TM 11-6625-539-15-1

TECHNICAL MANUAL

ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE MANUAL

TEST SET, TRANSISTOR TS-1836A/U

(NSN 6625-00-423-2195)

This copy is a reprint which includes current pages from Changes 1 through 3.

HEADUARTERS, DEPARTMENT OF THE ARMY
06 JULY 1967

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NG: State AG (8)
USA *R: None*
For explanation of abbreviation used, see AR 320-50.

WARNING

The fumes of TRICHLOROETHANE are toxic. Provide thorough ventilation whenever it is used; avoid prolonged or repeated breathing of vapor. Do not use near an open flame or hot surface; trichloroethane is nonflammable but heat converts the fumes to a highly toxic phosgene gas the inhalation of which could result in serious injury or death. Prolonged or repeated skin contact with trichloroethane can cause skin inflammation. When necessary, use gloves, sleeves and aprons which the solvent cannot penetrate.

MODEL 219C

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Pages

LIST OF ILLUSTRATIONS

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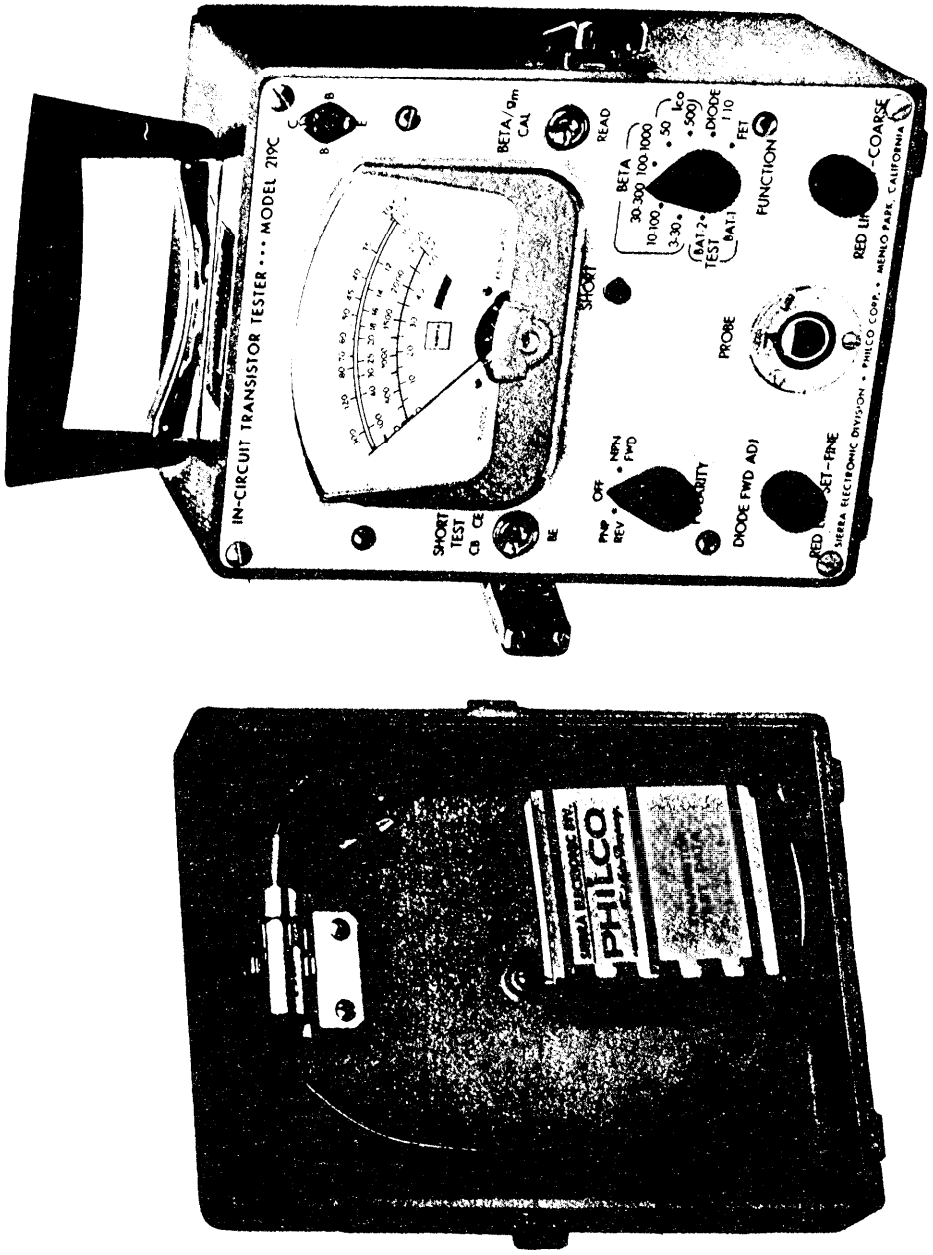


Figure 1-1. Model 219C In-Circuit Transistor Tester

SECTION A
INTRODUCTION

A. Scope

1. This manual includes installation and operation instructions and covers operator's, organizational, direct support (DS), general support (GS), and depot maintenance. It describes Test Set, Transistor TS-1836A/U (referred to throughout this manual as Sierra Model 219C). This manual also includes a maintenance allocation chart (app C).

2. To order this technical manual, requisition through pinpoint account number if assigned, otherwise through nearest Adjutant General facilities.

B. Indexes of Publications

a. *DA Pam 310-4.* Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. *DA Pam 31O-7.* Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO'S) pertaining to the equipment.

C. Forms and Records

a. Reports of **Maintenance** and *Unsatisfactory Equipment.* Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DLAR 4145.8.

c. *Discrepancy* in *Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR. 75-18/MCO P461O,19C and DLAR 4500.15.

C.1. Reporting Equipment Improvement Recommendations (EIR)

EIR's will be prepared using DA Form 2407 (Maintenance Request). Instructions for preparing EIR's are provided in TM 38-750, the Army Maintenance Management System. EIR's should be mailed direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-MA-Q, Fort Monmouth, New Jersey 07703. A reply will be furnished direct to you.

D. Reporting of Errors

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-MA-Q, Fort Monmouth, New Jersey 07703.

SECTION I

GENERAL

A. PURPOSE

The Sierra Model 219C Transistor Tester (Patent No. 2,922,544) is designed to make rapid, {n-circuit transistor beta measurements with a hiah dearee of accuracv. The instrument may also be used for out-of-circuit measurement of transistor leakage current co for indicating diode reverse-to-foward ratio and for measurlng the transconductance, gm, of Field Effect transistors. In addition, a shorted junction indicator for the transistor being tested is provided. The Instrument IS designed to provide maximum possible accuracy In the presence of small shunting Inpedances in the clrcuits external to the transistor. When a shunting impedance between transistor electrodes is greater than 500 ohms, there Is little difference in the accuracy between in circuit and out-of-circuit beta measurements. Significant in-circuit beta measurements can be made with shunting impedances as low as 25 ohms with some loss in accuracy. See speclflcations paragraph C.

B. DESCRIPTION

The Model 219C uses solid state components throughout and Is battery operated. The unit is housed In a sturdy plastic case fitted with a carrying handle for easy portabillity. The components are mounted on epoxy-glass clrcult boards fastened to the front panel with standoff spacers. Batteries are mounted on the rear circult board. The clrcult Is made up of an ascillator and amplifier as the signal source, and a tuned amplifier and meter rectifier far readout. The meter is calibrated to read beta, diode reverse-to-forward ratio, field effect transistor g_m and transistor leakage current.

A test cable Is furnished for In-clrcult use with mlnlature alligator clips to fasten to translstor leads for circuit board in-circuit transistor testing. Clips are provided to hold the cable inside the cover. A test socket is mounted on the front panel.

C. SPECIFICATIONS

TEST RANGES	
Transistor	
Beta, Maximum	30,100,300,1000
I_{co}	0-50 µa
	0-500 µa
Diode	
Reverse-to-forward Ratio	1:10
Field Effect Transistor	
Transconductance, g_m	0-2500 µ mhos
ACCURACY	
Beta, Out-of-Circuit	5%
Beta, In-Circuit (500 loading)	
Typical Deviation from	
Out-of-Circuit Reading	5%
Ice, Out-of-Circuit	5%
Diode, Out-af-Circuit	10%
g_m, Out-of-Circuit	5%
gm, In-Circuit (100 G-S, 4K D-S)	
Typical Deviation from	
Out-of-Circuit Reading	10%
OPERATING TEMPERATURE	0-65°C

POWER REQUIREMENTS

Battery Type	Quantity	Expected Life
Mercury, 12.15 volts	1	280 hours
Zinc-carbon, 1.5 volts	4	200 hours
Zinc-carbon, 1.5 volts	1	Shelf Life

● For low shunting resistances the deviation from out-of-circuit readings may be greater.

MODEL 219C

INPUT CONNECTORS
In-Circuit
Test Cable . . . . . Miniature Alligator Clips
Out-of-Circuit . . . . . Test Socket
DIMENSIONS, Overall . . . . . .
Height 10 inches
Width 7-5/8 inches
Depth 6-112 inches
WEIGHT . . . . . .7-3/4 Pounds

D. BATTERY INSTALLATION

Batteries are shipped wrapped in a separate fiberboard container in the instrument shipping carton. To install or replace batteries the instrument must be removed from its case. Procedure Follows:

Remove four (4) screws in corners of front panel.

Carefully set unit upright.

Slide unit out of case.

Place 12.15 volt Mercury battery BT1 in clips at top of rear circuit board. Observe polarity.

Place five (5) zinc-carbon 1.5 volt cells in clips in lower left-hand corner of rear circuit board. Observe polarity.

Slide unit into case, lay on back and insert screws in corners of front panel.

Batteries should always be removed from instrument before storing or shipping.

Zinc-carbon batteries, BT2-BT6 maybe replaced with 1.5V alkaline cells, if desired, to obtain somewhat greater battery life.

E. Items Comprising an Operable Equipment

FSN	QTY	Nomenclature, part No., and mfr code	FIG. No.
		NOTE The part number IS followed by the applicable 5-digit Federal supply code for manufacturers (FSCM) identified in SB 708-42 and used to identify manufacturer, distributor, Government agency, etc. NOTE Dry batteries shown are used with the equipment but are not considered part of the equipment. They will not be preshlpped automatically but are to be requisitioned in quantities necessary for the particular organization m accordance with SB 11-6.	
6625-926-6996		Test Set, Transistor TS-1 836A/U which includes:	1-1
6135-087-3933		Battery, Dry: TR-239, 72665	4-2
6135-120-1030		Battery, Dry: BA-58	
6625-120-1741		Cable Assembly, Special Electrical: C02005900; 94668	1-1
6625-329-2595		Data Book: 950100003; 94668	1-1

SECTION II

OPERATION

A. OPERATING CONTROLS AND INDICATORS

Control or Indicator	Use	Schem. Ref. No.
FUNCTION (Rotary Switch)	Battery Tests Rang. Switch For: Beta; Leakage Current, Ico; Diode Reverse-To-Forward Ratio; Field Effect Transistor Transconductance.	S2
POLARITY (Rotary Switch)	Selects Bias Battery Voltage To Transistor or Diode Under Test Power OFF Switch	S3
SHORT TEST (Spring-Return Toggle Switch)	CB CE Position: Collectar-Base, Collectar-Emitter Junction Short; or Low External Shunt Resistance. BE position: Base-Emitter Short; or Low External Shunt Resistance.	S1
SHORT (Red Panel Light)	Indicates Transistor Junction Short or Low External Shunt Resistance when Light Comes On	DS 1
BETA/~ (Spring-Retum Toggle Switch)	CAL Position: RED LINE SET Far Instrument Calibration. Meter indicates Microamps or Reverse-To-Forward Ratio READ Position: Meter indicates Beta or gm	S4
RED LINE SET-COARSE (10-Turn Patentiometer)	Coarse Calibration Signal Level Adjustment	R64

Control or Indicator	Use	Schem. Ref. No.
RED LINE SET-FINE (Potentiometer)	Fine Calibration Adjustment Diode Calibration Adjustment	R65

B. OPERATING PROCEDURE

1. Battery Test

a. Place FUNCTION switch in the BAT-1 TEST position Motor should read in green sector. If reading is below green sector replace batteries BT2 through BT6 before making transistor tests. See Section I paragraph D for replacement procedure.

b. Place FUNCTION switch in BAT-2 TEST position. Place POLARITY switch in NPN position. Meter should read in green sector. If reading is below green sector replace battery BT-1 before making transistor tests.

c. BT6 is good for normal shelf Ilfe so no test is provided. A now BT6 CeIl should be installed whenever BT2 - BT5 are replaced.

2. Beta Test (In-Circuit)

0. Turn POLARITY switch to OFF and FUNCTION switch to BETA.

b. Connect the test cable to PROBE jack. (Be sure them is no transistor in the front panel test socket when using probe.)

c. Attach alligator clips to transistor leads. Cable is color coded as follows:

BLUE - COLLECTOR (DRAIN)
GREEN - BASE (GATE)
YELLOW - EMITTER (SOURCE)

d. Turn RED LINE SET-COARSE full counterclockwise. (This is a ten turn potentiometer. There is no positive stop at the end of travel but an increase in torque is noticeable at the full counterclockwise point.)

CAUTION

Do not leave RED LINE SET-COARSE control in advanced clockwise position. Excessive drive may cause the next transistor tested to be damaged when it is connected or plugged into the tester.

Turn POLARITY switch to correct position for transistor type to be tested (Germaium usually PNP, Silicon NPN).

f. If SHORT light comes on, it may be caused by any one of the following:

(1) Transistor junctian is shorted.

(2) External circuit CE shunting impedance is less than approximately 100 ohms. If in doubt as to whether (1) or (2) is the case, remove transistor from circuit and test.

(3) POLARITY switch is in wrong position. If SHORT light comes an in either POLARITY position (1) or (4) is the case.

(4) RED LINE SET-COARSE control left at too high a setting.

If shunting resistance is less than 100 ohms the test maybe carried out even through the SHORT light stays on, taking into consideration the reduced accuracy os given in Specification Section I paragraph C.

g. Press down SHORT TEST to BE position. If SHORT light comes an l ither:

(1) The base-emitter junction is shorted.

(2) Or the external resistance shunting the hose-emitter junction is approximately 50 ohms or less. if (2) is the case, test maybe carried out as noted in 2.f(4) above.

h. Adjust RED LINE SET-COARSE until meter reads on RED LINE. Use RED LINE SET-FINE for exact adjustment. This calibrates instrument for transistor being tested. If meter pointer does not move when control is advanced junction of transistor under test is open.

i. Press down BETA/gm switch to READ position. If meter pointer swings to the left beyond the 120/40 scale mark, set FUNCTION switch to a higher BETA range. If meter pointer swings all the way to the right, set FUNCTION switch to a lower BETA range.

i. Read BETA an meter scale corresponding to FUNCTION switch BETA range setting.

NOTE

if a diode or another transistor is connected in the base circuit of the transistor waler test, the base lead should be disconnected and isolated in order to obtain an accurate indication of beta.

3. Beta Test (Out-of-Circuit)

a. Place POLARITY switch in OFF position.

b Plato transistor to be tested in test socket an instrument panel. Probe cable should be removed to make certain leads are not inadvertently shorted. If more convenient, use test cable for connection to transistor instead of placing it in test socket.

c. Turn POLARITY switch to correct position for transistor type to be tested .

d. If short light comes an:

(1) Transistor collector-base or collector-emitter junction is shorted and no further test is necessary.

(2) POLARITY switch is in the wrong position. If short light comes on in l ither POLARITY position transistor junction is shorted.

l . follow procedure given above in paragraph 2., g. through i.

49 I_{co} Test (Out-Of-Circuit Only)

The I_{co} test must be made with transistor out of circuit due to the very small Currents involved .

a. Place POLARITY switch In OFF position.

b. Insert transistor In test socket. If more convenient use test cable for connection to transistor instead of placing it in socket.

c. Set FUNCTION switch to I_{co} 500 position.

d. Turn POLARITY switch to proper position for transistor type Leing tested .

e. Read current on microamp scale.

f. If meter indication is very small turn FUNCTION switch to I_{co} 50 position. (It should be remembered that I_{co} is a very temperature dependent parameter. The warmth transmitted to the transistor by holding it m the fingers will cause this current to increase.)

5. Diode Test (Out-Of-Circuit Only)

a. Place POLARITY switch in OFF position.

b. Turn DIODE FWD ADJ to counterclockwise position.

c. Insert diode into test socket, anode to C and cathode to E. If mare convenient use test cable for connection to diode instead of placing it in socket.

d. Place POLARITY switch in FWD position.

e. Turn DIODE FWD ADJ control until meter pointer comes up to red mark .

f. Turn POLARITY switch to REV position.

Read the reverse-to-forward ratio on the 10-100 BETA/DIODE scale and divide by10.

6. Field Effect Transistor Test (In-Circuit or Out-Of-Circuit)

a. Plato POLARITY switch in OFF position.

b. Insert transistor into test socket.

DRAIN to C
GATE to B
SOURCE to E

If more convenient use test cable for connection to translstor instead of placing it in socket

c. Place FUNCTION switch in FET position.

d. Turn POLARITY-switch to NPN position for an N-channel FET and PNP for a P-channel FET.

e. Adjust RED LINE SET control until meter painter is an the red line.

f. Press dawn BETA/gin switch to READ position.

g. Read transconductance an g_m meter scale.

SECTION III

THEORY OF OPERATION

A. BETA MEASUREMENT

1. General

When measuring beta of a translstor removed from the circuit, conventional ac or dc current measurments suffice. However, when measuring beta of a transistor connected in the circuit, these methods are inadequate. This is due to the difficulty of seperating actual transistor junction currents from apparent junction currents, These apparent currents results from resistances and reactance that ore an integral part of the clrcuit, shuntlng the transistor junctions. The Sierra Model 219C in-Clrcult Translstor Tester l WIW a method that practically eliminates erroneous reading caused by these clrcuits l xtmnoous to the transistor.

2. In-Clrcuit Second Harmonic Method

Figure 3-1 is a simplified diagram of the 219C tester when meauring beta. See Figure 4-1 for overall schematic diagram.

The transistor beta parameter is defined as the current gain of a common-emitter transistor configuration, and is expressed by the equation

$$\beta = \left.\frac{\Delta I_c}{\Delta I_b}\right| E_o = \text{a constant}$$

β = beta

ΔI_c =change in collector current caused by a change In base current

ΔI_b = change in base current

E_o =output voltage

When an ac signal is applied to the base of a common-emitter circuit with no base bias voltage, transistor conduction results in a current wave shape (approximately half sine wave having a high second-harmonic content in both the base and collector currents. These second-harmonic currents are directly related to transistor beta. They have no relation to currents flowing in the circuits extraneous to the transistor. These extraneous currents flaw through linear components and thus no second-harmonic currents are generated

SIMPLIFIED. DIAGRAMS

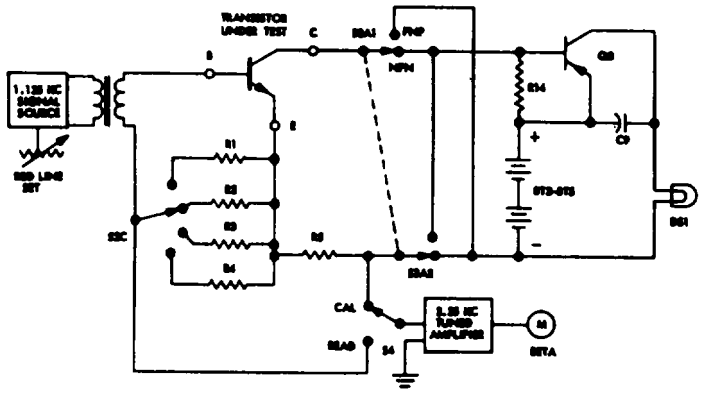


FIgure **3-1. Beta Test**

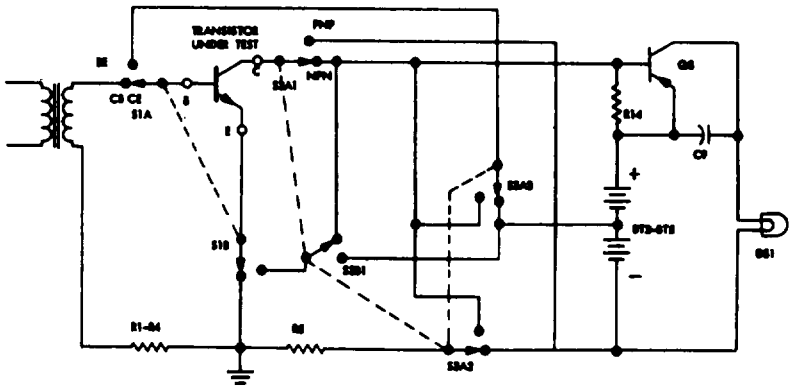


Figure **3-2. CE CB Short lost, NPN Transistor**

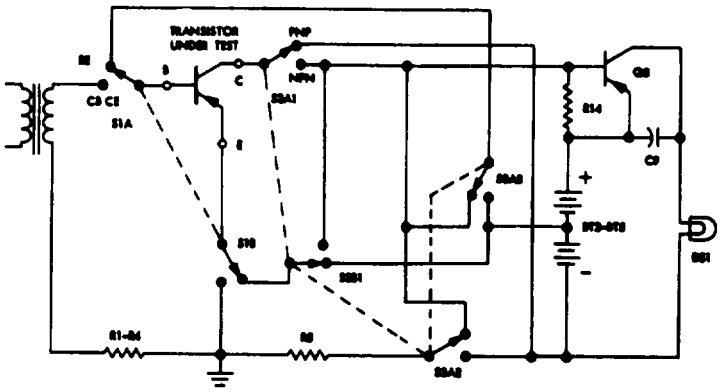


Figure **3-3. BE Short Test, PNP Transistor**

outside the t transistor. By measuring the relative values of the second-harmonic content of the base and collector currents, and applying the beta equation, an accurate determination of beta can be made. However, if there is a nonlinear device in the base circuit, such as another transistor or a diode, second-harmonic currents will be developed and can cause excessive error. Such a device should be disconnected for maximum accuracy.

From the basic beta equation, if I_c is held constant, beta will be inversely proportional to ΔI_b.

In the Model 219C Transistor Tester, the second harmonic Collector current of the transistor under test is set to a predetermined value with the RED LINE SET adjustment and is thus a constant. The base second harmonic current is then measured and indicated on the readout meter. The readout meter is calibrated directly in terms of beta as an inverse function of the current through the meter.

As shown in Figure 3-1, a 1.125 kc test signal is applied to the base of the transistor under test. The 2.25 kc. (second harmonic) tuned amplifier is switched across Collector load resistor R5, and the test signal is adjusted so that the readout meter indicates at the red I inc. When the tuned amplifier is switched across one of the series base resistors, R1-R4, the reading obtained on the meter indicates the beta of the transistor under test.

Currents do flow in the circuits extraneous to the transistor and this shunting effect reduces accuracy to a certain extent. Error does not begin to be significant, however, until these resistances are much less than 500 ohms. In-circuit readings may be taken with shunting resistances os low as 25 ohms, although accuracy will be considerably reduced at these low values.

B. INSTRUMENT CIRCUITS

1. Test Signal Source

The test signal source consists of a stable oscillator for frequency generation and an amplifier to raise the test signal to a suitable level.

a. 1.125 kc Oscillator. Q4 is connected in a common-base colpitts ascillator circuit in which L51-C51-C52 are the frequency determing components. L51 is tapped so that part of the inductance can be shunted out to raise the frequency to 2.25 kc when required for the Field Effect transistor test. Coupling to the amplifier is through two capacitors C54, C55. These capacitors also serve to block the dc bias currents from the RED LINE SET controls R64, R65.

b. Signal Source Amplifier. The signal is amplified by common-emitter amplifier Q5 and coupled to the push-pull output amplifier Q6-Q7 through transformer T51.

Sufficient signal level **is** provided by this amplifier to obtain approximately three milli-amperes average current into the collector of the transistor under test. This level is necessary to make the RED LINE SET calibration adjustment. One secondary of output transformer T52 provides negative feedback to the emitter of Q5 to reduce distortion and to reduce the output impedance of the amplifler, both of which are necessary for maximum accuracy of "in-circuit" beta measurement. The other secondary couples the output of the signal source to the transistor under test.

2. Applied Test Signal

The output of the signal source amplifier is applied to the base of the transistor under test. Since the base of the transistor is maintained at approximately the same dc voltage as the emitter (no bias) the signal appearing across both the base and the Collector sampling resistors of the transistor under test will be half-sine-wave pulses. This waveform, which is rich in second harmonic signal content, provides the desired test signal.

3. 2.250 kc Tuned Amplifier

Second harmonic voltages developed across the sampling resistors in the collector or base circuit of the transistor under test are amplified and rectified to provide a suitable meter readout. Since the fundamental frequency is also present, tuned circuits are necessary in the tuned amplifier to pass the second harmonic signals and reject the fundamental frequency.

The first tuned circuit is L1-C2, a series resonant circuit in the emitter of common-base amplifier Q 1. This circuit arrangement provides sufficient selectivity to reduce the fundamental to a point where it will not overdrive the input transistor. The second tuned circuit is the parallel resonant circuit, L2-C4, in the collector of common-emitter amplifier Q2. These circuits provide approximately 50 db rejection to the fundamental . Further amplification is provided by the common-emitter amplifier Q3 before the signal is applied to the bridge type meter rectifier CR1-CR4. Rectifier output is connected to the meter through switches S2B, S2G.

c . OTHER TEST CIRCUITS

1. Short Indicator Circuit

To indicate shorted junctions in the transistor under test, or low shunting resistance in the circuits external to the transistor, a Solid-state switch and indicator light are employed. R14, connected between emitter and base of transistor switch Q8, **is** in series with the test circuit in all test positions of FUNCTION switch, S2. Se. simplified schematics Figure 3-1 through 3-6. If current flow in the test circuit becomes excessive the voltage drop across R 14 biases Q8 into conduction causing SHORT indicator light, DS1, in the collector circuit of Q8, to come on.

With the SHORT TEST switch in the normal, CB CE, position an external shunting resistance of approximately 100 ohms between collector and base or emitter will cause the SHORT indicator to light. In the BE SHORT position an external shunting resistance of approximate y 50 ohms between base and emitter will cause the SHORT light to come on.

2. Short Test

The SHORT TEST applies a reverse bias to the junctions of the transistor under test. If the junction is normal only the regular leakage current will flow and there will be no SHORT indication. If the junction is shorted the excessive current flow will cause the SHORT indicator light to come on. (Open junctions will be detected in the Beta test.)

When the SHORT TEST switch, S1, is in the normal, CB CE, position the test battery, BT2 - BT5, is connected in series with the short indicator circuit to reverse bias both the CB and CE junctions of the transistor under test. See Figure 3-2. In the BE SHORT TEST position, S1 depressed, only the 3 volts of BT2, BT5 is applied through the short indicator circuit to reverse bias the BE junctian. See Figure 3-3. Although this voltage is sufficient for the test, it is low enough to protect transistors with a low BE voltage rating from damage.

3. I_{∞} Leakage Test Circuit

For this test, with FUNCTION switch S2 in the 50 microamp position, the six volt test battery is connected to reverse bias the collector-base j0unction of the transistor under test. The emitter must be open. The meter and a one thousand ohm current limiting resistor are a Isa in the circuit. Leakage current is read directly on the meter 50 microamp scale. In the 500 microamp FUNCTION switch position a meter range shunt, R7, is switched across the meter to increase the current range. See Figure 3-4. It will be noted that the emitter of the transistor under test is connected to ground. This electrode is effectively open since the remainder of the circuit is isolated from ground.

4. Diode Test Circuit

In the diode test position the six volt test battery is connected in series with the diode under test in the forward conduction made. The readout meter and its range shunt, R9, a current limiting resistor, R18, and DIODE FWD. ADJ. control, R19, are also in the series circuit. See Figure 3-5. For a reading to be made the meter is set to the red line as a calibration paint with the DIODE FWD. ADJ. control. When the battery polarity to the diode is reversed with polarity switch S3 (meter polarity is reversed at the same time), the reverse-to-forward ratio is indicated on the Beta/Diode scale and read from 1 to 10.

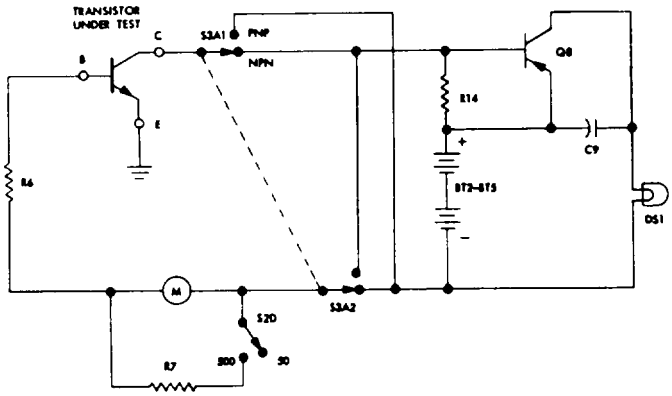


Figure 3-4. I_{co} Test

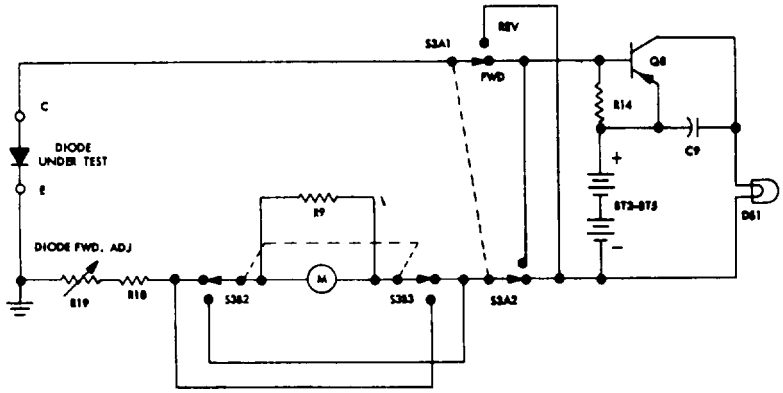
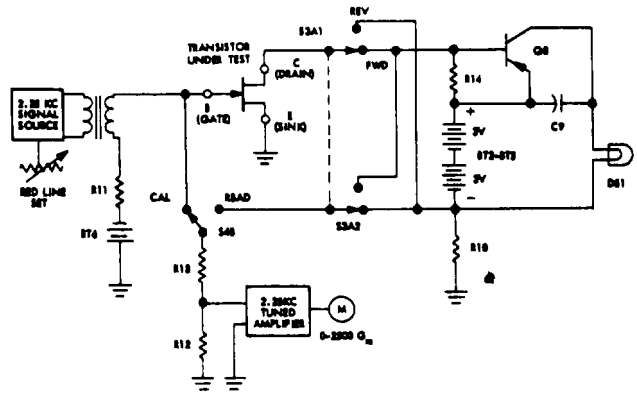


Figure 3-5. Diode Test



Ffgure 3-6. Field Effect Transistor Test

5. Field Effect Transistor Test

The field effect transistor is very similar to a vacuum tube in its operation so g_m is the significant factor for measurement.

$$\text{Since } g_m = \frac{\Delta i_o}{\Delta e_{in}}, \text{ and } i_o = \frac{\Delta e_o}{R_l}$$

$$\text{then } g_m = \frac{\Delta e_o}{\Delta e_{in} R_l}$$

where

g_m = transconductance

Δi_o = change in output current due to change in input voltage

Δe_{in} = change in input voltage

Δe_o = change in output voltage due to change in input voltage

R_l = load resistance

If e_{in} is held constant, then g_m varies directly with e_o, since RI is constant. In making a measurement, e_{in} is held constant by adjusting the input signal so that the meter reads to the Red Line when BETA/g_m,switch, S4, is in the CAL position. With switch, S4,in the READ positian the voltage developed across load resistor. R10, is measured and converted directly to g_m by the meter scale.

Since harmonic generation is not required for field effect transistor testing, a bias battery, BT6, is connected to the gate electrode to provide for I i near amplification of the test signal. In addition, a test signal of 2.25 kc is required since the meter amplifier is tuned to that frequent y. To change the oscillator frequency to 2.25 kc, switch S2H shunts out port of the tuning inductance in the Collector circuit of the signal source oscillator Q4.

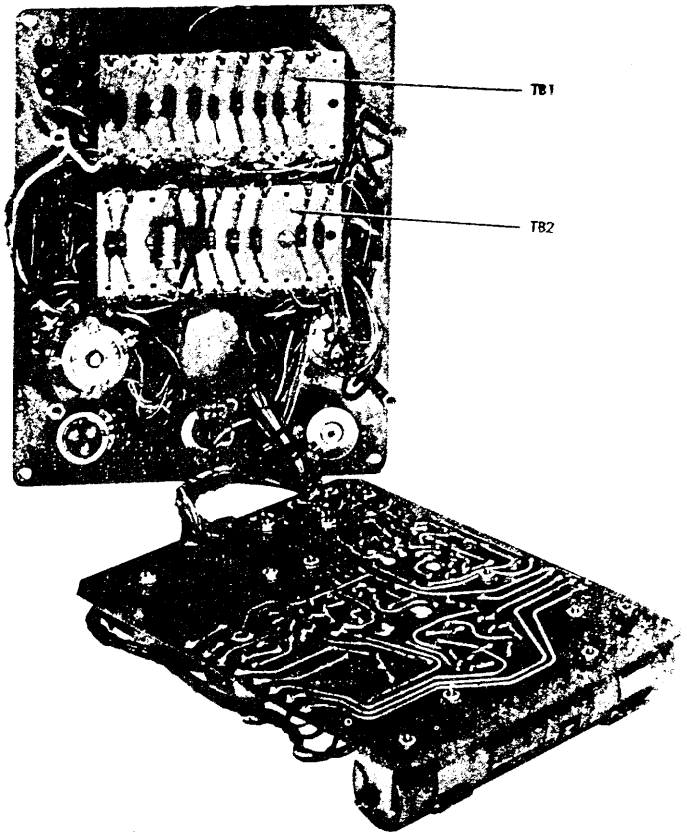


Figure 4-1. Rear of Front Panel Components

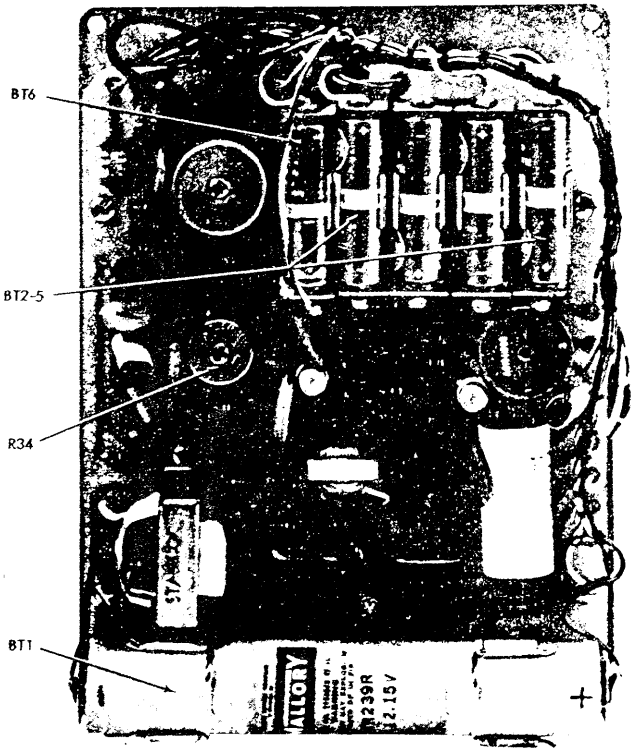


Figure 4-2. Rear Circuit Board Components

SECTION IV

MAINTENANCE

A. Preventive MAINTENANCE

The clips holding the batteries should be examined about every two months for signs of corrosion and cleaned if necessary. Wipe clean with rag. If necessary, polish with crocus cloth.

If the instrument is not to be used for some time, or is to be stored, the batteries should be removed and the battery clips cleaned. See paragraph D for instrument disassembly.

B. TROUBLE SHOOTING

1. Component Troubles

Expected component failure will usually be according to the following order from most likely to least likely: Weak or dead batteries, conductor breakage in most used test cable, erratic contact or operation of mast used controls, indicator light failure, instrument transistor beta and leakage current change, capacitor decreased leakage resistance, resistor change in value. Aside from normal expectations, a transistor junction short in the transistor tester circuit may cause the failure of one or more resistors due to excessive current flow.

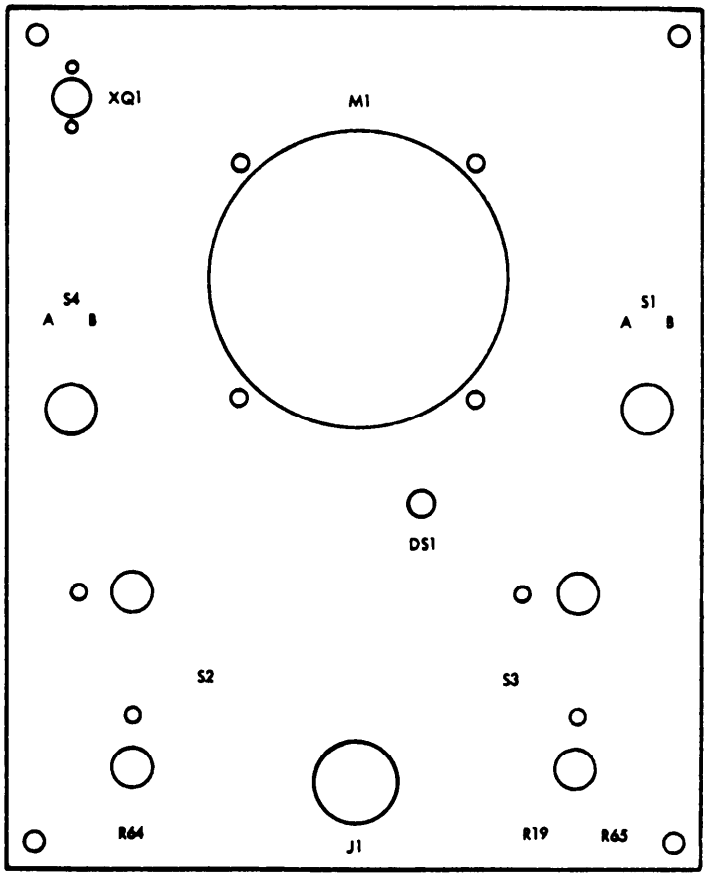
2. Functional Unit Checking

If the cause of improper functioning is not immediately apparent, the following procedure will help to localize the trouble to one functional unit. Refer to Figure 4-1 for overall schematic diagram.

a. Check battery condition. Make sure battery terminals are making good contact with their connector clips.

b. Check output of reference oscillator-amplifier with switch in BETA posit ion. Use calibration procedure given in paragraph 3 below to determine proper output. Check switch continuity from amplifier output to transistor under test.

If oscillator amplifier unit is functioning properly, place a transistor known to be good in the test socket. If meter does not indicate when RED LINE SET-COARSE control is advanced; check continuity through switches to 2.25 kc tuned amplifier and from amplifier output to meter. Check amplifier and rectifier. (Switch deck A is next to panel.)



Flgure 4-3. Component Location, Terminal Boards and Rear of Front Panel

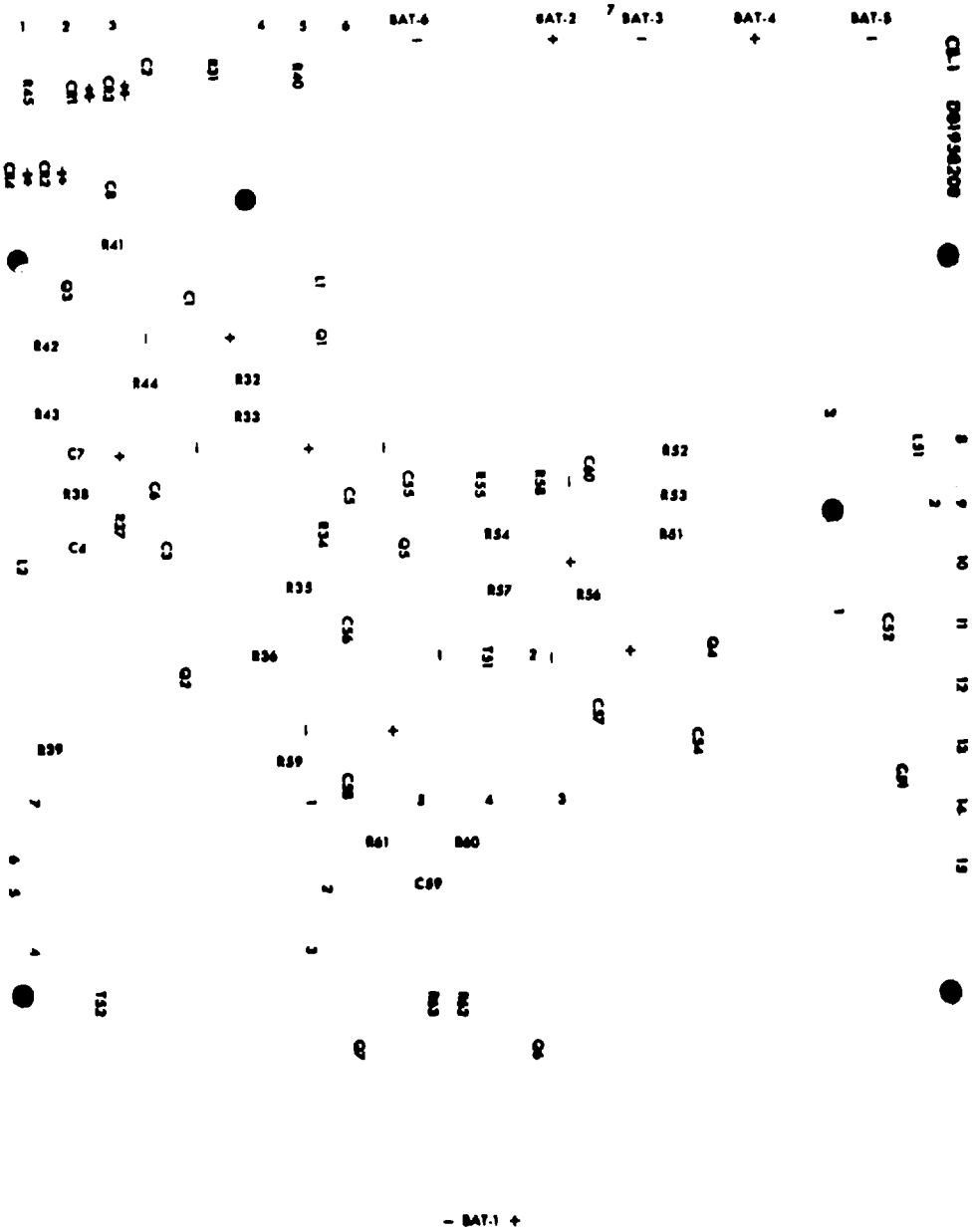


Figure 4-4. Rear Circuit Board Component Location

d. When a functional unit containing the trouble has been isolated, signal tracing techniques, using an oscilloscope, may be employed to isolate the difficulty to a particular area. Components related to that area then may be individually checked.

e. The SHORT indicator may be checked by connecting a 82-100 ohm resistor between C and E in one of the test sockets. If the light does not come on and batteries are o. k., Q8 is probably faulty.

c CALIBRATION

In the event of parts replacement or normal aging of the transistor compoents, re-calibration of the meter amplifier may be necessary.

Procedure is as follows:

1. With POLARITY switch in the OFF position, zero meter pointer with mechanical zero set adjustment.

2. Place a silicon transistor, known to be good, in one of the test sockets.

3. Set FUNCTION switch to the proper BETA range fro the test transistor being used.

4. Turn RED LINE SET-COARSE to maximum CCW. (Control turns somewhat horder when it reaches end of range.)

5. Connect a dc clip-on ammeter on the collector lead to the socket containing the test transistor. Set ammeter for current direction into the collector and switch to the 10 ma scale.

6. Turn POLARITY switch on transistor tester to NPN.

7. Adjust RED LINE SET-COARSE until the ammeter reads 3 ma ±1O%.

8. Adjust R34 (center-left on rear circuit board) until meter pointer is on the red line. Gain of meter amplifier is now properly set.

D. DISASSEMBLY FOR SERVICING

Remove four (4) screws in corners of front panel and SIide instrument out of case.

Remove four (4) screws which fasten rear circuit board to standoff spacers. Since all connecting wires are cabled at the top of this board it may now be folded out from the bottom and the instrument laid open an the test bench. This gives maximum access to components.

SECTION V

PREVENTIVE MAINTENANCE INSTRUCTIONS

A. SCOPE OF MAINTENANCE

The maintenance duties assigned to the operator and organizational repairman of the TS-1836A/u are listed below together with a reference to the paragraphs covering the specific maintenance functions. .

1. Operator's daily preventive maintenance checks and services (para D).
2. Organizational weekly preventive maintenance checks and services (para E).
3. Organizational monthly preventive maintenance checks and services (Para F).
4. Organizational quarterly preventive maintenance checks and services (para G).
5. Cleaning (para H).
6. Touchup painting (para I).

B. PREVENTIVE MAINTENANCE

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrance of trouble, to reduce downtime, and to assure that the equiment is serviceable.

1. Systematic Care. The procedures given in paragraphs H and I cover routine systematic care and cleaning essential to proper upkeep and operation of the TS-1836A/U.

2. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (para D through G) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat-serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and what the *normal* conditions are; the References column lists the illustrations, paragraphs, or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by performing the corrective action indicated, higher category of maintenance or repair is required. Records end reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750.

c. PREVETIVE MAINTENANCE CHECKS AND SERVICES PERIODS

Preventive maintenance checks and services of the equipment are required dally, weekly, monthly, and quarterly.

1. Paragraph D specifies the checks and services that must be accomplished daily (or at least once each week if the equipment is maintained in standby condition).

2. Paragraphs E, F, and G specify additional checks and services that must be performed on a weekly, monthly, and quarterly basis, respectively.

D. OPERATOR'S DAILY PREVENTIVE MAINTENANCE CHECKS AND SERVICES CHART

Sequence No.	Item to be inspected	Procedure	References
1	Completeness	Check to see that the equipment is complete (appx B).	None.
2	Exterior surfaces	Clean the exterior surfaces, including the panel and cover. Check the panel meter for cracked glass or a bent pointer.	Para H.
3	Connectors	Check the tightness of all connectors.	None.
4	Controls and indicators	While making the operating checks (item 5), check to see that the mechanical action of each switch and control is smooth and free of external or internal binding and that there is no excessive looseness.	None.
5	Operation	During operation, be alert for any unusual performance or condition.	None.

E. ORGANIZATIONAL WEEKLY PREVENTIVE MAINTENANCE CHECKS AND SERVICES CHART

Sequence No.	Item to be inspected	Procedure	References
1	Cables	Inspect cords, cables, and wires for chafed, cracked, or frayed insulation. Replace connectors that are broken, arced, stripped, or worn excessively.	None.
2	Handles and latches.....	Inspect handles and latches for looseness. Replace or tighten as necessary.	None.
3	Metal surfaces.....	Inspect exposed metal surfaces for rust and corrosion. Touchup paint as required.	Para l.

ORGANIZATIONAL MONTHLY PREVENTIVE MAINTENANCE CHECKS AND SERVICES CHART

Sequence No.	Item to be inspected	Procedure	References
1	Pluckout items	Inspect seating of pluckout items. Make certain that the crt tube clamp grips the crt base tightly.	None.
2	Jacks and plugs	Inspect jacks and plugs for snug fit and good contact.	None.
3	Printed circuit board	Inspect printed circuit boards for loose connections and cracks.	None.
4	Resistors and capacitors. . .	Inspect the resistors and capacitors for-cracks, blistering, or other detrimental defects.	None.

G. ORGANIZATIONAL QUARTERLY PREVENTIVE MAINTENANCE CHECKS AND SERVICES CHART

Sequence No.	Item to be inspected	Procedure	References
1	Publications	Check to see that all publications are complete, serviceable, and current.	DA Pam 310-4.
2	Modifications	Check DA Pam 310-4 to determine if new applicable MWO's have been published. All URGENT MO's must be applied immediately. ALL NORMA.L MWO's must be scheduled.	TM 38-750.
3	Spare parts	Check all spare parts (operator and organizational) for general condition and method of storage. There should be no evidence of overstock, and all shortages must be on valid requisitions.	

H. Cleaning

Inspect the exterior of Test Set, Transistor TS- 1836A/U. The exterior surfaces must be free of dirt, grease, and fungus.

1. Remove dust and other loose dirt with a clean, soft cloth.

WARNING

The fumes of TRICHLOROETHANE are toxic. Provide thorough ventilation whenever it is used; avoid prolonged or repeated breathing of vapor. Do not use near an open flame or hot surface; trichloroethane is nonflammable but heat converts the fumes to a highly toxic phosgene gas the inhalation of which could result in serious injury or death. Prolonged or repeated skin contact with trichloroethane can cause skin inflammation. When necessary, use gloves, sleeves and aprons which the solvent cannot penetrate.

2. Remove grease, fungus, and ground-in dirt from the case and cover of the test set. Use a cloth dampened (not wet) with trichloroethane.

3. Remove dirt from plugs and jacks with a brush.

4. Clean the front panel and control knobs with a soft clean cloth. If dirt is difficult to remove, dampen the cloth with water; use mild soap if necessary.

I. Touchup Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TM 43-0118.

SECTION VI
DEPOT OVERHAUL STANDARDS

A. Applicability of Depot Overhaul Standards

The tests outlined in paragraphs D through N of this section are designed to measure the performance capability of a repaired equipment. Equipment that is to be returned to stock should meet the standards given in these tests.

B. Applicable References

1. *Repair Standards.* Applicable procedures of the depots performing these tests, and the general standards for repaired electronic equipment given in TB SIG 355 1. TB SIG 355 2 and TB SIG 355-3 form a part of the requirements for testing this equipment.

2. Modification Work Orders. Perform all modification work orders applicable to this equipment before making the tests specified. DA Pam 310-7 lists all available MWO's.

C. Test Facilities Required

The test equipments given in the chart below are required for depot testing.

Item	Technical manual	Common name
Voltmeter. Electronic ME-30 (*)/U.	TM 11-6625-320-12	Ac vtvm
Multimeter TS 352B/U	TM 11-6625-366-15	Multimeter
Type 2N3640 transistor or equal.		
Type 2N3641 transistor or equal		
Type 2N4360 transistor or equal.		
Type 2N3684 transistor or equal		
Resistor 240K 1/2 watt ±5%		
Resistor 24K, 1/2 watt ± 5%		

Voltmeter. Electronic ME-30(*)/U designates Voltmeter. Meter ME-30A/U or Voltmeter, Electronic ME-30B/U. ME-30C/U. or ME-30E/U.

D. Battery Test

To perform the battery test, proceed as follows:

1. Zero the meter pointer of the TS--1836A/U, using the merchanical zero-set adjustment knob.

CAUTION

Make sure that the FUNCTION switch is not in either of the BAT positions when installing the Batteries.

2. Set the TS-1836A/U controls to the following positions:

Control	Position
POLARITY switch.	OFF
FUNCTION switch	I_{CO}
RED LINE SET-COARSE control	Fully counterclockwise

3. Remove the meter from the case.

4. Referring to figure 4 2, insert the batteries in their proper positions, observing correct polarity as indicated on battery holders.

5. Turn the FUNCTION switch to BAT -1TEST. The meter sould indicate in the green section, or slightly above. If the indication is below the green section. replace batteries BT2 through BT6 and repeat the test before proceeding.

6. Turn the FUNCTION switch to BAT- 2 TEST and the POLARITY switch to NPN. The meter should indicate in the green section, If the indication is below the green section, replace battery BT1 and repeat the test before proceeding.

7. Return the POLARITY switch to OFF.

CAUTION

Whcn the TS- 1836A/U is not in use, the POLARITY switch must be set to OFF.

E. Local Oscillator Check

1. Connect an ac vtvm between point 12 of the rear circuit board and ground. Point 12 is the fourth terminal counting from the positive end of battery BT1 (fig. 4 -2). Set ac vtvm to the IV range.

2. Set the POLARITY switch to NPN.

3. Set the FUNCTION switch to a BETA position (any one of four available). The ac vtvm should indicate an rms voltage of at least 0.35V.

4. Set the FUNCTION switch to FET. The ac vtvm should indicate an rms v'oltage of at least 0.21 V.

5. Return the POLARITY switch to OFF.

F. Meter Amplifier Adjustment

1. Zero the meter. using the mechanical zero-set adjustment.

2. Select an NPN silicon transistor that is known to be good for use as a test transistor.

3. Set the FUNCTION switch to the proper BETA range for the test transistor.

4. Turn the RED LINE SET-COARSE control fully counterclockwise. (This control is a 10-turn resistor without a mechanical stop. The maximum counterclockwise position is detected by the higher torque required for turning.)

5. Attach the probe assembly to the probe connector on the front panel of the TS- 1836A/U.

6. Attach the probe lead to the base and emitter terminals of the test transistor. Insert the multimeter between the collector terminal and collector probe lead. Set the multimeter to the 10-ma scale with current direction into the collector. Probe lead colors are coded as follows:

a. Blue: collector.

b. Green : base.

c. Yellow: emitter.

7. Turn the POLARITY switch to NPN.

8. Adjust the RED LINE SET-COARSE until the multimeter reads 3 ma ±10 percent.

9. Adjust R34 (renter-left on rear circuit board) until meter pointer is on the red line. The amplifier gain is now properly set.

10. Turn the POLARITY switch to OFF, and disconnect the probe.

11. Reinstall the TS-I836A/U in the case.

CAUTION

When setting up tests, the POLARITY switch must always be in the OFF position. Switching to NPN or PNP should not be done until all other switches have been positioned. Check carefully to see whether the test transistor is NPN or PNP.

CAUTION

Always reset the RED LINE SET-COARSE control to the extreme counterclockwise position. Excessive drive may cause the next transistor tested to be damaged when it is connected or plugged into the tester.

G. Beta and Polarity Operational Tests: PNP Transistor

Use the procedure given in I through 7 below for checking the Beta-test and polarity circuits.

1. Set the POLARITY switch to OFF.

2. Insert a type 2N3640 transistor that is known to be good in the transistor socket on the front panel. Make sure that the probe cable is disconnected at the front panel.

3. Set the FUNCTION switch to BETA 30-300.

4. Set the POLARITY switch to PNP.

5. Adjust the RED LINE SET-COARSE control until the meter indicates on the red line. Use the RED LINE SET-FINE control for exact adjustment. This procedure calibrates the TS– 1836A/U for the transistor being tested. If t he meter pointer fails to move when the control is advanced. the transistor junction is open.

6. Press down the BETA/g_m switch to READ. The meter pointer should be between 30 and 120 on the BETA scale.

7. Return the POLARITY switch to OFF, and reset the RED LINE SET-COARSE control to the extreme counterclockwise position,

H. Beta and Polarity Operational Tests: NPN Transistor

1. Insert a type 2N3641 transistor t hat is known to be good in the transistor socket on the front panel. Make sure that the probe is disconnected at the front panel.

2. Set the FUNCTION switch to BETA 30-300.

3. Set the POLARITY switch to NPN.

4. Adjust the RED LINE SET-COARSE control until the meter indicates on the red line. Use the RED LINE SET-FINE control for exact adjustment. This procedure calibrates the TS-1836A/U for the transistor being tested. If the meter pointer fails to move when the control is advanced, the transistor junction is open.

5, Press down the BETA/gin switch to READ. The meter pointer should be between 40 and 120 on the BETA scale.

6. Return the POLARITY switch to OFF, and reset the RED LINE SET-COARSE control to the extreme counterclockwise position,

1. I_{co} Operation Tests: 50 µA Range

Use the procedure given in 1 through 5 below for checking the I_{co} test circuits.

1. Insert the probe assembly in the PROBE socket on the front panel of the TS-1836A/U.
2. Connect a 240-kilohm, 1/2-watt ±5 percent resistor between the collector (blue) and base (green) leads oft he test probe.
3. Set the FUNCTION switch to I_{co} 50.
4. Set the POLARITY switch to NPN, The current indication on the meter should be 20 to 30 µA.
5. Return the POLARITY switch to OFF.

J. I_{co} Operational Tests: 500 µA Range

1. Connect a 24-kilohm, 1/2-watt ±5 percent resistor between the collector (blue) and base (green) leads of the test probe.
2. Set the FUNCTION switch to I_{co} 500.
3. Set the POLARITY switch to NPN. The current indication on the meter should be 200 to 300 µA.
4. Return the POLARITY switch to OFF.

K. Short Operational Tests

Use the procedures given in 1 through 7 below for testing the short indication circuits.

1. Set the FUNCTION switch to BETA.
2. Short-circuit the collector and base leads by clipping the blue and green probe leads together,
3. Set the POLARITY switch to NPN. The red SHORT light should light. Return the POLARITY switch to OFF, and remove the short-circuit.
4. Short-circuit the collector and emitter leads by clipping the blue and yellow probe leads together.
5. Set the POLARITY switch to NPN. The red SHORT light should light, Return the POLARITY switch to OFF, and remove the short-circuit.
6. Short-circuit the base and emitter leads by clipping the green and yellow probe leads together.
7. Set the POLARITY switch to NPN, and depress the SHORT TEST switch to BE, The red SHORT light should light. Return the POLARITY switch to OFF, and remove the short-circuit.

L. Diode Reverse-to-Forward Ratio Operational Test

Use the procedures given in 1 through 7 below for testing the reverse-to-forward ratio test circuits.

1. Turn DIODE FWD ADJ control to fully counterclockwise.
2. Set the FUNCTION switch to DIODE.
3. Insert a type 1N459 diode known to be good into the transistor test socket on the front panel, placing the anode at C and the cathode at E. Make sure that the probe cable is disconnected at the front panel.
4. Place POLARITY switch in FWD position.
5. Turn the DIODE FWD AD.] control until the meter pointer comes up to the red mark.
6. Turn the POL.ARITY switch to REV position. The meter pointer should move beyond the 100 mark on BETA DIOIDE scale.
7. Return the POLARITY switch to OFF.

M. Field Effect Transistor Transconductance Operational Tests: P Channel

Use the procedures given in 1 through 6 below to test the transconductance test circuits.

1. Insert a type 2N4360 FET into the transistor test socket on the front panel, Locate the transistor pins as given in *a, b,* and c below. Make sure that the probe cable is disconnected at the front pane].
   a. DRAIN to C.
   b. GATE to B.
   c. SOURCE to E.
2. Set the FUNCTION switch to FET.
3. Set the POLARITY switch to PNP
4. Adjust the RED LINE SET controls until the meter pointer is on the red line.
5. Press the BETA/gm switch to READ, Transconductance (g_m) scale should show between 700 and 2500.
6. Return the POLARITY switch to OFF, and reset the RED LINE SET-COARSE control to its maximum counterclockwise position.

N . Field Effect Transistor Transconductance Operational Tests: N Channel

1. Insert a type 2N3684 FET into the transistor test socket on the front panel. Locate the transistor pins as in paragraph M2 above.
2. Set the FUNCTION switch to FET.
3. Set the POLARITY switch to NPN.
4. Adjust the RED LINE SET controls Until the meter pointer is on the red line,
5. Press the BETA/gin switch to READ. Transconductance (g_m) scale should show between 2000
6. Return the POLARITY switch to OFF, and reset the ,RED LINE SET-COARSE control to its maximum counterclockwise position,

APPENDIX A
REFERENCES

Following are applicable references that should be available to the operator and maintenance personnel of Test Set, Transistor TS-1836A/U.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8 and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U.S. Army Equipment Index of Modification Work Orders.
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 11-6625-203-12	Operator and Organizational Maintenance: Multimeters AN/URM-105 and AN/URM-105C Including Multimeters ME-77/U and NE-77C/U.
TM 11-6625-320-12	Operator's and Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U, ME-30C/U, and ME-30E/U.
TM 11-6625-366-15	Operator's, Organizational, DS, GS, and Depot Maintenance Manual: Multimeter TS-352B/U.
TM 38-750	The Army Maintenance Management System (TAMMS).

APPENDIX B
BASIC ISSUE ITEMS LIST (BIIL) AND ITEMS TROOP INSTALLED OR AUTHORIZED LIST (ITIAL)

Section I. INTRODUCTION

B-1. Scope

This appendix lists only basic issue items required by the crew/operator for installation, operation, and maintenance of Test Set, Transistor TS-1836A/U

B-2 General

This Basic Issue Items and Items Troop Installed or Authorized List is divided into the following sections:

a. *Basic* Issue Items List - Section II. A list, in alphabetical sequence, of items which are furnished with, and which must be turned in with the end item.

b. Items Troop Installed or Authorized List-Section III. Not applicable.

B-3. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

a. Illustration This column is divided as follows:

(1) Figure *Number.* Indicates the figure number of the illustration in which the item is shown.

(2) Item *Number.* Not applicable.

b. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. *Part Number.* Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

d. Federal Supply Code for Manufacturer (FSCM). The FSCM is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., and is identified in SB 708-42.

e. *Description* Indicates the Federal item name and a minimum description required to identify the item.

f. *Unit of Measure (U/M).* Indicates the standard of basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation, (e.g., ea, in., pr, etc.). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

g. Quantity Furnished *with Equipment (Basic Issue Only).* Indicates the quantity of the basic issue item furnished with the equipment.

(1) Illustration		(2) Federal stock number	(3) Part number	(4) FSCM	(5) Description Usable on code	(6) Unit of mess	(7) Qty furn with equip
(A) Fig. no.	(B) Item no.						
1-1		92100010	94668		COVER, TEST SET	EA	1

APPENDIX C
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations for TS-1836A/U. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

a. *Inspect.* To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. *Service.* Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. *Adjust.* To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. *Align.* To adjust specified variable elements of an item to bring about optimum or desired performance.

f. *Calibrate. To* determine and cause c_{orrec}-tions to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. *Install.* The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. *Replace.* The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. *Repair.* The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. *Rebuild.* Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments components.

C-3. Column Entries

a. Column 1, Group *Number.* Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. *Column 3, Maintenance Functions.* Column 3 lists the functions to be performed on the item

listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance *Category.* Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C-Operator/Crew
O-Organizational
F-Direct Support
H-General Support
D-Depot

e. Column 5, *Tools and Equipment.* Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, *Remarks.* Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

C-4. Tool and Test Equipment Requirements (sec III)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

cl. *National/NATO Stock Number.* This column lists the National/NATO stock number of the specific tool or test equipment.

e. *Tool Number.* This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

C-5. Remarks (sect IV)

a. Reference Code. This code refers to the appropriate item in section II, Column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in section II.

SECTION II MAINTENANCE ALLOCATION CHART
FOR

TEST SET TRANSISTOR TS-1836A/U

(1) GROUP NUMBER	(2) COMPONENT,/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
00	TEST SET, TRANSISTOR TS-1836A/U	Inspect		0.2					A
		Inspect		0.5				4	
		Service		1.0				4	B
		Test		0.5				1	C
		Test				1.0		2	D
		Repair				1.5		2,3,6	
		Replace		0.2				4	
		Overhaul					3.0	2,3,5,6	
01	CABLE ASSEMBLY , SPECIAL PURPOSE, ELECTRICAL	Repair				1.5		3	
02	FRONT PANEL ASSEMBLY	Test				0.2		2	
		Repair				0.8		3	A
		Repair		0.2				4	
0201	TERMINAL BOARD ASSEMBLY TB1	Test				0.2		2	
		Repair				0.8		3	
0202	TERMINAL BOARD ASSEMBLY TB2	Test				0.2		2	
		Repair				0.8		3	
0203	CIRCUIT CARD ASSEMBLY	Test				0.2		2	
		Repair				1.0		3,6	

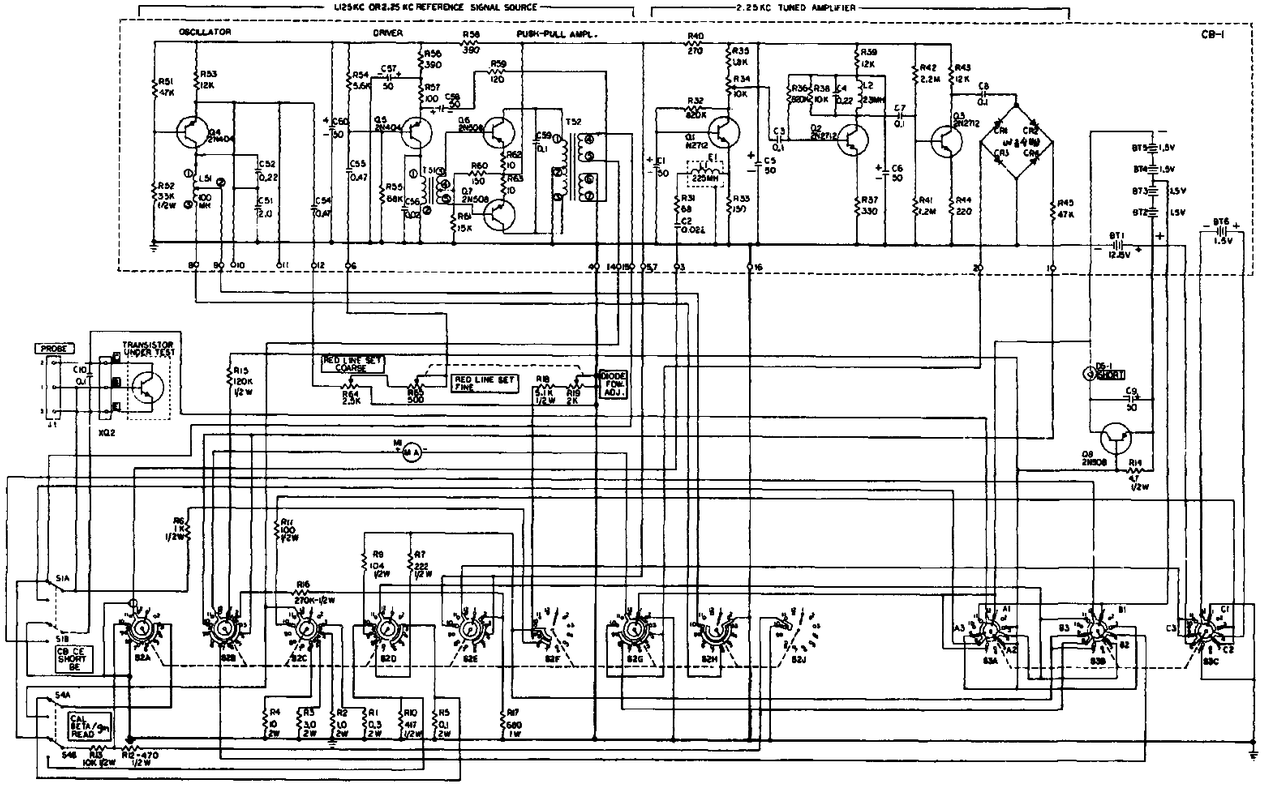
SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
TEST SET, TRANSISTOR TS-1836A/U

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NAT0 STOCK NUMBER	TOOL NUMBER
1	O	MULTIMETER AN/URM-105C	6625-00-999-6282	
2	H, D	MULTIMETER TS-352B/U	6625-00-553-0142	
3	H, D	TOOL KIT ELEC EQUIP TK-100/G	5180-00-605-0079	
4	O	TOOLS AND TEST EQUIPMENT AVAILABLE TO REPAIRPERSON USE: BECAUSE OF HIS/HER ASSIGNED MISSION		
5	D	VOLTMETER, ELECTRONIC ME-30/U	6625-00-669-0742	
6	H, D	TEST SST, TRANSISTOR TS-1836/U	6625-00-893-2628	

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	FUSES , DIALS, ETC.
B	CLEANING , PREVENTIVE MAINTENANCE, BATTERIES.
c	OPERATIONAL AND FUSE .
D	ALL TESTS .

*U.S. GOVERNMENT PRINTING 0FFICE : 1981 0 - 341-662 (9829)



NOTES:
1. ALL ROTARY SWITCHES SHOWN IN EXTREME COUNTER-CLOCKWISE POSITION AS VIEWED FROM FRONT OR KNOB END OF SWITCH.
2. ALL OTHER SWITCHES SHOWN IN NORMAL POSITIONS.
3. RESISTOR VALUES ARE IN OHMS AND 1/4 WATT UNLESS OTHERWISE NOTED. K=10^3, M=10^6.
4. CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE NOTED.
5. MOVING CONTACT ELEMENT IS REPRESENTED BY BLACK BAR IN ROTARY SWITCH SYMBOLS.

EXAMPLE

SWITCH FUNCTIONS		
SWITCH NO.	POSITION	FUNCTION
1 SHORT TEST	NORMAL DEPRESSED (SPRING RETURN)	CB, CE SHORT BE SHORT
2 FUNCTION	1	TEST BAT. 2,3,4,5,
	2	TEST BAT. 1
	3	BETA - 3-90
	4	BETA - 10-400
	5	BETA - 30-1200
	6	BETA - 100-3000
	7	Ico - 0-50 μA
	8	Ico - 0-500 μA
	9	DIODE 1-10
	10	F.E.T.
3 POLARITY	1	PNP (REV)
	2	OFF
	3	NPN (FWD)
4 BETA/9m	NORMAL DEPRESSED (SPRING RETURN)	CALIBRATE READ

Figure 4-5. Model 219C In-Circuit Transistor Tester Schematic Diagram

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.

SOMETHING WRONG WITH PUBLICATION

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE

BE EXACT PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER	SIGN HERE

TEAR ALONG PERFORATED LINE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

THE METRIC SYSTEM AND EQUIVALENTS

NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

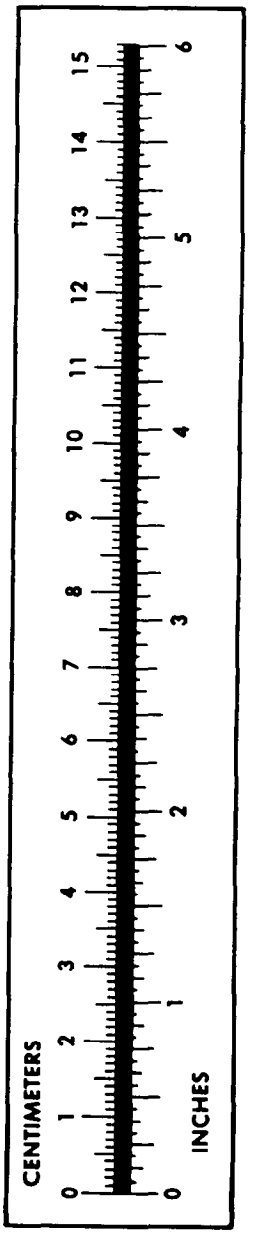
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



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