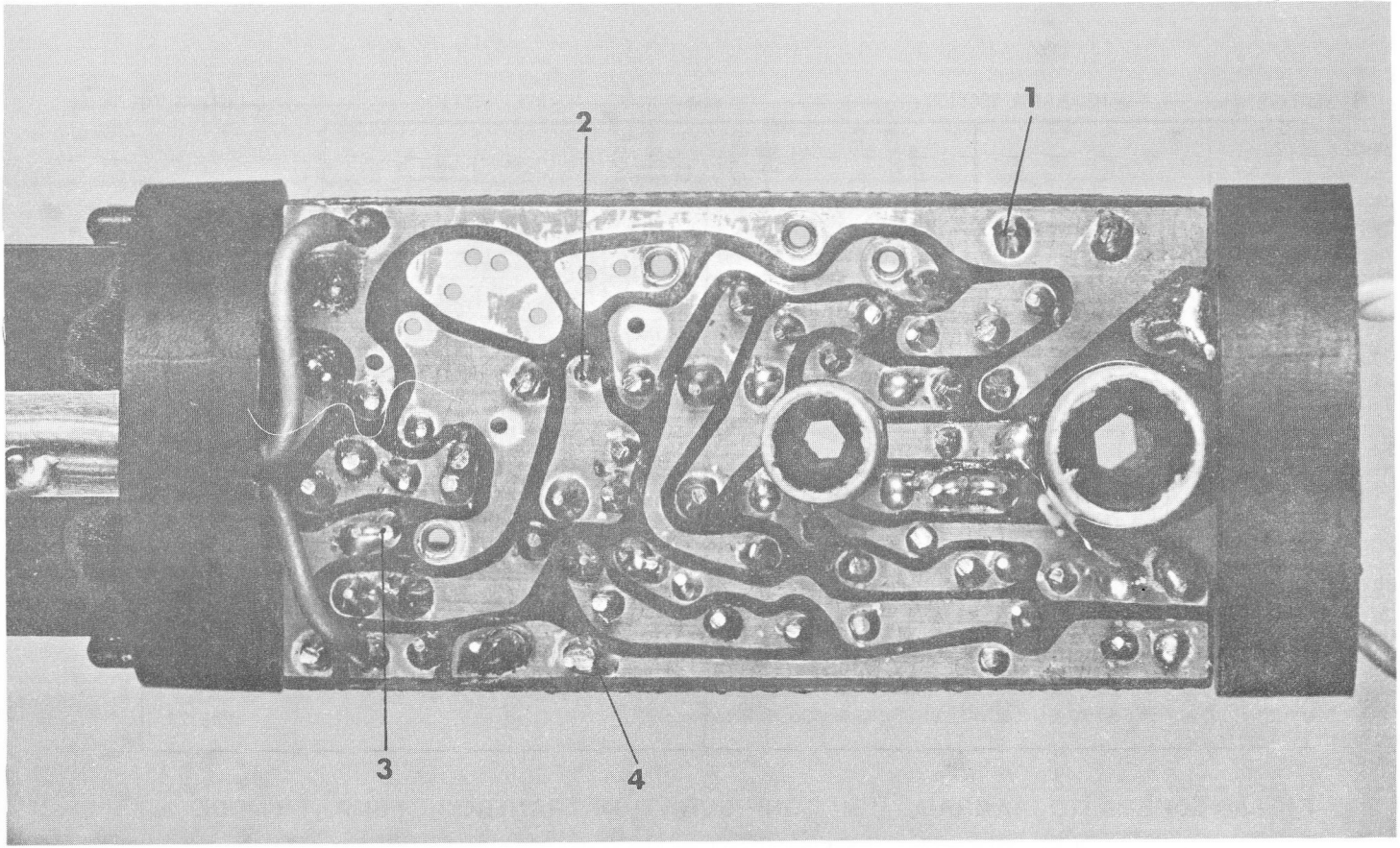


FIG. 3B BOTTOM VIEW, "B" CONFIG. TRANSROC, TEMP TM MODE

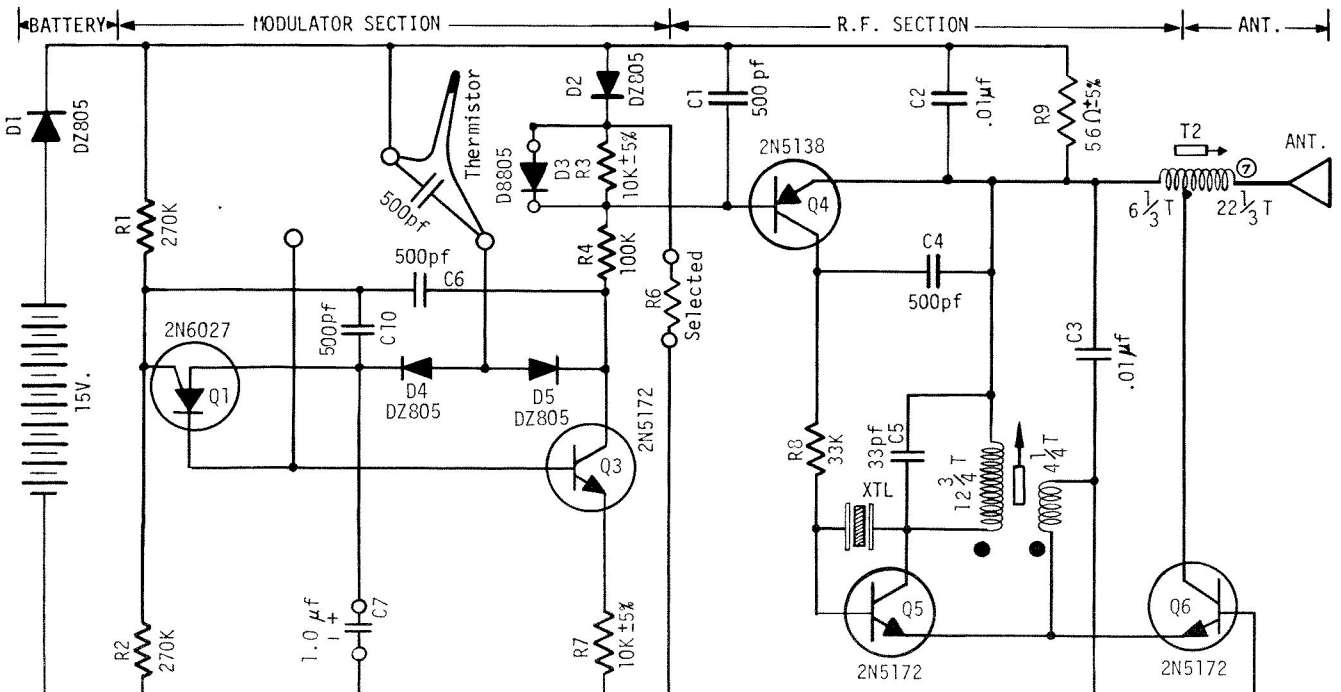


FIG. 4B SCHEMATIC DIAGRAM, "B" CONFIGURATION TRANSROC, TEMP. TM MODE

CHAPTER III.
TUNING:

The tuning procedure for the telemetering modes is the same as that for the rocket-finder mode. If retuning appears to be required, consult the procedure for final tuning in the "TRANSROC Owner's Manual."

CHAPTER IV.
TROUBLESHOOTING:

If your TRANSROC does not operate properly after you convert it to the temperature TM mode, refer to the trouble-shooting section of your TRANSROC Owner's Manual. If you send your TRANSROC for factory service in the temperature TM mode, be sure to include the thermistor and outrigger assembly (carefully packed) .

CHAPTER V.
OPERATION:

The objective for most temperature telemetering flights is to examine air temperature versus flight time. The use of a thermistor shaded and mounted externally in the air stream allows you to do this. The TRANSROC in the temperature TM mode transmits a series of pulses. The frequency of this pulse train is proportional to temperature. Several methods of data reduction are possible.

SECTION A. Listening During Flight:

The least expensive method of data reduction consists of merely listening to the receiver during rocket flight. With this technique, you can "hear" the changes in temperature, but the amount of change and the timing will remain obscure.

SECTION B. Tape Recording:

A greater degree of data reduction accuracy is achieved by tape recording the output of the receiver and playing it back repeatedly. The repetition allows you to digest much better the finer points of what happened during a few moments of action and excitement. See Chapter V in the "TRANSROC Owner's Manual" for instructions on how to tape record the output of your receiver.

SECTION C. Full Data Reduction:

You may use an analog recorder to achieve full data reduction. See Chapter V in the "TRANSROC Owner's Manual" for details of how to record and reduce your data.

SECTION D. Beat Frequency Oscillator:

This section which was added for the "B" configuration Owner's Manual is reproduced here for the benefit of rocketeers who have an "A" configuration TRANSROC.

When the "cw" signal from your TRANSROC is received by a walkie-talkie under various conditions, it produces different effects as follows:

1. If the signal being received from the TRANSROC is weak and little or no interference is being received, the signal will beat with the noise (hiss) generated in your receiver to cause an easily audible increase in this noise level. This is okay for rocket finding, since you can control the strength of the received signal by adjusting the length of your walkie-talkie antenna.
2. If a TRANSROC signal is being received in the presence of interference from one or more other CB transmitters, the TRANSROC signal will beat with the interference to generate a distinct tone which is easily recorded. Of course, the level of TRANSROC signal and the interference must be within reasonable proportions of each other, but this will usually be approximately the case. Under these conditions, the interference can actually work to your advantage and improve the recordability of your telemetry signal. This condition is not optimum, however, since the interference will contain amplitude modulation and there will usually be more than one interfering station causing one or more beat notes. Also, you will have only limited control over the signal level of the interference. (See Chapter V, Section A. in your TRANSROC owners manual.)
3. If the TRANSROC TM signal is strong and little or no interference is being received, it will sound okay to your ear but will actually consist of pairs of clicks spaced according to the TM format. If these spikes are recorded on an analog recorder with a mixture of receiver noise, power line interference, etc., they will be difficult to interpret. A BFO (beat frequency oscillator) can be used to greatly improve the quality and fidelity of your TM recordings. A BFO signal gains you the advantages of interference without the disadvantages, since it is pure "cw" (not modulated) and can be controlled to any desired level.

PROVIDING A BFO:

Most communications receivers used for amateur radio, etc., have a BFO built in; but we know of no portable receiver, such as a walkie-talkie, that has this feature. You can simulate this feature, however, by the use of a second walkie-talkie with its transmitter keyed "on" continuously during your TM flight. With the antenna collapsed, place this second walkie-talkie (BFO) a few feet from your TM receiver walkie-talkie and tape down the "talk" button in the "on" position. Wrap the BFO walkie-talkie in a towel, or otherwise deaden its microphone, so that it will not pick up and add to the recording any local sounds, such as the wind. Adjust the separation between your BFO walkie-talkie and your TM receiver walkie-talkie so that you are receiving and recording a prelaunch TM signal that has the strongest and clearest tone possible.

Note that, although a super-regenerative walkie-talkie is unsuitable for use as a TM receiver, it is just as good as a superheterodyne for use as a BFO. If you have a super-regen. that will transmit on the same CB channel as your TRANSROC, this is a good way to use it.

CHAPTER VI.
APPLICATIONS OF THE TEMPERATURE TM MODE:

The TRANSROC in the temperature TM mode is capable of measuring temperature as a function of flight time in the lower atmosphere. Since altitude is also a function of flight time, it is possible to determine temperature versus altitude. (See Figure 7.) Of course, this has a variety of applications. Some of the more interesting ones are discussed below.

SECTION A. Predicting Air Pollution:

There is a growing trend today toward the use of model rockets with temperature telemetry capability for predicting air pollution conditions. Models, many times as expensive as the TRANSROC, are being manufactured for this specific purpose and are being used by municipalities. You can use your TRANSROC for this purpose too.

Smog is most likely to accumulate when there is a temperature inversion in the area. Since temperature normally decreases with increasing altitude, a temperature inversion is the condition that exists when temperature increases with increasing altitude. The plot of temperature versus flight time in Figure 7 would be approximately inverted if a temperature inversion had been present. By making plots of temperature versus flight time, you will be able to determine if a temperature inversion condition exists. See Chapter V in your "TRANSROC Owner's Manual" for information relating to the recording, calibration, and reduction of telemetry data.

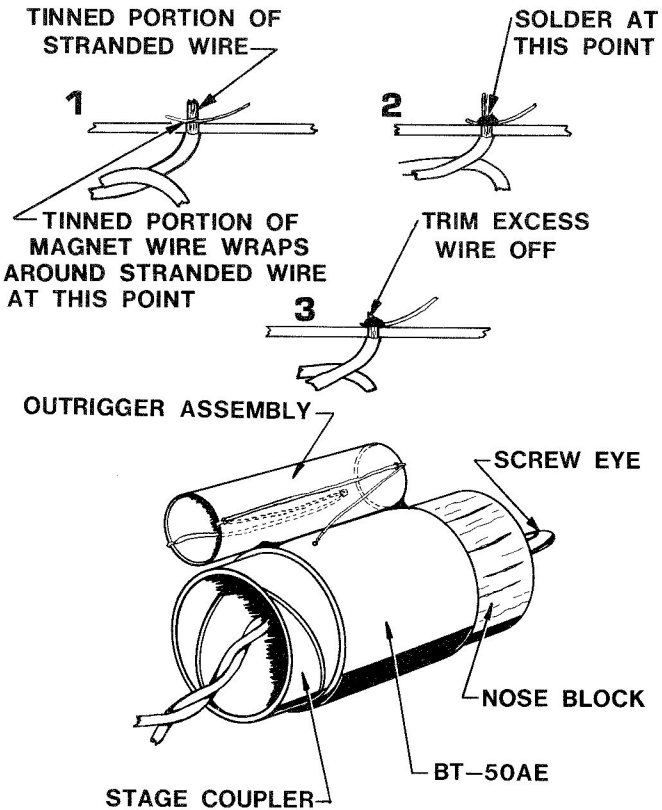


FIG. 5 ASSEMBLY OF THE THERMISTOR MOUNT

SECTION B. Velocity Determination By Temperature Measurement:

One of the more intriguing possible uses of the TRANSROC in the temperature TM mode is the measurement of rocket velocity. This usage was originally suggested by Dr. G. M. Gregorek of Ohio State University.

This will be a brief, much-simplified description of aerodynamic heating. If you choose this subject for a project, it is suggested that you begin with a full-scale research of aerodynamic heating and measurement. Here, we are only trying to establish a feel for the subject.

It is common knowledge that friction creates heat; and, when heat is added to a body faster than it is removed, an increase in the temperature of that body is observed. Many of us have used this principle to warm our hands when they were cold. With our TRANSROC in the temperature TM mode, the thermistor is heated during the high velocity portion of the flight by the friction of the air passing over the thermistor body. The amount of heating or the temperature reached is related to the rocket's velocity.

Now that we have a rough feel for the subject, we will get a little more complicated. What we are really trying to measure is the stagnation temperature of air travelling at rocket velocity. The stagnation temperature is the temperature to which the air stream would be converted if it were decelerated to zero velocity with no gain or loss of heat. The following formula gives the stagnation temperature (or hopefully, the temperature we measure with the thermistor) which we will call T_t:

$$T_t = T\,(1 + 0.2M^2)$$

where T is the temperature of the surrounding atmosphere as measured in degrees Rankin ($^{\circ}R = {}^{\circ}F + 460$) and M is the velocity of the rocket expressed as a Mach number. The Mach number is equal to the velocity of the rocket divided by the speed of sound. Remember! The thermistor temperature (T_t) is also in degrees Rankin in the formula.

We can now see that, if we know the temperature of the surrounding air and if we can measure the stagnation temperature accurately, we can establish a Mach number for our rocket. With a little rearranging of our first formula (you may wish to try this also), we have:

$$M = \sqrt{(5T_t/T) - 5}$$

Now, if we assume the temperature of the surrounding air to be 60° F and the speed of sound to be constant at 1100 ft./sec. (it isn't really, see Table 1), we arrive at the next formula and have a chance to check our work.

$$V = 1100 \sqrt{0.0096T_t - 5}$$

As an example, we fire a modified Alpha with the TRANSROC temperature TM using a D13-5 and we measure a thermistor temperature of about 70°F at burnout (maximum velocity); we then have:

$$V = 1100 \sqrt{0.0096\ (530) - 5}$$

$$V = 1100 \sqrt{0.09}$$

$$V = 330 \text{ feet per second}$$

Velocity determination by measurement of stagnation temperature is possible, but there are problems. If the thermistor gains or loses any heat to or from a source other than the air, we have an error creeping in. This is mostly due to the method of mounting the thermistor. We believe that our mounting system is very close to optimum for easy usage and accuracy. The thermistor and the TRANSROC are potential error sources. There is a response time associated with them. This means that we might not see a short duration temperature rise or drop and that we probably won't see the full value of maximum stagnation temperature. We can overcome this partially by using longer burning engines and/or using multistaged carrier rockets to that our rocket spends more time at or near its peak velocity. Also, it may be possible to use photography (ground based or Cineroc) in conjunction with the TRANSROC to establish a correction factor to be used with the measured thermistor temperature.

Velocity determination by temperature measurement is a sophisticated project and is wide open for development by the advance rocketeer. Who knows: Perhaps you will be the one to make the major contribution to Model Rocketry in this area.

TABLE 1

PROPERTIES OF THE STANDARD ATMOSPHERE

h	t	c	p	d
0	59.00	1117	2116.2	0.002378
5,000	41.18	1098	1760.8	.002049
10,000	23.36	1078	1455.4	.001756
15,000	5.54	1058	1194.3	.001497
20,000	-12.28	1037	972.6	.001267
25,000	-30.10	1017	785.3	.001066
30,000	-47.92	995	628.5	.000890

In the preceding table:

h = height above sea level (feet).

t = temperature ($^{\circ}$F).

c = speed of sound (ft/sec).

p = pressure (lb/ft^2).

d = mass density (slug/ft^3).

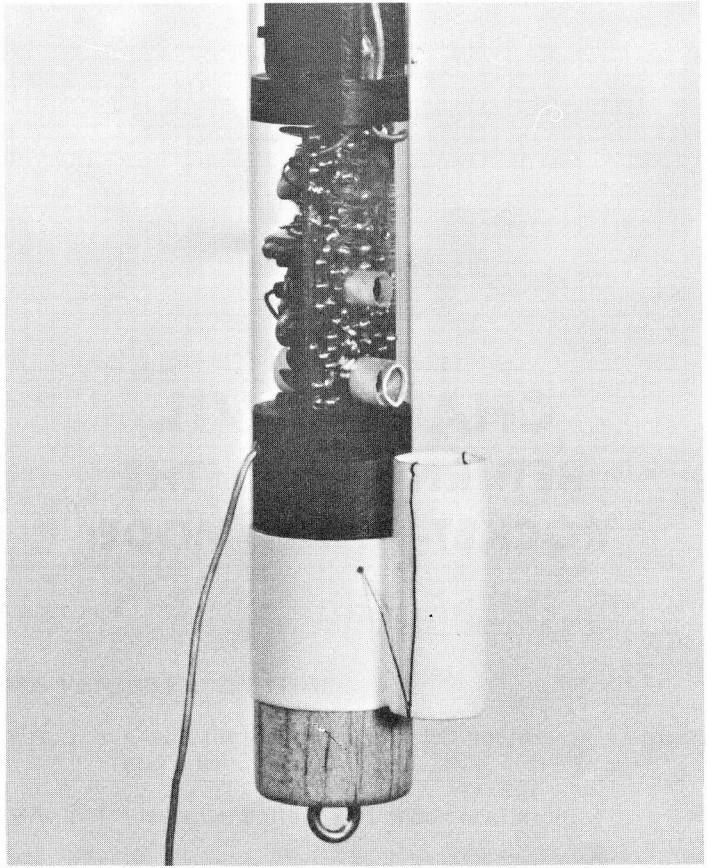


FIG. 6
TYPICAL INSTALLATION, TRANSROC, TEMP. TM MODE

CHAPTER VII.
RETURNING TO THE ROCKET-FINDER MODE:

Once you have finished using your TRANSROC in the temperature TM mode, you may want to change it back to the rocket-finder mode. Two alternate sets of modification steps (A and B) are presented below. Compare your TRANSROC with the figures in the "A" and "B" sections and use only the section which applies.

Modification Steps, (TRANSROC Configuration):

If your TRANSROC is of the "A" configuration, it will look like Figures 1A, 2A, and 3A, and the modification steps will be per the instructions which appear below:

1A. ( ) Desolder and disconnect the thermistor leads from the PC board. Also remove the 500 pf capacitor from these same eyelet terminals. (See Figures 1A and 2A.)

2A. ( ) Install R5 (a 270K resistor - red, violet, yellow, silver). (See Figure 1 in your "TRANSROC Owner's Manual.")

3A. ( ) Desolder and remove C7 (a 1.0 mfd capacitor). (See Figure 1A.)

4A. ( ) Install C7 (a 3.3 mfd tantalum capacitor). Be sure to observe polarity per Figures 1 and 2 in the "TRANSROC Owner's Manual." The positive lead mounts "up" (away from the PC board).

5A. ( ) Inspect the assembly to verify that it looks like Figure 2 in the "TRANSROC Owner's Manual." If Q2, C9, R11, and R12 have previously been added for use of the microphone accessory, the

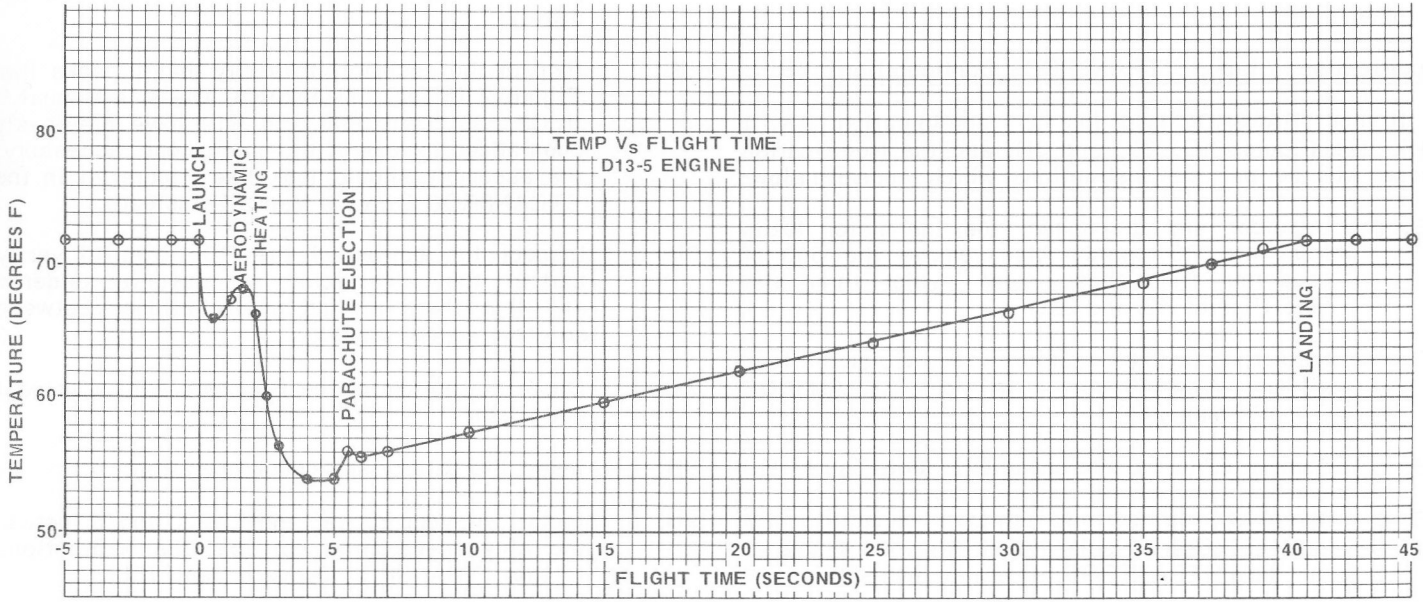


FIG. 7 PLOT OF TEMPERATURE VERSUS FLIGHT TIME

assembly should look like Figure 23 in the "TRANSROC Owner's Manual."

6A. ( ) Inspect the bottom of the PC board to verify that all the solder joints are smoothly soldered and that there are no solder bridges between adjacent copper lands.

7A. ( ) Clean the bottom of the PC board with a solvent and brush.

8A. ( ) Insert the battery and check operation.

9A. ( ) Install in your rocket, and check and/or retune the antenna-matching coil per the instructions in the "TRANSROC Owner's Manual."

Note that R6 is not removed when returning to the use of other modes.

Modification Steps, (TRANSROC Configuration "B"):

If your TRANSROC is of the "B" configuration, it will look like Figures 1B, 2B, and 3B, and the modification steps will be per the instructions which appear below:

1B. ( ) Desolder and disconnect the thermistor leads from the PC board. Also remove the 500 pf capacitor from these same eyelet terminals. (See Figures 1B and 2B.)

2B. ( ) Install R5 (a 270K resistor - red, violet, yellow, silver). (See Figure 1 in your "TRANSROC Owner's Manual.")

3B. ( ) Remove C7 (a 1.0 mfd capacitor). (See Figure 1B.)

4B. ( ) Install C7 (a 3.3 mfd tantalum capacitor). Be sure to observe polarity per Figures 1 and 2 in the "TRANSROC Owner's Manual." The positive lead mounts "up" (away from the PC board).

5B. ( ) Inspect the assembly to verify that it looks like Figure 2 in the "TRANSROC Owner's Manual." If Q2, C9, C11, R11 and R12 have previously been added for use of the microphone accessory, the assembly should look like Figure 23 in the "TRANSROC Owner's Manual" instead.

6B. ( ) Inspect the bottom of the PC board to verify that all the solder joints are smoothly soldered and that there are no solder bridges between adjacent copper lands.

7B. ( ) Clean the bottom of the PC board with a solvent and brush.

8B. ( ) Insert the battery and check operation.

9B. ( ) Install in your rocket and check and/or retune the antenna-matching coil per the instructions in the "TRANSROC Owner's Manual."

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