SENCORE
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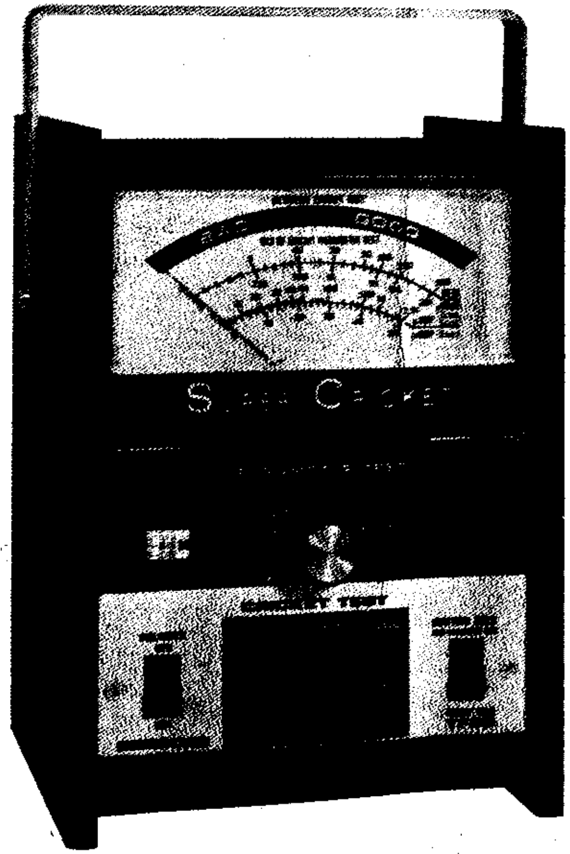
TF30

SUPER CRICKET

SERVICE MANUAL



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SAFETY REMINDERS

When testing electronic equipment, there is always a danger present. Unexpected high voltages can be present at unusual locations in defective equipment. The technician should become familiar with the device that he is working on and observe the following precautions.

1. When making test lead connections to high voltage points, remove the power. If this cannot be done, be sure to avoid contact with other equipment or metal objects. Place one hand in your pocket as a safety precaution and stand on an insulated floor to reduce the possibility of shock.

2. Discharge filter capacitors before connecting test leads to them. Capacitors can store a charge that could be dangerous to the technician.

3. Be sure your equipment is in good order. Broken or frayed test leads can be extremely dangerous and can expose the technician to dangerous potentials.

4. Remove the test leads immediately after the test has been completed to reduce the possibility of shock.

5. Do not work alone when working on hazardous circuits. Always have another person close by in case of accident. Remember, even a minor shock can be the cause of a more serious accident, such as falling against the equipment, or coming in contact with high voltages.

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DESCRIPTION

INTRODUCTION

The TF30 Super Cricket is the ultimate in transistor testers. It combines the patented, quick, good-bad in-circuit test, used in the popular Cricket, and out-of-circuit parameter tests for those cases where precise information concerning gain and leakage is needed. With the TF30 Super Cricket, there is no need to know the basing diagram, polarity, or even if the device under test is a regular transistor or an FET unless parameter testing is desired. Generally the technician needs to know only if a transistor is good or bad since in most instances a transistor will fail completely or develop leakage which causes it not to perform properly. However, there are times when transistors must be selected for beta or FETs for Gm or zero bias drain current (IDSS). The Super Cricket makes these tests simple and easy even if you do not know the basing of the transistor. Basing information is easily obtained from the identification drum used in conjunction with the push buttons.

FEATURES

* Test any transistor or FET, in or out-of-circuit, with no technical knowledge required.

* Automatic lead coding and basing selection.

* Fast in-circuit GOOD-BAD test and out-of-circuit parameter test.

* Simple push button test operation. No meter zero or calibration controls.

* Basing determined quickly.

* Audio and visual Cricket test indication.

SPECIFICATIONS

Devices Tested — Diodes, transistors, single and dual gate FETs.

REGULAR (BI-POLAR) AND FET TRANSISTORS

IN-CIRCUIT TEST:

Test Method — Dynamic gain indication with patent pending circuit.

Test Frequency	2KHz
Test Voltage	$V_{CE} = \pm$ 5.6VDC V_{BE} = 7V P-P centered on zero reference
Test Currents	I_C = 12mA Maximum 2 - 3 mA average continuous I_B = 7mA Maximum 3mA average continuous

REGULAR BI-POLAR TRANSISTOR

OUT-OF-CIRCUIT GAIN TEST:

Test Method	Dynamic AC Beta
Test Frequency	2KHz
Test Voltage	$V_{CE} = \pm$ 5.6VDC V_{BE} = 7V P-P centered on zero reference
Test Currents	I_C - RF and Low Power = 15mA Maximum MED Power = 50mA Maximum HI Power = 150mA Maximum I_B - RF and Low Power = 30uA Maximum MED Power = 100uA Maximum HI Power = 300uA Maximum
Beta Range	0 - 500
Formula Used	$B = \frac{\text{Delta } I_C}{\text{Delta } I_B}$

LEAKAGE TEST (ICBO):

Test Levels	$V_{CB} = \pm$ 4VDC (emitter open)
Leakage Range	0 - 2500 Microamps

FIELD EFFECT TRANSISTOR

OUT-OF-CIRCUIT GAIN TEST:

Test Method	Dynamic mutual conductance

Test Frequency	2KHz
Test Voltage	$V_{DS} = \pm$ 5.6VDC V_{GS} @ 0
Signal Level	.4 volts P-P
G_m Range	0 - 25,000 Micromhos
Formula Used	$G_m = \frac{\text{Delta } I_D}{\text{Delta } E_G}$

LEAKAGE TEST (IGSS):

Voltage Level	$V_{GS} = \pm$ 4 VDC (source open)
Leakage Range	0 - 2500 Microamps

ZERO BIAS DRAIN CURRENT TEST (IDSS):

Voltage Levels	$V_{DS} = \pm$ 5.6VDC V_{GS} @ 0
IDSS Range	0 - 50 Milliamps

GENERAL

Meter	6", 100uA, 2%
Power	105 - 130 VAC, 8.5 watts
Size	Height: 9¾" (24.7cm) Width: 7½" (19cm) Depth: 7¼" (18.4cm) Weight: 6 lbs. (2.7Kg)
ACCESSORIES	(Included) 1 set - 39G84 Test Leads 1 set - 39G85 Test Probe

CONTROLS

POLARITY SWITCH: This rocker switch selects the polarity of the test voltages applied to the device under test. Normal operating procedure is to set the switch to the NPN position for NPN transistors and N-channel FET's, and to the PNP position for PNP transistors and P-channel FET's. However, if the polarity is not known you will not damage the device if the switch is in the wrong position.

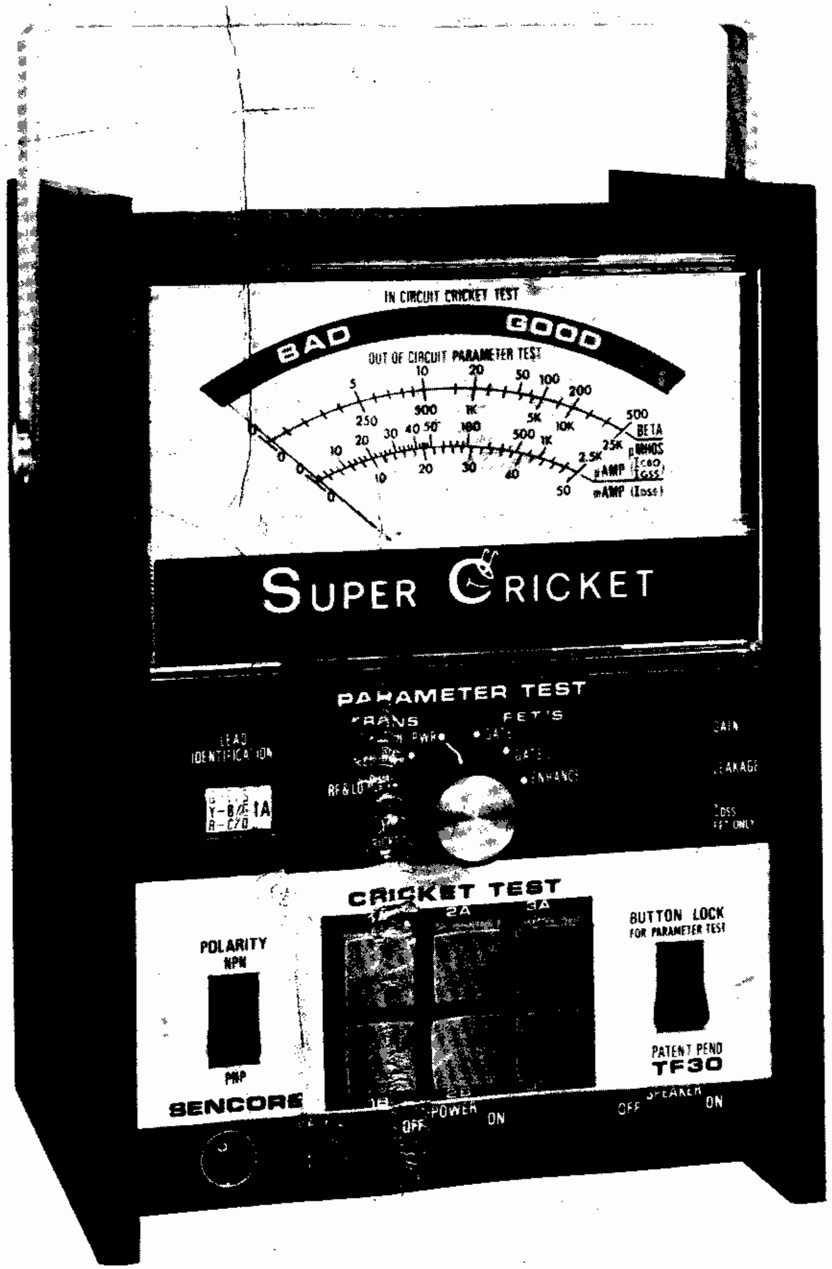


Fig. 1 TF30 Super Cricket

PARAMETER TEST SWITCH: This rotary switch selects RF - LO PWR, MED PWR or HI PWR tests for regular transistors and GATE 1, GATE 2 or ENHANCEMENT tests for FET's. The extreme counter clockwise position of this switch selects the Cricket Test for in-circuit test of either transistors or FET's.

PERMUTATOR TEST SWITCHES: The six pushbutton switches on the keyboard apply the test voltages to the elements of the device under test, for in-circuit and out-of-circuit tests.

BUTTON LOCK: This rocker lock, when activated, locks any one of the pushbuttons down for parameter testing.

SPEAKER SWITCH: This switch may be used to turn off the speaker when desired.

GAIN BUTTON: This button, when depressed, is used to read gain of the device under test, on the meter.

LEAKAGE BUTTON: This button, when depressed, is used to read leakage of a device on the meter.

IDSS BUTTON: This button is used to read IDSS current of an FET only.

LEAD IDENTIFICATION: This is not a control, but a drum containing lead identification information. This provides basing information of each of the six test pushbuttons.

CONNECTIONS

The TF30 Super Cricket is supplied with a lead cable which plugs into the jack provided on the front panel. The connections to the device under test are made with E-Z-Mini-Hook connectors. To use this connector, use the thumb and first two fingers to squeeze the collar towards the ball of the connector, and hook the spring-loaded hook to the lead of the device being tested. Release the pressure on the collar, and the E-Z-Mini-Hook will remain securely connected to the lead.

For in-circuit testing of transistors mounted closely to printed circuit board where connection to the lead is difficult, a swivel tip probe (39G85), for testing from the foil side of the board, has been furnished with your TF30 Super Cricket. To use this probe, connect E-Z-Mini-Hook connectors to the rear of the probe. There are three terminals recessed into slots at the rear of the probe. These are color coded with raised letters, R, Y and G, on the beveled edge at the rear of the probe. Connect the E-Z-Mini-Hooks to the terminals coded to match the color of the connector: R = red, Y = yellow and G = green. The needle points at the front of the probe are identically coded on the front beveled edge. Place the longest needle point to one foil connection of the transistor. Press firmly toward the board and sideways as necessary to spread the needle points to make contact with the other foil connections of the device under test.

OPERATION

Before proceeding with the in-circuit test, be sure to remove all power from the equipment containing the device being tested, and discharge all power supply filter capacitors.

IN-CIRCUIT TESTING

There is no need to know the transistor basing, polarity, or even if the device is a transistor or FET, to use the TF30 Super Cricket. Just hook the leads to transistor in any order, rotate the PARAMETER Test switch to the CRICKET TEST position (extreme counter clockwise), press all permutator buttons. If no "chirp" and meter indication is obtained place the POLARITY switch in the opposite position and push the test buttons again. The Super Cricket will indicate a good transistor with a chirp and meter indication generally on two buttons, one above the other. If a good indication is not obtained on either position of the polarity switch the device is not inverting a signal and may be open or shorted. It should then be removed from the circuit and tested again to be certain because some solid state circuits may be connected with diodes or large electrolytics in some configuration which will shunt the signal and a bad indication may be obtained even though the device is good.

If a transistor tests BAD in-circuit and GOOD out-of-circuit, this may indicate other problems in the circuit. First check the schematic for resistors of less than 100 ohms between base and collector or electrolytic capacitors of 50uF or more connected to the transistor base or collector. If these are not found, check the circuit board for possibilities of:

1. Shorted foils on the board.

2. Large resistors on the board that may have changed value or become shorted.

A good FET and most good transistors will test good on two of the permutator test buttons. Some special devices will test good on only one button. If it is desired to determine the exact basing of the device and whether it is a transistor or FET refer to the section of this manual on DETERMINING BASING.

OUT-OF-CIRCUIT TESTING

For out-of-circuit Cricket tests of a regular transistor, proceed as described in the IN-CIRCUIT TESTING instructions above. For out-of-circuit parameter testing, if the basing is not known, make the in-circuit Cricket test to determine which two buttons indicate a good transistor. Switch the rotary switch to select the power classification of the transistor being tested. Depress one of the "good" buttons then engage the BUTTON LOCK to lock the button down. Press the GAIN button and read the gain on the meter. Release the GAIN button and depress the other "good" test button; it too will lock down. Press the GAIN button and read the gain on the meter. Of the two readings taken the highest reading will be the proper gain reading. The permutator button which gave the highest reading will give the proper connections, or basing, of the transistor. This may be determined by rotating the identification drum to read the basing shown by that button number on the drum. With the permutator button depressed leakage may be read by simply depressing the LEAKAGE button and reading the leakage directly in microamps on the meter.

If basing of the transistor is known, lock down button 1A and connect the green lead to emitter, yellow lead to base and red lead to collector. Set the POLARITY switch to the proper position. Select the power classification and simply push the GAIN button for gain readings and LEAKAGE button for leakage readings. Gain is read in Beta and leakage in microamps.

Out-of-circuit parameter testing of FET's uses the same method as for regular transistors except that power classification is not distinguished as all FET's are checked at zero bias. For a single gate FET you merely select the GATE 1 position and when checking a dual gate FET you simply connect the second gate lead and test both GATE 1 and GATE 2. A third position may be selected for testing enhancement type FET's. Two permutator test buttons will give a "good" indication on FET's and the gain shown in the parameter test will read the same on either button since FET's are designed so that the source and drain may be interchanged. Therefore, it is not possible to derive the exact basing of an FET from "good" buttons, however, you will be able to determine the gate lead. FET gain is read in micromhos and leakage in microamps. IDSS is read in milliamps.

DETERMINING BASING

If the device being tested, tests good on two of the permutator buttons, it is either a regular transistor or an FET. To determine if the device is a transistor or FET and the basing diagram, if it is a transistor, it is necessary only to make an out-of-circuit parameter test on the device. Connect the leads to the device, set SELECTION switch to the Cricket Test position and find the two permutator buttons that give "good" indications. Set SELECTION switch to FET's GATE 1 position. Press one of the two "good" permutator buttons and push the GAIN button. If the device reads a reasonable gain it is an FET since a regular transistor will not read gain, or very low gain, on FET test position. If it is a regular transistor, set the SELECTION switch to the proper power classification position and test with both "good" permutator buttons.

The button giving the highest gain will give the proper connections for basing. The lead code for basing is then taken from the Lead Identification drum for that button. Using the same method for an FET you will be able to identify the gate lead on the device but not definitely which lead is source and which is drain since they are interchangeable on an FET and consequently both "good" buttons will give the same gain reading. The "good" buttons will be either 1A - 1B, 2A - 2B or 3A - 3B and either button of one set will have the base/gate lead connected to the same color lead. E.g. buttons 1A and 1B both have the base/gate lead connected to the yellow lead. Only the emitter and collector leads are reversed.

LEAKAGE TEST

The leakage test on a transistor is nearly the same as the grid leakage test of a tube. It is possible for a transistor or FET to have good gain and still not work in the circuit because the leakage upsets the DC circuit values. To make the leakage test proceed as follows:

1. Remove the transistor from the circuit and connect the test leads to the device. Select the Cricket Test position, push the permutator buttons and note which two buttons result in a good indication.

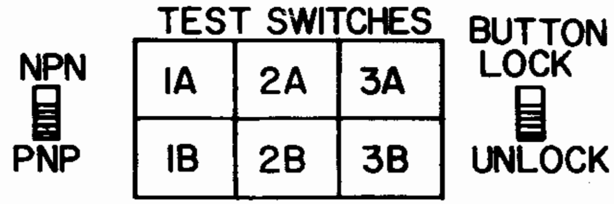
2. Set the PARAMETER TEST switch to the proper power classification position and push and hold the LEAKAGE button. Press each of the two buttons that gave a good indication in Step 1. This makes the ICBO and IEBO leakage measurements of transistors or the IGDO and IGSO leakage of FET's. These leakages should measure zero for FET's and small silicon transistors. High power

silicon and low power germanium transistors may indicate up to 100uA leakage, while high power germanium transistors may read up to 3,000uA and still be acceptable.

3. Press the remaining four buttons. Two of these buttons will result in full scale leakage readings while the other two may or may not indicate leakage depending on the transistor. A junction FET will indicate full scale on all four remaining buttons, while a MOS FET should indicate leakage on only two buttons. If you desire to determine the exact type leakage for a particular transistor refer to the LOCATING LEAKAGE section of the manual.

LOCATING LEAKAGE

In some cases it may be desirable to determine the exact nature of leakage in a transistor. With the permutator test buttons on the TF30 Super Cricket, there is no need to connect the transistor four different ways, the test switches do it for you. To locate the exact nature of the leakage proceed as follows:



LEAD COLOR	1A		2A		3A		1B		2B		3B	
GREEN	E	S	B	G	C	D	C	D	B	G	E	S
YELLOW	B	G	C	D	E	S	B	G	E	S	C	D
RED	C	D	E	S	B	G	E	S	C	D	B	G

TEST SWITCHES — TRANSISTOR OR FET BASING COMBINATIONS

Fig. 2 Transistor Basing Combinations

1. Determine the basing of the transistor or FET, connect the green test lead to the emitter, yellow test lead to the base and the red lead to the collector. If the device is an FET, connect the yellow lead to the gate and the red lead to either the source or drain. Connect the green lead to the remaining element of the FET. Set the PARAMETER TEST switch to the proper function.

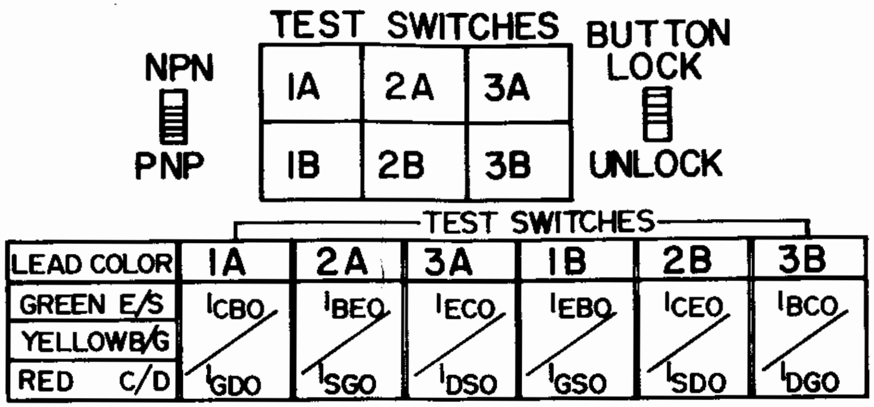


Fig. 3 Leakage Currents for Properly Connected Transistor

2. Refer to Fig. 3 and press the permutator button corresponding to the desired leakage test. Hold or lock this button down and press the LEAKAGE button. Note that for regular transistors, buttons numbered 2A and 3B will produce a full scale leakage reading, corresponding to the conduction of the forward biased base-emitter and base-collector junctions respectively. Junction FET's will produce a full scale reading on buttons 2A and 3B corresponding to the for-

TYPE OF DEVICE	BUTTON 1A I_{CBO} (GDO)	BUTTON 2A I_{BEO} (SGO)	BUTTON 3A I_{ECO} (DSO)
Small Si. Transistor	0-.1uA	3000uA	0-.1uA
Large Si. & Small Ge. Transistor	1-50uA	3000uA	1-50uA
Large Ge. Transistor	10-3000uA	3000uA	10-3000uA
JFET	0uA	3000uA	3000uA
MOSFET	0uA	0uA	3000uA
	BUTTON 1B I_{EBO} (GSO)	**BUTTON 2B** I_{CEO} (SDO)	**BUTTON 3B** I_{BCO} (DGO)
Small Si. Transistor	0-.1uA	0-1uA	3000uA
Large Si. & Small Ge. Transistor	1-50uA	10-500uA	3000uA
Large Ge. Transistor	10-3000uA	100-3000uA	3000uA
JFET	0uA	3000uA	3000uA
MOSFET	0uA	3000uA	0uA

Fig. 4 Maximum Leakage for Good Transistors and FET's

ward conduction of the gate diode; and on buttons 2B and 3A corresponding to the current flow through the low resistance source - drain channel. MOS or IG FET's should only produce a full scale reading on buttons 2B and 3A corresponding to the current flow through the channel. Fig. 4 contains a table which establishes guidelines for limits of leakage currents to be expected on good devices.

3. The following is an explanation of which leakage is measured with each permutator button and its importance to the operation of the transistor or FET:

Button 1A: ICBO is the leakage current that flows in a transistor when a voltage is applied between the collector and base, with the emitter open and the collector-base junction reverse biased. (Collector positive with respect to base for NPN transistor.) Its effect is similar to grid leakage in a tube in that even a small amount will upset the DC bias in the circuit. In an FET, this leakage is called IGDO, and its effect on the DC bias of the circuit is even greater than for transistor ICBO. When making this leakage measurement, press the button carefully and note any up-scale deflection of the meter. Even a very small up-scale deflection should be cause to reject a small silicon transistor or FET. Larger silicon and small germanium transistors may safely indicate up to 50uA of leakage, while some special high power germanium transistors may indicate up to 3,000uA and still be within manufacturers specifications.

Button 2A: IBEO in transistors is the current that flows through the forward biased base-emitter junction. (Base positive with respect to the emitter for an NPN transistor.) This button should produce a full scale indication for transistors. For FET's this leakage would be called ISGO and indicate full scale for junction FET's and zero for MOS or IG FET's.

Button 3A: IECO is the leakage current that flows in a transistor when a voltage is applied between emitter and collector with the base open. (Emitter positive with respect to collector for an NPN transistor.) IECO is a measurement of the transistors ability to block reverse voltage, such as would be encountered in circuits with an inductive load in the collector. In FET's, this current would be called IDSO and should indicate full scale because of the normal conduction of the low resistance drain-source channel.

Button 1B: IEBO is the leakage current that flows in transistors when a voltage is applied between emitter and base, with the collector open and the emitter-base junction reverse biased. (Emitter positive with respect to base for NPN transistor.) IEBO is most important in pulse circuits, where the base is driven deep into reverse bias and the leakage current could influence the pulse shaping circuits. In a FET, this leakage is called IGSO, and is a measurement of leakage current that flows from gate to source, with the gate source junction reverse biased for junction FET's. Even a small up-scale deflection should be cause to reject a small silicon transistor or any FET. Larger silicon and small germanium transistors may safely indicate up to 50uA of leakage, while some special high power germanium transistors may indicate up to 3,000uA and still be within manufacturers specifications.

Button 2B: ICEO is the leakage current that flows in a transistor when a voltage is applied between the collector and the emitter, with the base open. (Collector positive with respect to emitter for an NPN transistor.) Excessive ICEO will cause a transistor to operate unreliably in any circuit, however, the transistors most prone to this type leakage are high power types such as those used in audio output circuits and power supply regulators. In FET's this current would be called ISDO and should indicate full scale because of the normal conduction of the low resistance source-drain channel.

Button 3B: IBCO in transistors is the current that flows through the forward biased base-collector junction. (Base positive with respect to the collector for an NPN transistor.) This button should produce a full scale indication for transistors. For FET's this leakage would be called IDGO, and indicate full scale for junction FET's and zero for MOS and IG FET's.

CHECKING DIODES

The leakage test on the TF30 provides a simple, accurate method of determining the front to back ratio of a diode or rectifier. The permutator switches allow out-of-circuit measurement of both forward and leakage currents with no need to reconnect the diode.

1. Set the polarity switch to the NPN position and the Parameter Test switch to the RF - LOW PWR position.

2. Connect the red test lead to the diode anode and the yellow lead to the cathode.

3. Press button number 1A and the LEAKAGE button to measure the forward current. The forward current should indicate at or near full scale.

4. Press button number 3B and the LEAKAGE button to measure the leakage current. The leakage current should measure at or near zero on the leakage scale.

PROTECTION

Complete protection is provided so that the permutator buttons can be operated at any time without fear of heavy currents damaging the transistor when it is improperly connected. Power for out-of-circuit gain testing is only provided when the transistor first shows a good Cricket test indication. Power for the gain test will be switched off if a second permutator button is depressed while holding the GAIN button depressed. This protection system makes the Super Cricket completely safe. It is impossible to destroy a transistor under test.

CIRCUIT DESCRIPTION

THEORY OF OPERATION

CRICKET TEST

The Cricket test operation of the TF30 represents a unique approach to the testing of transistors and FET's. The test depends upon a good transistor or FET providing a signal polarity reversal from input to output when operating with the emitter or source common.

A 2KHz square wave is generated by IC1 and coupled to the base or gate of the device by the permutator switches. The permutator switches also connect V_C from the power supply to the collector or drain and ground the emitter or source. If the device under test is good, the collector or drain signal voltage developed and coupled through C106 to IC2 will be 180 degrees out of phase with the reference signal coupled from IC1 to the base of TR104.

The collector signal is amplified by IC2 and coupled to a NAND gate comprised of TR103 and TR104. The NAND gate will provide an output when the base and collector signals, of the device under test, are 180 degrees out of phase. This output signal then provides both audio and visual indication of a good transistor or FET. With a collector signal in phase with the base signal, as in the case of a shorted transistor, or no collector signal in the case of an open transistor, there will be no output signal from the NAND gate and thus, no audio or visual indication.

GAIN TEST

The out-of-circuit gain test provides a reading of AC Beta for regular transistors and mutual conductance for FET's. With the permutator test button indicating proper connection depressed and the GAIN button depressed, a 2KHz square wave calibrated signal is coupled to the base (or gate) of the device under test. The resulting signal from the collector (or drain) is amplified by IC3 and IC4, detected by the meter bridge circuit and read on the meter directly in Beta or micromhos. The gain test can only be activated when a permutator button giving a good indication (proper connections) is depressed. The inverted collector (or drain) signal, fed through the NAND gate TR103 and TR104, turns on TR106 which activates the reed relay, L1. L1 then provides DC voltage for the gain test. L1 is self latching until the depressed permutator button is released or another button depressed. This action provides protection for the device under test by not applying voltage should the device be improperly connected through the permutator by pushing an incorrect test button.

POWER SUPPLY

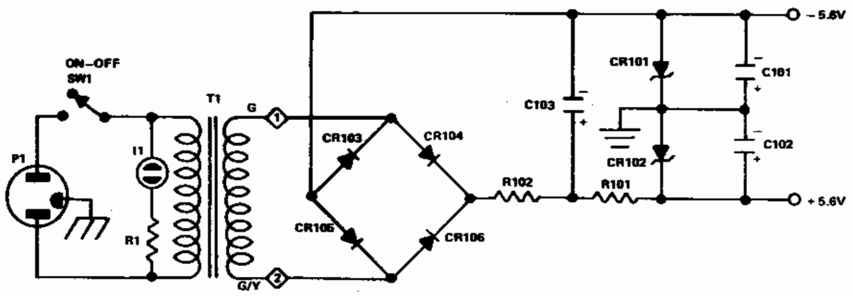


Fig. 5 Power Supply

The secondary voltage of T1 is rectified by bridge rectifiers CR103 - CR106 and filtered by C103 to provide 22 volts DC. R102 has been included as a surge limiting resistor to protect CR103 - CR106 during initial charging of C103 when power is applied. The DC voltage across C103 is regulated by CR101 and CR102 to provide plus and minus 5.6 volts to operate the TF30 circuitry. Resistor R101 limits the current through diodes CR101 and CR102. The DC output voltages are further filtered by C101 and C102.

2KHz OSCILLATOR AND EMITTER FOLLOWER

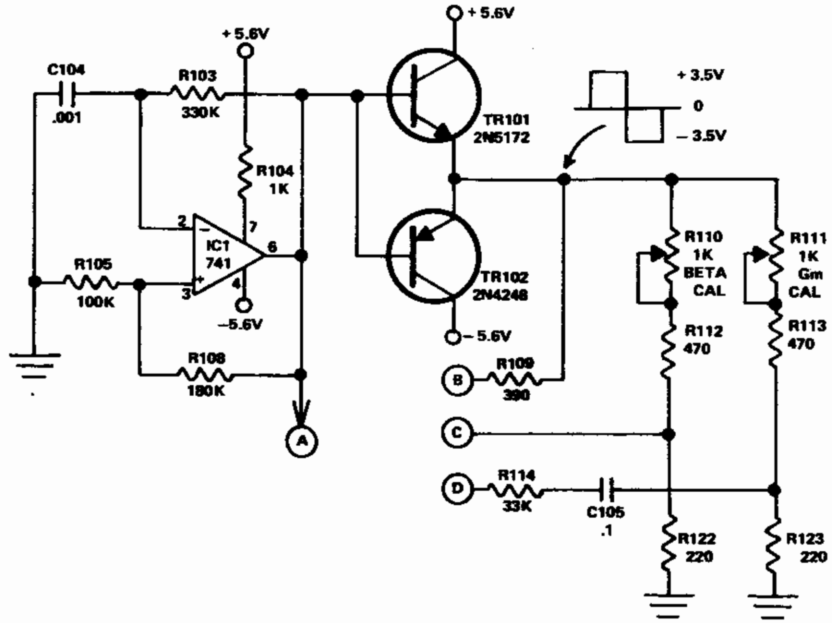


Fig. 6 2KHz Oscillator and Emitter Followers

IC1 is connected as a square wave oscillator operating at approximately 2KHz. R103, R105, R108 and C104 are the frequency determining components. TR101 and TR102 function as dual emitter followers with TR101 conducting on the positive portion of the signal and TR102 conducting on the negative portion. The total signal appears at the emitters symmetrically around zero reference.

This circuit has four outputs as shown in Fig. 6. Output A is a phase reference signal coupled to the base of TR104 and is used for phase comparison with the collector signal from the transistor under test. Now refer to Fig. 7 for the schematic of the following signal paths. Output B is a 7V P-P test signal applied to the base of the transistor under test through R109, SW8B and the permutator test switches during the Cricket test. During out-of-circuit test, this signal is applied to the base of the transistor under test through R109, SW101, SW102, SW103, SW8B and the permutator test switches. Output C is a square wave signal calibrated by R110 to 1V P-P.

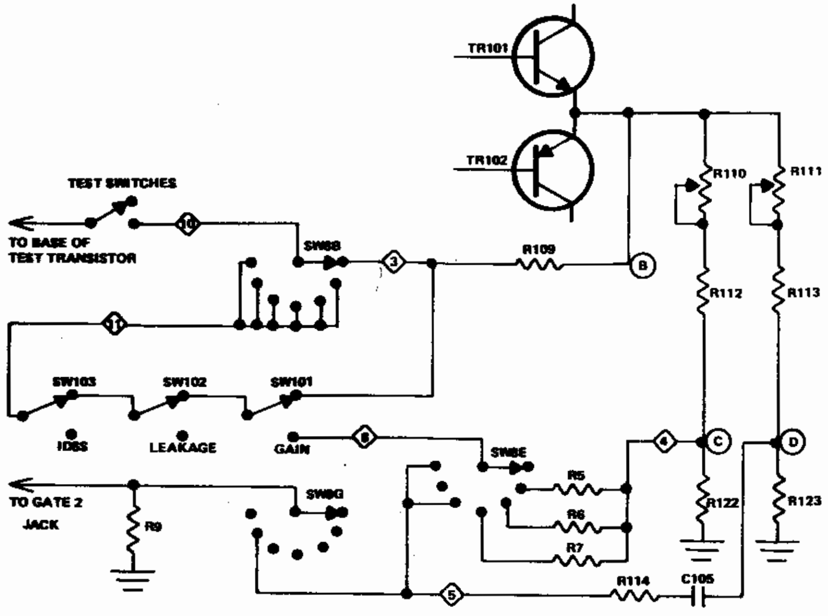


Fig. 7 Test Signal Distribution

This signal is applied to the base of the test transistor during parameter gain test of a regular transistor through SW8E, SW101, SW102, SW103, SW8B and the permutator test switches.

Output D is a square wave signal calibrated by R111, to approximately 1V P-P and AC coupled to gate 1 of an FET under parameter gain test, through C105, R114, SW8E, SW101, SW103, SW8B and permutator test switches. For test of gate 2 of a dual gate FET, output signal D is coupled through C105, R114, and SW8G to the Gate 2 jack. For calibration procedure see CALIBRATION INSTRUCTIONS section of this manual.

PHASE COMPARISON AND INDICATOR CIRCUITRY

The heart of the Cricket test circuitry is the NAND gate comprised of TR103, TR104, and associated resistors. Transistors TR103 and TR104 are biased on by R118 and R120 connected to the positive supply. This places the base of TR105 at a nearly ground potential or no signal condition. A phase reference signal is coupled from IC1 through R119 to the base of TR104 but this signal produces no output signal since TR103 is DC biased in an on condition holding the collector of TR104 at ground potential.

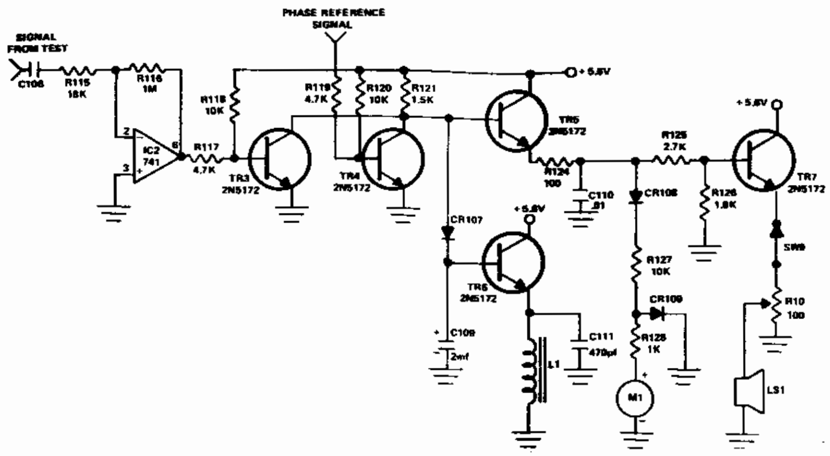


Fig. 8 Phase Comparison and Indicator Circuitry

With no signal at the base of TR105 there can be no audio or visual indication. We have now established a condition of open, unconnected-test-leads for the TF30. This same condition exists if an "open" transistor is being tested.

Now let us assume a good transistor or FET is being tested. When the correct permutator test button is pressed (proper connection) a collector signal that is 180 degrees out of phase with the test reference signal is applied to input 2 of IC2 through C106 and R115. IC2 is an OP AMP with a gain of approximately 50. This gain factor is established by the ratio of R116 to R115. The output of IC2 at pin 6 is inverted 180 degrees and therefore the signal at the base of TR103 is now in phase with the reference signal on the base of TR104. With these signals in phase there will be a signal present at the base of TR105. TR105 is a buffer which passes the signal on to the lower impedance meter circuit. The signal is taken from the emitter of TR105 through an integrating circuit, R124 and C110, which rounds off the corners of the square wave signal. This signal is rectified by CR108 to provide a meter indication and also a portion is fed to the base of TR107 to provide an audio tone from the speaker LS1. Audio volume is adjusted by R10 at the rear of the TF30.

In the meter circuit CR109 and R128 function as a meter compression circuit which prevents the meter from going full scale when a "good" indication is presented. This meter circuit is used only in the Cricket test position.

The "good indication" signal at the base of TR105 is also applied to the base of TR106 through CR107, which rectifies the signal, and across C109 filter capacitor. This positive signal on the base of TR106 turns this transistor on and energizes L1, the gain test relay. L1 will now provide DC voltage to the elements of the device under test for parameter gain test.

GAIN TEST AND METER CIRCUIT

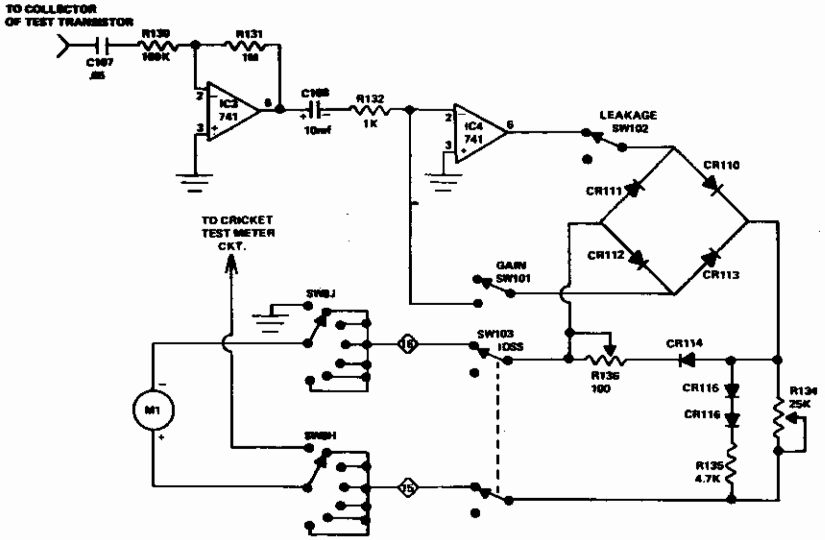


Fig. 9 Gain Test and Meter Circuit

For parameter gain test of a regular transistor a current test signal is applied to the base, and for an FET a voltage test signal is applied to the gate. The collector or drain of the device under test is grounded through a load resistor and with the GAIN button pushed a DC voltage of the proper polarity, dependent upon the position of the POLARITY switch, is applied to the emitter or source. The amplified signal from the collector or drain is coupled to OP AMP IC3, through C107 and R130 to input 2. The gain of IC3 is fixed at 10 by the ratio of R130 and R131 precision resistors. The output signal from IC3 is coupled through C108 and R132 to OP AMP IC4 input 2. The meter bridge and meter circuit is connected from the output of IC4 back to the input which becomes a zero summing point. The current into IC4 input (2) is fed from the output (6) through the meter circuit back to the input (2). The value of R132 determines the current into IC4 input 2.

LEAKAGE TEST METER CIRCUIT

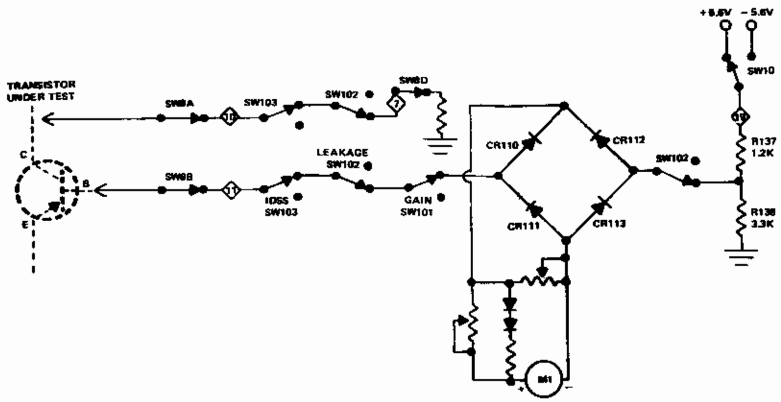


Fig. 10 Leakage Test Meter Circuit

During the leakage test the collector (drain) of the transistor (FET) under test is tied to ground through a series of switches, SW8A, SW103, SW102, SW8D, and a small resistance, R2, R3 or R4 or a combination thereof, depending upon the power classification of the device. The base (gate) of the device is tied back to either positive or negative 4VDC, depending upon the polarity of the device, through SW8B, SW103, SW102, SW101, meter bridge circuit, and SW102. Any leakage current will flow through the meter bridge and meter circuit and give a leakage indication. The polarities shown in Fig. 10 are for a PNP type transistor or P-channel FET.

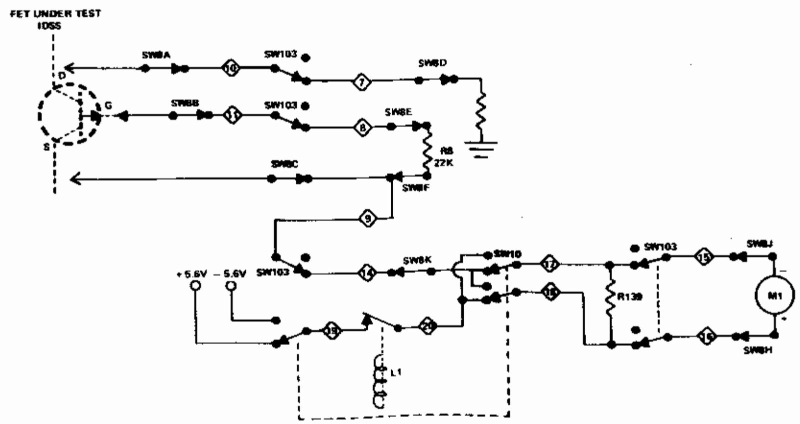


Fig. 11 IDSS Test Meter Circuit

The IDSS test is made only on an FET and indicates static drain to source current with the gate tied to the source. The polarities, and switch SW10 position, shown in Fig. 11 are for a P-channel FET.

The drain is tied to ground through SW8A, SW103, SW8D and a low resistance comprised of R3 and R4. The gate is tied to the source through SW8B, SW103, SW8E, R8, SW8F, and SW8C. The source is tied to positive or negative 5.6VDC through SW8C, SW103, SW8K, SW10, R139 and meter, SW10, L1 and another contact on SW10. R139 functions as a shunt for the meter, M1. The shunt must be used since the meter movement is 100uA full scale and IDSS is normally measured in several milliamps. The meter sees the voltage developed across R139 by the IDSS current. L1 is activated to supply voltage for the IDSS measurement by first pushing and holding, or locking, the "good" permutator test button. The IDSS measurement can then be made by depressing the IDSS button.

DISSASSEMBLY INSTRUCTIONS

1. Remove the panel assembly from the case by removing two phillips head screws from the back of the case just above the book holder compartment. Then remove two phillips head screws from bottom lip of the front panel. Pull the panel assembly straight out from the case.

2. Remove two screws from the top edge of the PC board and one from the pushbutton switch bracket mounted on the bottom, front edge of the PC board.

3. Remove two molex connectors from the board and lift the board from the panel assembly.

METER REPLACEMENT

1. Disconnect the red and black wires from the meter terminals and remove two nuts from the meter mounting studs.

2. Lift the meter from the panel.

3. Reverse the proceedure to install the meter.

SPEAKER REPLACEMENT

1. Disconnect the yellow and black wires from the speaker.

2. Remove three screws holding the meter into the sub chassis. Lift the speaker out from the top of the sub chassis.

3. To install the speaker reverse the proceedure and use caution when installing the screws. If the screwdriver slips the speaker cone may be damaged by puncture.

PERMUTATOR SWITCH BOARD ASSEMBLY

1. Disconnect 4 wires from each switch board assembly.

2. Remove one screw from the right hand side of each switch assembly mounting tab.

3. Slide the switch assembly to the right, lift up and out of the switch assembly mounting panel.

CALIBRATION INSTRUCTIONS

STATIC METER ZERO

With the power off to the TF30, use a small screwdriver, and adjust the mechanical meter zero screw on the front of the meter to position the meter pointer to the zero at the left edge of the scale.

LEAKAGE CALIBRATION

1. Turn on the power to the TF30 and select NPN polarity and HI PWR transistor test.

2. Connect an accurate DC milliammeter with the + lead to the TF30 red test connector. Connect the − lead in series with a 20K variable resistor to the yellow test connector.

3. Depress and lock the 1A test button. Press the LEAKAGE button and adjust the variable resistor to read 2.5 milliamps on the milliammeter.

4. While holding the LEAKAGE button depressed, adjust R136 on the PC board for a reading of 500 on the TF30 meter.

5. Depress the leakage button and adjust the variable resistor for a reading of .25 milliamps on the milliammeter.

6. Adjust R134 on the PC board until the TF30 meter indicates at 50.

7. Repeat steps 3 through 6 until the readings are repeatable without further adjustment of R134 or R136.

BETA AND Gm CALIBRATION

1. Turn on power to the TF30 and connect a scope to the test leads: connect red connector to scope common and yellow connector to the scope probe.

2. Select HI PWR test position and depress and lock button 1A.

3. Depress the GAIN button and adjust R110 on the PC board for a 1V P-P signal displayed on the scope.

4. Connect the scope common to the green lead connector and scope probe to the GATE 2 lead (blue connector).

5. Switch to GATE 2 position with selector switch and adjust R111 on the PC board for a .4V P-P signal displayed on the scope.

TROUBLE CHARTS

CRICKET TEST INOPERATIVE

Check test leads by shorting all three leads together, switch to LO PWR. Depress LEAKAGE button and push all 6 test buttons in sequence. Do all buttons indicate nearly full scale?

NO
CONCLUSION:
Check and repair or replace as necessary: wiring and test leads.

YES
Connect a known good transistor to the TF30. Green lead to emitter, yellow to base, red to collector. Select Cricket test, proper polarity and push button 1A. Are both meter and speaker indication inoperative?

NO
CONCLUSION:
Troubleshoot the defective indicator circuit beginning at test point 7 on the schematic.

YES
Disconnect transistor and connect scope ground lead to green test lead and probe to yellow lead. Press yellow lead measure 6 - 7V P-P, 2KHz square wave?

NO
CONCLUSION:
Use a scope and starting at IC1 pin 6, locate where the 2KHz signal is lost.

YES
Measure DC voltage red lead with green lead as a reference. Does red lead measure 5.6VDC?

YES
Connect a known good transistor to TF30 leads. Green lead to emitter, yellow lead to base, red to collector and select correct polarity. Using a dual trace scope with reference to ground, check for in phase signals on the bases of TR103 and TR104 with button 1A depressed. Are proper signals present?

NO
CONCLUSION:
Using a meter with ground reference, start at SW10 and trace where DC voltage is missing.

YES
Using a scope reference to ground, with button 1A depressed check for 2KHz signal on base of TR105. Is signal present?

NO
CONCLUSION:
If no signal present on base of TR103 replace IC2.

YES
CONCLUSION:
Check and replace if necessary, TR105.

NO
CONCLUSION:
Check and replace if necessary TR103 or TR104.

GAIN TEST INOPERATIVE

Connect a known good transistor to the TF30, green lead to emitter, yellow to base, red to collector. Select proper power classification and polarity. Push button 1A. Is a speaker tone present?

NO
CONCLUSION:
Using a scope start at IC2 pin 2 and trace back to find where the 2KHz signal is lost.

YES
Depress button 1A and GAIN button and check for DC voltage between ground and the green emitter connection on test transistor. Is DC voltage present?

NO
CONCLUSION:
Check TR106 and L1 circuits.

YES
Depress button 1A and GAIN button. Check with scope for 2KHz signal at IC3 pin 2. Is signal present?

NO
CONCLUSION:
Using a scope trace back from IC3 pin 2 to find where 2KHz signal is missing.

YES
Depress button 1A and GAIN button. Check with a scope for 2KHz signal at IC3 pin 6. Is signal present?

NO
CONCLUSION:
If power supply voltages are present at pins 4 and 7 of IC3 replace IC3.

YES
Check DC voltages at all pins of IC4. Are proper voltages present?

NO
CONCLUSION:
Replace IC4.

YES
CONCLUSION:
Check meter bridge and meter circuit diodes and replace as necessary.

SERVICE AND WARRANTY

You have just purchased the finest transistor tester on the market today. The Sencore TF30 has been inspected and tested twice at the factory and has passed a rugged use test by our Quality Assurance Department to insure the best quality instrument to you. If something should happen, the TF30 is covered by a standard 90 day warranty as explained in the Quality Assurance tag, enclosed with your instrument.

Sencore has six regional offices to serve you. Instruments to be serviced should be returned to the nearest office by UPS if possible. Parcel Post should only be used as a last resort. Instruments should be packed with the original packing materials or equivalent, and boxed to insure safe arrival at the regional office. The display carton IS NOT an acceptable shipping container. When returning an instrument for service, be sure to state the nature of the problem to insure faster service.

If you wish to repair your own TF30 Transistor Tester, we have included a schematic, trouble charts, and parts list. Any of these parts may be ordered directly from the regional office nearest you.

We reserve the right to examine defective components before an in warranty replacement is issued.

SENCORE REGIONAL OFFICES:

Sencore East Central
4105 Duke Street
Alexandria, VA 22304
703 751-3556

Sencore Central
2711 B Curtis Street
Downers Grove, IL 60515
312 852-6800

Sencore Western Coast
833 Mahler Road
Burlingame, CA 94010
415 697-5854

Sencore West
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Sioux Falls, SD 57107
605 339-0100

Sencore Southeastern
2459 Roosevelt Hway Suite B-9
College Park, GA 30337
404 768-0606

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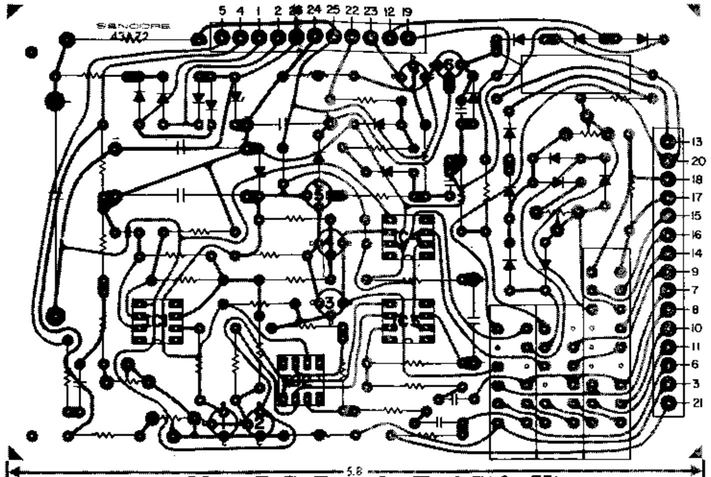
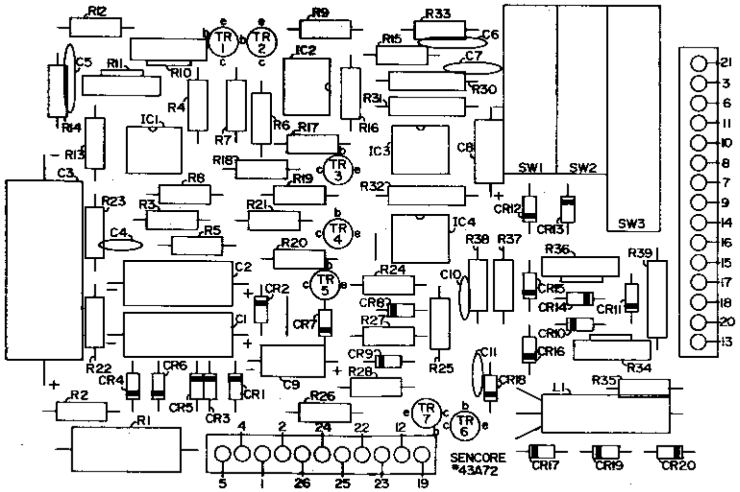
Albany, NY 12205
518 869-0996

Form 971 PRINTED IN U.S.A.

BOARD LEGENDS



Main P.C. Board - Foil Side View



Main P.C. Board - Component Side View

THE IDEA PEOPLE

SENCORE

3200 SENCORE DRIVE, SIOUX FALLS, SOUTH DAKOTA 57107

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SCHEMATIC AND PARTS LIST SENCORE TF30

THE IDEA PEOPLE

SENCORE

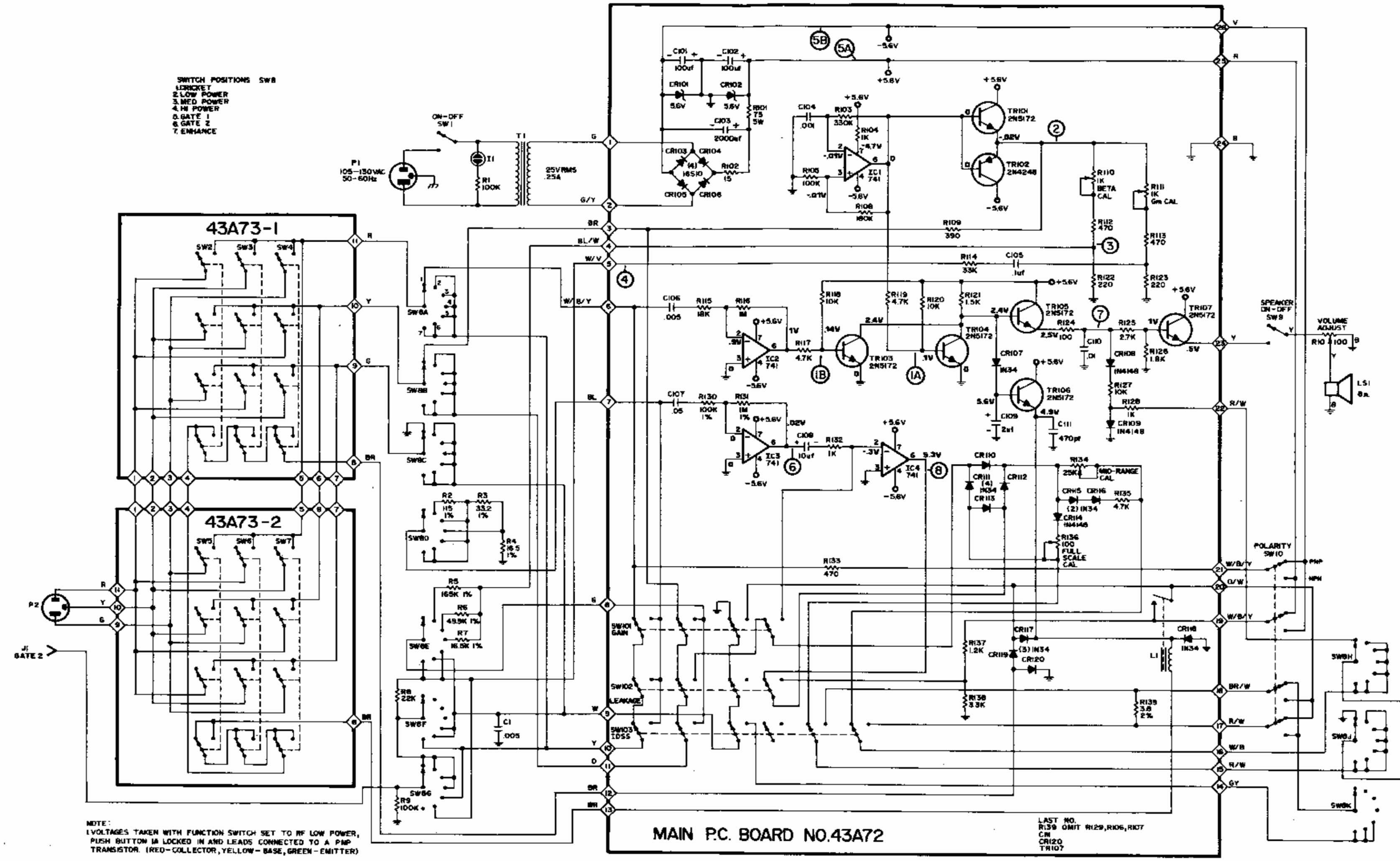
3200 SENCORE DRIVE, SIOUX FALLS, SOUTH DAKOTA 57107

PARTS LIST

SCHEMATIC REF. NO.	PART NO.	DESCRIPTION	PRICE
	8B122	Escutcheon, Front Panel	2.00
	108K120	Front Panel Assy., Riveted	22.50
	110K320	Case Assy., Riveted	18.50
	143A72	Main P.C. Board Assy.	56.00
	143A73-1	Permutator Sw. Bd. Assy., Top	7.25
	143A73-2	Permutator Sw. Bd. Assy., Bottom	7.25
	21A45B	Pushbutton, Black	.25
	21A58	Pushbutton, Gray	.25
	21A63	Knob, Function Sw.	1.75
R2	14C29-1152	115 Ohm, ½W, 1%	.75
R3	14C29-3321	33.2 Ohm, ½W, 1%	.75
R4	14C29-1651	16.5 Ohm, ½W, 1%	.75
R5	14C29-1655	165K, ½W, 1%	.75
R6	14C29-4994	49.9K, ½W, 1%	.75
R7	14C29-1654	16.5K, ½W, 1%	.75
R130	14C29-1005	100K, ½W, 1%	.75
R131	14C29-1006	1 Meg., ½W, 1%	.75
R132	14C29-1003	1K, ½W, 1%	.75
R139	14C42-3830	3.83 Ohm, ½W, 1%	.75
R10	15C3-17	Control, 100 Ohm, ½W, 30%	.75
R110, 111	15C7-17	Control, 1K, 30%	.75
R134	15C7-12	Control, 25K, 30%	.75
R136	15C7-9	Control, 100 Ohm, 30%	.75
TR101, 103, 104, 105, 106, 107	19A4-1	Transistor 2N5172	.50
TR102	19A14-1	Transistor 2N4248	.50
M1	23C52	Meter, 100uA	22.50
SW8	25A204	Function Switch	7.25
	125A204	Function Switch, Assy.	13.25
SW101, 102, 103	25A207	Pushbutton Switch Assy.	3.50
SW2, 3, 4, 5, 6, 7	25A208	Pushbutton Switch Assy.	3.75
T1	28B62	Transformer	5.75
L1	41G2	Relay, Reed 5V. SPST	4.25
CR101, 102	50C4-14	Zener Diode, 5.6V, 5%	1.00
CR103, 104, 105, 106	16S10	Diode, Rectifier, 1 Amp	.50
CR107, 110, 111, 112, 113, 115, 116, 117, 118, 119, 120	50C3-1	Diode 1N34A	.25
CR108, 109, 114	50C5-2	Diode 1N4148	.25
IC1, IC2, IC3, IC4	69G1	IC OP AMP 741	2.00
	39G84	Test Lead Assy.	10.00
	39G85	Cricket Probe	10.00

Prices in effect at date of printing and are subject to change without notice.

When ordering parts, please specify model number, part number and description. Service and parts invoices are C.O.D. Please include remittance (check or money order) with your order to save C.O.D. charges. Minimum billing $3.00.



SCHEMATIC DIAGRAM
TF30 SUPER CRICKET

ISSUE DATE: 9-23-74

1.4V P-P In Phase 2KHz | 1.4V P-P Out of Phase 2KHz | 6V P-P | 1V P-P Calibrated | .6V P-P Calibrated | A&B .025V P-P | 2.4V P-P (Gain Button Pushed) | 4.5V P-P | 3V P-P (Gain Button Pushed)