

TECHNICAL MANUAL

OPERATOR'S, AVIATION UNIT AND  
INTERMEDIATE MAINTENANCE MANUAL  
(INCLUDING DEPOT MAINTENANCE REPAIR  
PARTS AND SPECIAL TOOLS)  
FOR

TEMPERATURE AND SPEED SIMULATOR

H296A-1

NSN 4920-01-116-2631

This manual supersedes TM 55-4920-411-12&P, dated 27 July 1979, including all changes.

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HEADQUARTERS, DEPARTMENT OF THE ARMY  
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CHANGE }  
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 DEPARTMENT OF THE ARMY  
 WASHINGTON, D. C., 29 June 88

Technical Manual

Operator's, Aviation Unit and Intermediate  
 Maintenance Manual (Including Depot Maintenance  
 Repair Parts and Special Tools)

For

Temperature and Speed Simulator  
 H296A-1

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TM 55-4920-411-13&P, 2 June 1986, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	insert pages
i and ii	i and ii
A-1/A-2	A-1/A-2
B-1 through B-4	B-1 through B-4
C-1 through C-14	C-1 through C-3-2, I-1 through I-3
D-1 and D-2	D-1/D-2

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

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# OPERATOR'S, AVIATION UNIT AND INTERMEDIATE MAINTENANCE MANUAL

## TEMPERATURE AND SPEED SIMULATOR H296A-1

NSN 4920-01-116-2631

### REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to Commander, U.S. Army Aviation Systems Command, ATTN: AMSAV-MMD, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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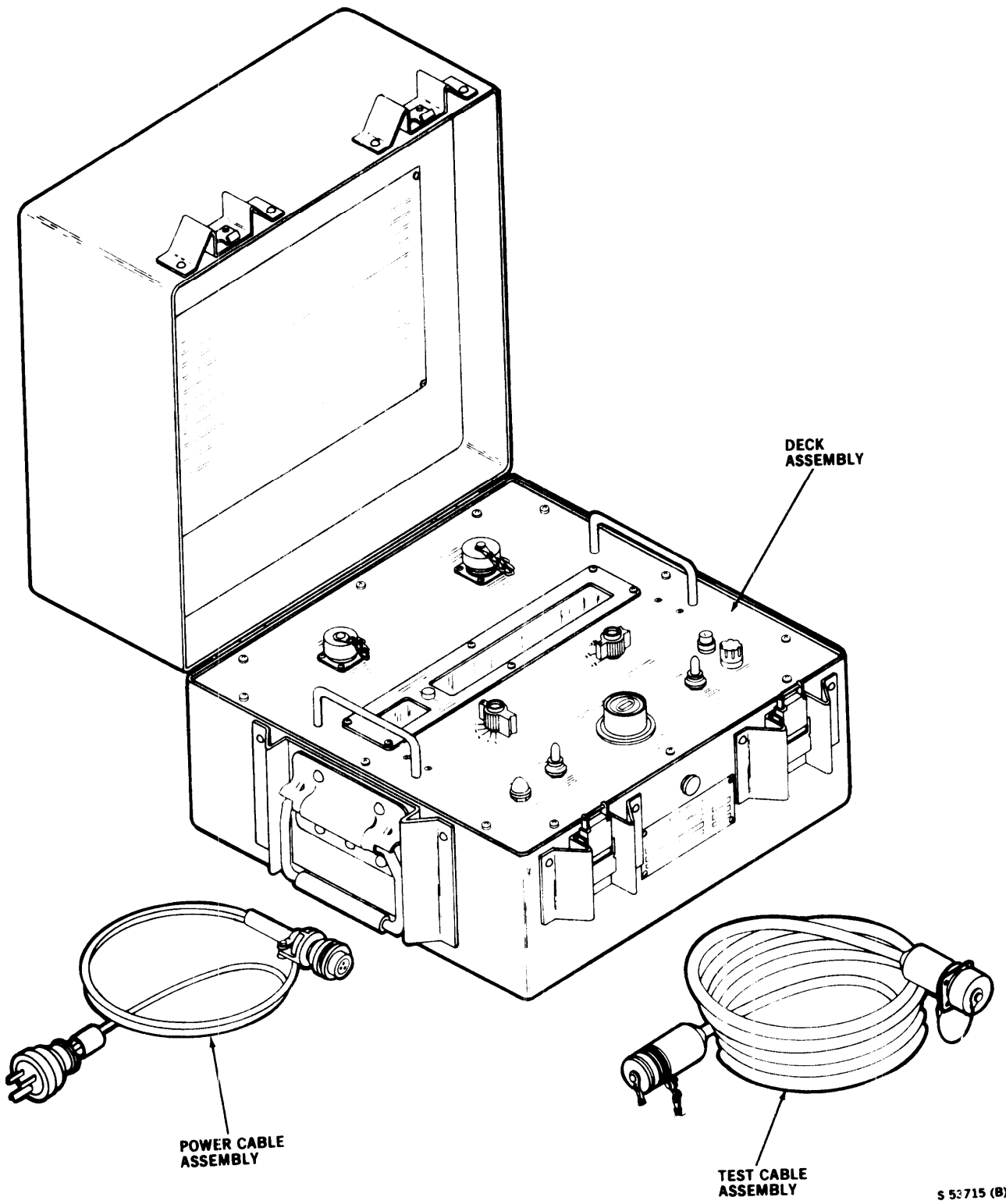


Figure 1-1. Temperature and Speed Simulator

# CHAPTER 1

## INTRODUCTION

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### Section 1. GENERAL

#### 1-1. Scope.

This manual describes the Temperature and Speed Simulator (Figure 1-1) and provides instructions for operation and aviation unit maintenance. It includes instructions for replacement of parts available to the operator aviation unit, and aviation intermediate maintenance repairmen and a repair parts and special tools list (RPSTL).

#### 1-2. Maintenance Forms, Records, and Reports.

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-751.

#### 1-3. Destruction of Army Material to Prevent Enemy Use.

Refer to TM 750-2414-2, Procedures for Destruction of Electronic Material to Prevent Enemy Use

#### 1-4. Preparation for Storage or Shipment.

For administrative storage, refer to TM 740-90-1 and Chapter 4.

#### 1-5. Quality Assurance/Quality Control (QA/QC).

Refer to FM 55-411 for information about quality assurance and quality control.

#### 1-6. Equipment Improvement Recommendations (EIR).

EIR can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to do a procedure; just simply tell why the design is unfavorable or why a procedure is difficult. EIR may be submitted on SF 368 (Quality Deficiency Report). Mail directly to Commander, US Army Aviation Systems Command, ATTN: AMSAV-MPSD, 4300 Goodfellow Blvd. St. Louis, MO 63120-1798. A reply will be furnished to you.

### Section II. EQUIPMENT DESCRIPTION AND DATA

#### 1-7. Purpose and Use.

The Temperature and Speed Simulator test set checks the operation of the auxiliary power unit (APU) start sequence control in the UH-60A Helicopter. For proper operation of the start sequence control, the test set provides selectable frequency and temperature output signals to the control, and monitors switch closures from the control. The test also provides signals to simulate low oil pressure and high oil temperature, and includes an elapsed time clock to time the start sequence.

#### 1-8. Description

Temperature and Speed Simulator (Figure 1-1) is in a portable metal case. Test cable and power cable are in the lid. POWER input and SIGNAL OUTPUT connectors and all operating switches, controls, and displays are on a single deck. Two handles permit easy removal of the deck when opening the unit.

#### 1-9. Equipment Data.

Refer to Table 1-1 for equipment data.

Table 1-1. Equipment Data

Power Input:	115 vac, 50-400 Hz. 10 va
Frequency Output:	Five selectable values (5, 15, 70, 90, and 110% rpm), where 100% rpm = 4800 Hz
Frequency Output Variation:	± 5% rpm about each selectable value in 1% rpm units Note one exception At 5% setting, lower limit of output is not 0% rpm. but is instead 1% rpm = 48 Hz.
Frequency Output Amplitude:	10 volts peak-to-peak square wave
Switch Monitoring Lamps:	Six red light emitting diode (LED) lamps identified as follows: L1 L2 L3 L4 L5 L6
Sequence Timer:	0 to 99 seconds in 1 second units.
Temperature output :	Simulated chromel-alumel thermocouple signal variable from 0°C (32° F) to 800°C (1472°F) in 1°C (2°F) units with digital potentiometer.
Dimensions	35.5 cm (14 inches) wide by 35.5 cm (14 inches) deep by 30.5 cm (12 inches) high.
Weight:	7.26 kg (16 lbs)

## CHAPTER 2

## SERVICE UPON RECEIPT

## Section 1. SITE AND SHELTER REQUIREMENTS

**2-1. Siting.**

The only requirement for operating the Temperature and Speed Simulator is the availability of 115 vac, 50-400 Hz power source supplying 10 volt-amperes.

## Section II. SERVICE UPON RECEIPT OF MATERIEL

**2-2. Unpacking.**

*a. Packaging Data.* When received, the Temperature and Speed Simulator is packaged in a corrugated cardboard carton 50.8 cm (20 inches) long by 50.16 cm (19-3/4 inches) wide by 41.275 cm (16-1/4 inches) deep. The volume of the carton is 0.1 cubic meters (3.7 cubic feet), and the total weight of the carton when packed for shipment is about 14.4 kg (32 pounds). A typical shipping carton and contents is shown in Figure 2.1.

*b. Removing Contents.*

(1) Cut or remove gummed tape from top of carton, and open top of carton

(2) Remove polyethylene cushioning material from top of carton.

(3) Lift carrying case from carton and remove remaining polyethylene cushioning material.

**2-3. Checking Unpacked Equipment.****CAUTION**

To open the test set, release air pressure by opening the air release valve.

a. Inspect equipment for damage caused during shipment. If equipment has been damaged, report it on DD Form 6 in accordance with instructions in AR 700-58.

b. Check equipment against component listing in operator's manual anti packing slip, to see if shipment is complete. Report all discrepancies per instructions of DA PAM 738-751. Equipment should be placed in service even though a minor assembly or part that does not affect proper functioning is missing.

c. Check to see whether equipment has been modified (Equipment which has been modified will have the MWO number on the front panel, near the nomenclature plate.) Check also to see whether all currently applicable MWO have been applied. (Current MWO applicable to the equipment are listed in DA PAM 310-1.)



### Section III. INSTALLATION INSTRUCTIONS

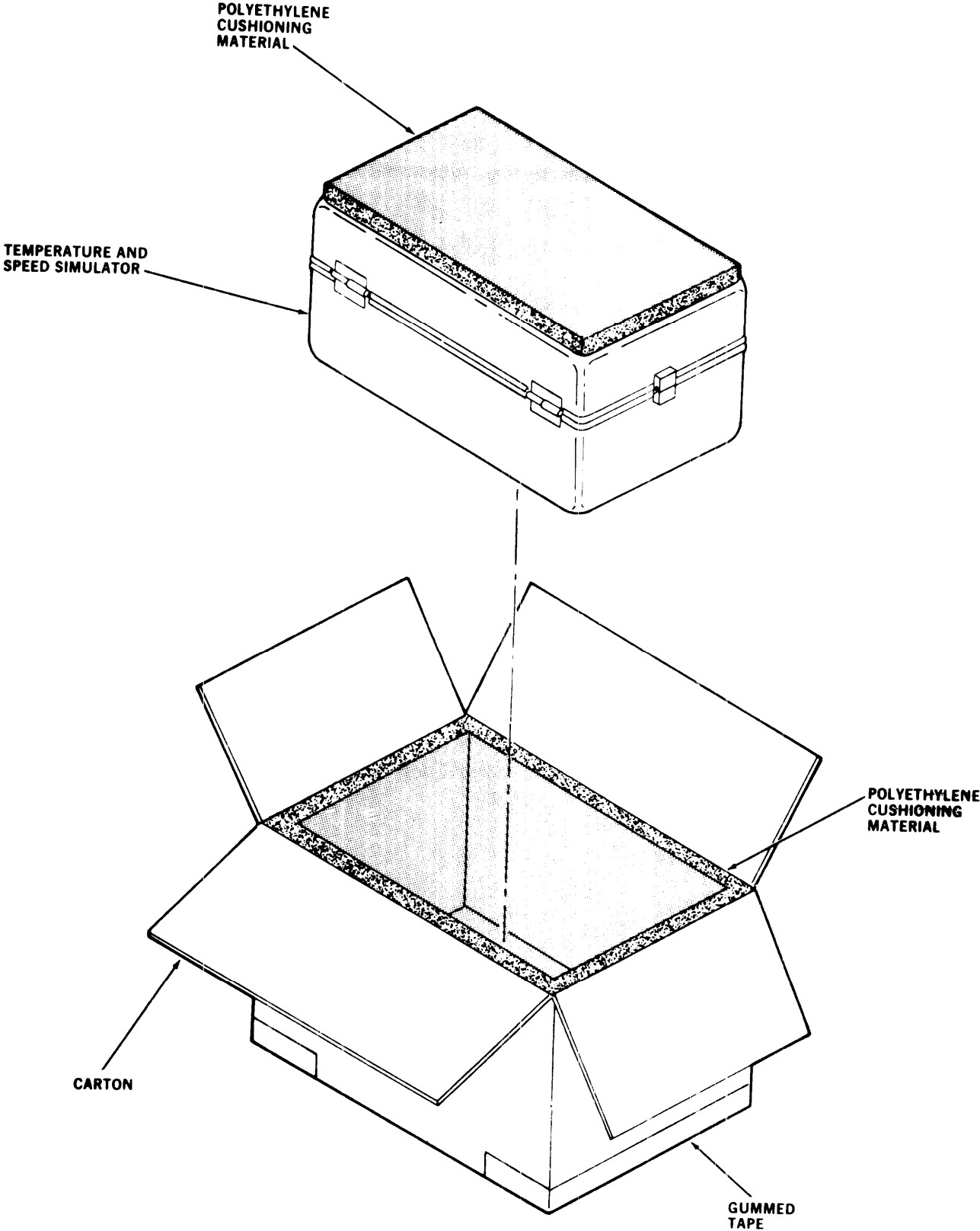
**2-4. Connections.**

Cable connections to Temperature and Speed Simulator are shown in Figure 2-2. The chart below lists

interconnecting cable assemblies and their terminations.

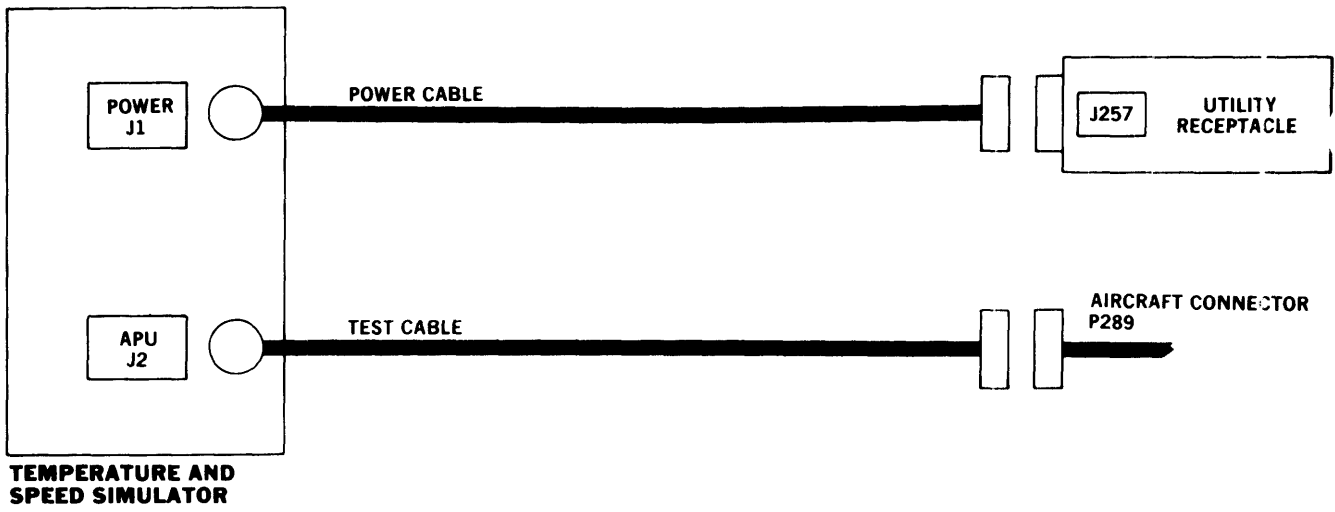
Cable	Cable Terminations	
	Temperature and Speed Simulator	Helicopter Connector*
Power	J1	J257
Test	J2	P289


\*Refer to TM 55-1520-237-23-3.



S 53716 (B)

Figure 2-1. Typical Packaging



<b>NOTE</b>
1.  INDICATES EQUIPMENT MARKINGS.

S 13725 (B)

Figure 2-2. Test Setup Diagram

## CHAPTER 3

## OPERATING INSTRUCTIONS

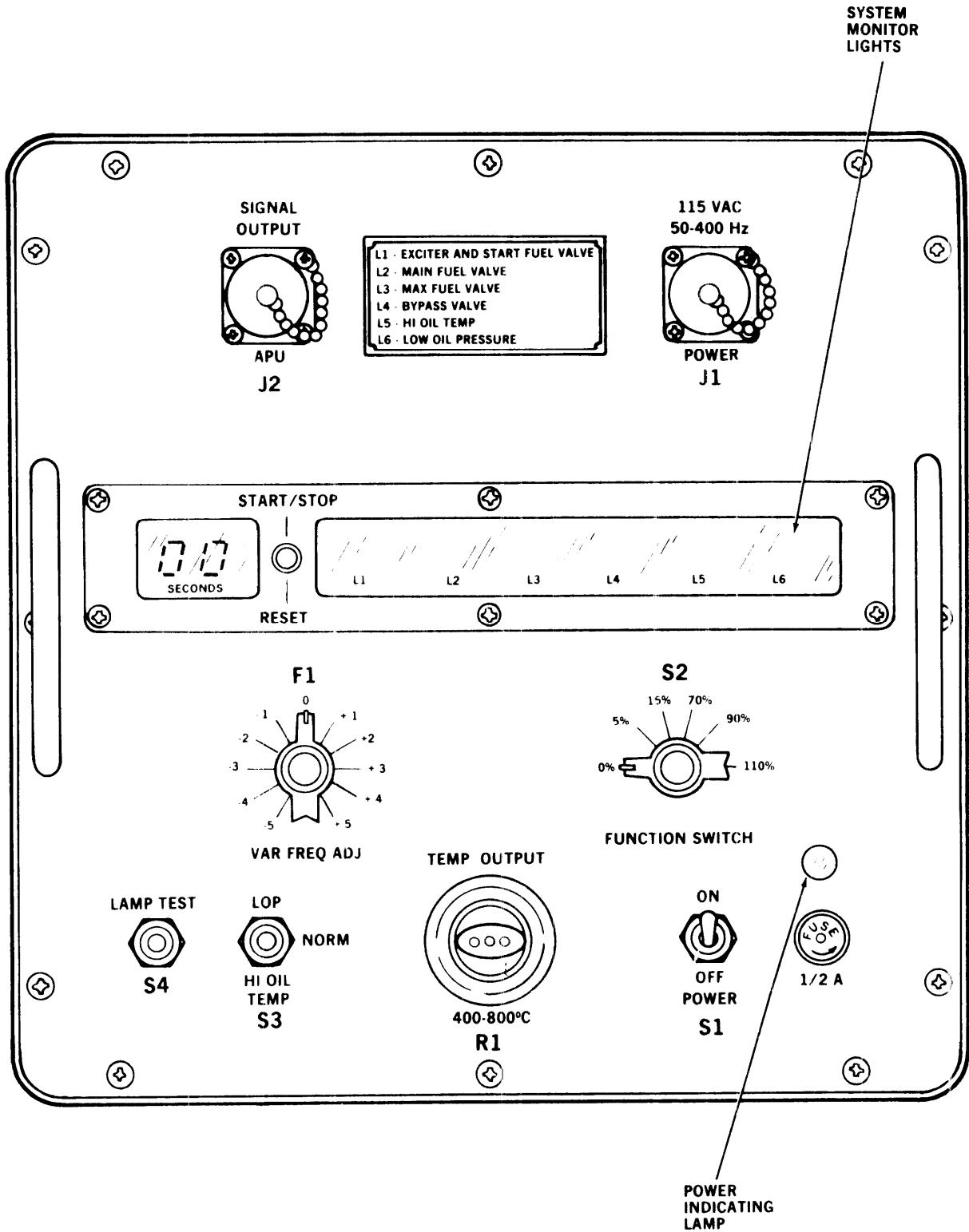
## Section I. CONTROLS AND INSTRUMENTS

**3-1. Operator's Controls.**

All operator's controls, indicators, and connectors are shown in Figure 3-1 and described in Table 3-1.

Table 31. Indicator and Control Functions

Indicator, Control or Connector	Function
SIGNAL OUTPUT APU (J2) connector	Connects frequency and temperature outputs through test cable to start sequence control. Also connects switch inputs to test set.
115 VAC, 50 – 400 HZ POWER (J1)	Power input connector connects to power cable.
SECONDS display	Manually-actuated sequence timer displays intervals over range 0-99 seconds.
START/STOP RESET switch	Starts, stops, and resets SECONDS timer.
Lamps L1 – L6	Monitor APU switch closures. Lamps L1 through L6 monitor exciter and start fuel valve, main fuel valve, max fuel valve, bypass valve, high oil temp, and low oil pressure, respectively.
VAR FREQ ADJ (F1)	Adjusts frequency output, selected by FUNCTION SWITCH, in 1% rpm units over range $\pm 5\%$ rpm. See Note in paragraph 3-3.
FUNCTION SWITCH (S2)	Selects 0, 5, 15, 70, 90 or 110% rpm frequency output when VAR FREQ ADJ is in zero position
LAMP TEST switch (S4)	Tests lamps L1 – L6.
LOP/HI OIL TEMP/NORM switch (S3)	Simulates low oil pressure, high oil temperature, and normal operating conditions.
TEMP OUTPUT, 400° — 800°C (R1)	Adjusts simulated chromel-alumel signal output.
POWER switch (S1)	Controls application of power to signal unit.
Power indicating lamp (DS1)	Indicates when power is applied to (on) or removed from (off) test set.



S 53717 (B)

Figure 3-1. Operator's Controls and Indicator Lamps

## Section II. OPERATION UNDER USUAL CONDITIONS

### CAUTION

To prevent damage to equipment, do not operate Temperature and Speed Simulator at Ambient Temperatures of -25°C, or lower.

#### 3-2. Preliminary Starting Procedure.

- a. Place POWER switch (S1) OFF.
- b. Place LOP/HI OIL TEMP switch (S3) to NORM.
- c. Turn FUNCTION SWITCH (S2) to 0%.
- d. Turn VAR FREQ ADJ (F1) to 0.
- e. Connect Simulator as shown in Figure 2-2.

#### 3-3. Operation Procedure.

##### NOTE

Additional operational checks of APU system is listed in TM 55-1520-237-23-3.

- a. Place POWER switch in OFF position.
- b. Turn FUNCTION SWITCH to 0%.
- c. Turn VAR FREQ ADJ to 0.
- d. Connect BH18604A test cable to SIGNAL OUTPUT connector and to appropriate connector on APU as shown in figure 2-2.
- e. Connect BH2833 power cable to POWER connector and to a 115 vac, 50 to 400 Hz power source.
- f. Place POWER switch and OIL PRESSURE switch in ON position. Power lamp should illuminate and SECONDS display should read 00.
- g. Press LAMP TEST switch Lamps L1 through L6 should illuminate.
- h. Determine at what frequencies the events L1 through L6 occur in the APU under test.
- i. Select frequencies using the FUNCTION SWITCH and VAR FREQ ADJ.

##### NOTE

The FUNCTION SWITCH selects outputs of 5, 15, 70, 90, or 110% rpm. The VAR FREQ ADJ increases or decreases these outputs by + 1, 2, 3, 4, or 5% rpm. An exception occurs when the FUNCTION SWITCH is at 5% and the VAR FREQ ADJ is at -5, the frequency output is 1% rpm (not 0% rpm), equivalent to 48 Hz.

j. Adjust TEMP OUTPUT potentiometer to produce simulated temperature that lights the CAUTION light on annunciator panel.

k. Place the OIL PRESSURE switch in OFF position and L 1 through L6 will turn off.

1. The SECONDS display provides a means of measuring start cycle duration in seconds (0 to 99). The START/STOP/RESET switch, adjacent to the display, allows the operator to start, stop, or reset the display.

#### 3-4. Procedures for Shutdown.

- a. Place POWER switch (S1) OFF
- b. Disconnect Simulator cables.

#### 3-5. General Theory of Operation.

- a. Signal Generator Board,

(1) The output of the 1 MegaHertz oscillator on the signal generator board (figure 3-2) is divided down to 768 Hz by a frequency divider consisting of Z1, Z2, and Z7. The output of the frequency divider provides the reference signal for phase-locked loop Z6, Function switch S2 and variable frequency adjust F1 preset a programmable frequency divider ( $\div N$ ). The output of the phase-locked loop (VCO out) is defined by the equation  $f_{vco} = N \times 768 \text{ Hz}$ . An additional frequency divider (Z7) makes the signal unit output frequency =  $\frac{N \times 768}{16}$  or 48N. Since 100% rpm = 4800 Hz,  $N = 100$  at 100% rpm.

(2) The temperature output adjust controls the gain of operational amplifier A5 in the temperature signal generator. Two thermal resistors cancel the thermocouple effect created by the joining of the thermocouple output leads to the copper wiring of the signal generator.

b. Display Board. One megahertz from the signal generator board is divided down to 1 Hz by Z6-Z8. This 1 Hz signal is then counted, decoded and displayed. Switch monitoring lamps L1-L6 are excited by 28 vdc from the APU. Load resistors R1-R6, located on a heat sink in the bottom of the signal unit, provide the required load for the APU switches.

**3-6. Operation Instructions.**

Signal unit indicators and controls are shown in figure 3-1 and listed with their functions in table 3-1.

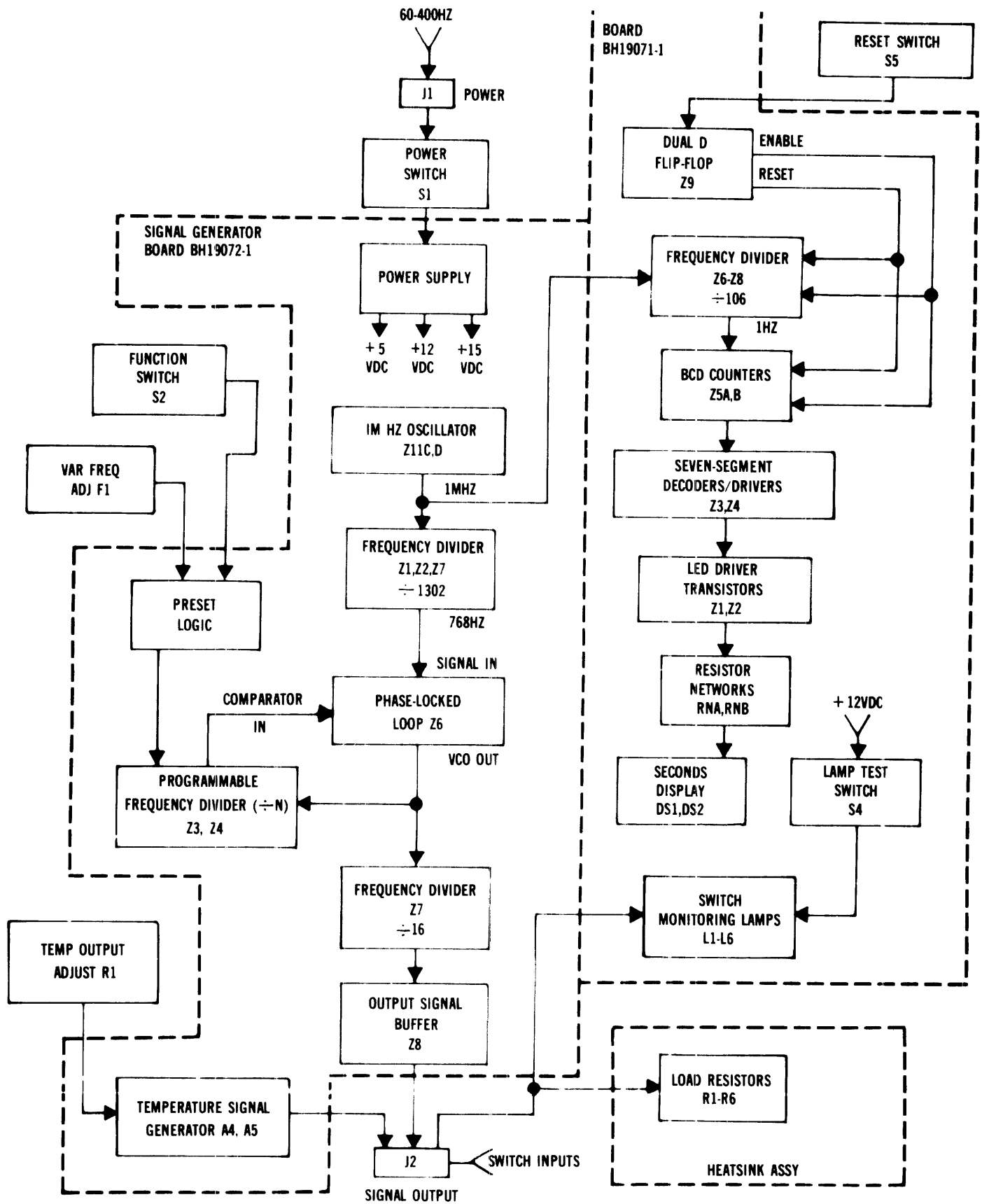


FIGURE 3-2. Block Diagram of Speed-Temperature Signal Unit





# CHAPTER 4

## MAINTENANCE INSTRUCTIONS

### Section I. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

#### 4-1. General.

Preventive maintenance checks and services consists of a visual inspection to be done at each operation of the test set, operational check, any troubleshooting required, and the repair required to correct any malfunctions. If your equipment does not operate, troubleshoot

with proper equipment Report any deficiencies using the proper forms, see DA PAM 738-751.

#### 4-2. Inspections.

Do inspections as shown in Table 4-1.

Table 4-1. Operator/Aviation Unit Preventive Maintenance Checks and Services

**NOTE:** Within designated interval, these checks are to be performed in the order listed.

B – Before  
D – During  
A – After

Item No.	Interval					C	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment is not ready/ available if:
	B	D	A	W	M				
1	•		•				Cables	Check for broken wires, burnt insulation, damage or dirt in connectors.	
2	•						Controls and Switches	Positive action and freedom (of movement).	
3	•						Bezel	Cleanness and absence of scratches.	
4		•					Lights and Indicators	Check operation of lights.	

### Section II. TROUBLESHOOTING

#### 4-3. Scope.

a. This section contains troubleshooting or malfunction information and tests for locating and correcting most of the troubles which may develop in the Temperature and Speed Simulator. Each malfunction or trouble symptom for an individual component, unit, or

system is followed by a list of tests or inspections necessary for you to determine probable causes and corrective actions for you to remedy the malfunction.

b. This manual cannot list all possible malfunctions that may occur or all tests or inspections and corrective actions. If a malfunction is not listed (except when

malfunction and cause are obvious), or is not corrected by listed corrective actions, you should notify higher level maintenance.

c. Table 4-2 lists the common malfunctions that you may find during the operation or maintenance of the

Temperature and Speed Simulator or its components. You should do the tests/inspections and corrective actions in the order listed.

Table 4-2. Troubleshooting, Aviation Unit

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
<p>1. POWER INDICATING LAMP DOES NOT GO ON WITH SIMULATOR PROPERLY CONNECTED AND POWER AVAILABLE.</p> <p>Step 1. Place POWER switch (S1) ON. Power indicating lamp should go on.</p> <ul style="list-style-type: none"> <li>a. Replace 1/2A fuse.</li> <li>b. Replace power indicating lamp.</li> <li>c. Send simulator - to higher maintenance.</li> </ul>
<p>2. LAMPS L1 THROUGH L6 DO NOT TO ON WITH LAMP TEST SWITCH PRESSED.</p> <p>Step 1. Press LAMP TEST switch Lamps L1 through L6 should go on.</p> <ul style="list-style-type: none"> <li>a. If lamps do not go on send simulator to higher maintenance</li> </ul>
<p>3. SECONDS DISPLAY DOES NOT OPERATE WHEN START/STOP RESET BUTTON IS PRESSED.</p> <p>Step 1. Press START/STOP RESET button. SECONDS counter should step through 99 then reset to 00 and continue counting.</p> <ul style="list-style-type: none"> <li>a. If SECONDS counter does not operate, send simulator to higher maintenance.</li> <li>b. If only one side of SECONDS counter does not operate, replace malfunctioning LED, paragraph 4-6.</li> </ul>

### Section III. REPAINTING AND REFINISHING INSTRUCTIONS

#### 4-4. Cleaning Instructions.

equipment is readily available prior to use.



Observe all cautions and warnings on containers when using consumables. When applicable, wear necessary protective gear during handling and use. If a consumable is flammable or explosive, MAKE CERTAIN consumable and its vapors are kept away from heat, spark, and flame. MAKE CERTAIN helicopter is properly grounded and firefighting

- a. Remove dust and loose dirt with a clean, soft cloth, item 5, App. D.
- b. Remove grease, fungus and ground-in dirt with cloth dampened with dry-cleaning solvent, item 4, App. D.
- c. Remove moisture with a dry cloth.

**4-5. Repainting and Refinishing Instructions.**

**NOTE**

Refer to TM 43-0139. Painting Instructions for Field Use.

a. Repaint test set using these colors:

(1) Case (interior). Finished with two coats of gray baked enamel, item 1, App. D.

(2) Case (exterior). Finished with two coats of yellow baked enamel, item 2, App. D.

(3) Instrument Deck (front only). Since deck is photo-etched, it cannot be refinished. Retouch using instrument black enamel, item 3, App. D Enamel is then covered with one coat of clear, flat lacquer.

Section IV. MAINTENANCE, REPAIR AND REPLACEMENT OF AUTHORIZED PARTS

**4-6. Maintenance.**

a. The only authorized replacement of authorized parts by Aviation Unit personnel (AVUM) is indicated in App B. Maintenance allocation chart and identified below. (Knobs, lamps seconds display and fuse).

(1) Knobs.

Knobs for VAR FREQ ADJ (f1) switch and FUNCTION SWITCH (S2) are both attached using two socket head setscrews, that are included with the knob.

(2) Power Lamp.

The power indicating lamp, immediately above the half-ampere fuse, is replaced by unscrewing the yellow lamp cap and lifting out the malfunctioning lamp

(3) Seconds Display.

Remove seconds display as follows:

(a) Remove six screws holding display bezel to deck, and remove bezel.

(b) Gently lift malfunctioning display package from board, and replace with a new package

(c) Inspect bezel screws before reinstalling, and replace screws if seals are worn.

(d) Inspect and replace bezel if damaged.

(4) Fuse.

The fuse is replaced by unscrewing the fuse cap and lifting out the malfunctioning fuse.

(5) Power Lamp Lens.

Unscrew and remove power lamp lens.

(6) Cable Assemblies.

Remove cable assembly from Simulator case and send to higher maintenance.

(7) Bezel Assembly

Remove six screws holding bezel as assembly to deck.

(8) Lubrication.

None is required.

b. Authorized repair of the Temperature-Speed Simulator Test Set by Aviation Intermediate Maintenance (ATST) personnel is indicated in App. B, Maintenance Allocation Chart.

**NOTE**

Aviation Intermediate Maintenance (ATST) will perform only the authorized maintenance which includes replacement and repair of components and end items which can be accompanied efficiently with available skills, tools, and test equipment. Evacuate circuit boards, components, and end items beyond capability of ATST to the Depot.

**NOTE**

Perform paras 4-8, 4-9, and 4.10 as directed by troubleshooting table 4-3 and Waveform Test points table 4-4 or as applicable. Schematic diagrams and assembly boards are listed in figures 4-1 through 4-6. Do not replace circuit board if repair can be accomplished for authorized replacement components on display and signal generator boards.

Table 4-3. Troubleshooting Table, AVIM

**NOTE**

Use table 4-4 when troubleshooting Signal Generator Display Boards in conjunction with this table as applicable. (Also, see figures 1-1, 4-5, 4-6 and FO-1).

TROUBLE	PROBABLE CAUSE	REMEDY
Power lamp fails to light when power switch is on. (Para 4-8)	Open fuse, FUI  Defective POWER switch, S1  Defective power lamp, DS1  Defective power cable	Replace (Fig 4-5)  Replace (Fig 4-5)  Replace (Fig 4-5)  Repair or replace
SECONDS display does not read 00 when power is applied to signal unit. (Para 4-8)	Defective display/s, DS1, DS2  C4, R9, Z1-Z5, or Z9 on display board  + 12 vdc or + 5 vdc supply on signal generator board T1 or associated components	Replace (Fig 4-1)  Replace (Fig 4-1 and 4-2)  Repair (Fig 4-7 and FO-1)
SECONDS display reads 00 when power is applied to signal unit but does not proceed to display seconds when START/STOP/RESET switch is pressed. (Para 4-9)	START/STOP/RESET switch, S5  R7 on display board  Z6-Z9 on display board  1 MHZ oscillator circuit on signal generator board	Replace (Fig 4-5)  Replace (Fig 4-1 and 4-2)  Replace (Fig 4-1 and 4-2)  Repair
SECONDS display starts running when power is applied to signal unit and cannot be reset  Para 4-8)	Z9 on display board	Replace (Fig 4-1 and 4-2)

Table 4-3. Troubleshooting Table, AVIM (continued)

TROUBLE	PROBABLE CAUSE	REMEDY
All of lamps L1-L6 do not light when LAMP TEST switch is pressed.  (Para 4-8)	Defective lamp, S4  R10-R15 or CR1-CR4 on display board or associated components	Replace (Fig 4-1 and 4-2)
None of lamps L1-L6 light when LAMP TEST switch is pressed.  (Para 4-8)	LAMP TEST switch, S4  + 12 vdc or + 5 vdc supply on signal generator board	(Replace (Fig 4-5)  Repair
Frequency output impedance exceeds 1.5 K ohms. (Para 4-8)	R31 on signal generator board	Replace (Fig FO-1)
Output frequencies out of tolerance.  (Para 4-9)	Clock oscillator out of adjustment	Monitor oscillator frequency between test points 1 (+) and 3 (-) (Figure 4-7) and adjust R 10 for 1 microsecond period
No output frequency when FUNCTION SWITCH is in any position other than 0% or output frequency out of tolerance and oscillator frequency correct.  (Para 4-9)	One of frequency signal generator components defective	Replace  (See Fig 4-7 and FO-1).
No temperature output  (Para 4-10)	T2, CR10, CR11, A4, A5,  C27 on signal generator board or associated components.	Replace  Replace
Temperature output several volts high and unadjustable.  (Para 4-10)	TEMP OUTPUT potentiometer open (R1) or associated components	Replace

Table 4-3. Troubleshooting Table, AVIM (continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Temperature output low and cannot be adjusted. (Para 4-10)	R36, R39, R40, R41 or R42, A4, A5 on signal generator board	Replace (Fig 4-7 and FO-1)
Temperature output affected by ambient temperature. (Para 4-10)	R32 on signal generator board out of adjustment	Adjust per paragraph 4-10 (Fig 4-7 and FO-1)

Table 4-4. Test and Reference Points (Waveforms and Voltages)

Signal Generator Board - Test and Reference Points		Switch/Control Settings	Waveforms and Voltages
(+)	(-)		
TP 1	TP 3		
TP 2	TP 3		12.0V
TP 5	TP 4	Temp output 400°C Temp output 800°C	8.63V 14.83V
TP 6	TP 4	Temp output 400°C Temp output 800°C	23.6MV 40.0MV
Ref 7 Z6 pin 14	TP 3		
Ref 8 Z7 pin 9	TP 3	F1:0 S2:70	
Ref A	TP 3	F1:0 S2:70	



Table 4-5. Test and Reference Points (Waveforms and Voltages) (con't)

Display Board Reference Points		Switch/Control Settings	Waveforms and Voltages
(+)	(-)		
10	15 12VRTN		
11	15 12VRTN	Start Clock	
12	15 12VRTN	Start Clock	
13	15 12VRTN	Start Clock	
14	15	Start Clock	

Note: Voltages/Waveforms are approximate indications expected. If voltages/waveforms are not present, see figs 4-1 and FO-1 and replace defective components.

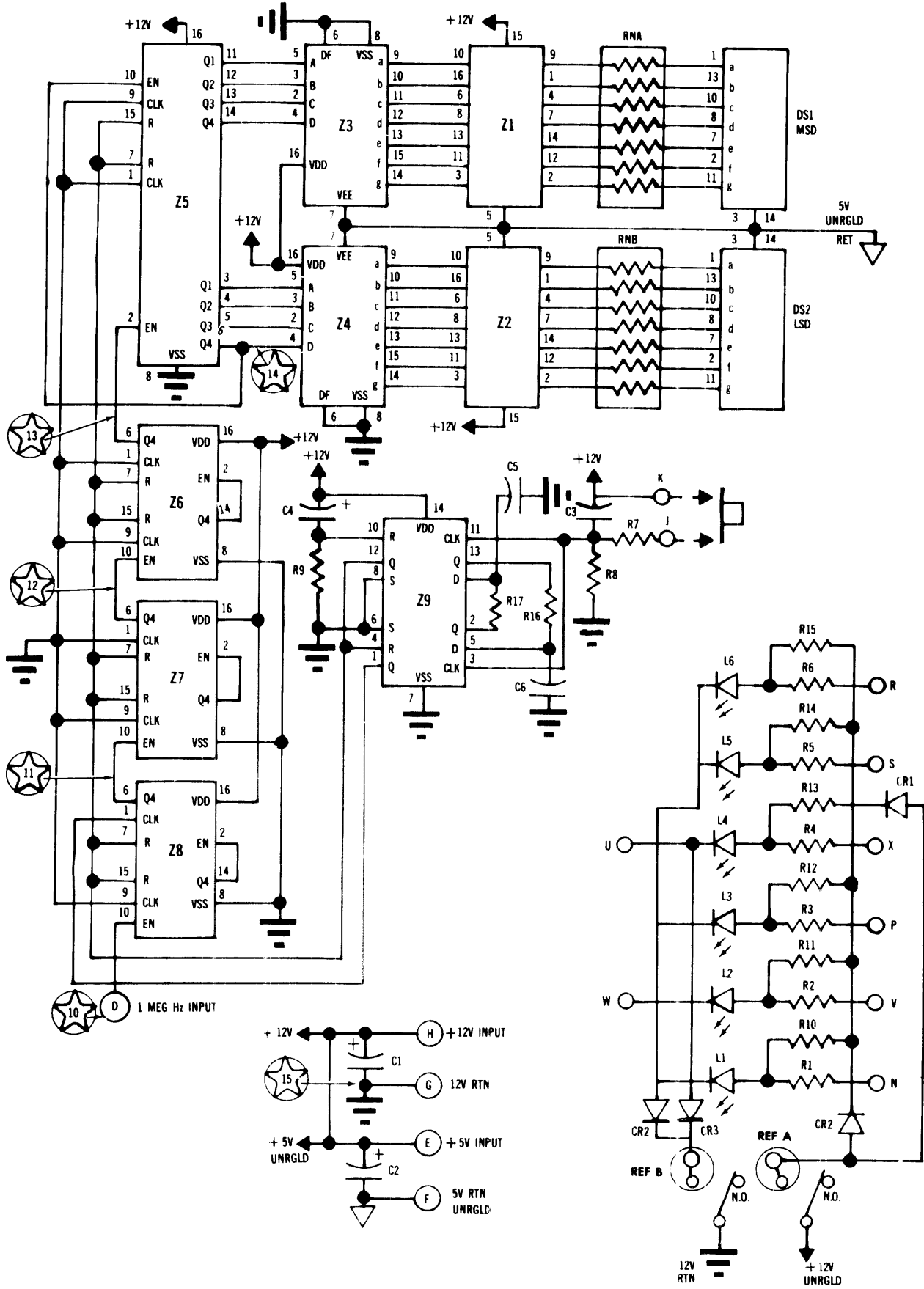


FIGURE 4-1. Display Board Schematic

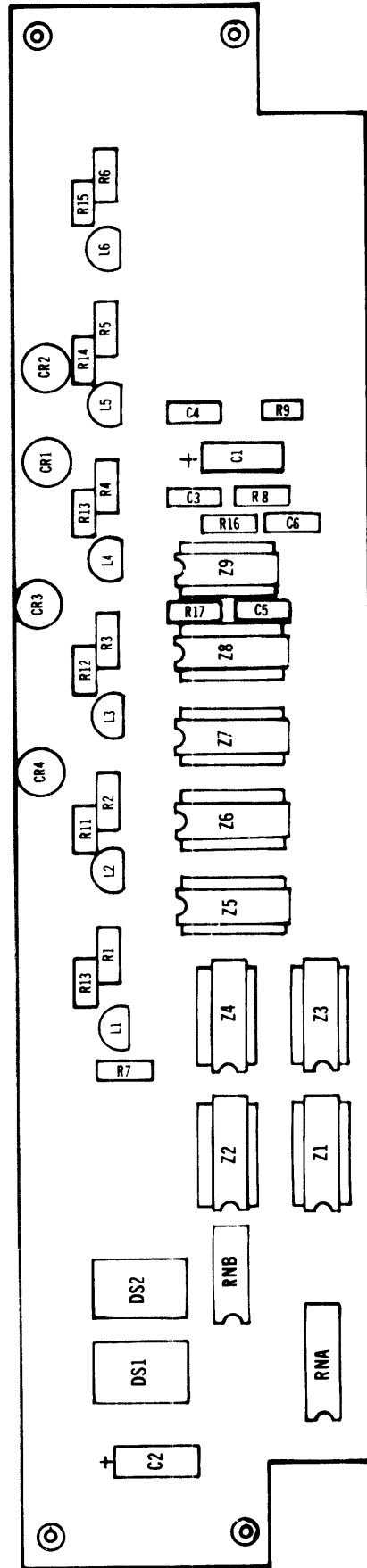


FIGURE 4-2. Display Board Assembly

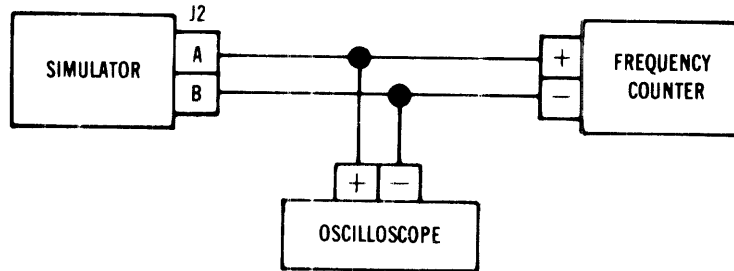


FIGURE 4-3. Frequency Output Check Setup

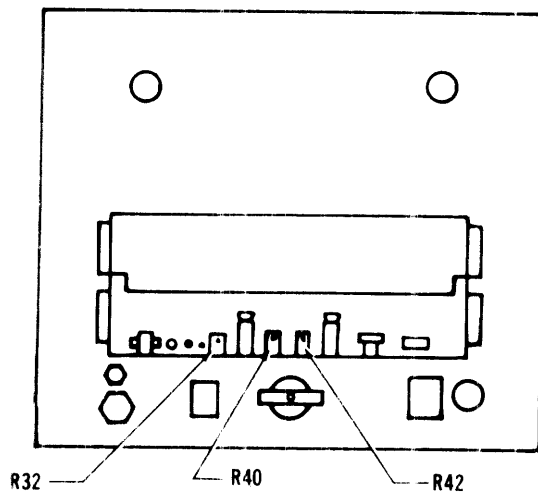


FIGURE 4-4. Temperature Adj

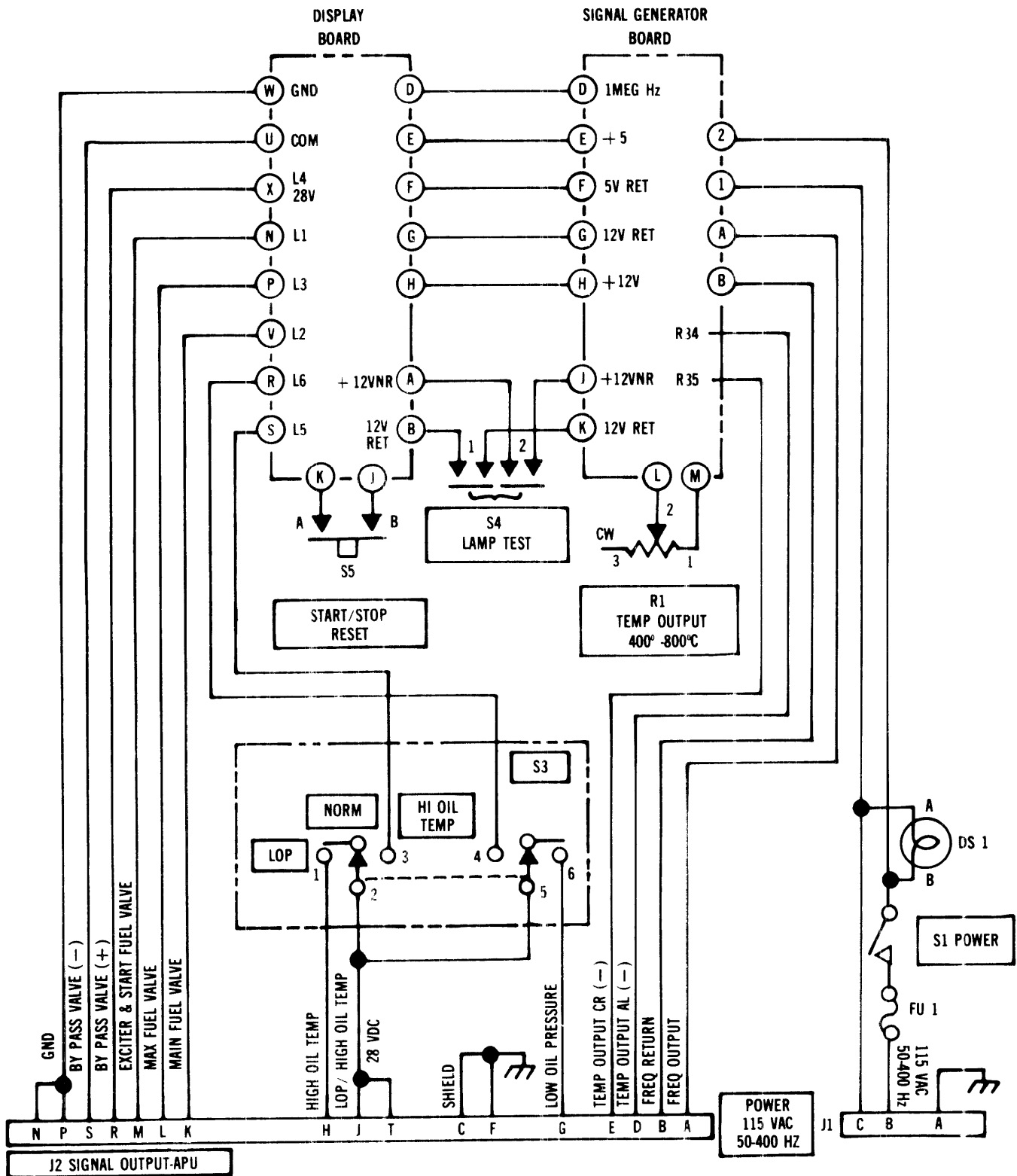


FIGURE 4-5. Simulator Schematic

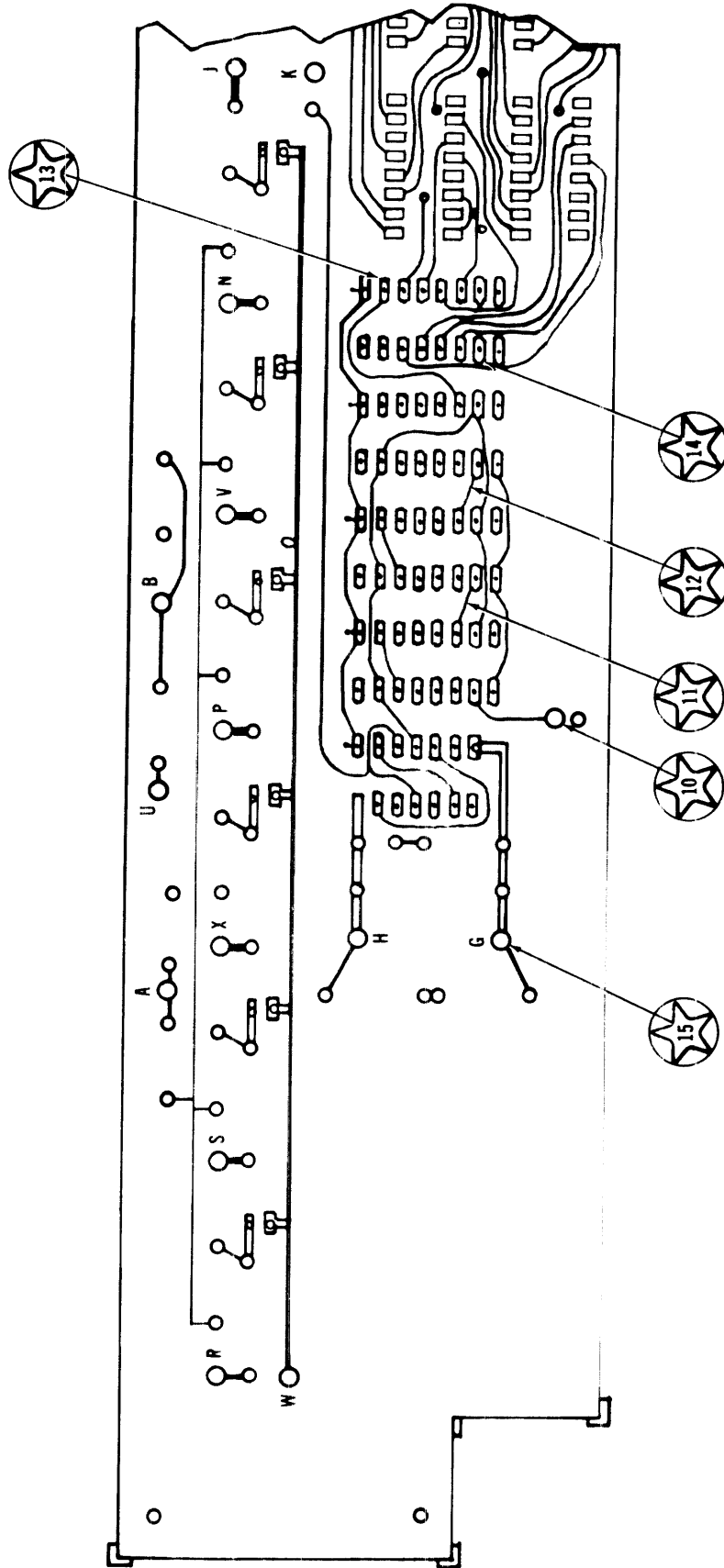


FIGURE 4-6. Display Board Test Point Locator

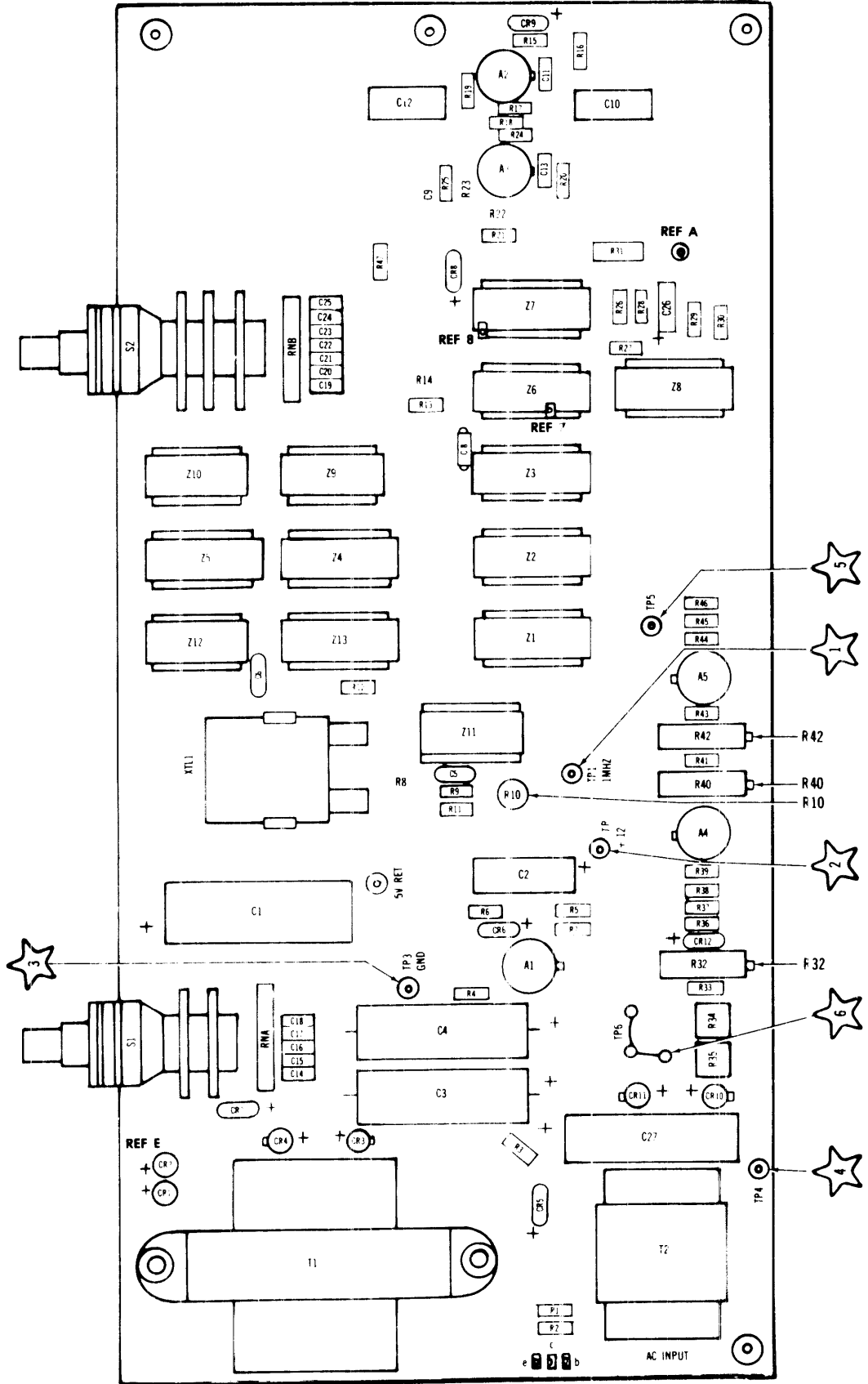


FIGURE 4-7. Signal Generator Board

**4-7. Troubleshooting and Repair.**

- a. This para contains references for repair information and maintenance instructions.
- b. Test equipment is listed in table 4-5. Test points

are identified on the assembly drawings and schematic diagrams with star encircled Arabic numerals. Reference points are circled. Test cable, power cable and connector ,J2 are shown in figs 4-8, 4-9 and 4-10.

Table 4-5 Test Equipment

NOMENCLATURE	PART/MODEL NO. OR EQUIVALENT
Autotransformer	GENRAD Model W10MT3A53(7910809)
Frequency Counter	Hewlett-Packard Model 5345A (MIS-28754 (Type 1))
Oscilloscope Sys Displacing Graphical	Tektronik Model 5440 (6625-01-034-3269)
Digital Multimeter	Tekronix, DM501A or Equiv (6695-01-075-8583)
Differential Voltmeter	John Fluke Model 887AB/AN 887AB/AN
Thermometer	Instrulab, Model 1100 (7915890)
DC Power Supply	NJE CORP, Model CS36CR30 (4931-00-962-2133)
Adapter	BNC Plug to double banana jack (MS 90578-1441) (7909401)
Test Leads	Single banana plug to E-Z Hook (SK4850-14)(7916122)



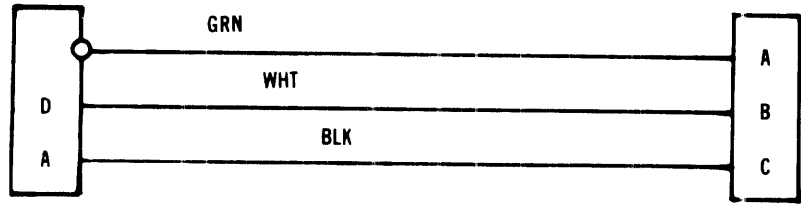


FIGURE 4-8. Power Cable Schematic

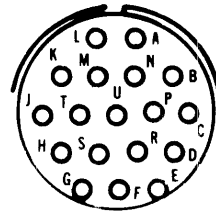


FIGURE 4-9. Connector J2 Pin Arrangement

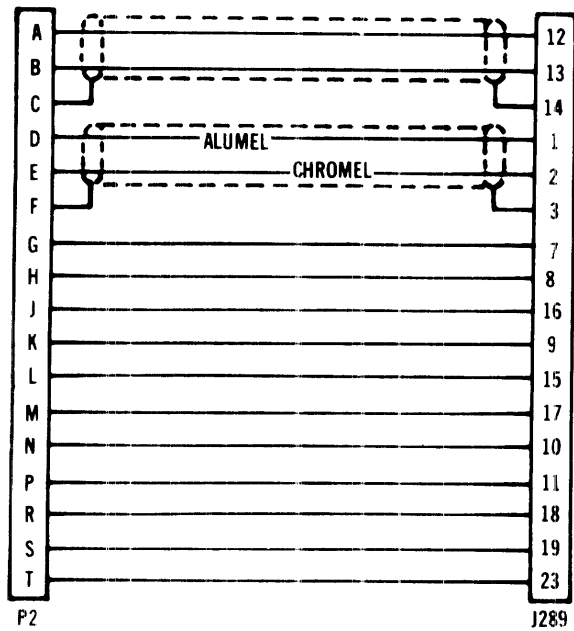


FIGURE 4-10. Test Cable Schematic

**4-8. Power Supply and Lamp Circuit.**

a. Using a volt-ohm-milliammeter, determine that pin A of receptacle J 1 and pins F and C of receptacle J2 are connected to the signal unit case.

b. Using a VOM, measure the resistance between pins A and B of receptacle J2. Resistance should be less than 1.5K ohms. (See Troubleshooting Table 4-3 and fig 4-5.)

c. Using a VOM, check the test cable for continuity and shorts.

d. Connect a VOM between pins J and G of receptacle J2. VOM should show continuity when S3 switch is placed to low oil pressure. Disconnect lead from pin G

and reconnect to pin H. VOM should show continuity when S3 switch is placed to high oil temp. If not, see fig 4-5 to isolate the problem.

e. Using a 28 vdc power supply, apply 23 vdc to the J2 terminals listed in table 4-6. Corresponding lamps should light. If not, see figs 4-1 and 4-5.

f. Turn POWER switch off and connect power cable to POWER receptacle and to a single-phase source of 115 Vac, 50-400 Hz (fig 4-11).

g. Turn POWER switch on. Power lamp should light and SECONDS timer should read 00. If not, see Troubleshooting Table 4-3, steps h, i and j and fig 4-1 to isolate the problem.

Table 4-6. Lamp Circuit Test Table

J2 TERMINAL		LAMP
+28 VDC		
	-	L1
K	P	L2
L	P	L3
R	S	L4
J	P	L5
J	Hi Oil Temp. P	L6
	Low Oil Press.	

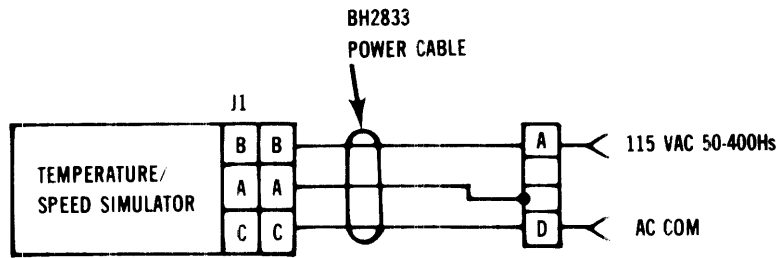


FIGURE 4-11. Simulator Power Connection

h. If result is not as specified, check continuity of fuse (1/2A), power lamp, and POWER switch in on position. If open, replace fuse (58, figure 4-12) power lamp (61) or POWER switch (56). Check for broken or loose wires. (See Troubleshooting Table 4-3 and fig 4-5.)

i. If power lamp lights and SECONDS display does not light, measure 5-volt nonregulated supply between reference points E and F, and fig F0-1. Voltage shall measure  $5.0 \pm 0.5$  vdc. If not, perform Troubleshooting Table 4-3 and use fig FO-1 as applicable.

j. If power lamp lights and SECONDS display does not light, measure 12-volt supply between test points 2

(t) anti 3 (-) (figure FO-1). Voltage shall measure  $12.0 \pm 0.6$  vdc. If not, perform Troubleshooting Table 4-3 and fig FO-1 as applicable.

k. If SECONDS display starts running when power is applied to simulator and cannot be reset with START/STOP, RESET switch. See Troubleshooting Table 4-3 and use fig 4-5 as applicable.

1. Press LAMP TEST switch. Lamps through L6 shall light. If not, see Table 4-3 and fig 4-1.

m. If some, but not all, lamps light, see Troubleshooting Table 4-3 as applicable.

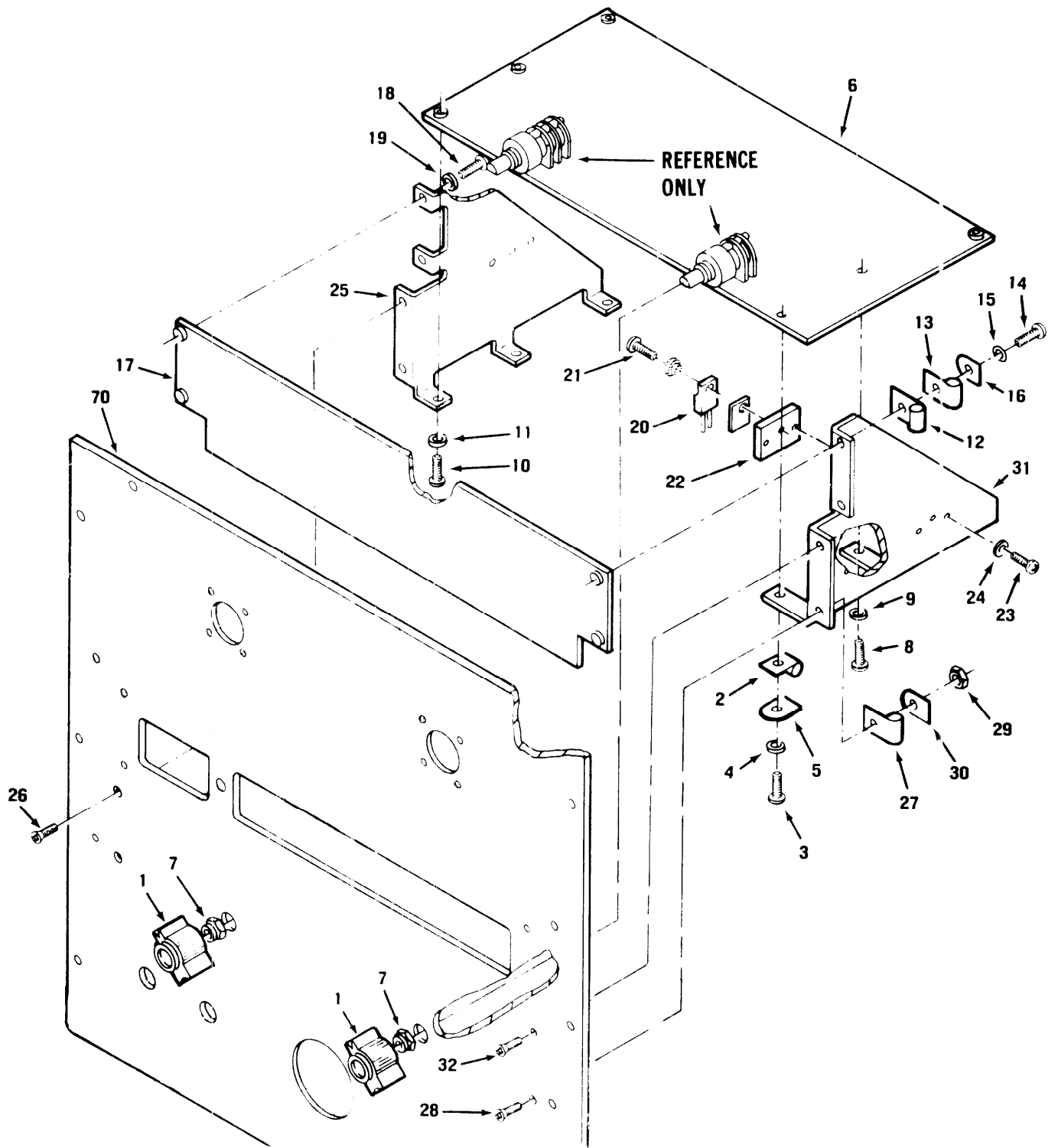


FIGURE 4-12. Deck Assembly Exploded View (Sheet 1 of 2)

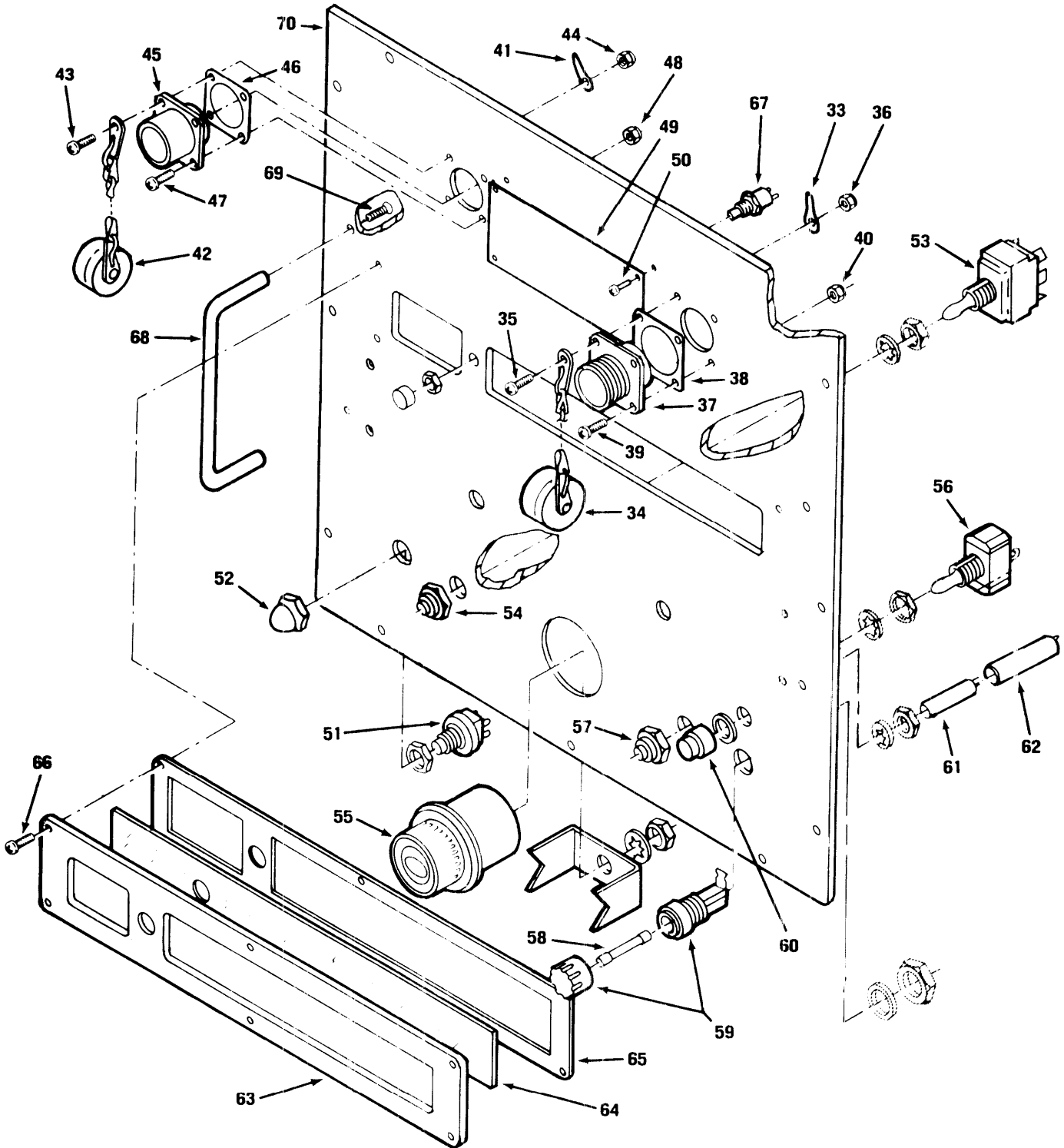


FIGURE 4-12. Deck Assembly Exploded View (Sheet 2 of 2)

**4-9. Percent RPM Circuit.**

Press START/STOP, RESET switch

RESULT: SECONDS display shall increase in 1 second increments to 99 and then repeat.

a. If SECONDS display does not increase, check START/STOP, RESET switch for continuity while pressing switch. If switch is open, replace switch S5 (67, figure 4-12). (See Troubleshooting Table 4-3.)

b. If START/STOP, RESET switch checks good, use an oscilloscope and frequency counter to check waveform between test points 1 (+) and 3 (-), fig 4-7. If waveform (fig 4-13) is absent, replace defective associated components on generator board, fig 4-7. If waveform is out-of-adjustment, adjust to 1 megahertz with RIO (fig 4-7) on signal generator board.

Press START/STOP, RESET switch a second time.

RESULT: SECONDS display shall stop.

c. If SECONDS display does not stop, see Troubleshooting Table 4-3.

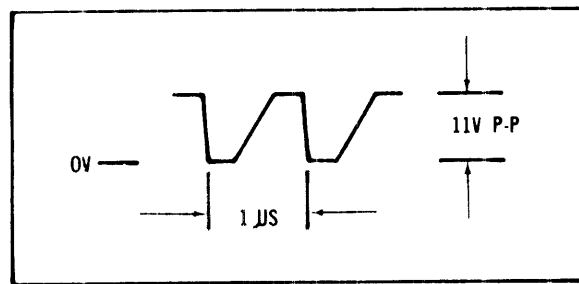
Press START/STOP, RESET switch a third time.

RESULT: SECONDS display shall reset to 00.

d. If SECONDS does not reset, see Troubleshooting Table 4-3.

e. Set POWER switch to OFF,

f. Connect frequency counter and oscilloscope 10 to 1 positive lead to J2 pin A and negative lead J2 to pin B, using adapter and two test leads as required in fig 4-3.



**FIGURE 4-13. Oscillator Waveform**

g. Set POWER switch to ON.

h. Set FUNCTION switch to 5% and FREQ ADJ to 0 position. Frequency counter will indicate between 4.058 and 4.175 ms and disconnect frequency counter. Waveform on oscilloscope should be a square wave at approximately 8 volts peak to peak. If not, remove lead from J2 pin A and reconnect to TP1 on Signal Generator Board and adjust RIO for 1.0 MHz. If indications cannot be met, see Troubleshooting Table 4-3 as applicable and replace defective associated components, fig FO- 1.

i. Disconnect lead from TP1 on Signal Generator Board and reconnect to J2 pin A. Reconnect frequency counter.

j. Set FUNCTION switch and FREQ switch to each settings as listed in table 4-7. Frequency counter will indicate within limits specified. If not, repeat technique (h) above setting FUNCTION switch to 110% and FREQ ADJ to +5 readjust R10 for 1.0 MHz. Adjusting for midpoint between low and high settings. If indications are out of tolerance, replace defective components, see fig FO-1 and Troubleshooting Table 4-3.

Table 4-7. Frequency Output Check Table

FUNCTION SWITCH	VAR FREQ ADJ	OUTPUT FREQUENCY (HZ)
5%	5	2.079 ms to 2.087 ms
5%	-4	20.791 ms to 20.875 ms
5%	-5	20.791 ms to 20.85 ms
15%	0	718.56 ms to 721.44 ms
70%	0	3353.28 ms to 3366.72 ms
90%	0	4311.36 ms to 4328.64 ms
110%	0	5269.44 ms to 5290.56 ms
110%	-5	5029.92 ms to 5050.08 ms
110%	-4	5077.82 ms to 5098.18 ms
110%	-3	5125.73 ms to 5146.27 ms
110%	-2	5173.63 ms to 5194.37 ms
110%	-1	5221.54 ms to 5242.46 ms
110%	+1	5317.34 ms to 5338.66 ms
110%	+2	5365.25 ms to 5386.75 ms
110%	+3	5413.15 ms to 5482.94 ms
110%	+4	5461.06 ms to 5482.94 ms
110%	+5	5508.96 ms to 5531.04 ms

**4-10. Temperature Circuit.**

a. Performance Check.

(1) Position controls as listed below:

- (a) POWER SWITCH to OFF.
- (b) FUNCTION SWITCH to 0%.
- (c) VAR FREQ ADJ SWITCH to 0.
- (d) TEMP SWITCH to NORM.

(2) Connect test set to autotransformer, using power cable supplied with unit and connect autotransformer to a 115-V ac power source and adjust for 115-V output.

(3) Set POWER SWITCH to ON and allow at least 15 minutes for warmup

(4) Connect differential voltmeter to SIGNAL OUTPUT (J2) pin E(+) and pin D(-), using two leads (B2).

(5) Place probe end of thermometer adjacent to terminals of J2. Wait 10 minutes for thermometer to stabilize.

**NOTE**

Constantly check thermometer temperature values to insure proper millivolt values.

(6) Set TEMP OUTPUT control for 400°C plus value in degrees C as indicated on thermometer. If differential voltmeter indication is not between 16.14 and 16.65 mV dc, adjust R40 for 16.400 mV dc indication on differential voltmeter. If indication cannot be met, see table 4-3 and para b.

(7) Set TEMP OUTPUT control for 800°C plus value in degrees C as indicated on thermometer. If differential voltmeter indication is not between 33.031 and 33.523 mV dc, perform (a) and (b) below. If necessary, see para b and table 4-3.

(a) Adjust R42 for 33.277 mV dc indication on differential voltmeter.

(b) Repeat (6) and (7), as necessary for best intolerance compromise.

(8) Repeat techniques of (7) above at TEMP OUTPUT control settings listed in table 1-8. Differential voltmeter indications will be within limits specified

Table 4-8. Temperature Check

TEMP OUTPUT control settings	Differential voltmeter indications (mV dc)	
	Min	Max
500	20.385	20.896
600	24.646	25.157
700	28.877	29.380

**NOTE**

If test set will not adjust on both 400 and 800 settings, try adjusting R32 (fig 4-4 instead of R40). Adjusting R32 changes ambient readings. Take a new ambient reading before returning to para 4-10a.

b. Troubleshooting and Repair (Temperature Circuit).

(1) If output voltage is several volts high and unadjustable, check TEMP OUTPUT potentiometer R1 for continuity and broken or loose wires. R1 is a 2K lo-turn pot. Replace R1 (55, fig 4-12), if defective.

(2) If there is no output voltage or output voltage cannot be adjusted, see Troubleshooting Table 4-3. Check connector J2 for continuity between pins J and H and J and G with switch S3 in NORM position. Fig 4-5 shows pin arrangement of J2.

RESULT : Continuity shall be present.

(3) If continuity is absent, open simulator and check switch S3 for continuity (fig 4-5). Switch action is NORM: 2-1, 5-6; LOP: 1-2, 4-5; HI OIL TEMP: 2-3, 5-6. Replace S3 if defective. Also replace seal (54, fig 4-12), if worn or damaged.

(4) If S3 checks good, check wiring between S3 and J2. Check connector J2 for continuity between pins J and H and between J and G when switch S3 is held in LOP position

RESULT: Continuity present from J to H and absent from J to G.

(5) If result is not true, open simulator and check switch S3 for continuity. Replace S3 if defective.



(6) If S3 checks good, check wiring between S3 and J2.

Check connector J2 for continuity between pins J and H and J and G when switch S3 is held in HI OIL TEMP position.

RESULT: Continuity absent from J to H and present from J to G.

(7) If result is not true, open simulator and check switch S3 for continuity.

(8) If S3 checks good, check wiring between S3 and J2. Connect a dc power supply, set at 28 vdc, between pins J(+) and P(-) of connector J2. Figure 4-5 shows Pin arrangement of J2.

Hold switch S3 in LOP position.

RESULT: Lamp L6 shall light.

(9) If L6 does not light, open simulator and check switch S3 for continuity. Replace S3, if defective.

(10) If S3 checks good, check wiring between S3, the display board and connector J2.

(11) If wiring checks good, refer to Troubleshooting Table 4-3 and FO-1.

Hold switch S3 in HI OIL TEMP position.

RESULT: Lamp L5 shall light.

(12) If L5 does not light, open simulator and check switch S3 for continuity. Replace S3, if defective.

(13) If S3 checks good check wiring between S3, the display board and connector J2.

(14) If wiring checks good, refer to Troubleshooting Table 4-3 and FO-1.

(15) Compensator Resistor R34 on the Signal Generator Board should measure approximately  $10.3 \pm 0.2$  ohms at  $20^{\circ}$  C ( $68^{\circ}$  F) and R35 should measure approximately  $22.4 \pm 0.2$  ohms at  $20^{\circ}$  C ( $68^{\circ}$  F).

(16) Different ambient temperature will effect compensator resistors resistance readings. If R34 and R35 have to be replaced, send unit to Depot for repair. When resistors R32, R33 and diodes CR12 are replaced, perform temp check, para 4-10a.

## Section V. DISASSEMBLY/ASSEMBLY

**4-11. General.** This section contains instructions for disassembly of the simulator. Disassembly shall be done only to the level necessary for returning the simulator to a satisfactory serviceable condition.

**4-12. Removal of the Deck Assembly From Case (fig 4-14).**

- a. Disconnect cables from simulator.
- b. Remove twelve screws (6) around edge of deck assembly (5).
- c. Use handles to lift deck assembly from case.

**4-13. Disassembly of the Deck Assembly (fig 4-12).**

a. Control Knobs. Loosen two setscrews and lift control knobs (1) from shafts of rotary switches protruding through deck (70) but mounted on signal generator board assembly (6).

b. Signal Generator Board Assembly.

(1) Do step a.

(2) Remove switch seal nuts (7).

(3) Remove adhesive at wire points.

(4) Except for white and green twisted pair, tag and unsolder wires on both sides of signal generator board (6). Unsolder white and green twisted pair at connector J2 (45),

(5) Remove screw (21) and shoulder washer attaching transistor (20) and mica washer to heatsink (22).

(6) Remove screw (3), lockwasher (4), D-washer (5), and cable clamp (2).

(7) Remove screw (8) and lockwasher (9).

(8) Remove four screws (10) and lockwashers (11) and remove board assembly from two brackets (25, 31).

c. Display Board Assembly.

(1) Do step a and b.

(2) Remove sealant at wire points.

(3) Tag and unsolder wires at display board (17).

(4) Remove screw (14), lockwasher (15), D-washer (6) and two cable clamps (12, 13).

(5) Remove screw (28), locknut (29), D-washer (30) and cable clamp (27).

(6) Remove screw (32) and two screws (26) freeing support brackets (25, 31) from deck (70).

(7) Remove three screws (18) and three lockwashers (19) to separate circuit board (17) from brackets (25, 31).

d. Start/Stop, Reset switch.

(1) Do step a.

(2) Remove circuit boards (6, 17) and brackets (25, 31) as a unit by removing two screws (26), one screw (32), and screw (28) with locknut (29), D-washer (30) and cable clamp (27).

(3) Carefully lay the unit aside without strain on wire terminations or tag and unsolder wires.

(4) Pull red cap straight up to remove it from switch (67).

(5) Remove mounting hardware and push switch through hole in deck (70).

e. Switch, S4.

(1) Tag and unsolder wires from switch (51)

(2) Remove switch seal (52).

(3) Remove mounting hardware and push switch through hole in deck (70).

f. Switch, S3.

(1) Tag and unsolder wires from switch (53)

(2) Remove seal nut (54).

(3) Push switch through hole in deck (70).

g. Potentiometer, Digital, R1.

(1) Tag and unsolder wires from potentiometer (55).

(2) Remove mounting hardware and pull potentiometer through hole in deck (70).

h. Switch, S1.

(1) Tag and unsolder wires from switch (56).

(2) Remove seal nut (57),

(3) Push switch through hole in deck (70).

i. Fuse, Remove fuseholder cap (59) and extract fuse (58) from fuseholder.

j. Fuseholder.

(1) Tag and unsolder wires from fuseholder (59).

(2) Remove mounting hardware from fuseholder and pull fuseholder from hole in deck (70).

k. Power On Lamp. Unscrew lamp cap (60) and extract lamp (61) from lamp holder (62).

1. Indicator Light.

(1) Do step k.

(2) Tag and unsolder wires at lampholder (62).

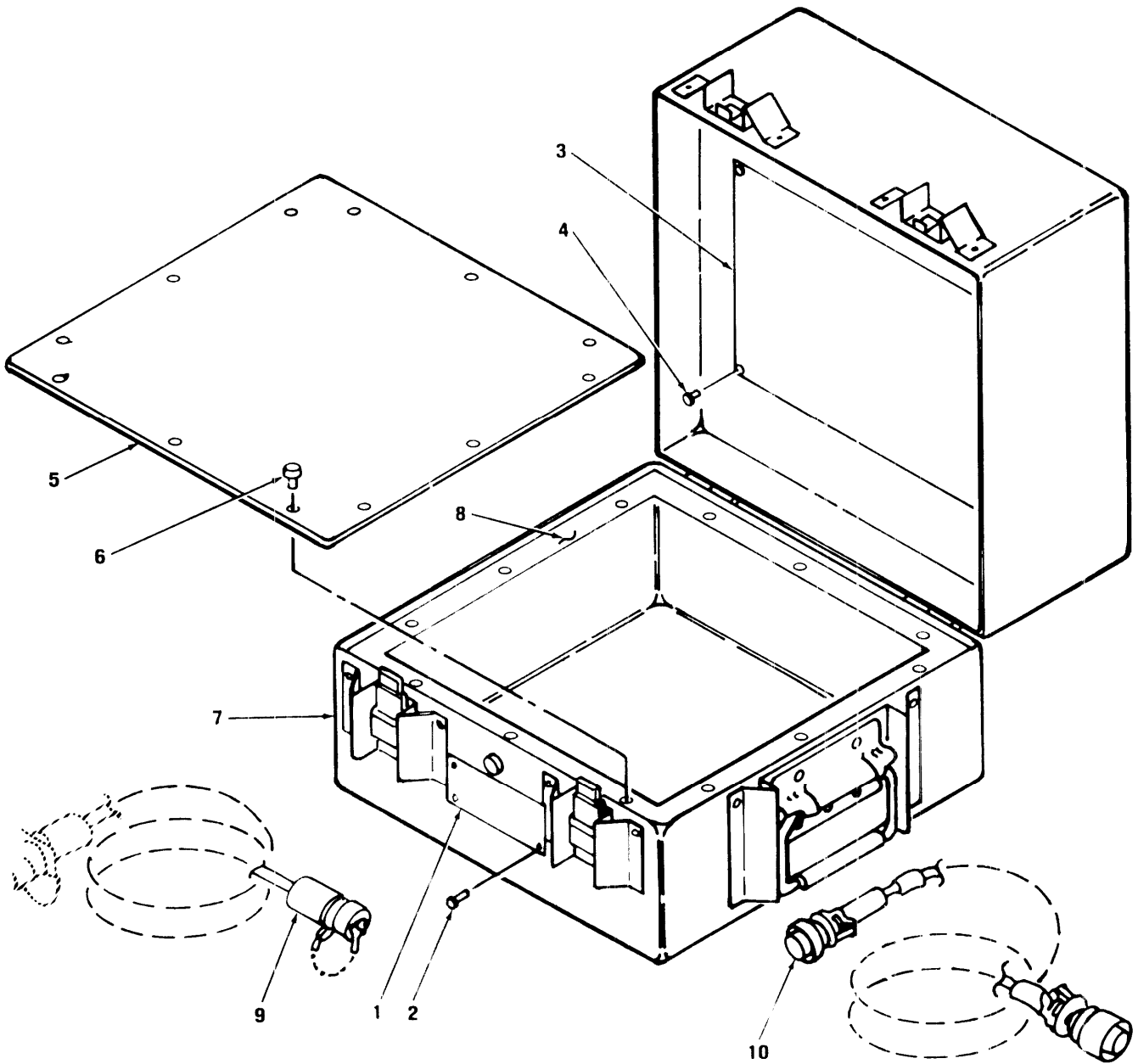


FIGURE 4-14. H296A-1. Temperature/Speed Simulator Exploded View

(3) Remove hardware from lampholder and push lampholder through hole in deck (70).

m. Display Frame and Window. Remove six screws (66), frame (63), window (64), and gasket (65).

n. Connector, J2.

(1) Tag and unsolder wires at connector J2 (45).

(2) Remove screw (43), dust cover (42), locknut (44), and solder lug (41).

(3) Remove three screws (47) and three locknuts (48).

(4) Pull connector (45) from hole in gasket (46) and deck (70). Remove gasket.

o. Connector, J1.

(1) Tag and unsolder wires at connector J1 (37).

(2) Remove screw (35), dust cover (34), locknut (36), and solder lug (33).

(3) Remove three screws (39) and three locknuts (40).

(4) Pull connector (37) from hole in gasket (38) and deck (70). Remove gasket.

#### 4-14. Assembly (figure 4-12).

a. Signal Generator Board Assembly

(1) Hold generator assembly (6) in position with rotary switch shafts extending through holes in deck (70).

(2) Attach signal generator board assembly to left support bracket (25) with screws (10) and three lockwashers (11).

(3) Attach signal generator board assembly to right support bracket (31) with one screw (10), one lockwasher (11), one machine screw (8), one lockwasher (9), one machine screw (3), one lockwasher (4), one D-washer (5), and one cable clamp (2).

(4) Attach rotary switch to deck (70) with two seal nuts (7),

(5) Attach wires to wire points (figs 4-15 and 4-16) on both sides of signal generator board assembly with solder. Use flux when soldering thermocouple wires (white and green twisted pair).

(6) Apply RTV adhesive to wire points on circuit board.

(7) Secure thermocouple wires to capacitors C1 and C2 with adhesive.

(8) Remove tags from wires.

(g) Insert transistor (20, fig 4-12) leads into signal generator board assembly, observing position of emitter, collector, and base.

(10) Coat both sides of mica insulator supplied with transistor, with heatsink compound. No continuity shall exist between transistor and bracket.

(11) Hold mica insulator in position behind transistor and attach transistor to heatsink (22) with machine screw (21) and shoulder washer supplied with transistor.

(12) Attach transistor leads to signal generator board circuit assembly pattern with solder.

(13) Cut off extra transistor leads on bus side of generator board assembly.

b. Display Board Assembly

(1) Do step a., as required.

(2) Hold display board assembly (17) in position against left support bracket (25) and attach with two machine screws (18) and two lockwashers (19).

(3) Hold display board assembly in position against right support bracket (31) and attach with one machine screw (18), one lockwasher (19), one machine screw (14), one lockwasher (15), one D-washer (16), and two cable clamps (12, 13).

(4) Attach left support bracket (25) to back of deck (70) with two machine screws (26).

(5) Attach right support bracket (31) to back of deck with one machine screw (32), one machine screw (28), one new locknut (29), D-washer (30), and cable clamp (27).

(6) Attach wires to wire points (Figure 4-17) on bus side of circuit, board with solder per Figure 4-17 and Table 4-9. Remove tags from wires.

(7) Apply RTV adhesive to wire points on circuit board.

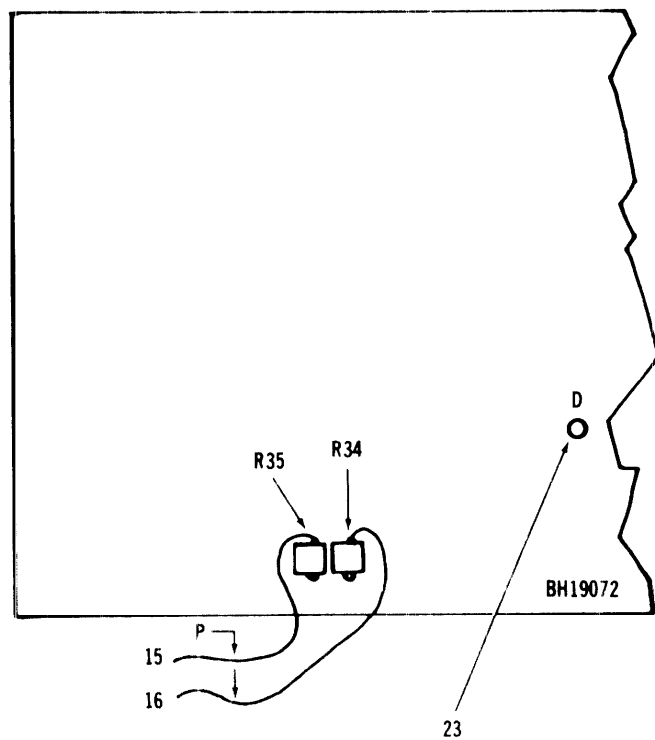
c. START/STOP, RESET switch

(1) Pull button from switch S5 (67, fig 4-12) and insert switch S5 through hole from back of deck (70) using hardware supplied. Seal nut at deck with RTV adhesive.

(2) Push button on to switch S5.

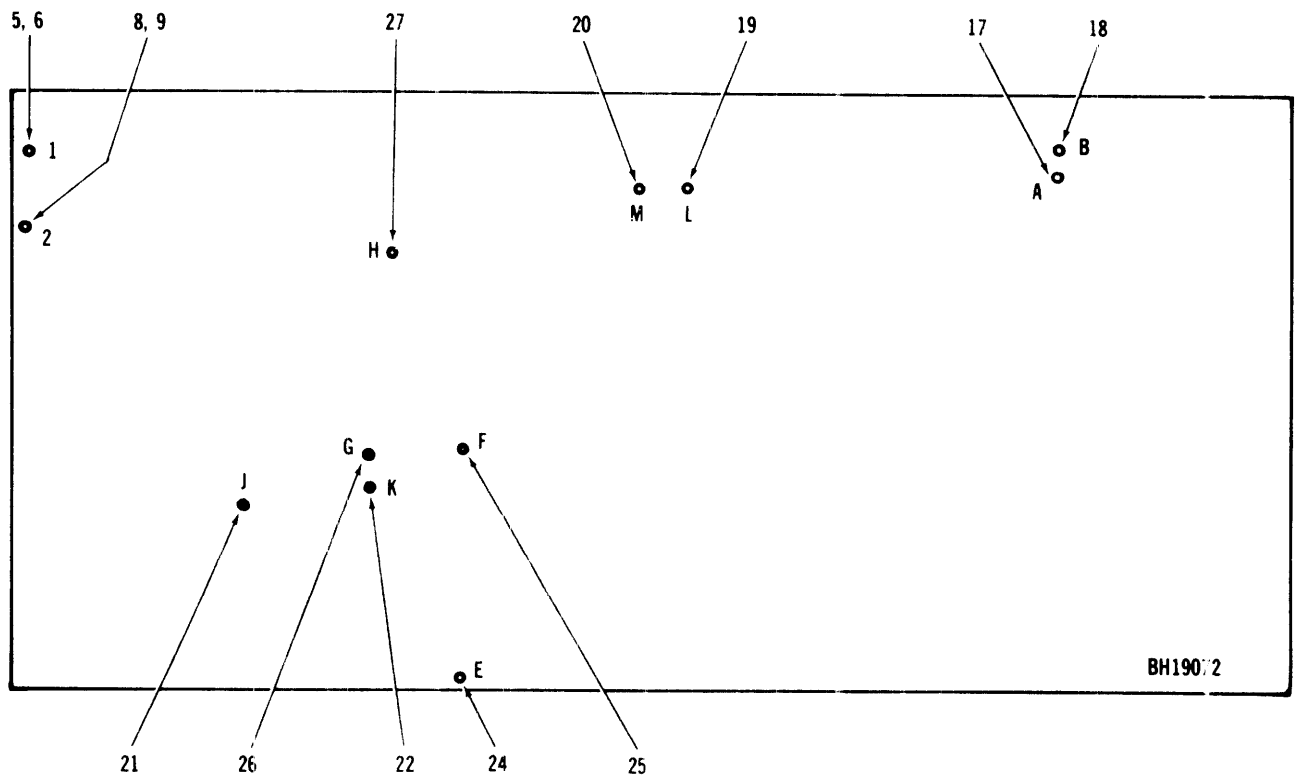
(3) Place gasket (65) in position on deck and attach gasket, window (64), and frame (63) to deck with six new seal screws (66).

(4) Attach wires to switch S5 with solder per Table 4-9. Remove tags from wires.



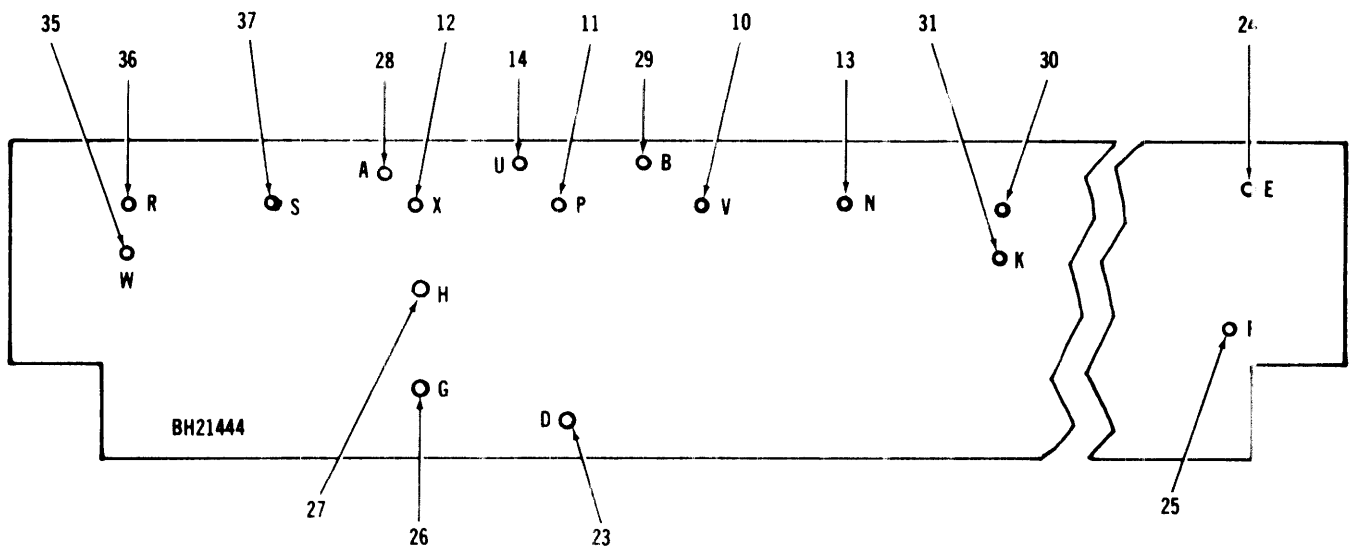
NOTE:  
KEY TO WIRES LISTED IN TABLE 4-9

FIGURE 4-15. Signal Generator Board (PCB 2) Wiring, Component Side



NOTE:  
KEY TO WIRES LISTED IN TABLE 4-9

FIGURE 4-16. Signal Generator Board (PCB 2) Wiring, Bus Side



NOTE:  
KEY TO WIRES LISTED IN TABLE 4-9.

FIGURE 4-17. Display Board (PCB 1) Wiring, Bus Side

Table 4-9. Wiring Table

WIRE NO.	COLOR	AWG	FROM	TO
1	Grn-Blk	18	J1 Pin A	Gnd Lug J1
2	Grn-Blk	24	J2 Pin C	Gnd Lug J2
3	Grn-Blk	24	J2 Pin F	Gnd Lug J2
4	Black	18	J1 Pin B	Fuse Line Side
5	White	18	J1 Pin C	PCB2, AC "1"
6	White	24	PCB2,AC"1"	DS1 H cider, Pin A
7	Wht-Blk	18	Fuse Load Side	S1 Contact
8	Grey	18	S1 Wiper	PCB2, AC "2"
9	Grey	24	PCB2 AC "2"	DS2 Molder, Pin B
10	Purple	22	PCB1, Point V	J2 Pin K
11	Yellow	22	PCB 1, Point P	J2 Pin L
12	orange	22	PCB1, Point X	J2 Pin R
13	Red	22	PCB1, Point N	J2 Pin M
14	Grey	22	PCB1, Point U	J2 Pin S
15	Wht (CR)	REF	PCB2, R35	J2 Pin E
16	Grn (AL)	REF	PCB2, R34	J2 Pin D
17	Wht-Blk	24	PCB2, Point A	J2 Pin A
18	Wht-Brn	24	PCB2. Point B	J2 Pin B
19	Grn-Red	24	PCB2, Point L	R1 Pin 2
20	Grn-Orn	24	PCB2, Point M	R1 Pin 1
21	Yel-Brn	24	PCB2, Point J	S4 Side 2
22	Yel-Orn	24	PCB2, Point K	S4 Side 1
23	Wht-Red	24	PCB2, Point D	PCB1, Point D
24	Wht-Orn	24	PCB2, Point E	PCB1, Point E
25	Wht-Yel	24	PCB2, Point F	PCB1, Point F
26	Wht-Grn	24	PCB2, Point G	PCB 1, Point G
27	Wht-Blue	24	PCB2, Point H	PCB1, Point H
28	Yel-Blk	24	PCB1, Point A	S4 Side 2
29	Yel-Red	24	PCB1, Point B	S4 Side 1
30	Wht-Gray	24	PCB1, Point J	S5 Pin B
31	Wht-Prp	24	PCB1, Point K	S5 Pin A
32	Green	22	S3 POLE (2)& (5)	J2 Pin J
33	Brown	22	S3 Contact (6)	J2 Pin G
34	Blue	22	S3 Contact (1)	J2 Pin H
35	Green	22	PCB1, Point W	J2 Pin P
36	Yel-Blue	22	PCB1, Point R	S3 Contact (4)
37	Yel-Grn	22	PCB1, Point S	S3 Contact (3)
38	Green	22	J2 Pin P	J2 Pin N
39	Green	22	J2 Pin T	J2 Pin J

d. Switch, S4.

(1) Insert switch S4(51) through hole from back of deck (70) and hold in position.

(2) Adjust nut so that threaded bushing of switch protrudes through deck enough to allow seal nut (52) to tighten.

(3) Attach switch S4(51) with seal nut (52).

(4) Attach wires to switch S4 with solder per Table 4-9. Remove tags from wires.

e. Switch, S3.

(1) Insert switch S3, (53) through hole from back of deck (70) and hold in position.

(2) Adjust nut so that threaded bushing of switch S3 protrudes through deck enough to allow seal nut (54) to tighten.

(3) Attach switch S3 (53) with seal nut (54).

(4) Attach wires to switch S3 with solder, per Table 4-9. Remove tags from wires.

f. Potentiometer, R1.

(1) Insert potentiometer R1 (55) through hole from front of deck (70). Hold in position.

(2) Place furnished mounting bracket over potentiometer RI from back of deck (70) with sharp points against deck.

(3) Fasten bracket and potentiometer R1 with furnished lockwasher and nut.

(4) Attach wires to potentiometer R1 with solder per Table 4-9. Remove tags from wires.

g. Switch, S1.

(1) Insert switch S1 (56) through hole from back of deck (70) and hold in position.

(2) Adjust nut so that threaded bushing of switch S1 protrudes through deck enough to allow seal nut (57) to tighten.

(3) Attach switch S1 (56) with seal nut (57).

(4) Attach wires to switch S1 with solder per Table 4-9. Remove tags from wires.

h. Fuse, FU1.

(1) Remove cap from fuseholder (59) and insert fuse FU1 (58).

(2) Replace cap on fuseholder.

i. Fuseholder.

(1) Insert fuseholder (59) through hole from front of deck (70) and hold in position.

(2) Attach fuseholder with furnished lockwasher and nut.

(3) Attach wires to fuseholder with solder per Table 4-9. Remove tags from wires.

j. Power on lamp. Insert lamp DS1 (61) into lamp-holder (62) and screw lens (60) onto lampholder.

k. Power on Lampholder.

(1) Insert contact end of lampholder (62) through hole on top side of deck (70).

(2) Install lampholder mounting hardware.

(3) Untag and solder wires to lampholder (62).

l. Display Frame and Window. Insert frame (63), window (64), gasket (65) into deck (70), using six screws (66).

m. Connector, J2.

(1) Place gasket (46) in position on deck (70).

(2) Insert connector J2 (45) from front of deck through hole in gasket and deck, and hold in position.

(3) Attach dust cap (42), connector J2, and gasket to deck with one new seal screw (43), one terminal lug (41), and one new locknut (44), and three new seal screws (47) and three new locknuts (48).

(4) Attach wires to connector pins with solder per Table 4-9. Remove tags from wires.

n. Connector, J1.

(1) Place gasket (38) in position on deck (70).

(2) Insert connector J1 (37) from front of deck through hole in gasket and deck, and hold in position.

(3) Attach dust cap (34), connector J1, and gasket to deck with one new seal screw (35), one terminal lug (33), one new locknut (36), three new seal screws (39), and three new locknuts (40).

(4) Attach wires to connector pins with solder per Table 4-9. Remove tags from wires.

o. Knobs. Line up setscrew in knob (1) with flat surface of shaft of rotary switch and push knob onto shaft. Tighten setscrews.

p. Perform paras 4-8 through 4-10. Apply glyptol to adjustment screws, after circuit checks.



## Section VI. PREPARATION FOR SHIPMENT AND STORAGE

### 4-15. General.

Preparation for shipment and/or storage depends upon whether test set is retained in unit area or evacuated. Storage in unit area, when authorized, is on a rotational basis and is known as Administrative Storage. For Administrative Storage see TM 740-90-1.

### 4-16. Levels of Protection.

Select the level of protection which best suits the circumstances and follow the instructions for that level.

a. Level A. Use this level if shipment in into or out of a combat theater or is destined for outdoor storage or is destined for indoor storage exceeding five years.

b. Level B. Use this level if the shipment involves overseas surface transit and/or is destined for indoor storage up to five years.

c. Level C. Use this level if shipment is entirely within CONUS and storage will not exceed two years.

### 4-17. Procedures.

a. For All Levels. Clean the test set thoroughly of all contamination and debris. Use no cleaning fluids or preservative materials. Package each test set individually. Each individual package can be shipped without packing. Cushion the test set in 2 inches of one pound density polyethylene foam conforming to PPP-C-1752 and include eight units of desiccant conforming to MIL-D-3464 within the unit.

b. Unit Container. Provide a snug fitting unit container as follows:

(1) Level A. Wood-cleated, plywood conforming to style I, overseas type of PPP-B-601.

(2) Level B. Weather-resistant fiberboard container conforming to PPP-B-636.

(3) Level C. Domestic class fiberboard container conforming to PPP-B-636.

c. Marking. Mark all shipments in accordance with MIL-STD-129.

## APPENDIX A REFERENCES

**A-1. Publication Indexes.**

DA PAM 25-30 . . . . . Consolidated Index of Army Publications and Blank Forms

**A-2. Logistics and Storage.**

TM 55-1500-204-25/1 . . . . . General Aircraft Maintenance Manual

**A-3. Maintenance of Supplies and Equipment.**

AR 700-58, . . . . . Packaging Improvement Report

TM 43-0139 . . . . . Painting Operations Instructions for Field Use

DA Pam 738-751 . . . . . Functional User's Manual for the Army Maintenance Management System - Aviation (TAMMS-A)

**A-4. Other Publications.**

TB 43-180 . . . . . Calibration Requirements for the Maintenance of Army Material

FM 55-411 . . . . . Maintenance Quality Control and Technical Inspection Guide for Army Aircraft

TM750-244-2 . . . . . Procedures for the Destruction of Electronic Material to Prevent Enemy Use (Electronics Command)

TM 55-1520-237-23-2 . . . . . Aircraft Fault Isolation Procedures Manual



## APPENDIX B

# MAINTENANCE ALLOCATION CHART

---

### Section 1. INTRODUCTION

#### B-1. MAINTENANCE ALLOCATION CHART.

a. This Maintenance Allocation Chart (MAC) assigns maintenance functions in accordance with the Three Levels of Maintenance concept for army aircraft. These maintenance levels: Aviation Unit Maintenance (AVUM), Aviation Intermediate Maintenance (AVIM) and Depot Maintenance are depicted on the MAC as:

AVUM WHICH CORRESPONDS TO THE O CODE IN THE REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)

AVIM WHICH CORRESPONDS TO THE F CODE IN THE REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL:)

DEPOT WHICH CORRESPONDS TO THE D CODE IN THE REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)

b. The maintenance to be performed below depot and in the field is described as follows:

(1) Aviation Unit Maintenance (AVUM)- AVUM activities will be staffed and equipped to perform high frequency "On-Equipment" maintenance tasks required to retain or return equipment to a serviceable condition. The maintenance capability of the AVUM will be governed by the MAC and limited by the amount and complexity of support equipment, facilities required, and number of spaces and critical skills available. The range and quantity of authorized spare modules/components will be consistent with the mobility requirements dictated by the air mobility concept. (Assignment of maintenance tasks to divisional company size aviation units will consider the overall maintenance capability of the division, the requirement to conserve personnel and equipment resources and air mobility requirements).

(a) Company Size Aviation Units: Perform those tasks which consist primarily of preventive maintenance and maintenance repair and replacement functions associated with sustaining a high level of equipment operational readiness. Perform maintenance

inspections and servicing to include daily, intermediate, periodic and special inspections as authorized by the MAC or higher headquarters. Identify the cause of equipment/system malfunctions using applicable technical manual troubleshooting instructions, Built-In-Test Equipment (BITE), installed instruments, or easy to use Test Measurement and Diagnostic Equipment (TMDE). Replace worn or damaged modules/components which do not require complex adjustments or system alignment and which can be removed /installed with available skills, tools and equipment. Perform operational and continuity checks and make minor repairs. Perform servicing, functional adjustments, and minor repair/replacement. Evacuate unserviceable modules/components and end items beyond the repair capability of AVUM to the supporting AVIM.

(b) Less than Company Size Aviation Units: Aviation elements organic to brigade, group, battalion headquarters and detachment size units are normally small and have less than ten aircraft assigned. Maintenance tasks performed by the aircraft crew chief or assigned aircraft repairman will normally be limited to preventive maintenance, inspections, servicing, spot painting, stop drilling, minor adjustments, module/component fault diagnosis and replacement of selected modules/components. Repair functions will normally be accomplished by the supporting AVIM unit.

#### B-2. USE OF THE MAINTENANCE ALLOCATION CHART.

a. The MAC assigns maintenance functions to the lowest level of maintenance based on past experience and the following consideration:

(1) Skills available.

(2) Time required.

(3) Tools and test equipment required and/or available.

b. Only the lowest level of maintenance authorized to perform a maintenance function is indicated. If the lowest level of maintenance cannot perform all tasks of

any single maintenance function (e.g., test, repair), (then the higher maintenance level(s) that can accomplish additional tasks will also be indicated.

c. A maintenance function assigned to a maintenance level will automatically be authorized to be performed at any higher maintenance level.

d. A maintenance function that cannot be performed at the assigned level of maintenance for any reason may be evacuated to the next higher maintenance organization. Higher maintenance levels will perform the maintenance functions of lower maintenance levels when required or directed by the appropriate commander.

e. The assignment of a maintenance function will not be construed as authorization to carry the associated repair parts in stock, Authority to requisition, stock, or otherwise secure necessary repair parts will be as specified in the repair parts and special tools list appendix.

f. Normally there will be no deviation from the assigned level of maintenance. In cases of operational necessity, maintenance functions assigned to a maintenance level may, on a one-time basis and at the request of the lower maintenance level, be specifically authorized by the maintenance officer of the level of maintenance to which the function is assigned. The special tools, equipment, etc. required by the lower level of maintenance to perform this function will be furnished by the maintenance level to which the function is assigned. This transfer of a maintenance function to a lower maintenance level does not relieve the higher maintenance level of the responsibility of the function. The higher level of maintenance has the authority to determine:

(1) If the lower level is capable of performing the work,

(2) If the lower level will require assistance or technical supervision and on-site inspection.

(3) If the authorization will be granted.

g. Organizational through depot maintenance of the US Army Electronics Command equipment will be performed by designated US Army Electronics Command personnel.

h. Changes to the MAC will be based on continuing evaluation and analysis by responsible technical personnel and on reports received from field activities.

### B-3. DEFINITIONS.

a. Inspect. To determine serviceability of an item by comparing its physical, mechanical and electrical characteristics with established standards.

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

c. Service. To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents and air.

d. Adjust. To rectify to the extent necessary to bring into proper operating range.

e. Align. To adjust specified variable elements of an item to bring to optimum performance.

f. Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison 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 or test equipment being compared with the certified standard.

g. Install. To set up for use in an operational environment such as an emplacement, site or vehicle.

h. Replace. To replace unserviceable items with serviceable assemblies, subassemblies or parts.

i. Repair. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

j. Overhaul. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards prepared and published for the specific item to be overhauled.

k. Rebuild. To restore an item to a standard as nearly as possible to the original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

#### **B-4. FUNCTIONAL GROUPS.**

Standard functional groupings are not considered feasible for aviation ground support equipment due to variation and complexity. Therefore, variations to functional groupings may occur.

#### **B-5. MAINTENANCE CATEGORIES AND WORK TIMES.**

The maintenance categories (levels) AVUM, AVIM, and Depot are listed on the Maintenance Allocation Chart with individual columns that indicate the work times for maintenance functions at each maintenance level. Work time presentations such as 0.1 indicate the average time it requires a maintenance level to perform a specific maintenance function. If a work time has not been

established, the columnar presentation shall indicate “-•-”. Maintenance levels higher than the level of maintenance indicated are authorized to perform the indicated function.

#### **B-6. TOOLS AND TEST EQUIPMENT (Section III).**

Common tool sets (not individual tools), special tools, test and support equipment required to perform maintenance functions are listed alphabetically with a reference number to permit cross-referencing to column 5 in the MAC. In addition, the maintenance category authorized to use the device is listed along with the item National Stock Number (NSN) and, if applicable, the tool number to aid in identifying the tool/device.

Section II. MAINTENANCE ALLOCATION CHART

Nomenclature of end item

TEMPERATURE AND SPEED SIMULATOR

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equip (Note)	(6) Remarks
			AVUM	*AVIM	DEPOT		
01	Temperature and Speed Simulator	Test	.15		1.0		*Refer to TB 43-180
		Repair*		*ATST	1.5		
		Calibrate*		*ATST	1.0		
	Knob	Replace	.10				
	Test Cable	Replace	.01				
	Bezel Assy	Replace	.10				
	Power Cable	Replace	.01				
	Lens, Yellow	Replace	.05				
	Lamp	Replace	.05				
	Fuse	Replace	.05				
	Resistor, Variable (R1)	Test		.02			
		Replace		.05			
	Switch, Toggle (S1)	Test		.01			
		Replace		.04			
	Switch, Toggle (S3)	Test		.01			
		Replace		.04			
	Switch, Push (S4)	Test		.01			
		Replace		.03			
	Switch, Push (S5)	Test		.01			
		Replace		.03			
	PCB 1 Board Assy	Test		1.0			
		Replace		2.0*			
	PCB 2 Board Assy	Test		1.0			
		Replace		2.0*			
	Transistor (Q1)	Test		.01			
		Replace		.05			
	Display, DS1 & DS2	Test		.05			
Replace			1.0*				
Indicator, LED (L1-L6)	Test		.02				
	Replace		.05				

NOTE: Use Electrical Repairman's Tool Kit, NSN 5180-00-323-4915

\*Performed by ATST - Area TMDE Support Team

# APPENDIX C

## REPAIR PARTS AND SPECIAL TOOLS LIST

### SECTION I. INTRODUCTION

**CI. Scope.** This RPSTL lists and authorizes spares and repair parts; special tools; special test, measurement, and diagnostic equipment (TMDE); and other special support equipment required for performance of Aviation Unit and Aviation Intermediate maintenance of the Temperature and Speed Simulator . It authorizes the requisitioning, issue, and disposition of spares, repair parts and special tools as indicated by the source, maintenance and recoverability (SMR) codes.

**C-2. General.** In addition to Section I, Introduction, this Repair Parts and Special Tools List is divided into the following sections:

**a. Section II. Repair Parts List.** A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts, Parts lists are composed of functional groups in ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence. Bulk materials are listed in item name sequence. Repair parts kits are listed separately in their own functional group within Section II. Repair parts for repairable special tools are also listed in this section. Items listed are shown on the associated illustration (s)/figure (s).

**b. Section III. Special Tools List.** A list of special tools, special TM DE, and other special support equipment authorized by this RPSTL (as indicated by Basis of Issue (BOI) information in DESCRIPTION AND USUABLE ON CODE column) for the performance of maintenance. (Not applicable).

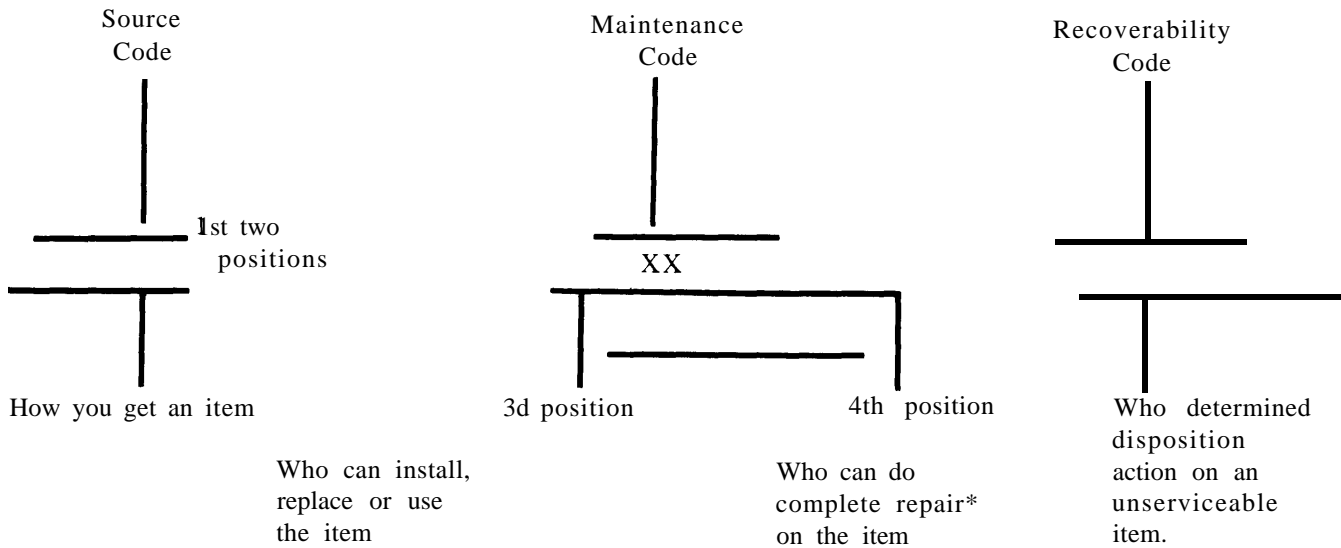
**c. Section IV. National Stock Number and Part Number Index.** A list, in National Item Identification Number (NIIN) sequence, of all National stock numbered items appearing in the listing, followed by a list in alphanumeric sequence of all part numbers appearing in the listings. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance.

#### **C-3. Explanation of Columns (Sections II and III).**

**a. Item No. (Column (1)).** Indicates the number used to identify items called out in the illustration.

**b. SMR Code (Column (2)).** The Source, Maintenance, and Recoverability (SMR) code is a 5- position code containing supply/requisitioning information, maintenance category authorization criteria, and disposition instruction, as shown in the following breakout:





\*Complete Repair: Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item.

(1) **Source Code.** The source code tells you how to get an item needed for maintenance, repair, or overhaul of an end item / equipment. Explanations of source codes follows:

Code	Explanation
PA PB PC** PD PE PF PG	Stocked items; use the applicable NSN to request requisition items these source codes. They are authorized to the category indicated by the code entered in the 3d position of the SMR code.  **NOTE: Items coded PC are subject to deterioration.
KD KF KB	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance category indicated in the 3d position of the SMR code. The complete kit must be requisitioned and applied.

CODE

Explanation

MO-	(Made at org/AVUM Level)	<p>Items with these codes are not to be requested/requisitioned individually. They must be made from bulk material which is identified by the part number in the DESCRIPTION AND USABLE ON CODE (UOC) column and listed in the Bulk Material group of the repair parts list in this RPSTL. If the item is authorized to you by the 3d position code of the SMR code, but the source code indicates it is made at a higher level, order the item from the higher level of maintenance.</p>
MF-	(Made at DS/AVUM Level)	
MH-	(Made at GS Level)	
ML-	(Made at Specialized Repair Act (SRA))	
MD-	(Made at Depot)	
AO-	(Assembled by org AVUM Level)	<p>Items with these codes are not to be requested/requisitioned individually. The parts that make up these assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the 3d position code of the SMR code authorizes you to replace the item, but the source code indicates the item is assembled at a higher level, order the item from the higher level of maintenance.</p>
AF-	(Assembled by DS/AVIM Level)	
AH-	(Assembled by GS Category)	
AL-	[Assembled by SRA)	
AD-	(Assembled by Depot)	

- XA- Do not requisition an "XA"-coded item. Order its next higher assembly. (Also, refer to the NOTE below.)
- XB- If an "XB" item is not available from salvage, order it using the FSCM and part number given.
- XC- Installation drawing, diagram, instruction sheet, field service drawing, that is identified by manufacturer's part number.
- XD- Item is not stocked. Order an "XD"-coded item through normal supply channels using the FSCM and part number given, if no NSN is available.

NOTE: Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes, except for those source coded "XA" or those aircraft support items restricted by requirements of AR 700-42.

(2) **Maintenance Code.** Maintenance codes tells you the level(s) of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the SMR Code as follows:

(a) The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to one of the following levels of maintenance.

Code	Application/Explanation
C	-Crew or operator maintenance done within organizational or aviation unit maintenance.
O	-Organizational or aviation unit category can remove, replace, and use the item.
F	-Direct support or aviation intermediate level can remove, replace, and use the item.
H	-General support level can remove, replace, and use the item.
L	-Specialized repair activity can remove, replace, and use the item.
D	-Depot level can remove, replace, and use the item.

(b) The maintenance code entered in the fourth position tells whether or not the item is to be repaired and identifies the lowest, maintenance level with the capability to do complete repair (i.e., perform all authorized repair functions). (NOTE: Some limited repair may be done on the item at a lower level of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes.) This position will contain one of the following maintenance codes.

CODE	Application/Explanation
O	-Organizational or (aviation unit) is the lowest level that can do complete repair of the item.
F	-Direct support or aviation intermediate is the lowest level that can do complete repair of the item.
H	-General support is the lowest level that can do complete repair of the item.
L	-Specialized repair activity (designate the specialized repair activity) is the lowest level that can do complete repair of the item.
D	-Depot is the lowest level that can do complete repair of the item.
Z	-Nonreparable. No repair is authorized,
B	-No repair is authorized. (No parts or special tools are authorized for the maintenance of a "B" coded item). However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.

(3) **Recoverability Code.** Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the SMR Code as follows:

Recoverability Codes	Application/Explanation
Z	-Nonreparable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in 3d position of SMR Code.
O	-Reparable item. When uneconomically reparable, condemn and dispose of the item at organizational or aviation unit level.
F	-Reparable item. When uneconomically reparable, condemn and dispose of the item at the direct support or aviation intermediate level.
H	-Reparable item. When uneconomically reparable, condemn and dispose of the item at the general support level.
D	-Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item not authorized below depot level.
L	-Reparable item. Condemnation and disposal not authorized below specialized repair activity (SRA).
A	-Item requires special handling or condemnation procedures because of specific reasons (e.g., precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals / directives for specific instructions.

**c. FSCM (Column (3)).** The Federal Supply Code for Manufacturer (FSCM) is a 5-digit numeric code which is used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

**d. PART NUMBER (Column (4)).** 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.

NOTE: When you use a NSN to requisition an item, the item you receive may have a different part number from the part ordered.

**e. DESCRIPTION AND USABLE ON CODE (UOC) (Column (5)).** This column includes the following information:

- (1) The Federal item name and, when required, a minimum description to identify the item.
- (2) The physical security classification of the item is indicated by the parenthetical entry (insert applicable physical security classification abbreviation, e.g., Phy Sec CI (C) -Confidential, Phy Sec CI (S) -Secret, Phy Sec CI -Top Secret).
- (3) Items that are included in kits and sets are listed below the name of the kit or set.

(4) Spare/repair parts that make up an assembled item are listed immediately following the assembled item line entry.

(5) Part numbers for bulk materials are referenced in this column in the line item entry for the item to be manufactured fabricated.

(6) When the item is not used with all serial numbers of the same model, the effective serial numbers are shown on the last line(s) of the description (before UOC).

(7) The usable on code, when applicable (see paragraph C-5, Special information.

(8) In the Special Tools List section, the basis of issue (BOI) appears as the last line(s) in the entry for each special tool, special TMDE, and other special support equipment. When density of issue, the total authorization is increased proportionately.

(9) The statement "END OF FIGURE" appears just below the last item description in Column 5 for a given figure in both Section 11 and Section 111.

*f. QTY (Column 6).* The QTY (quantity per figure column) indicates the quantity of the item used in the breakdown shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column in lieu of a quantity indicates that the quantity is variable and the quantity may vary from application to application.

**C-4. Explanation of Columns (Sect. IV).**

**a. NATIONAL STOCK NUMBER (NSN) INDEX.**

**(1) STOCK NUMBER Column.** This column lists the NSN by National item identification number (NIIN) sequence. The NIIN consists of the last nine digits of the NSN (i.e., 5305-01-674-1467). When using this column to locate an item, ignore the first 4 digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

**(2) FIG. column.** This column lists the number of the figure where the item is identified/located. The figures are in numerical order in Section II and Section III.

**(3) ITEM column.** The item number identifies the item associated with the figure listed in the adjacent FIG. column. This item is also identified by the NSN listed on the same line.

**b. PART NUMBER INDEX.** Part numbers in this index are listed by part number in ascending alphanumeric sequence (i.e., vertical arrangement of letter and number combination which places the first letter or digit of each group in order A through Z, followed by the numbers 0 through 9 and each following letter or digit in like order).

**(1) FSCM column** The Federal Supply Code for Manufacturer (FSCM) is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

**(2) PART NUMBER column.** Indicate the primary number used by the manufacturer (individual, 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.

(3) **STOCK NUMBER column.** This column lists the NSN for the associated part number and manufacturer identified in the PART NUMBER and FSCM columns to the left.

(4) **FIG. column.** This column lists the number of figure where the item is identified/located in Section II and 111.

(5) **ITEM column.** The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

**C-5. Special Information.** Use the following subparagraphs as applicable.

**a. USABLE ON CODE.** The usable on code appears in the lower left corner of the Description column heading. Usable codes are shown as "UOC . . . . . " in the Description Column (justified left) on the first line applicable item description/nomenclature. Uncoded items are applicable to all models.

**b. INDEX NUMBERS.** Items which have the word BULK in the figure column will have an index number shown in the item number column. This index number is a cross-reference between the National Stock Number/Part Number Index and the bulk material list in Section II.

**C-6. How to locate Repair Parts.**

**a. When National Stock Number or Part Number is Not Known.**

(1) **First.** Using the table of contents, determine the assembly group or subassembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and listings are divided into the same group.

(2) **Second.** Find the figure covering the assembly group or subassembly group to which the item belongs.

(3) **Third.** Identify the item on the figure and note the item number,

(4) **Fourth.** Refer to the Repair Parts Lists for the figure to find the part number for the item number noted on the figure.

(5) **Fifth.** Refer to the Part Number Index to find the NSN, if assigned.

**b. When National Stock Number or Part Number is Known:**

(1) **First.** Using the Index of National Stock Numbers and Part Numbers, find the pertinent National Stock Number or Part Number. The NSN index is in National Item Identification Number (NIIN) sequence (see C-4.a.(1)). The part numbers in the Part Number index are listed in ascending alphanumeric sequence (see C-4.b.). Both indexes cross-reference you to the illustration figure and item number of the item you are looking for.

(2) **Second.** After finding the figure and item number, verify that the item is the one you're looking for, then locate the item number in the repair parts list for the figure.

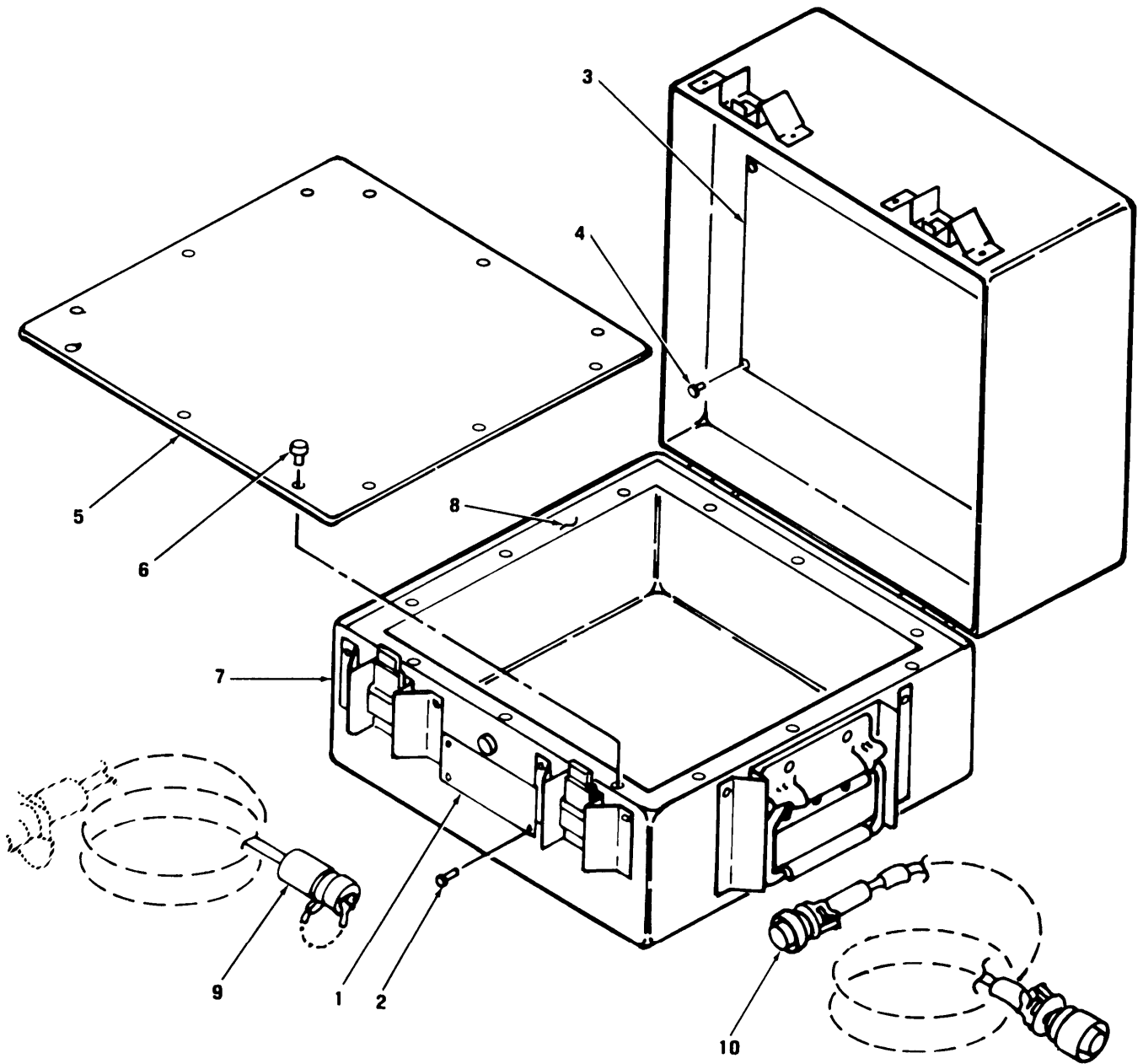


FIGURE C-1. H296A-1 Temperature/Speed Simulator Exploded View

## SECTION II

TM55-4920-411-13&amp;P C1

(1) ITEM NO	(2) SMR CODE	(3) FSCM	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODE (UOC)	(6) QTY
GROUP 01.TEMPERATURE AND SPEED SIMULATOR					
FIGURE C-1. H296A-1 TEMPERATURE/ SPEED SIMULATOR EXPLODED VIEW					
1	MFFZZ	98869	BH4742-1	NAME PLATE	1
2	PAFZZ	96906	MS21318-1	SCREW,DRIVE	4
3	MFFZZ	98869	BH18822A-1	INSTRUCTION PLATE	1
4	PAOZZ	96906	MS21318-1	SCREW,DRIVE	V
5	XAFFF	98869	BH18810A-1	DECK ASSY (SEE FIGS. C-2 AND C-3 FOR BREAKDOWN)	1
6	PAOZZ	96906	MS3212-35	SCREW,MACHINE	12
7	XAFFF	98869	BH21442	CASE ASSY	1
8	XDFZZ	98869	BH23539	GASKET	1
9	PBOFF	98869	BH2833	CABLE,ASSEMBLY	1
10	XDOFF	98869	BH21441	CABLE TEST	1

END OF FIGURE



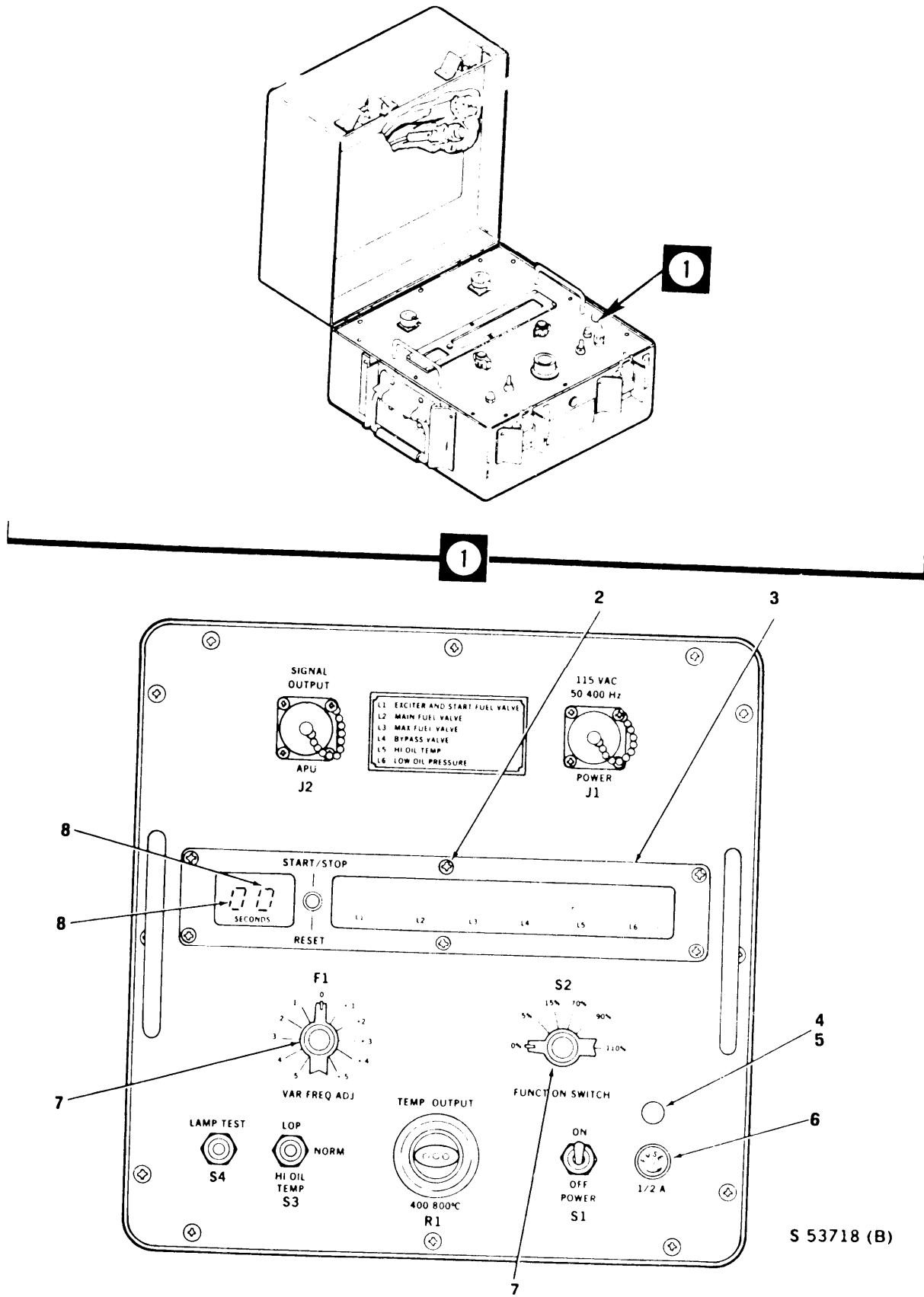


Figure C-2. Simulator, Temperature and Speed

## SECTION II

TM55-4920-411-13&amp;P C1

(1) ITEM NO	(2) SMR CODE	(3) FSCM	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODE (UOC)	(6) QTY
				FIGURE C-2. SIMULATOR, TEMPERATURE AND SPEED	
1	XAFFF	98869	BH18810A-1	DECK ASSY	V
2	PAOZZ	96906	MS3212-3	SCREW, MACHINE	6
3	XDFZZ	98869	BH18815-1	BEZEL ASSY, DISPLAY	1
4	PAOZZ	72619	250-1473-500	LENS, LIGHT	1
5	PAOZZ	72619	250-8758-33-504	LIGHT, INDICATOR	1
6	PAOZZ	81349	F02A250V1-2A	FUSE, CARTRIDGE	1
7	PAOZZ	21604	SS70BL2BLK	KNOB	2
8	XDFZZ	50436	5082-7653	SEMINCONDUCTOR, DEVIC	2

END OF FIGURE

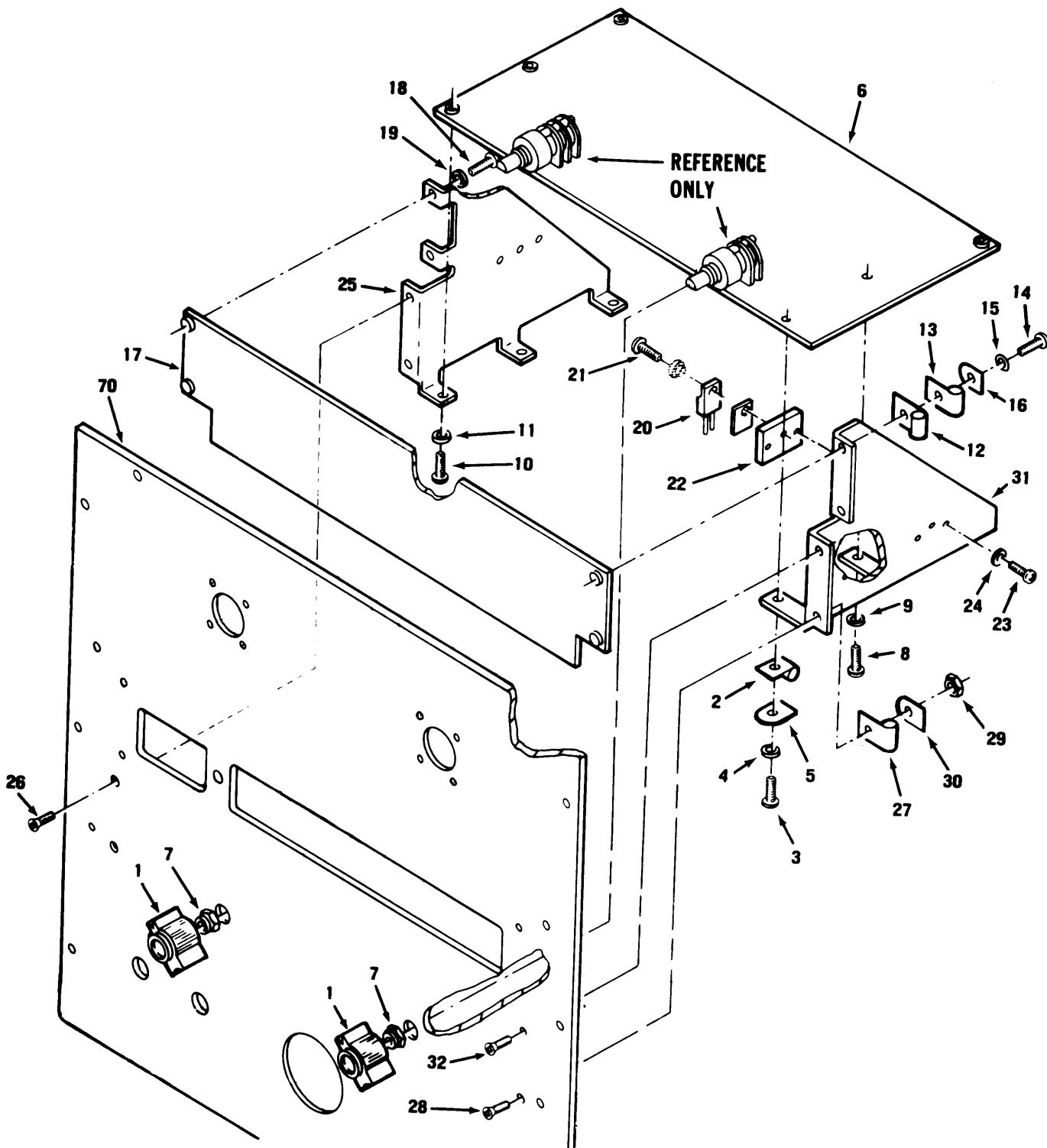


FIGURE C3. Deck Assembly Exploded View (Sheet 1 of 2)

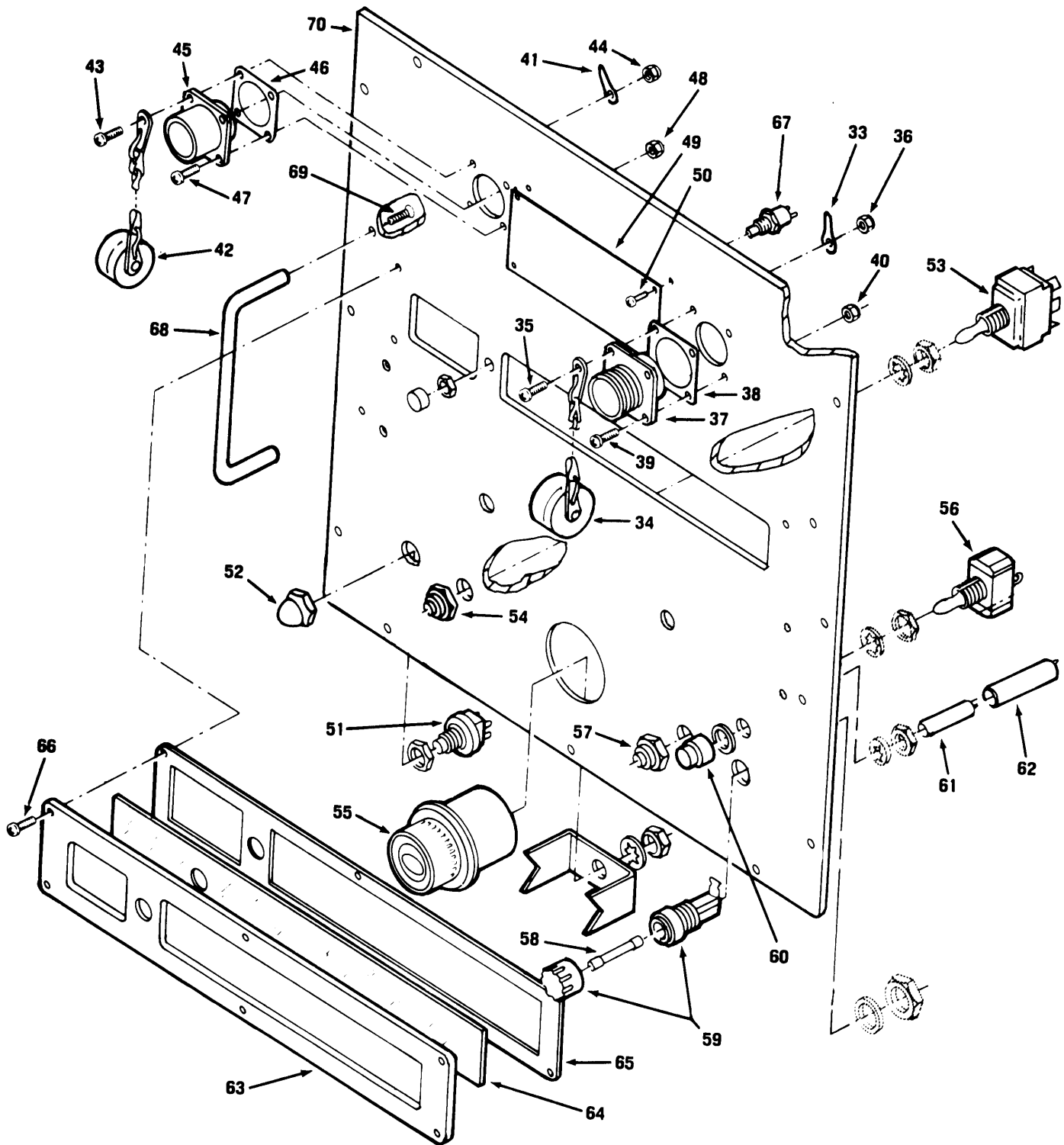


FIGURE C3.Deck Assembly Exploded View (Sheet 2 of 2)

(1) ITEM NO	(2) SMR CODE	(3) FSCM	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODE (UOC)	(6) QTY
FIGURE C-3. DECK ASSEMBLY EXPLODED VIEW					
1	PAOZZ	21604	SS70BL2BLK	KNOB	2
2	PAFZZ	96906	MS39014-3	CLAMP, LOOP	1
3	PAFZZ	96906	MS51957-30	SCREW, MACHINE	2
4	PAFZZ	96906	MS35333-71	WASHER, LOCK	2
5	XDFZZ	18876	10581512-1	WASHER, SADDLE	1
6	PBFFF	98869	BH19072-1	PRINTED CIRCUIT BOA	1
7	XDFZZ	97539	N-9030-1/4RFI	SEAL NUT	2
8	PAFZZ	96906	MS51957-30	SCREW, MACHINE	1
9	PAFZZ	96906	MS35333-71	WASHER, LOCK	1
10	PAFZZ	96906	MS51957-13	SCREW, MACHINE	4
11	PAFZZ	96906	MS35333-70	WASHER, LOCK	4
12	XDFZZ	96906	MS39014-2	CLAMP, CABLE	1
13	PAFZZ	96906	MS39014-3	CLAMP, LOOP	1
14	PAFZZ	96906	MS51957-13	SCREW, MACHINE	1
15	PAFZZ	96906	MS35333-70	WASHER, LOCK	1
16	XDFZZ	18876	10581512-1	WASHER, "D"	1
17	PBFFF	98869	BH21444-1	DISPLAY BOARD ASSY	1
18	PAFZZ	96906	MS51957-13	SCREW, MACHINE	3
19	PAFZZ	96906	MS35333-70	WASHER, LOCK	3
20	PAFZZ	02735	2N6109	TRANSISTOR	1
21	PAFZZ	96906	MS51957-13	SCREW, MACHINE	1
22	XDFZZ	98869	BH18808	HEATSINK, TRANSISTOR	1
23	PAFZZ	96906	MS51957-13	SCREW, MACHINE	2
24	PAFZZ	96906	MS35333-70	WASHER, LOCK	2
25	XDFZZ	98869	BH18806A	BRACKET, PCB L. H.	1
26	PAFZZ	96906	MS51959-14	SCREW, MACHINE	2
27	XDFZZ	96906	MS39014-2	CLAMP CABLE	1
28	PAFZZ	96906	MS51959-14	SCREW, MACHINE	1
29	PAFZZ	96906	MS21045-04	NUT, SELF-LOCKING, HE	1
30	XDFZZ	18876	10581512-1	WASHER, SADDLE	1
31	XDFZZ	98869	BH18807A	BRACKET, PCB R. H.	1
32	PAFZZ	96906	MS51959-14	SCREW, MACHINE	1
33	XDFZZ	98869	1410-4	GND LUG	1
34	PAFZZ	96906	MS25043-16DA	COVER, ELECTRICAL CO	1
35	XDFZZ	96906	MS3212-6	SCREW, MACHINE	1
36	PAFZZ	96906	MS21045-04	NUT, SELF-LOCKING, HE	1
37	XDFZZ	96906	MS3102E-16S-5P	CONNECTOR	1
38	PAFZZ	77820	10-36675-16	GASKET	1
39	PAFZZ	96906	MS3212-4	SCREW, MACHINE	3
40	PAFZZ	96906	MS21045-04	NUT, SELF-LOCKING, HE	3
41	XDFZZ	98869	1410-4	GND LUG	1
42	PAFZZ	96906	MS3181-14C	COVER, ELECTRICAL CO	1
43	XDFZZ	96906	MS3212-6	SCREW, MACHINE	1
44	PAFZZ	96906	MS21045-04	NUT, SELF-LOCKING, HE	1
45	PBFZZ	98869	BH9453P	CONNECTOR, RECEPTACL	1
46	PAFZZ	77820	10-101949-14	GASKET	1
47	PAFZZ	96906	MS3212-4	SCREW, MACHINE	3
48	PAFZZ	96906	MS21045-04	NUT, SELF-LOCKING, HE	3
49	MFFZZ	98869	BH21443	DECAL	1

## SECTION II

TM55-4920-411-13&amp;P C1

(1) ITEM NO	(2) SMR CODE	(3) FSCM	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODE (UOC)	(6) QTY
50	PAFZZ	96906	MS21318-1	SCREW,DRIVE	4
51	PBFZZ	81703	35-3	SWITCH,PUSH	1
52	PAFZZ	27193	SW1AN3030	BOOT,DUST AND MOIST	1
53	PAFZZ	96906	MS25201-6	SWITCH,TOGGLE	1
54	PAFZZ	81349	M5423/02-01	BOOT,DUST AND MOIST	1
55	PBFZZ	80294	3650S-1-202	RESISTOR,VARIABLE,W IRE WOUND	1
56	PAFZZ	96906	MS35058-23	SWITCH,TOGGLE	1
57	PAFZZ	81349	M5423/02-01	BOOT UOC:SPD	1
58	PAOZZ	81349	F02A250V1/2A	FUSE,CARTRIDGE	V
59	XDFZZ	75915	342004	FUSE HOLDER	1
60	PAOZZ	72619	250-1473-500	LENS,LIGHT	1
61	PAOZZ	72619	507-5824-0747-60 0	LAMP,CARTRIDGE	1
62	PAFZZ	72619	250-8758-33-504	LIGHT,INDICATOR	V
63	XAFZZ	98869	BH18819	FRAME	1
64	XAFZZ	98869	BH18820-1	WINDOW	1
65	XAFZZ	98869	BH18818	GASKET	1
66	PAOZZ	96906	MS3212-3	SCREW,MACHINE	6
67	PBFZZ	81073	30-251R	SWITCH,PUSH	1
68	XDFZZ	83330	1627	HANDLE	2
69	XDFZZ	96906	MS24693P6	SCREW MACHINE	4
70	XAFZZ	98869	BH18805A-1	DECK,MARKED	1

END OF FIGURE

## CROSS-REFERENCE INDEXES

## NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5930-00-044-3518	C-3	53	5935-01-113-1615	C-3	45
5305-00-054-5647	C-3	10	4920-01-121-5113	C-3	17
	C-3	14	4920-01-122-0446	C-3	6
	C-3	18	5935-01-184-7188	C-3	34
	C-3	21	5930-01-219-6973	C-3	51
	C-3	23			
5305-00-054-6654	C-3	3			
	C-3	8			
6210-00-244-1994	C-2	5			
	C-3	62			
5305-00-253-5603	C-1	2			
	C-1	4			
	C-3	50			
5920-00-280-8344	C-2	6			
	C-3	58			
5330-00-292-3958	C-3	38			
5355-00-403-1590	C-2	7			
	C-3	1			
5305-00-455-2636	C-1	6			
5930-00-522-1794	C-3	67			
5930-00-539-7013	C-2	57			
	C-3	54			
	C-3	57			
5310-00-550-3715	C-3	11			
	C-3	15			
	C-3	19			
	C-3	24			
5330-00-585-1591	C-3	46			
5310-00-616-3555	C-3	4			
	C-3	9			
5930-00-655-1515	C-3	56			
5305-00-763-7822	C-3	26			
	C-3	28			
	C-3	32			
5305-00-855-2996	C-2	2			
	C-3	66			
4920-00-877-3933	C-1	9			
5310-00-889-2543	C-3	29			
	C-3	36			
	C-3	40			
	C-3	44			
	C-3	48			
5935-00-899-9361	C-3	42			
6240-00-924-6438	C-3	61			
5305-00-965-5944	C-3	39			
	C-3	47			
5961-01-012-9316	C-3	20			
6210-01-018-7376	C-2	4			
	C-3	60			
5905-01-069-1533	C-3	55			

## NATIONAL STOCK NUMBER AND PART NUMBER INDEX

FSCM	PART NUMBER	PART NUMBER INDEX	
		STOCK NUMBER	FIG. ITEM
98869	BH18805A-1		C-3 70
98869	BH18806A		C-3 25
98869	BH18807A		C-3 31
98869	BH18808		C-3 22
98869	BH18810A-1		C-1 5
			C-2 1
98869	BH18815-1		C-2 3
98869	BH18818		C-3 65
98869	BH18819		C-3 63
98869	BH18820-1		C-3 64
98869	BH18822A-1		C-1 3
98869	BH19072-1	4920-01-122-0446	C-3 6
98869	BH21441		C-1 10
98869	BH21442		C-1 7
98869	BH21443		C-3 49
98869	BH21444-1	4920-01-121-5113	C-3 17
98869	BH23539		C-1 8
98869	BH2833	4920-00-877-3933	C-1 9
98869	BH4742-1		C-1 1
98869	BH9453P	5935-01-113-1615	C-3 45
81349	F02A250V1-2A	5920-00-280-8344	C-2 6
81349	F02A250V1/2A	5920-00-280-8344	C-3 58
96906	MS21045-04	5310-00-889-2543	C-3 29
			C-3 36
			C-3 40
			C-3 44
			C-3 48
96906	MS21318-1	5305-00-253-5603	C-1 2
			C-1 4
			C-3 50
96906	MS24693P6		C-3 69
96906	MS25043-16DA	5935-01-184-7188	C-3 34
96906	MS25201-6	5930-00-044-3518	C-3 53
96906	MS3102E-16S-5P		C-3 37
96906	MS3181-14C	5935-00-899-9361	C-3 42
96906	MS3212-3	5305-00-855-2996	C-2 2
			C-3 66
96906	MS3212-35	5305-00-455-2636	C-1 6
96906	MS3212-4	5305-00-965-5944	C-3 39
			C-3 47
96906	MS3212-6		C-3 35
			C-3 43
96906	MS35058-23	5930-00-655-1515	C-3 56
96906	MS35333-70	5310-00-550-3715	C-3 11
			C-3 15
			C-3 19
			C-3 24
96906	MS35333-71	5310-00-616-3555	C-3 4
			C-3 9
96906	MS39014-2		C-3 12
			C-3 27



## NATIONAL STOCK NUMBER AND PART NUMBER INDEX

FSCM	PART NUMBER	PART NUMBER INDEX STOCK NUMBER	FIG.	ITEM
96906	MS39014-3		C-3	2
			C-3	13
96906	MS51957-13	5305-00-054-5647	C-3	10
			C-3	14
			C-3	18
			C-3	21
			C-3	23
96906	MS51957-30	5305-00-054-6654	C-3	3
			C-3	8
96906	MS51959-14	5305-00-763-7822	C-3	26
			C-3	28
			C-3	32
81349	M5423/02-01	5930-00-539-7013	C-2	57
			C-3	54
			C-3	57
97539	N-9030-7/4RFI		C-3	7
21604	SS70BL2BLK	5355-00-403-1590	C-2	7
			C-3	1
27193	SW1AN3030		C-3	52
77820	10-101949-14	5330-00-585-1591	C-3	46
77820	10-36675-16	5330-00-292-3958	C-3	38
18876	10581512-1		C-3	5
			C-3	16
			C-3	30
98869	1410-4		C-3	33
			C-3	41
83330	1627		C-3	68
02735	2N6109	5961-01-012-9316	C-3	20
72619	250-1473-500	6210-01-018-7376	C-2	4
			C-3	60
72619	250-8758-33-504	6210-00-244-1994	C-2	5
			C-3	62
81073	30-251R	5930-00-522-1794	C-3	67
75915	342004		C-3	59
81703	35-3	5930-01-219-6973	C-3	51
80294	3650S-1-202	5905-01-069-1533	C-3	55
72619	507-5824-0747-60	6240-00-924-6438	C-3	61
	0			
50436	5082-7653		C-2	8



## APPENDIX D

### EXPENDABLE SUPPLIES AND MATERIALS LIST

#### Section 1. INTRODUCTION

**1. Scope.**

This appendix lists expendable supplies and materials you will need to operate and maintain the Temperature and Speed Simulator. These items are authorized to you by CTA 50-970, Expendable items (Except Medical, Class V, Repair Parts, and Heraldic Items).

**2. Explanation of Columns.**

*a. Column 1- Item number.* This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, App, D").

*b. Column 2- Level.* This column identifies the lowest level of maintenance that requires the listed item.

O - Organizational Maintenance

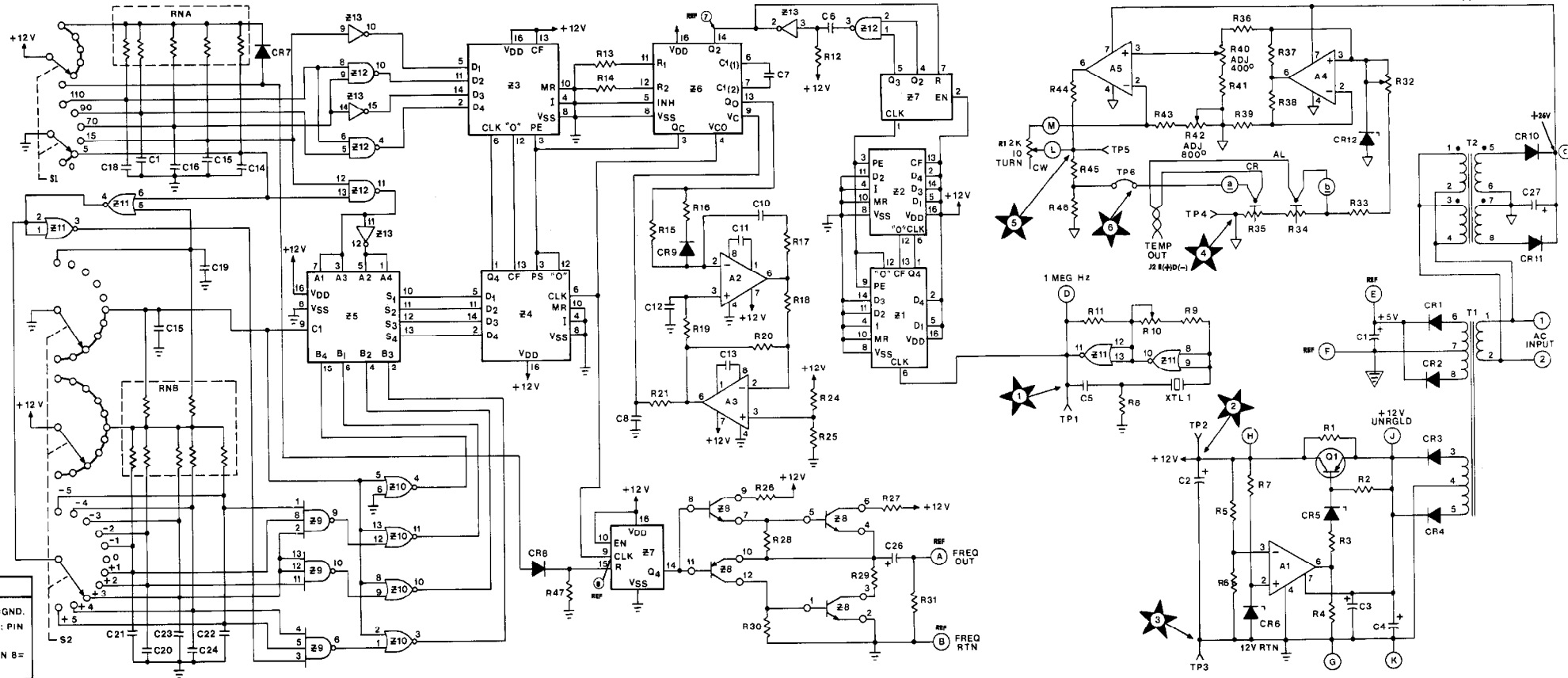
*c. Column 3- National Stock Number.* This is the National stock number assigned to the item; use it to request or requisition the item.

*d. Column 4 - Description.* Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

*e. Column 5- Unit of Measure (U/M).* Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	0	8010-00-598-5934	Enamel, Fed Std 595 #36231 Gray	PT
2	0	8010-00-286-7758	Enamel, Fed Std 595 #13538 Yellow	QT
3	0	8010-00-527-2884	Lacquer, Fed Std 595 #37038 Black	GL
4	0	6850-00-285-8011	Solvent, Dry-Cleaning, P-D-680, Type II	GL
5	0	8305-00-267-3015	Cloth, CCC-C-440	

PIN: 059991-001



**NOTES**

1. Z8, PIN 16 (SUBSTRATE)=GND.
2. Z9, IO, 11 & 12, PIN 7=GND; PIN 14=+12V.
3. Z13, PIN 1 & 16=+12V; PIN 8=GND.

FIGURE FO-1. Signal Generator Board (PCB 2) Schematic





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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 THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

PFC JOHN DOE  
COA, 3d ENGINEER BN  
FT. LEONARDWOOD, MD 63108

DATE SENT

PUBLICATION NUMBER

TM 55-4920-411-13&P

PUBLICATION DATE

2 June 1986

PUBLICATION TITLE Operator's, AVUM and AVIM Maintenance Manual, Temperature and Speed Simulator

BE EXACT... PIN-POINT WHERE IT IS

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

6

2-1  
a

B1

4-3

125

line 20

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

In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.

Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim - Please correct one or the other.

I ordered a gasket, item 19 on figure B-16 by NSN 2 910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER

JOHN DOE, PFC (268) 317-7111

SIGN HERE

JOHN DOE

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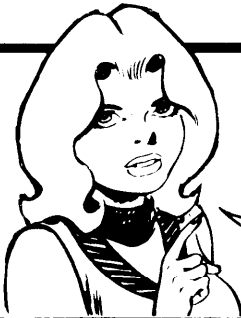
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DEPARTMENT OF THE ARMY  
DOD 314



COMMANDER  
U S ARMY AVIATION SYSTEMS COMMAND  
ATTN: AMSAV-MPSD  
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ST. LOUIS, MO 63120-1798

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PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO

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

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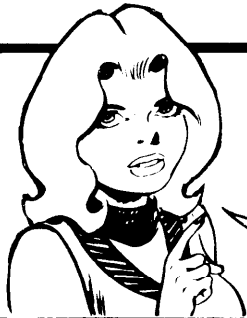
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TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



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FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER

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PUBLICATION DATE

2 June 1986

PUBLICATION TITLE Operator's, AVUM and AVIM Maintenance Manual, Temperature and Speed Simulator

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:

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**DA** FORM 1 JUL 79 **2028-2**

PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 2, 1 Nov 80.

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TEAR ALONG PERFORMANCE LINE

# The Metric System and Equivalents

## Linear Measure

1 centimeter = 10 millimeters = .39 inch  
 1 decimeter = 10 centimeters = 3.94 inches  
 1 meter = 10 decimeters = 39.37 inches  
 1 dekameter = 10 meters = 32.8 feet  
 1 hectometer = 10 dekameters = 328.08 feet  
 1 kilometer = 10 hectometers = 3,280.8 feet

## Weights

1 centigram = 10 milligrams = .15 grain  
 1 decigram = 10 centigrams = 1.54 grains  
 1 gram = 10 decigrams = .035 ounce  
 1 dekagram = 10 grams = .35 ounce  
 1 hectogram = 10 dekagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

## Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce  
 1 deciliter = 10 centiliters = 3.38 fl. ounces  
 1 liter = 10 deciliters = 33.81 fl. ounces  
 1 dekaliter = 10 liters = 2.64 gallons  
 1 hectoliter = 10 dekaliters = 26.42 gallons  
 1 kiloliter = 10 hectoliters = 264.18 gallons

## Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch  
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches  
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet  
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet  
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres  
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

## Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch  
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches  
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

## Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

## Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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