TM 11-5820-585-14

TECHNICAL MANUAL

TECHNICAL MANUAL
OPERATOR'S ORGANIZATIONAL, DIRECT SUPPORT
AND GENERAL SUPPORT MAINTENANCE MANUAL

FOR

MAINTENANCE CONTROL GROUP AN/GSA-100 (NSN 5895-00-930-5586) (NUS 6284)

HEADQUARTERS, DEPARTMENT OF THE ARMY

JULY 1976

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 24-volt dc power supply circuits, or on the 115-volt ac line connections. Serious injury or death may result from contact with these points.

DON'T TAKE CHANCES!

Technical Manual)
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NO. 11-5820-585-14)

HEADQUARTERS

DEPARTMENT OF THE ARMY

Washington, DC, 29 July 1976

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL FOR MAINTENANCE CONTROL GROUP AN/GSA-100 (NSN 5895-00-930-5586) (NUS 6284)

CONTENTS

PART I. OVERALL MAINTENANCE CONTROL CENTER (TRIBUTARY SITES)

CONTENTS (CONT)

CONTENTS (Cont)

This technical manual is an authentication of the manufacturer' commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

LIST OF ILLUSTRATIONS

PART II. MODULES

4-wire telephone NUS 5165-8 and NUS 5165-45

Power supply NUS 5165-27G1 through G5

1600 cps tone generator NUS 5165-30G1

1600 cps tone receiver NUS 5165-37G1

Audio amplifier NUS 5165-40G1 and G2

Status indicator NUS 5165-44G1

PREFACE

This manual describes maintenance control center NUS 6284 installed at tributary sites of the ET-A communications system. It provides installation instructions, operating procedures, theory of operation, and maintenance information. Theory of operation is described at the equipment level, and emphasis is placed on the interrelation of the modules rather than on circuit details. The modules are described in Part II.

The maintenance control center conforms to a modular concept and is maintained to the direct support (3rd echelon) level. Maintenance to this level of support is concerned with localizing trouble to a particular module. When the trouble is localized, replace the defective module. Refer to Instruction Manual for Test Facilities Kit MK-884/FRC-81(V), TM 11-6625-647-14/1 and -14/2 for maintenance information on the modules.

The maintenance control center is a component equipment in the *ET-A* communications system. The following is a list *of* publications pertaining to the ET-A communications system component equipments.

Manual Title	Manual Number
Maintenance Control Group AN/GSA-99(V)1 through AN/GSA-99(V)12 (NUS 6283)	11-5820-570-14
Operator's Manual for Center, Communications Operations AN/MSQ-76(V)1 through AN/MSQ-76(V)3 and AN/GSQ-106(V)1 through AN/GSQ-106(V)3 (Console Local Equipment)	11-5820-571-10
Radio Set AN/FRC-113(V)1 throughAN/FRC-113(V)11 (NUS 6060)	11-5820-572-14
Multiplexer Set AN/FCC-40 through AN/FCC-54	11-5820-573-15
Nodal Point Receiver (NUS 8021/8024)	11-5820-574-14
Console, Communication Control OA-8149/MRC-114(V) through OA-8154/MRC-114(V) (NUS 5972-5, -6)	11-5820-575-14
Console Training Facility (NUS 8423)	11-5820-576-14
Switching Set, Communications AN/MSQ-74(V)1 through AN/MSQ-74(V)10 and AN/MSQ-74(V)12 (Console Remote Equipment) (NUS 7640)	11-5820-577-14
Center, Communications Operations AN/MSQ-76(V)1 through AN/MSQ-76(V)3 and AN/GSQ-106(V)1 through AN/GSQ-106(V)3 (Console Local Equipment)	11-5820-578-24
Communication Group OA-8319/MSM (NUS 6052-23G1)	11-5820-578-14-1
Power Amplifier Group AN/MRA-15 (NUS 7561)	11-5820-579-15
Electronic Tube Cooler, ET-A Type 15-27-32.5	11-5820-579-15-1
Amplifier-Power Supply AM-4832/FRC-113(V) (NUS 6061-3)	11-5820-580-14
Transmitter (NUS 5951)	11-5820-581-14
Console, Communication Control OA-7695/GRC and OA-7696/GRC (NUS 5972-3, -7)	11-5820-582-14
Dual Receiver (NUS 5961)	11-5820-583-14
Maintenance Control Group AN/GSA-100 (NUS 6284)	11-5820-585-14
Tributary Terminal Set AN/FSC-34 (NUS 7957)	11-5820-587-15
Amplifier-Power Supply AM-4419/GRC (NUS 8013-2)	11-5820-603-14
ET-A Mainline Site Manual	11-5895-376-14-1
ET-A Tributary Site Manual	11-5895-376-14-2
ET-A Site Equipment, Towers and Antennas	11-5895-376-14-3
Test Facilities Kit MK-884/FRC-81( )	11-6625-647-14

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope of Manual

This manual describes the Maintenance Control Center NUS 6284 (Tributary Sites) (fig. 1) and covers its installation, operation, theory, and maintenance. It includes cleaning and inspection of the equipment and field level maintenance.

2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6, Report of Damaged or Improper Shipment as prescribed in AR 700-58 (Army), NAVSAND 4 Publication 378 (Navy) and AFR 71-4 (Air Force).

c. Comments on Manual. Forward all comments of this publication direct to: Commanding General, U.S. Army Electronics Command, DRSEL-MA-Q, Fort Monmouth, N.J., 07703. DA Form 2028 (Recommended Changes to Publications) should be used.

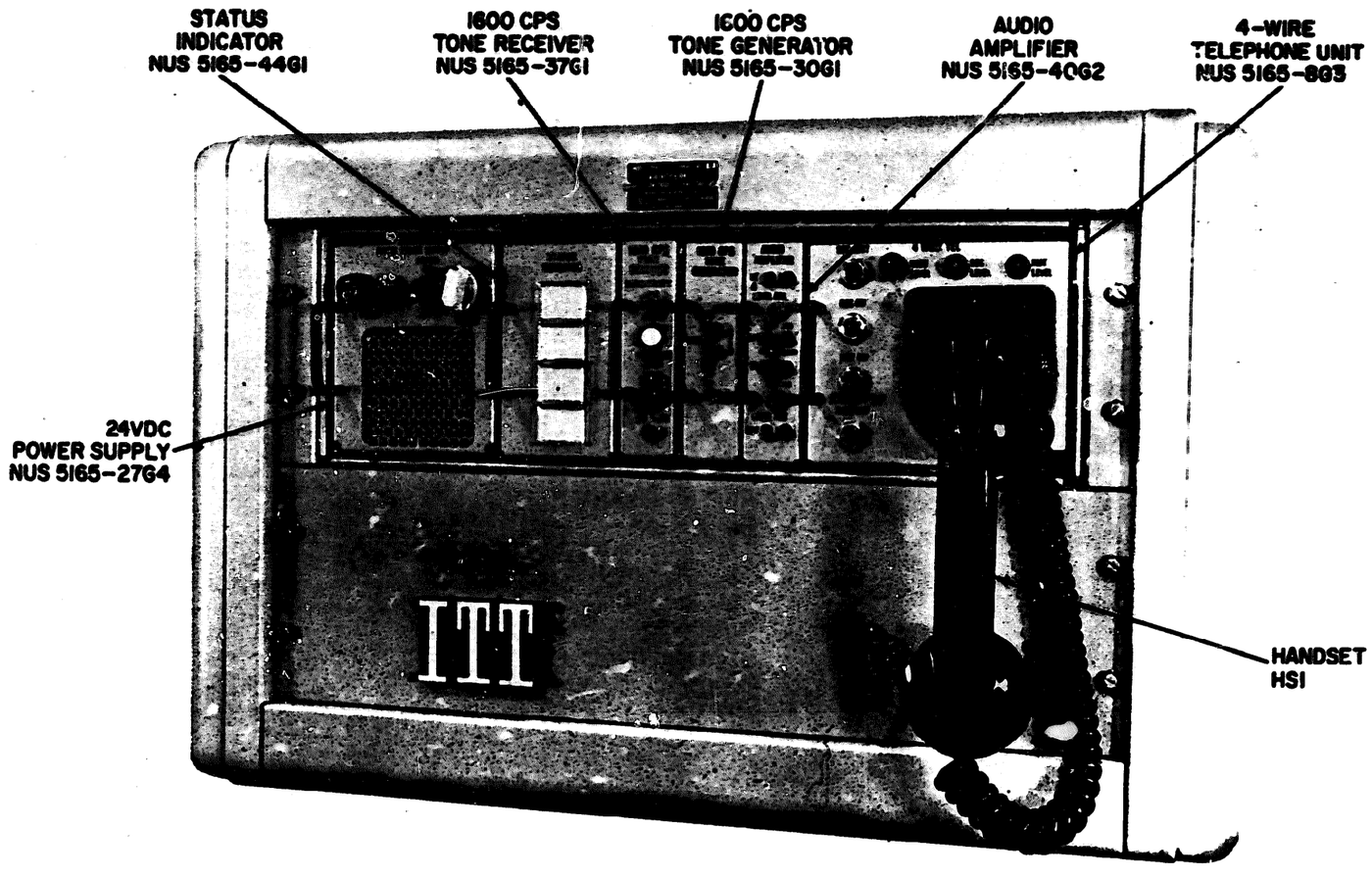


Figure 1. Maintenance Control Center NUS 6284 (tributary sites).

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Maintenance Control Center NUS 6284 (Tributary Sites) provides fault indicating, communicating, and signaling facilities to a local radio shelter. These facilities are extended through an order-wire circuit so that communication can be established between distant shelters and vans at mainline sites.

4. Technical Characteristics

Line Voltage	**115 vac at 0.5 amp**
Operating voltages	**-24 vdc and 24 vac**
Operating ambient temperature	**-29°C to +55°C (-20°F to 121°F)**
Non-operating ambient temperature	**-62°C to +71°C (-80°F to 160°F)**
Ambient relative humidity (external)	**100 percent**
Operating barometric pressure	**Sea level to 10,000 feet**
Non-operating barometric pressure	**Sea level to 40,000 feet**
Number of equipments that can be monitored	**4**

5. Major Assemblies

The major assemblies of the Maintenance Control Center NUS 6284 (Tributary Sites) are listed below.

5. Major Assemblies (cont)

Component	Height (in.)	Depth (in.)	Width (in.)
Frame and Module Assembly NUS 6052-22G1	10.5	14.0	19.0
Cabinet Assembly NUS 6298G1	14.5	19.5	23.5

6. Nomenclature

A list of nomenclature and manufacturers designations for the Maintenance Control Center NUS 6284 (Tributary Sites) is given in the chart below. A common name is provided for each listed item.

Nomenclature	Manufacturers Designation	Common Name
Maintenance Control Group AN/GSA-100	Maintenance Control Center (Tributary) NUS 6284G1	Maintenance control center
Cabinet, Electrical Equipment CY-4875/ GSA-100	Cabinet Assembly NUS 6298G1	Cabinet
Communication Control Group OA-7935/GSA-100	Frame and Module Assembly NUS 6052-22G1	Frame
Drawer, Electrical Equipment, Rack Mounted CH-554/FCC	Frame Assembly NUS 5165-1G1	Frame assembly
Four Wire Telephone Unit, Order Wire TA-655/FCC	4-Wire Telephone NUS 5165-8G3	4-Wire telephone unit

6. Nomenclature (cont)

Nomenclature	Manufacturers Designation	Common Name
Power Supply PP-4444/GRC	Power Supply NUS 5165-27G4	Power supply module
Oscillator, Audio Frequency O-1323/G	1600 CPS Tone Generator NUS 5165-30G1	Tone generator module
Alarm-Monitor BZ-128/GSA-100	Status Indicator NUS 5165-44G1	Status indicator module
Monitor, Audio Frequency ID-1354/G	1600 CPS Tone Receiver NUS 5165-37G1	Tone receiver module
	Audio Amplifier NUS 5165-40G2	Audio amplifier module

7. Modular Subassemblies

The frame and module assembly NUS 6052-22G1 contains six modular subassemblies. Each modular subassembly is shown in figure 1 and its function is given in the chart below.

Modular subassembly	Function
Audio amplifier module	Provides amplification of speech and tone signals.
4-Wire telephone unit	Provides two-way voice communications.
Tone generator module	Provides 1600 cps tone for signaling.
Tone receiver module	Provides audible and visual indication of 1600 cps tone during incoming calls.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. CONTROLS, CONNECTORS, AND INDICATORS

12. Cabinet, Controls and Indicators

The maintenance control center cabinet does not contain any controls, connectors, or indicators, All operating controls, connectors, and indicators are located on the individual module assemblies.

13. 4-Wire Telephone Unit, Controls and Connectors

(fig. 1)

Control or connector	Reference designation	Function
HDST level potentiometer	R9	Adjusts signal level to handset.
REC LEVEL potentiometer	R3	Adjusts signal input level to module.
XMT LEVEL potentiometer	R20	Adjusts signal output level from module.
REC 4W jack	J1	Provides connection for incoming signal measurements.
REC HDST jack	J2	Provides connection for receive handset signal measurements.
XMT 4W jack	J3	Provides connection for outgoing signal measurements.

7. Status Indicator Module, Controls and Indicators

(fig 1)

Control or indicator	Reference designation	Function
Status indicator pushbuttons and associated indicators (4 indicators per circuit)	S1 through S4 and DS2 through DS17	Provide continuous alarm monitoring of site equipments. Light steady green during normal conditions. Corresponding pushbutton flashes red when fault develops and changes to steady red when pushbutton is operated to acknowledge fault. Flashes green when fault is repaired and changes back to steady green when pushbutton is reoperated.
Buzzer	DS1	Sounds when any indicator, DS2 through DS17, is flashing; silenced when flashing indicator is depressed.

18. Power Supply Module, Controls and Indicators

(fig. 1)

Control or indicator	Reference designation	Function
POWER switch	S1	Controls application of 115-vac power to module.
Rower indicator lamp.	DS1	Provides indication that power is applied to power supply.
1 AMP 250V fuse	F1	Protects power lines from shorts developed within the power supply module.
1/2 AMP 250v fuse	F2	Not used.

Section II. OPERATING PROCEDURES

19. Initiating and Answering Calls

To initiate a call from a tributary maintenance control center to a local or distant shelter, remove handset HS1 from its cradle, press the handset signal pushbutton momentarily and communicate with the called party. At the conclusion of conversation, replace the handset on its cradle. To answer an incoming call, remove the handset from its cradle and communicate with the calling party.

20. Monitoring Status Indicators

To monitor the four status indicator pushbuttons, S1 through S4, located on the status indicator module, proceed as follows:

a. Observe that all status indicator pushbuttons, S1 through S4, are not depressed and all lights are green.

b. When a fault develops, the associated status indicator pushbutton changes from steady green to flashing red and buzzer DS1 sounds.

c. Press the flashing red pushbutton to silence the buzzer and acknowledge the fault.

d. Observe that depressed pushbutton changes to steady red and buzzer is silenced.

e. When the fault is corrected, pushbutton changes to flashing green and buzzer sounds.

f. Press the flashing green pushbutton to silence buzzer and acknowledge the all clear condition.

g. Observe that the pushbutton changes to steady green and the buzzer is silenced.

CHAPTER 4

THEORY OF OPERATION

Section I. GENERAL

21. System Application

(fig. 3)

The tributary maintenance control center provides signaling and communication facilities at remote tributary sites. These facilities are extended to a tributary radio shelter for transmission to mainline sites. A nodal point radio van at a mainline site receives the radio transmission for connection to the mainline maintenance control center. Call switching and routing to mainline shelters and vans is accomplished at the mainline maintenance control center. The tributary maintenance control center also provides central alarm status monitoring of major site equipments.

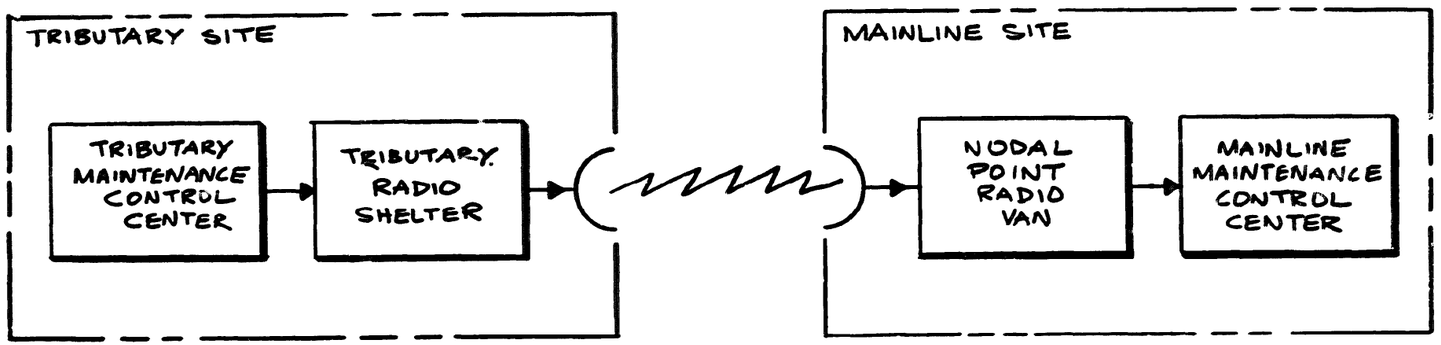


Figure 3. System application, block diagram.

13. 4-Wire Telephone Unit, Controls and Connectors (cont)

Control or connector	Reference designation	Function
XMT HDST jack	J4	Provides connection for transmit handset signal measurements.
Handset	HS1	Used for two-way voice communications.
Pushbutton (on handset)		Used for signaling.

14. Audio Amplifier Module, Controls and Connectors

(fig. 1)

Control or connector	Reference designation	Function
A LEVEL ADJ potentiometer	R8	Adjusts gain of A amplifier.
A IN jacks	J1 and J2	Provide connection for input level measurements to A amplifier.
A OUT and GRD jacks	J3 and J4	Provide connection for output level measurements from A amplifier.
B LEVEL ADJ potentiometer	R27	Adjusts gain of B amplifier.
B IN jacks	J5 and J6	Provide connection for input level measurements to B amplifier.
B OUT and GRD jacks	J7 and J8	Provide connection for output level measurements from B amplifier.

15. Tone Generator Module, Connectors

(fig. 1)

Front panel connectors on the tone generator module are OUTPUT jacks J1 and J2. These jacks are used to measure the tone generator output signal level.

16. Tone Receiver Module, Controls, Indicators, and Connectors

(fig. 1)

Control, connector, or indicator	Reference designation	Function
INCOMING CALL indicator	DS1	Lights when 1600-cps tone signal is present.
Incoming call buzzer	DS2	Sounds to indicate the presence of an incoming call.
SENSITIVITY ADJUST potentiometer	R2	Adjusts sensitivity of tone receiver.
IN test jacks	J1 and J2	Provide connection for input signal measurements.
DC TEST jack	J3	Provides connection for dc voltage measurements.

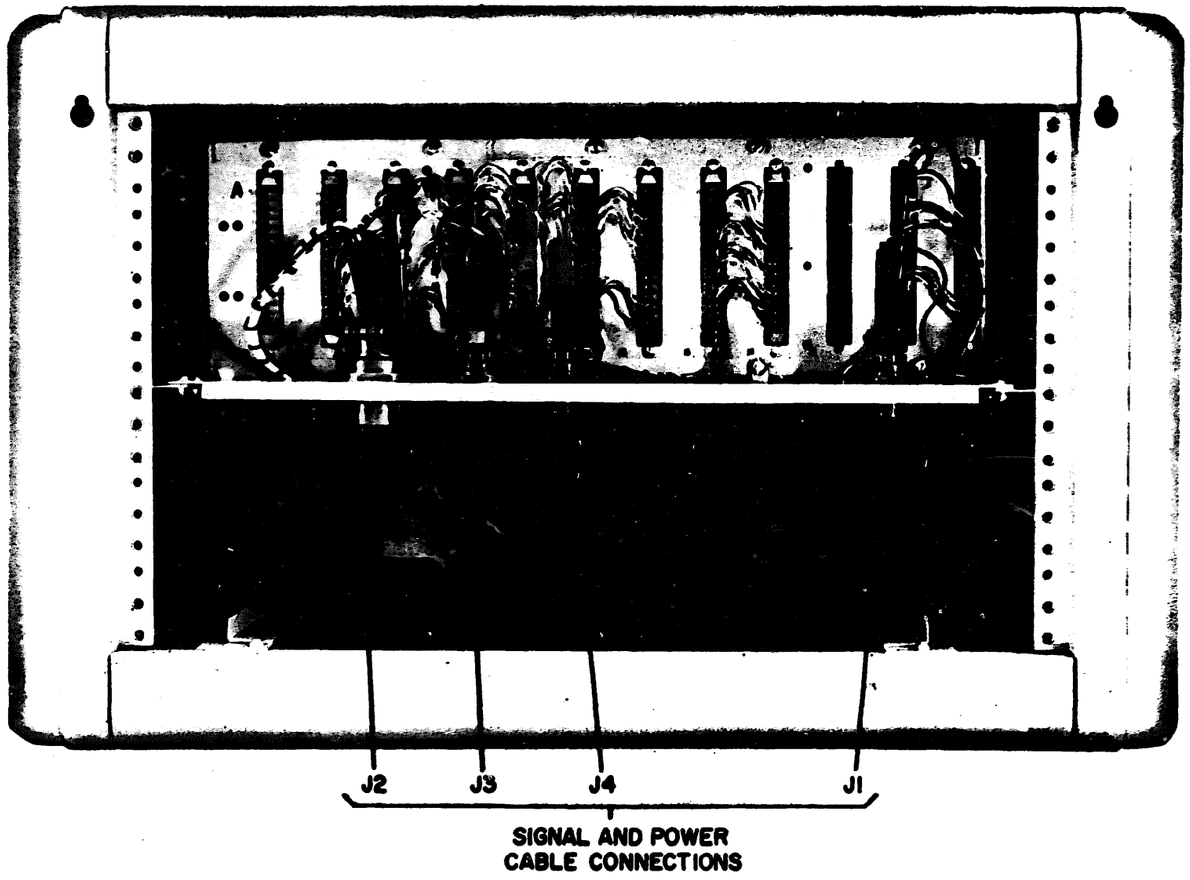


Figure 2. Maintenance control center, rear view.

7. Modular Subassemblies (cont)

Modular subassembly	Function
Status indicator module	Provides continuous monitoring of site equipment.
Power supply module	Provides -24 vdc power for all modules and 24 vac for certain modules.

8. Equipment Description

(fig. 1)

The maintenance control center is located in the generator and maintenance building at tributary sites. Six plug-in modules are contained within a desk type cabinet. An identification plate is located in the upper center of the front of the cabinet. Below the identification plate, on the right side of the cabinet, is a I-wire telephone unit. An audio amplifier, tone generator and tone receiver module are located at the left of the I-wire telephone unit. Next are the status indicator and power supply modules, completing the equipment complement. A blank panel is located below the modules. All modules are readily accessible from the front of the cabinet, for maintenance. Incoming signal and power cables enter through four connectors at the lower rear of the cabinet (fig. 2).

CHAPTER 2

INSTALLATION

9. Equipment Inspection

a. Inspect cabinet and modules for damage incurred during shipment; report any damage on DD Form 6 (para. 2). Check that all modules are properly seated in their receptacles. Check that all power and signal connections conform to figures 11 and 12.

b. Determine that the equipment complement is complete as listed on the packing slip.

10. Connecting Associated Equipment

(fig. 2)

When shipped, all cabling within the maintenance control center is properly connected, Connect all incoming signal and power cables. Make all connections at the bottom rear of the cabinet. Refer to the as-built site drawings for interconnection data.

11. Initial Application of Power

Apply power to the maintenance control center by turning on the power supply module. Power is distributed through cabinet wiring to all modules.

Section II. FUNCTIONAL DESCRIPTION

22. Typical Call Operation

(fig. 4)

A tributary maintenance control center, located in the generator and maintenance shelter, uses a 1600-cps tone for signaling the local radio shelter. The tributary telephone is connected through a junction network to the order wire in the local radio shelter for transmission to distant sites. Paragraphs a through d below describe the functional operation of a typical call.

a. When the maintenance technician originates a call, handset HS1 is removed from the cradle and the signal pushbutton, located on the handset, is pressed momentarily. Ground is connected from the signal button through the I-wire telephone unit to the input of the tone generator module (fig. 11). A relay is operated in the tone generator module applying a 1600-cps tone to its output. This tone is applied to the audio amplifier module. The maintenance technician hears the sidetone in the telephone handset receiver while the handset button is depressed. The tone applied to the channel B input of the audio amplifier module is amplified for transmission to the local radio shelter over the site line facilities.

b. The transmit talking path through the tributary maintenance control center starts at the telephone handset. Voice signals are sent through the 4-wire telephone unit to the channel B input of the audio

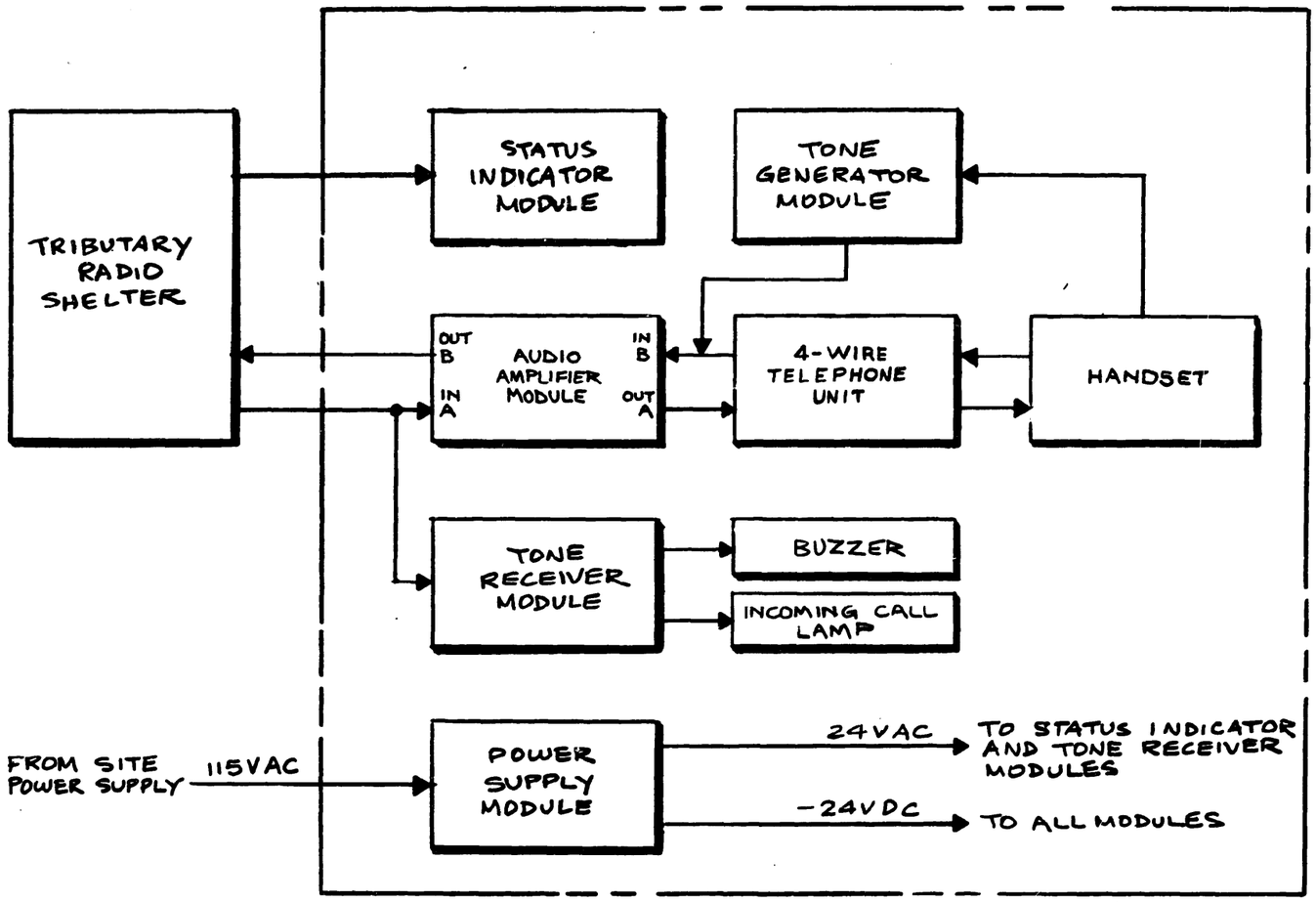


Figure 4. Typical call operation, block diagram.

amplifier module. The voice signals then follow the same path to the local radio shelter as described for tone signal in a. above,

c. Incoming tone signals from the local radio shelter or a distant shelter or van at a mainline site are connected directly to the tone receiver module. When signals of -7 dbm level and 1600-cps frequency are received, the lamp on the tone receiver module lights and the buzzer sounds. As long as the calling party keeps the tone on the line, the lamp will remain on and the buzzer will continue to sound. When the tone is removed, the lamp goes out and buzzer is silenced.

d. Incoming voice signals enter the maintenance control center and are connected to the 4-wire telephone unit. The signals are looped within the module and sent to the channel A input of the audio amplifier module. The incoming talking path is completed when the amplified voice signals from the audio amplifier module are returned to the 4-wire telephone unit and connected to the handset.

23. Status Indicator Operation

(fig. 5)

Status indicator lamps, displayed on the status indicator module at the tributary maintenance control center, provide continuous monitoring of the condition and status of site equipment at one central point. A maximum of four equipments, external to the maintenance control center, are monitored through fault lines by the status indicator module. The operation of a typical circuit is described in the following paragraphs.

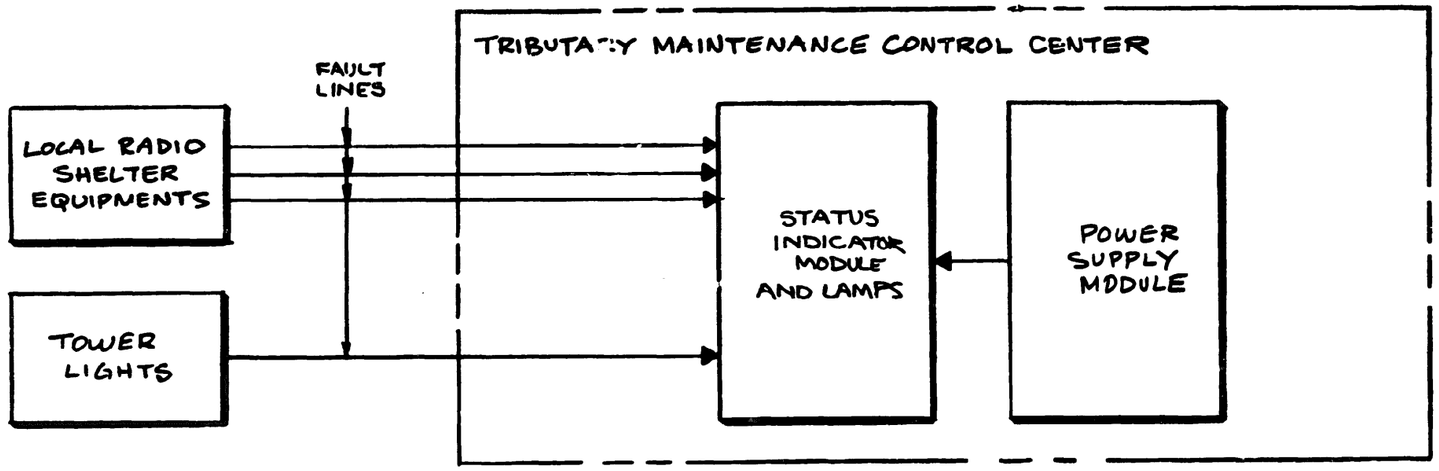


Figure 5. Status indicators, block diagram.

a. In the normal condition (fig. 11) with all equipments functioning properly, a closed loop is provided to the tributary maintenance control center by the monitored equipment. A relay in the status indicator module is held operated by this loop. The operated relay, connects ground through its own contacts and contacts of the released status indicator pushbutton, to a pair of green status indicators. Thus, in the normal state, with no fault conditions existing, all status indicators remain steady green.

b. When a fault develops, the related steady green indicators go out, associated indicators start flashing red, and buzzer DS1 sounds. The closed loop holding the relay operated under normal conditions is opened during fault or trouble conditions. The relay releases, removes ground from the green indicators, and transfers interrupted ground through its own contacts and normally closed contacts of the associated status indicator pushbutton to a Pair of red status indicators. The indicators start flashing red, signifying an alarm condition. The interrupted ground for the lamps is provided by a flashing circuit contained within the status indicator module. When the indicators start flashing, alarm buzzer DS1 sounds to audibly indicate the alarm condition. Buzzer operation is controlled by the release of the line relay which connects 24 vac from the power supply module to the buzzer through released relay and pushbutton contacts.

c. The maintenance technician at the tributary maintenance control center acknowledges the alarm condition by pressing the status indicator pushbutton containing the flashing red indicators. Operation of the pushbutton opens the buzzer circuit and removes the interrupted ground. The buzzer is silenced and a steady ground is connected to the red indicators through contacts of the now operated pushbutton and the still released relay.

d. As long as the alarm condition exists, the indicators remain steady red. When the fault at the equipment is corrected, the red indicators go out, the green status indicator (par. a.) flashes, and the buzzer sounds. This is caused by the restoration of the closed loop from the repaired equipment, reoperating the associated line relay. Interrupted ground is connected through operated contacts of both the relay and pushbutton, flashing the green indicators. The buzzer reoperates as 24 vac from the power supply module is connected through operated relay and pushbutton contacts.

e. The maintenance technician releases the status indicator pushbutton, changing the flashing green indicators to steady green and causing the buzzer to be silenced. Steady ground is connected to the green indicators through the operated relay and now released pushbutton. The released pushbutton opens the buzzer operate path, returning the status indicator circuit to normal.

CHAPTER 5

MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE

24. General

Preventive maintenance procedures for the tributary maintenance control center consist of general and weekly cleaning and inspection procedures.

25. Maintenance Materials

Item	Federal stock no.
Abrasive, sheet: sandpaper #0000; 9- by 12-in.	627500-0000[b]
Cloth, textile: cheesecloth; lint-free; 36 in.	408-2701[c]
Orangestick	5120-408-4036
Tape TL-83	5970-184-2003
Cleaning compound	7930-395-9542
Abrasive, sheet: crocus, 9- by 11-in.	(Orda)[a]
Alcohol or non-leaded gasoline	
Polish, metal: paste	6G1516[b]

a. Ordnance Corps item

b. Signal Corps stock number

c. Interim Federal stock number

26. General Cleaning and Inspection

Clean and inspect the equipment using the following procedures:

a. Use a clean, dry, lint-free cloth for dusting.

Warning: Prolonged breathing of cleaning compound is dangerous. Cleaning compound is flammable; do not use near open flame.

Caution: Do not use cleaning compound on electrical parts.

b. If necessary, moisten a cloth or brush with cleaning compound (Federal Stock No. 7930-395-9542); after cleaning, wipe area dry with clean cloth.

c. If available, use a vacuum cleaner to remove dust from inaccessible areas.

27. Weekly Cleaning and Inspection

Perform the following procedure each week.

a. Clean and tighten cables and connectors.

b. Inspect electrical and mechanical parts, mounting hardware, and exposed metal surfaces for rust, corrosion, or moisture. Clean or dry items, as required

c. Inspect cables and wiring for kinks, strains, moisture, and frayed, cut, or damaged insulation.

d. Check switches, cable assemblies, and indicator lamps for looseness of accessible items. Tighten items as required.

Section II. CORRECTIVE MAINTENANCE

28. Troubleshooting

a. Troubleshooting of the tributary maintenance control center consists of duplicating normal operating conditions to isolate the trouble to a defective module or panel. It is very important that the maintenance control center is operational at all times and that down time is kept to a minimum. Modular substitution is the most efficient method of rapid service restoration. Substitute properly adjusted and working spare modules in an attempt to locate the trouble, Since the maintenance control center is entirely modularized, a trouble condition will usually be within one or more modules. The maintenance technician should only resort to point-to-point circuit checks when modular substitution has failed to locate the trouble.

b. The following charts cover common troubles that might occur during the operation of the equipment. Since all possible troubles cannot be covered, use the procedures given in the charts as a guide in isolating a trouble to a defective module or modules. After the defective module has been replaced, repeat the procedure given to ensure that the trouble has been corrected. Return defective modules to the depot for maintenance. Refer to POMM 11-6625-647-14/1 and 2 for module maintenance procedures.

(1) Unable to receive incoming calls

Step	Procedure	Normal indication	If indication is normal	If indication is abnormal
1	Contact local radio shelter and have maintenance technician originate call.	Incoming call indicator lights and buzzer sounds.	End of test.	Proceed to step 2.
2	Substitute spare tone receiver module and repeat step 1.	Incoming call indicator lights and buzzer sounds.	End of test.	Proceed to step 3.
3	Substitute spare power supply module and repeat step 1.	Incoming call indicator lights and buzzer sounds.	End of test.	Perform point-to-point troubleshooting. Refer to figure 11.

(2) Unable to originate outgoing calls

Step	Procedure	Normal indication	If indication is normal	If indication is abnormal
1	Remove handset HS1 from cradle and press handset push-button.	Called station answers.	End of test.	Check handset push-button. Proceed to step 2.
2	Substitute spare tone generator module and repeat step 1.	Called station answers.	End of test.	Proceed to step 3.
3	Substitute spare audio amplifier module. Spare module must be properly aligned (para. 32d).	Called station answers.	End of test.	Proceed to step 4.
4	Substitute spare 4-wire telephone unit. Spare unit must be properly aligned (para. 32d).	Called station answers.	End of test.	Perform point-to-point circuit check. Refer to figure 11.

(3) Unable to talk to calling party

Step	Procedure	Normal indication	If indication is normal	If indication is abnormal
1	Contact local radio shelter and have maintenance technician originate call. Listen to calling party.	Conversation is normal.	End of test.	Check handset transmitter. Proceed to step 2.
2	Substitute spare audio amplifier module and repeat step 1. Spare module must be properly aligned (para. 32d).	Conversation is normal.	End of test.	Proceed to step 3.
3	Substitute spare telephone set module and repeat step 1.	Conversation is normal,	End of test.	Perform point-to-point circuit check. Refer to figure 11.

(4) Unable to hear called party

Step	Procedure	Normal indication	If indication is normal	If indication is abnormal
1	originate call to local radio shelter and talk to called party.	Conversation is normal.	End of test.	Check handset receiver. Proceed to step 2.
2	Substitute spare audio amplifier module and repeat step 1.	Conversation is normal.	End of test.	Proceed to step 3.
3	Substitute spare telephone set module and repeat step 1.	Conversation is normal.	End of test.	Perform point-to-paint circuit check. Refer to figure 11.

(5) Unable to monitor status indicators

Step	Procedure	Normal indication	If indication is normal	If indication is abnormal
1	Observe the color of status indicator pushbuttons S1 through S4.	All pushbuttons light steady green.	Proceed to step 2.	Check pushbutton indicators, associated relay and incoming line circuits. Proceed to step 6.
2	Contact local radio shelter and have maintenance technician simulate trouble condition. Note: Be sure maintenance technician remains at shelter in case actual trouble condition develops.	Status indicator pushbutton changes to flashing red and buzzer sounds.	Proceed to step 3.	Proceed to step 6.

(5) Unable to monitor status indicators (cont)

Step	Procedure	Normal indication	If indication is normal	If indication is abnormal
3	Press flashing red status indicator pushbutton.	Status indicator changes to steady red and buzzer goes off.	Proceed to step 4.	Proceed to step 6.
4	Remove simulated trouble condition at local radio shelter.	Status indicator changes to flashing green and buzzer sounds.	Proceed to step 5.	Proceed to step 6.
5	Press flashing green status indicator pushbutton.	Status indicator changes to steady green.	End of test.	Proceed to step 6.
6	Substitute spare status indicator module and repeat steps 2 through 5.	Same as steps 2 through 5.	End of test.	Proceed to step 7.
7	Substitute spare power supply module.	Same as step 1.	Repeat steps 2 through 5.	Perform point-to-point circuit check. Refer to figure 11.

Section III. ALIGNMENT

29. General

This section contains procedures for adjusting the tone receiver, 4-wire telephone, tone generator, and audio amplifier modules. The alignment of the maintenance control center is performed after installation of the equipment, at scheduled intervals as directed by site maintenance policies, and after extensive repairs have been performed Individual adjustments are performed when a particular module has been repaired or replaced.

30. Test Equipment Required

Electronic Counter, Hewlett-Packard 5243L (AN/USM-26)

Test Oscillator, Hewlett-Packard 650A (AN/FPM-25)

VTVM, Hewlett-Packard 400D (ME-30/U)

Module extender card ITTFL NUS 5165-19

Test cable and adapters: see figures 6 through 10

31. Test Setup

a. Turn on maintenance control center power supply and allow a one-minute warmup period.

b. Set all status indicators on status indicator module to the steady red condition. (Depress flashing status indicator buttons to obtain steady red condition).

c. Connect test equipment as directed in the individual alignment procedures.

32. Alignment Procedure

Note: Before performing any of the following alignment procedures, take the maintenance control center off line by disconnecting the cable at connector J2 (fig. 2). This will prevent test signals from being transmitted to the mainline maintenance control center. Perform the alignment as quickly as possible.

a. Tone Receiver Adjustment

(1) Connect test setup illustrated in figure 6.

(2) Set SENSITIVITY ADJUST potentiometer R2 (fig. 1) on tone receiver module fully counterclockwise.

(3) Set test oscillator for an output of 1600 (±5) cps at a level of -15 dbm as indicated on vtvm.

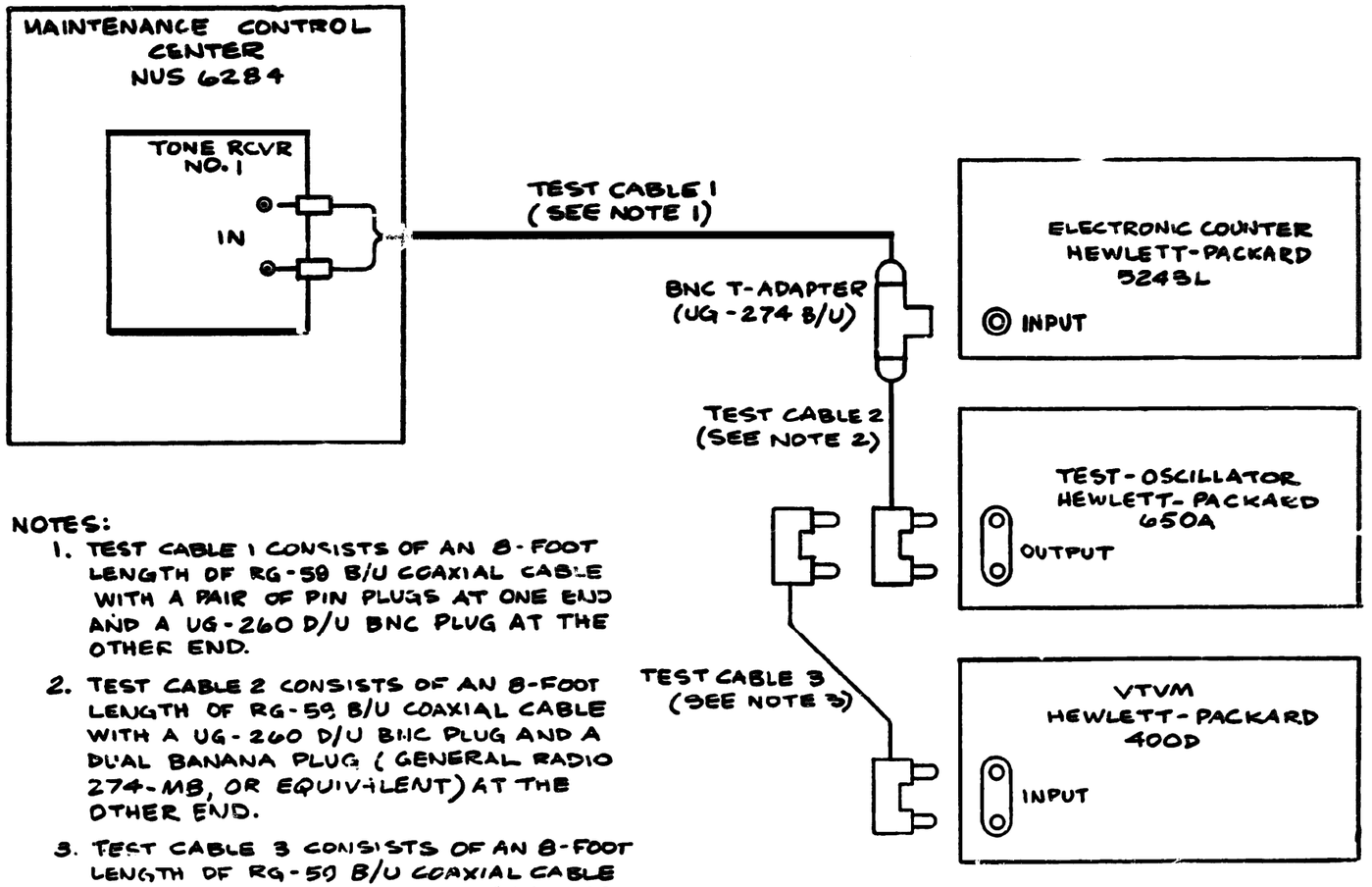
(4) Slowly rotate SENSITIVITY ADJUST potentiometer R2 clockwise until buzzer sounds and INCOMING CALL indicator DS1 on tone receiver module lights.

(5) Set test oscillator output level to -24 dbm. Buzzer should be silenced and INCOMING CALL indicator should go out.

b. 4-Wire Telephone Transmit Level Adjustment

(1) Connect test setup illustrated in figure 7.

(2) Adjust test oscillator for an output of 1000 (±5) cps at a level of 0 dbm as indicated on vtvm. Disconnect vtvm.



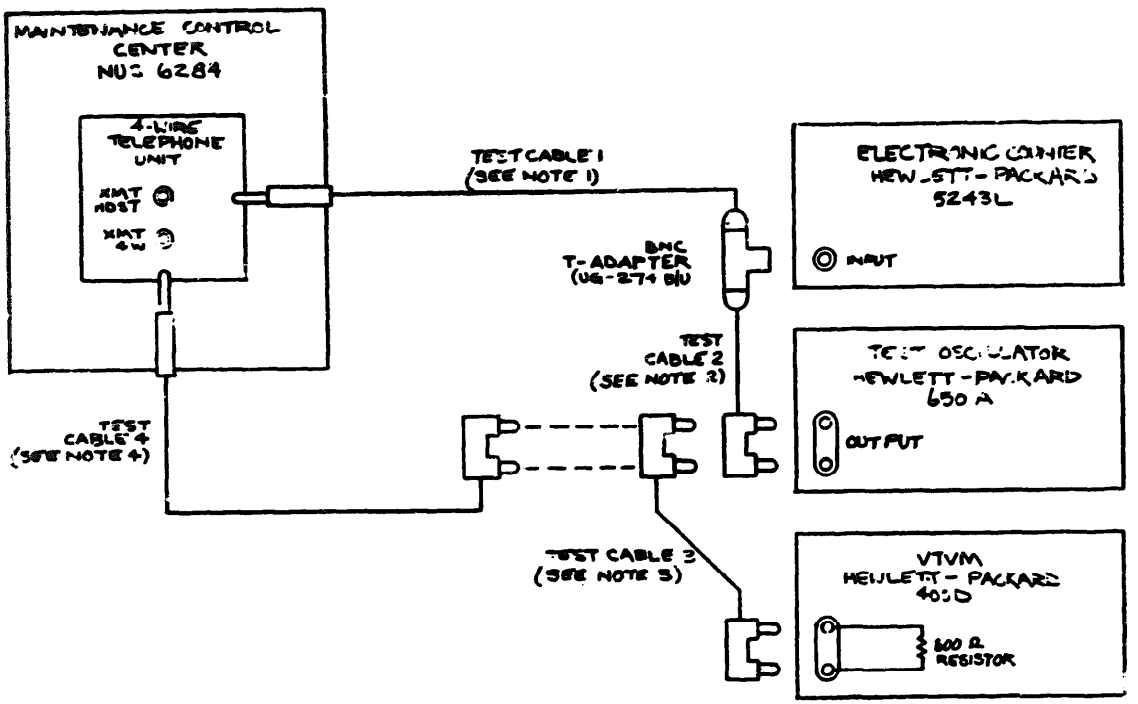
NOTES:

1. TEST CABLE 1 CONSISTS OF AN 8-FOOT LENGTH OF RG-58 B/U COAXIAL CABLE WITH A PAIR OF PIN PLUGS AT ONE END AND A UG-260 D/U BNC PLUG AT THE OTHER END.
2. TEST CABLE 2 CONSISTS OF AN 8-FOOT LENGTH OF RG-58 B/U COAXIAL CABLE WITH A UG-260 D/U BNC PLUG AND A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT) AT THE OTHER END.
3. TEST CABLE 3 CONSISTS OF AN 8-FOOT LENGTH OF RG-58 B/U COAXIAL CABLE WITH A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT) AT BOTH ENDS.

Figure 6. Tone receiver adjustment, test setup.

-34-

TM 11-5820-585-14



NOTES:

1. TEST CABLE 1 CONSISTS OF AN 8-FOOT LENGTH OF RG-59B/U COAXIAL CABLE WITH A PJ-055B TELEPHONE PLUG AT ONE END, AND A UG-260 D/U BNC PLUG AT THE OTHER END.
2. TEST CABLE 2 CONSISTS OF AN 8-FOOT LENGTH OF RG-59 B/U COAXIAL CABLE WITH A UG-260 D/U BNC PLUG AT ONE END AND A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT) AT THE OTHER END.
3. TEST CABLE 3 CONSISTS OF AN 8-FOOT LENGTH OF RG-59B/U COAXIAL CABLE WITH A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT) AT BOTH ENDS.
4. TEST CABLE 4 CONSISTS OF AN 8-FOOT LENGTH OF RG-59 B/U COAXIAL CABLE WITH A PJ-055B TELEPHONE PLUG AT ONE END AND A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT AT THE OTHER END.

Figure 7. 4-Wire telephone transmit level adjustment, test setup.

(3) Connect a 600-ohm resistor across vtvm input terminals and connect vtvm to XMT 4W jack J3 (fig. 1) on 4-wire telephone unit.

(4) Adjust XMT LEVEL potentiometer R20 on 4-wire telephone unit for an indication of -16 dbm on vtvm. Disconnect test equipment.

c. Tone Generator Adjustment

(1) Connect test setup illustrated in figure 8.

(2) Extend the tone generator module by means of the module extender card.

(3) Depress handset pushbutton and hold depressed.

(4) Adjust potentiometer R15 (right side of card) on tale generator module for an indication of -16 dbm on vtvm. Electronic counter should indicate 1600 (±25) cps. Release pushbutton and disconnect test equipment.

d. Audio Amplifier Adjustment

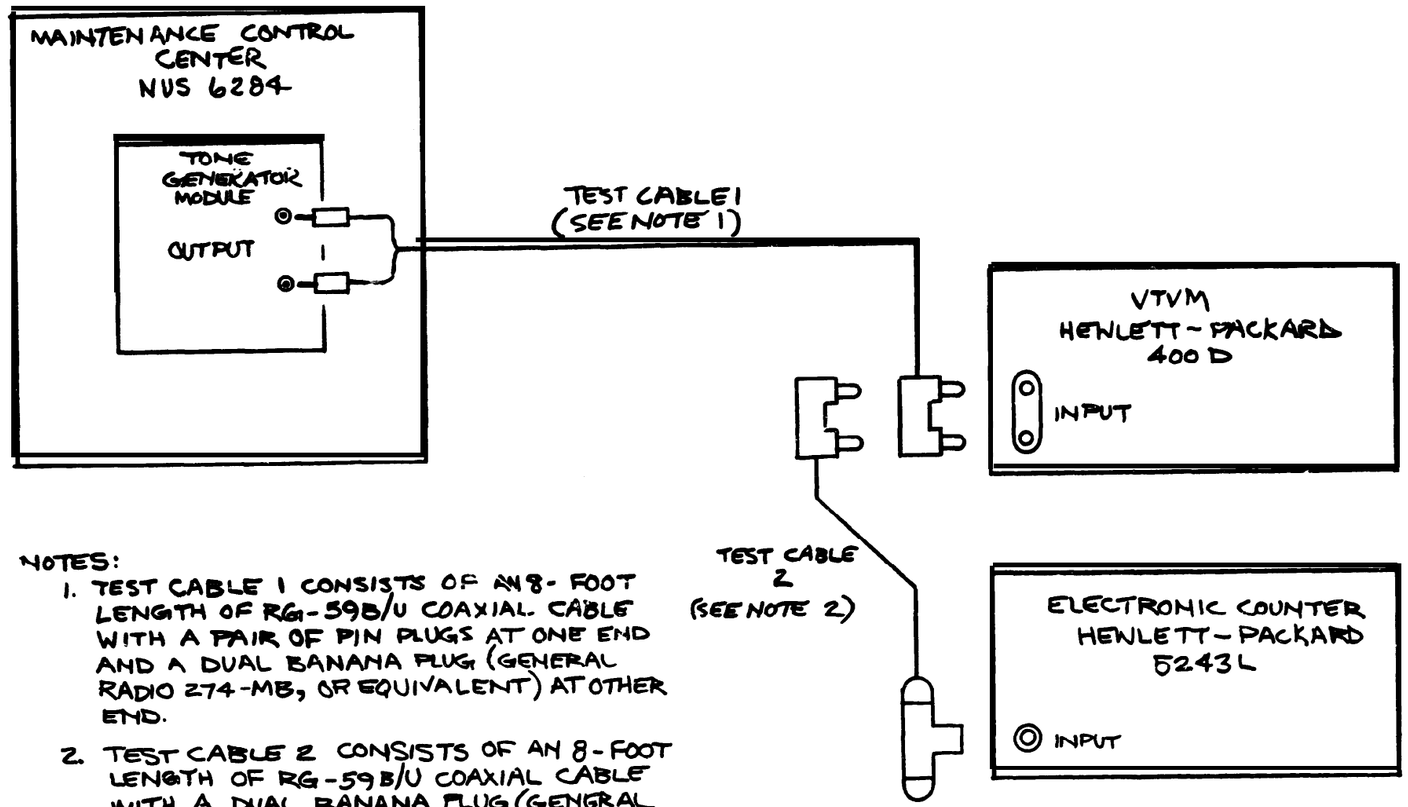
(1) Connect test setup illustrated in A, figure 9.

(2) Depress pushbutton on handset and hold depressed.

(3) Adjust B LEVEL ADJ potentionmeter R27 (fig. 1) an audio amplifier module for a -7 dbm vtvm indication. Release pushbutton and disconnect vtvm.

(4) Connect test equipment as illustrated in B, figure 9.

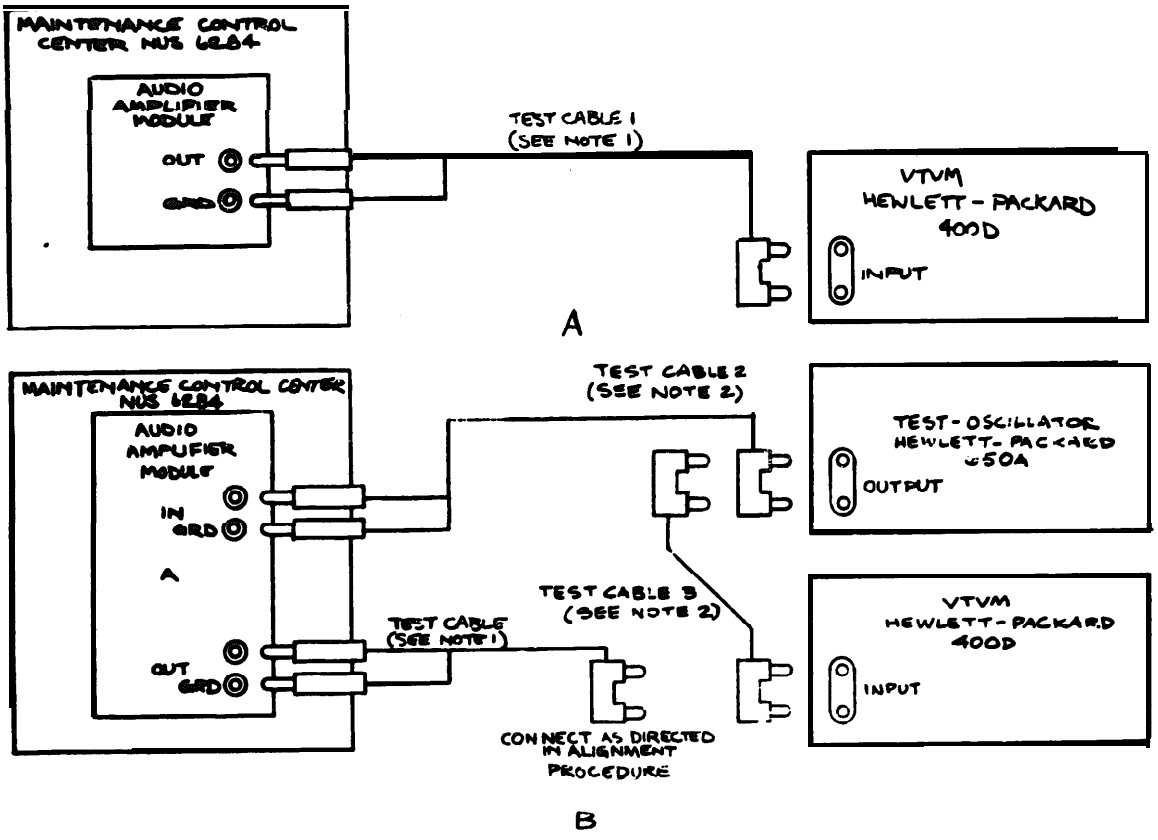
(5) Adjust test oscillator for an output of 1000 (±5) cps at a level of -7 dbm as indicated on vtvm. Disconnect vtvm.



NOTES:

1. TEST CABLE 1 CONSISTS OF AN 8-FOOT LENGTH OF RG-59B/U COAXIAL CABLE WITH A PAIR OF PIN PLUGS AT ONE END AND A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT) AT OTHER END.
2. TEST CABLE 2 CONSISTS OF AN 8-FOOT LENGTH OF RG-59B/U COAXIAL CABLE WITH A DUAL BANANA PLUG (GENGRAL RADIO 274-MB, OR EQUIVALENT) AT ONE END AND A UG-260D/U BNC CONNECTOR AT OTHER END.

Figure 8. Tone generator adjustment, test setup.



NOTES:

1. TEST CABLES 1, 2, AND 4 CONSIST OF 8-FOOT LENGTHS OF RG-59B/U COAXIAL CABLE WITH A PAIR OF PIN PLUGS AT ONE END AND A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT) AT THE OTHER END.
2. TEST CABLE 3 CONSISTS OF AN 8-FOOT LENGTH OF RG-59B/U COAXIAL CABLE WITH A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT AT EACH END.

Figure 9. Audio amplifier adjustment, test setup.

(6) Disconnect test cable 3 in test setup (B, figure 9) and connect test cable 4 to vtvm.

(7) Adjust A LEVEL ADJ potentiometer R8 for a -7 dbm vtvm indication. Disconnect test equipment.

e. 4-Wire Telephone Receive Level Adjustment

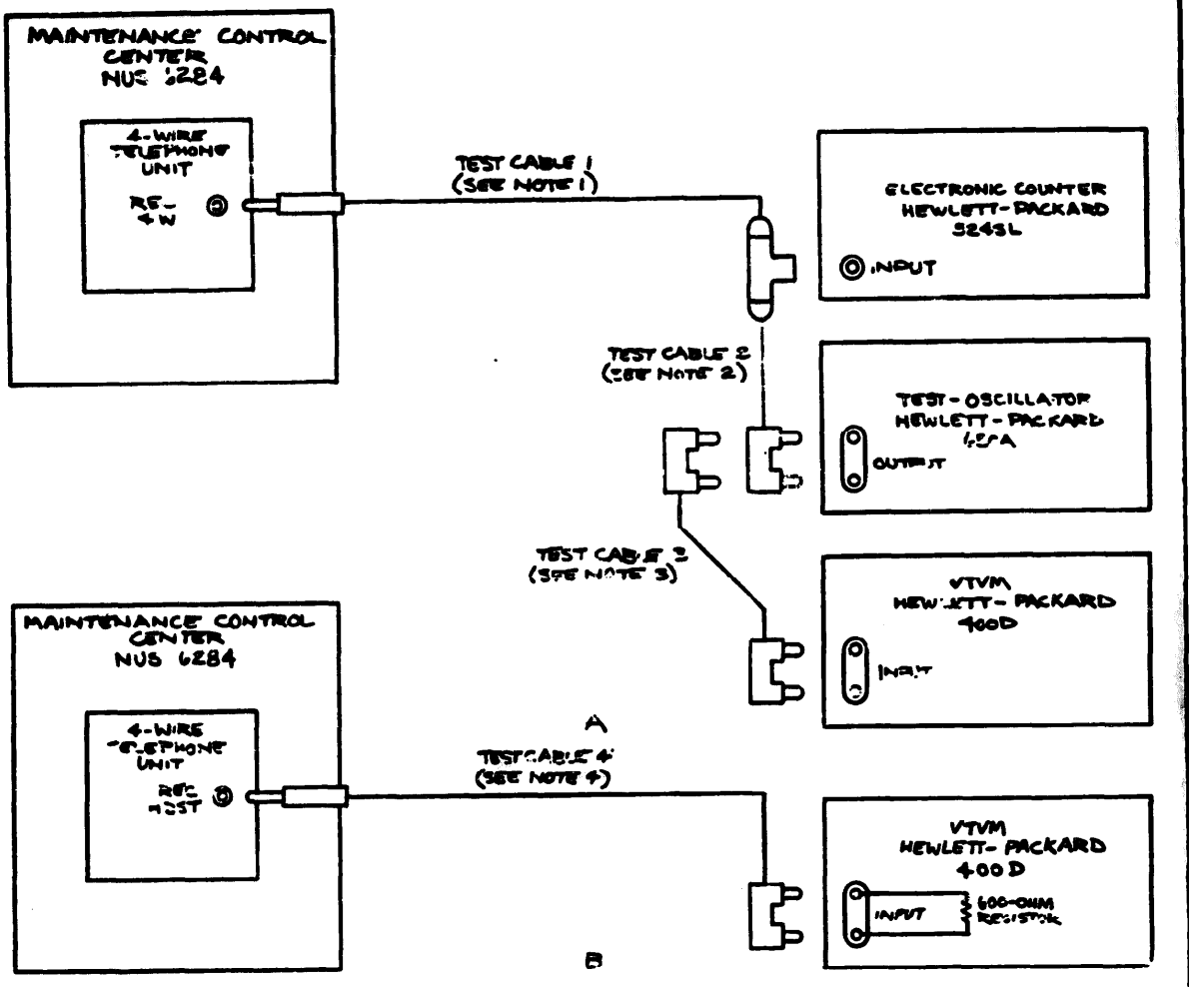
(1) Connect test setup illustrated in A, figure 10.

(2) Adjust test oscillator for an output of 1000 (±5) cps at a level of -7 dbm as indicated on vtvm. Disconnect vtvm.

(3) Connect 600-ohm resistor across vtvm input terminals and connect test equipment as shown in B, figure 10.

(4) Set REC LEVEL potentiometer R3(fig. 1) on 4-wire telephone unit fully clockwise. Vtvm should indicate between -2 and 0 dbm. Disconnect vtvm.

(5) Adjust HDST LEVEL gain control knob (R9) on 4-wire telephone set for a convenient hearing level on hand set receiver. Disconnect test equipment.



NOTES:

1. TEST CABLE 1 CONSISTS OF AN 8-FOOT LENGTH OF RG-59B/U COAXIAL CABLE WITH A PJ-055B TELEPHONE PLUG AT ONE END, AND A UG-260 D/U BNC PLUG AT THE OTHER END.
2. TEST CABLE 2 CONSISTS OF AN 8-FOOT LENGTH OF RG-59 B/U COAXIAL CABLE WITH A UG-260 D/U BNC PLUG AT ONE END AND A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT) AT THE OTHER END.
3. TEST CABLE 3 CONSISTS OF AN 8-FOOT LENGTH OF RG-59B/U COAXIAL CABLE WITH A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT) AT BOTH ENDS.
4. TEST CABLE 4 CONSISTS OF AN 8-FOOT LENGTH OF RG-59 B/U COAXIAL CABLE WITH A PJ-055B TELEPHONE PLUG AT ONE END AND A DUAL BANANA PLUG (GENERAL RADIO 274-MB, OR EQUIVALENT AT THE OTHER END.

Figure 10. 4-wire telephone receiver level adjustment, test setup.

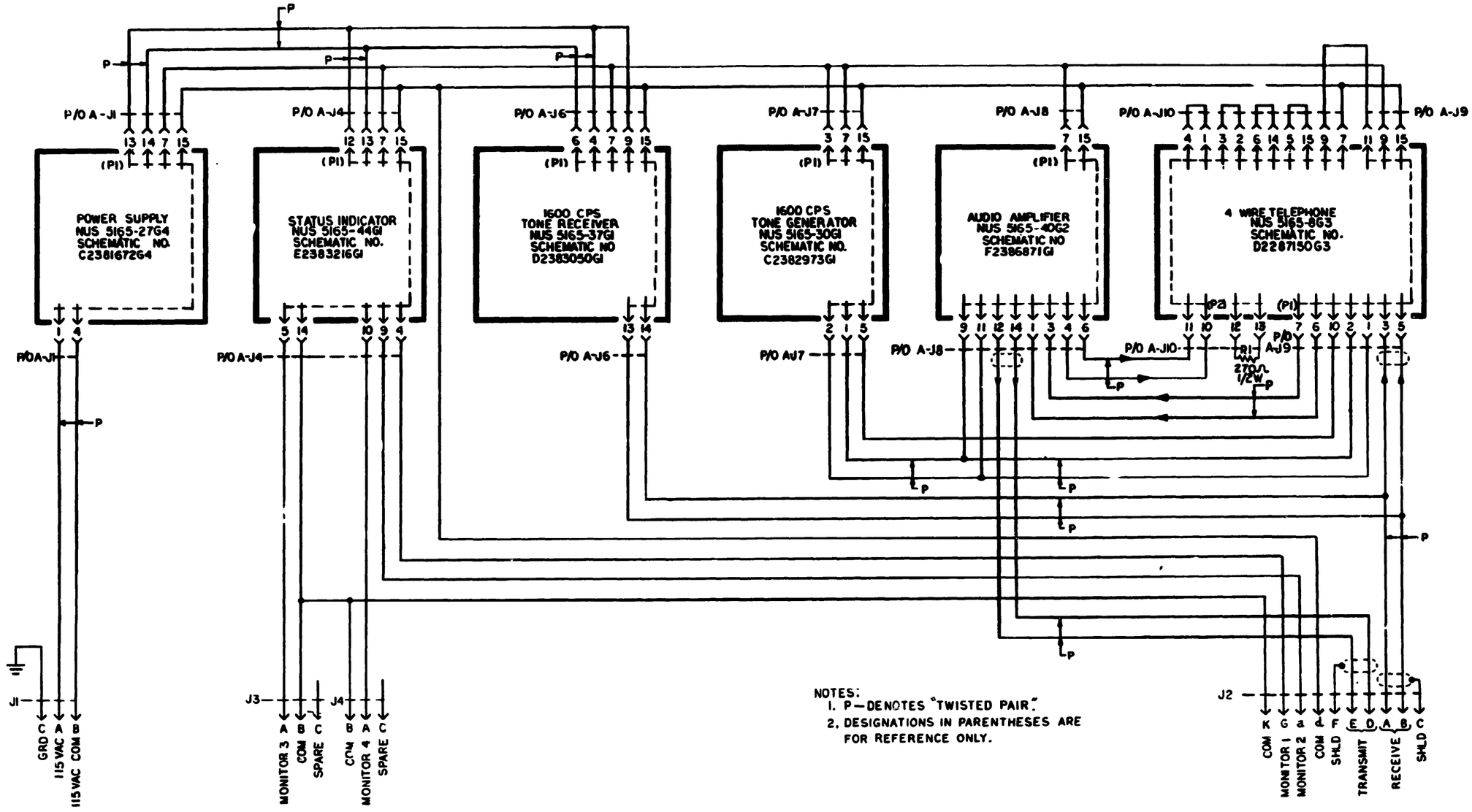
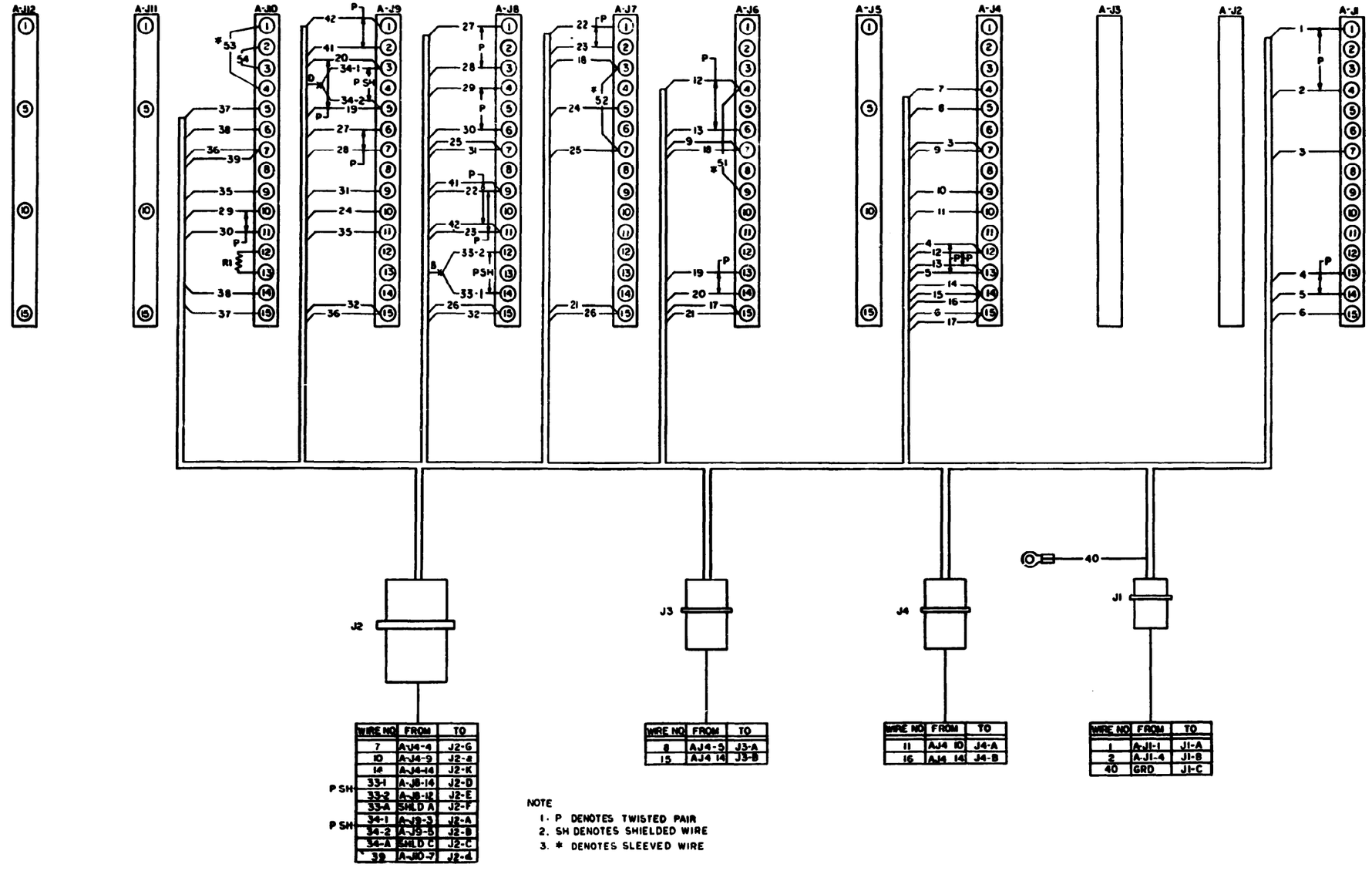


Figure 11. Maintenance control center (tributary), schematic diagram.



WIRE NO	FROM	TO
7	AJ4-4	J2-G
10	AJ4-9	J2-a
14	AJ4-14	J2-K
33-1	A-J8-14	J2-D
33-2	A-J8-12	J2-E
33-A	SHLD A	J2-F
34-1	A-J9-3	J2-A
34-2	A-J9-5	J2-B
34-A	SHLD C	J2-C
39	A-J10-7	J2-d

WIRE NO	FROM	TO
8	AJ4-5	J3-A
15	AJ4 14	J3-B

WIRE NO	FROM	TO
11	AJ4 10	J4-A
16	AJ4 14	J4-B

WIRE NO	FROM	TO
1	A-J1-1	J1-A
2	A-J1-4	J1-B
40	GRD	J1-C

Figure 12. Maintenance control center (tributary), wiring diagram.

PART II

MODULES

GENERAL

This part contains a separate manual for each of the modules contained in the maintenance control center. Each manual contains a general description, a circuit description, and schematic and parts location diagrams. Since defective modules are replaced in the field rather than repaired, no maintenance data for the modules is included. For maintenance data, refer to TM 11-6625-647-14/1 and -14/2.

4-WIRE TELEPHONE
NUS 5165-8 and NUS 5165-45

DESCRIPTION

The 4-wire telephone NUS 5165-8 or NUS 5165-45 permits order-wire speech communication between remote sites. It operates on a party-line basis and utilizes telephone headsets. The module consists of two printed circuit boards fastened to a single front panel. One printed circuit board is hinged at the front panel end to provide access to the second board. The two printed circuit boards are held together at the end away from the front panel by captive screws that can be released to free the hinged board. These captive screws must be secured before plugging in the module to ensure good electrical contact. On the NUS 5165-8 module, the telephone handset is mounted on the front panel, which also is equipped with phone jacks to permit monitoring and the insertion of test tones. The unit slides into a compartment of the frame and module assembly of the central equipment cabinet or the tributary maintenance control center. When transmission is desired, a key on the handset is depressed to actuate a 1,600-cps tone generator in the central equipment cabinet. This applies the ringing signal through the four-wire telephone unit to other sites to notify the operators that speech communication is about to begin. Both the ringing and speech signals are superimposed on a baseband signal used in transmitting all messages from one site to another. A sidetone level of the transmitted speech is applied to the receiver to provide a natural background to the operator, who hears his own voice. On the NUS 5165-45 module, the handset is mounted remotely and does not include the signaling key. The hookswitch is not included on this module. Pertinent characteristics of the four-wire telephone module follow:

Input impedance	150 or 600 ohms
Input frequency range	300 cps to 4 kc
Order-wire frequency range	300 cps to 3 kc
Signaling frequency	1,600 cps
Output impedance	150 or 600 ohms
Sidetone level	-32 db (ref to 0 dbm)
Power requirement	-48 vdc

CIRCUIT DESCRIPTION (Figures 1 and 2)

Order-wire signals enter the NUS 5165-8 module through pins 3 and 5 of plug BD1, pass through closed circuit REC 4W jack J1, are amplified externally, and then returned to the module. They are applied across a network consisting of resistors R1 and R2 and REC LEVEL potentiometer R3, which is used to adjust the sensitivity of the unit to order-wire input signals. The signals developed across this network are applied to hybrid R4, R5, and R6, which attenuates incoming signals approximately 6 db. From the hybrid, they are applied to pins 14 and 15 of BD2 and to 20-db pad R10, through R13. The cross-conversion from the 20-db pad is used in the transmitting portion of the four-wire telephone module as a sidetone path. The signals applied to pins 14 and 15 of BD2 are amplified externally and sent back to the unit through pins 5 and 6 of BD2. (In central equipment cabinets NUS 5972-3 and -7, pins 14 and 15 of BD2 are strapped internally to pins 6 and 5, respectively.) The signals are sent through 2-kc or 3-kc low-pass filter FL1 to prevent the 4-kc pilot tone from entering the handset. The filtered signals pass through closed-circuit REC HDST jack J2 and are applied across a network consisting of resistors R7 and R8 and HDST LEVEL potentiometer R

which is used to adjust the audio level. The incoming 1,600-cps signaling tone bypasses this network and is fed directly to the 1,500/1,600-cps tone receiver. The audio signals from potentiometer R9 are again amplified externally and sent through TB1 and hookswitch XHS1 to the receiver portion of handset HS1. Resistor R16 terminates the incoming signal line when the handset is cradled.

Signals to be transmitted are sent from the transmitter portion of handset HS1 through hookswitch XHS1, terminal board TB1, and dc blocking capacitor C1 to terminals 6 and 7 of transformer T2. Capacitor C2 blocks the dc voltage, and resistor R17 serves as a termination when the handset is cradled. The output from terminals 1 and 5 of the secondary of T2 passes through closed-circuit XMT HDST jack J4 and 2-kc or 3-kc low-pass filter FL2 to hybrid R14 and R15. The hybrid attenuates the signal approximately 6 db. The output of the hybrid is applied across a network consisting of resistors R18 and R19 and XMT LEVEL potentiometer R20, which is used to adjust the transmitting level of the module. The output of the hybrid also is applied to 20-db sidetone pad R10 through R13. These signals pass through hybrid R4, R5, and R6 and provide a sidetone level at about -32 db to the receiving portion of the unit. The sidetone level provides a natural background to the operator who is speaking. In addition, the R14, R15 hybrid is used as the point of entry for the 1,600-cps signaling tone. This tone is keyed on over BD1-10 by a pushbutton on the handset, and enters the module from the external tone generator over BD1-12 and 13. The signal from XMT LEVEL potentiometer R20 is applied to primary terminals 4 and 6 of transformer T1. (In central equipment cabinets NUS 5972-3 and -7, pins 1 and 2 of BD2 are strapped to pins 4 and 3, respectively.) The secondary of T1 is tapped to permit matching the transmitted signals to a 150-ohm or 600-ohm load. These signals pass through closed-circuit XMT 4W jack J3 and leave the module on BD1 terminals 1 and 2.

Jacks J1 through J4 (REC 4W, REC HDST, XMT 4W, and XMT HDST, respectively) permit measurements of the inputs to, and the outputs from, the four-wire telephone module.

Operation of the NUS 5165-45 module is similar to that of the NUS 5165-8 module. The NUS 5165-45 configuration does not include the jackbox and hookswitch XHS1. Also, the handset does not include the signaling key.

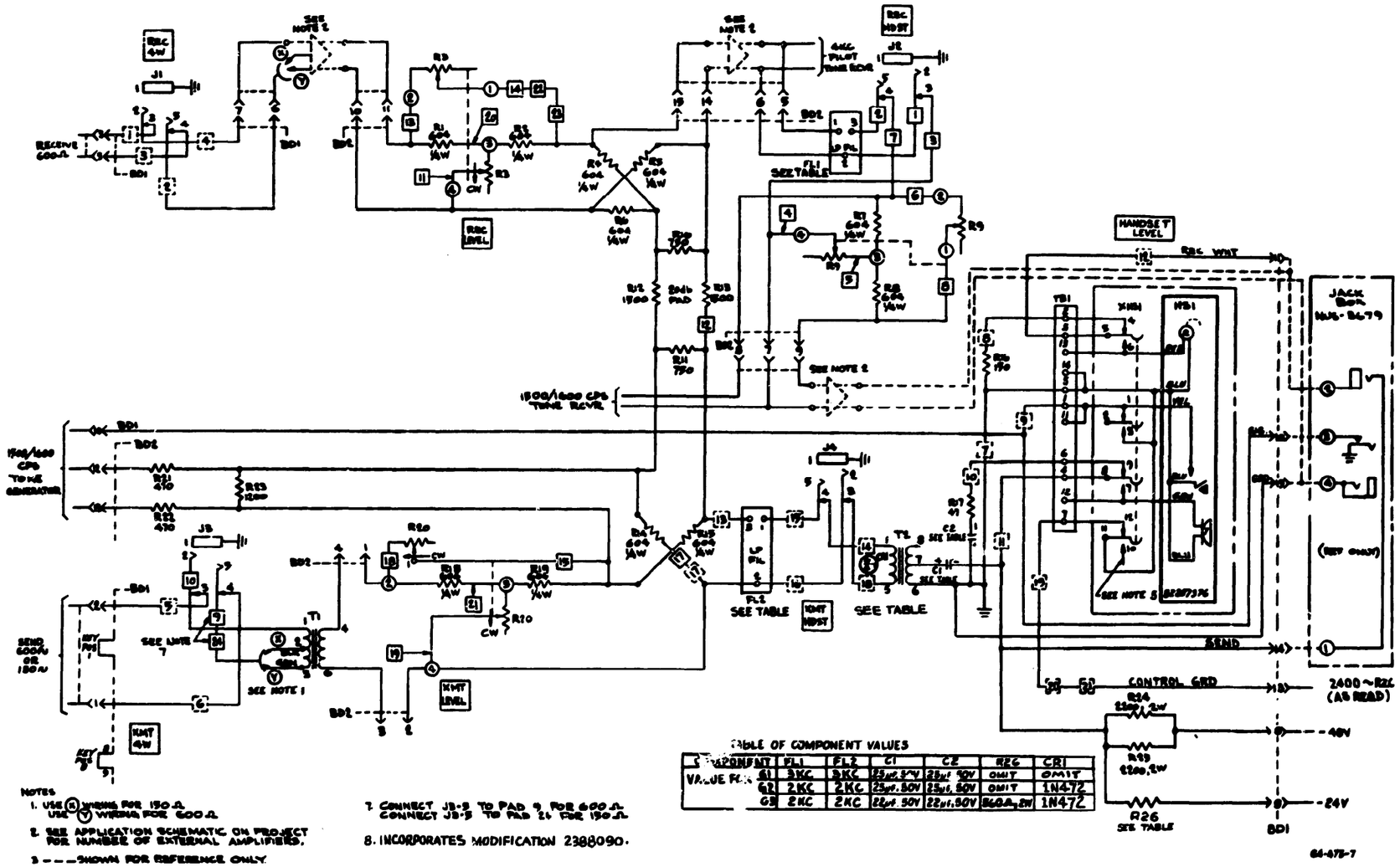


TABLE OF COMPONENT VALUES

COMPONENT	FL1	FL2	C1	C2	REG	CR1
VALUE FOR	G1 3KC	3KC	25μf. 5KV	25μf. 50V	OMIT	OMIT
	G2 2KC	2KC	25μf. 50V	25μf. 50V	OMIT	1N472
	G3 2KC	2KC	22μf. 50V	22μf. 50V	5600Ω 2W	1N472

NOTES
1. USE (R) WIRING FOR 150Ω. USE (V) WIRING FOR 600Ω.
2. SEE APPLICATION SCHEMATIC ON PROJECT FOR NUMBER OF EXTERNAL AMPLIFIERS.
3. - - - SHOWN FOR REFERENCE ONLY.
4. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, ¼W. CAPACITANCE VALUES ARE IN MICRO-FARADS.
5. HOOK SWITCH CONTACTS SHOWN WHEN PHONE IS ON HOOK.
6. □ DENOTES PAD MARKING ON PRINTED BOARD #2. ⬚ DENOTES PAD MARKING ON PRINTED BOARD #1.
7. CONNECT J3-2 TO PAD 9 FOR 600Ω. CONNECT J3-2 TO PAD 24 FOR 150Ω.
8. INCORPORATES MODIFICATION 2388090.

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Text

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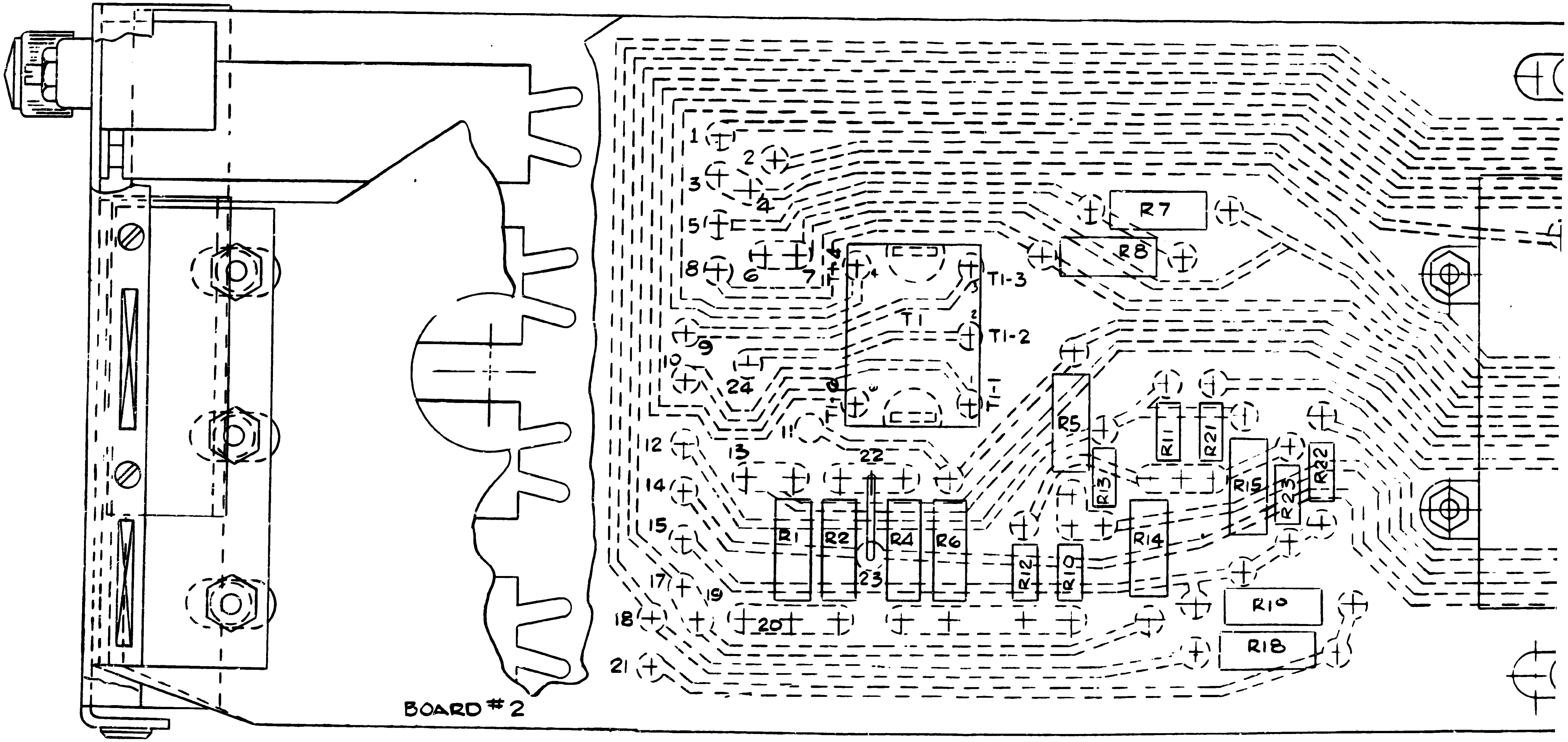
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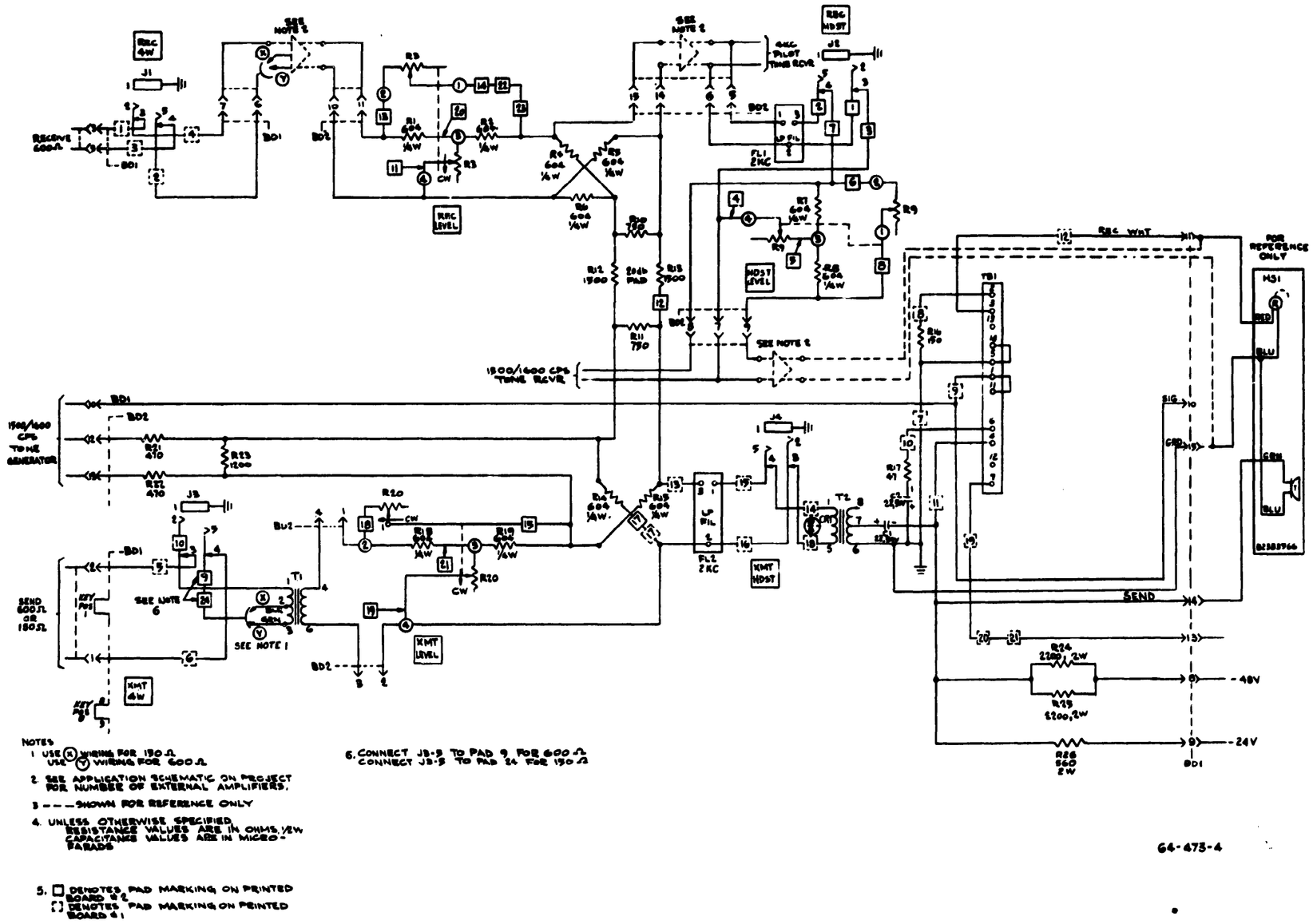
BOARD # 2



NOTES

1. USE (X) WIRING FOR 150 Ω
   USE (Y) WIRING FOR 600 Ω
2. SEE APPLICATION SCHEMATIC ON PROJECT FOR NUMBER OF EXTERNAL AMPLIFIERS.
3. - - - SHOWN FOR REFERENCE ONLY
4. UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE IN OHMS, 1/2W CAPACITANCE VALUES ARE IN MICRO-FARADS
5. □ DENOTES PAD MARKING ON PRINTED BOARD # 2
   [ ] DENOTES PAD MARKING ON PRINTED BOARD # 1
6. CONNECT J3-3 TO PAD 9 FOR 600 Ω
   CONNECT J3-3 TO PAD 24 FOR 150 Ω

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Figure 2. 4-Wire Telephone NUS 5165-45, Schematic Diagram

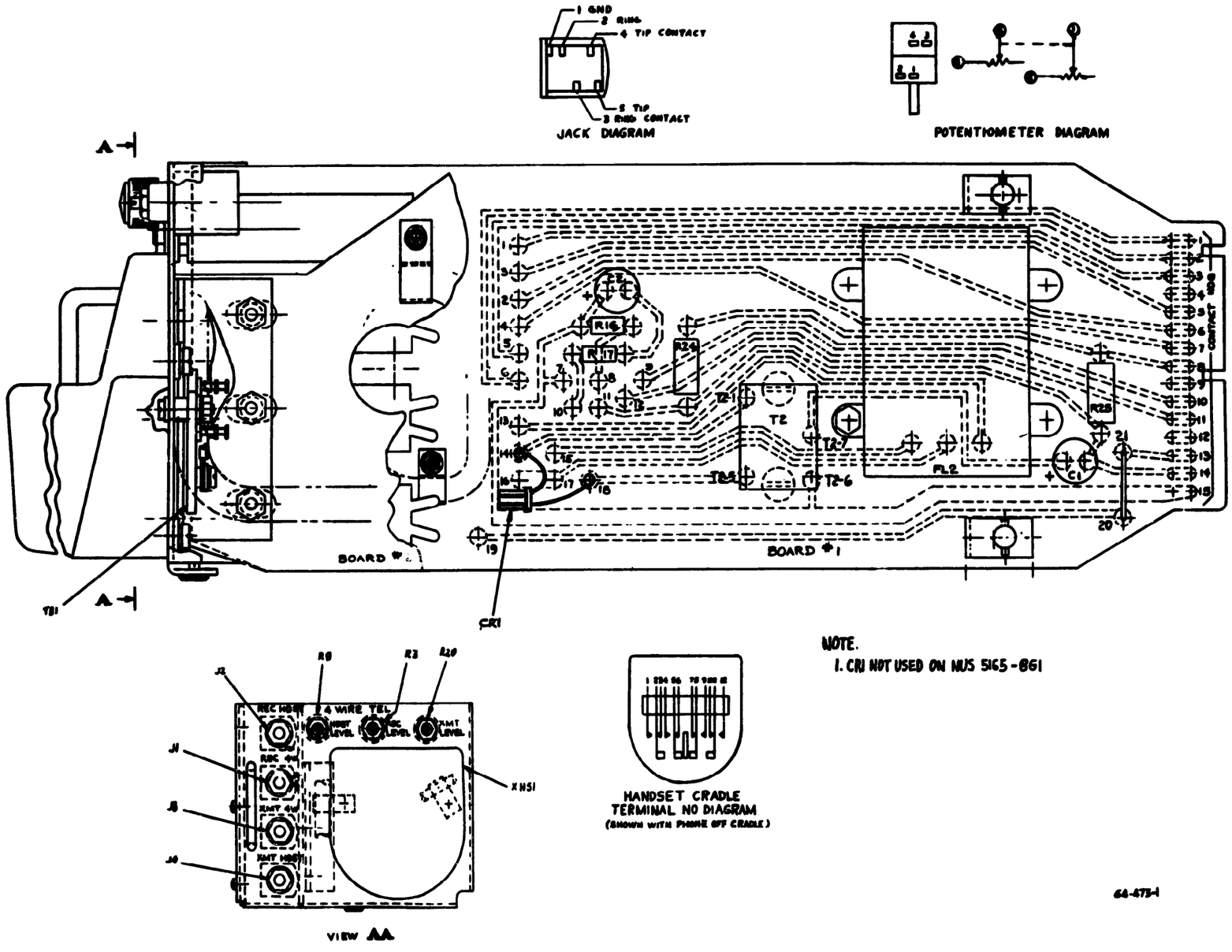


Figure 3. 4-Wire Telephone NUS 5165-8G1,
Parts Location (Sheet 1 of 3)

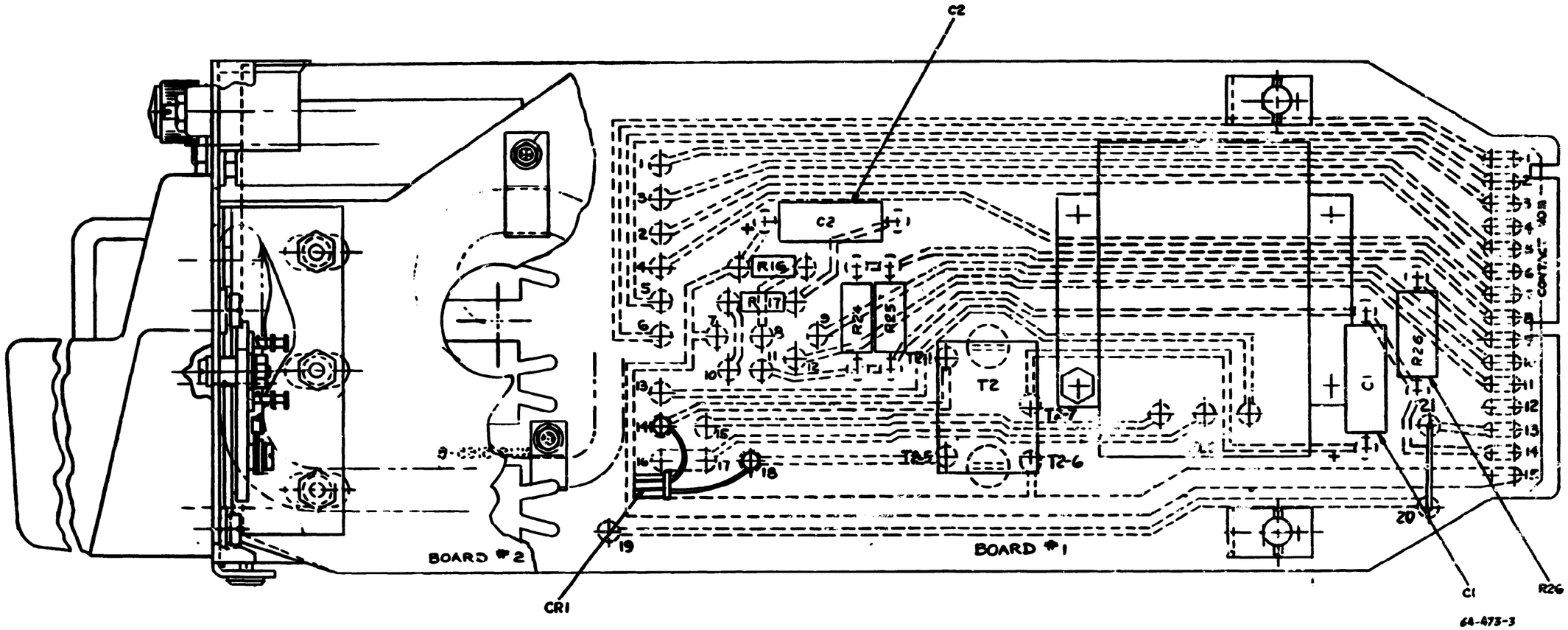


Figure 3. 4-Wire Telephone NUS 5165
Parts Location (Sheet 3 of 3).

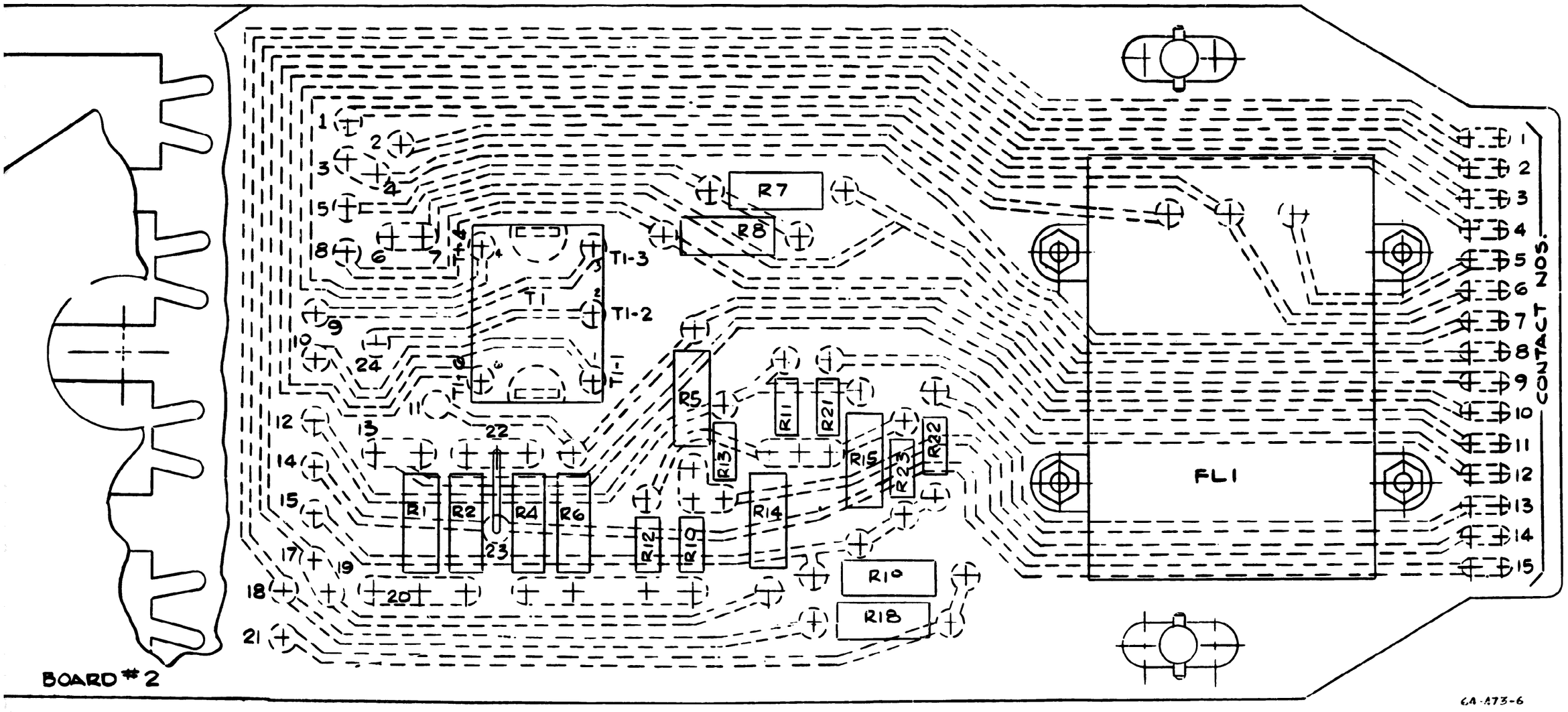
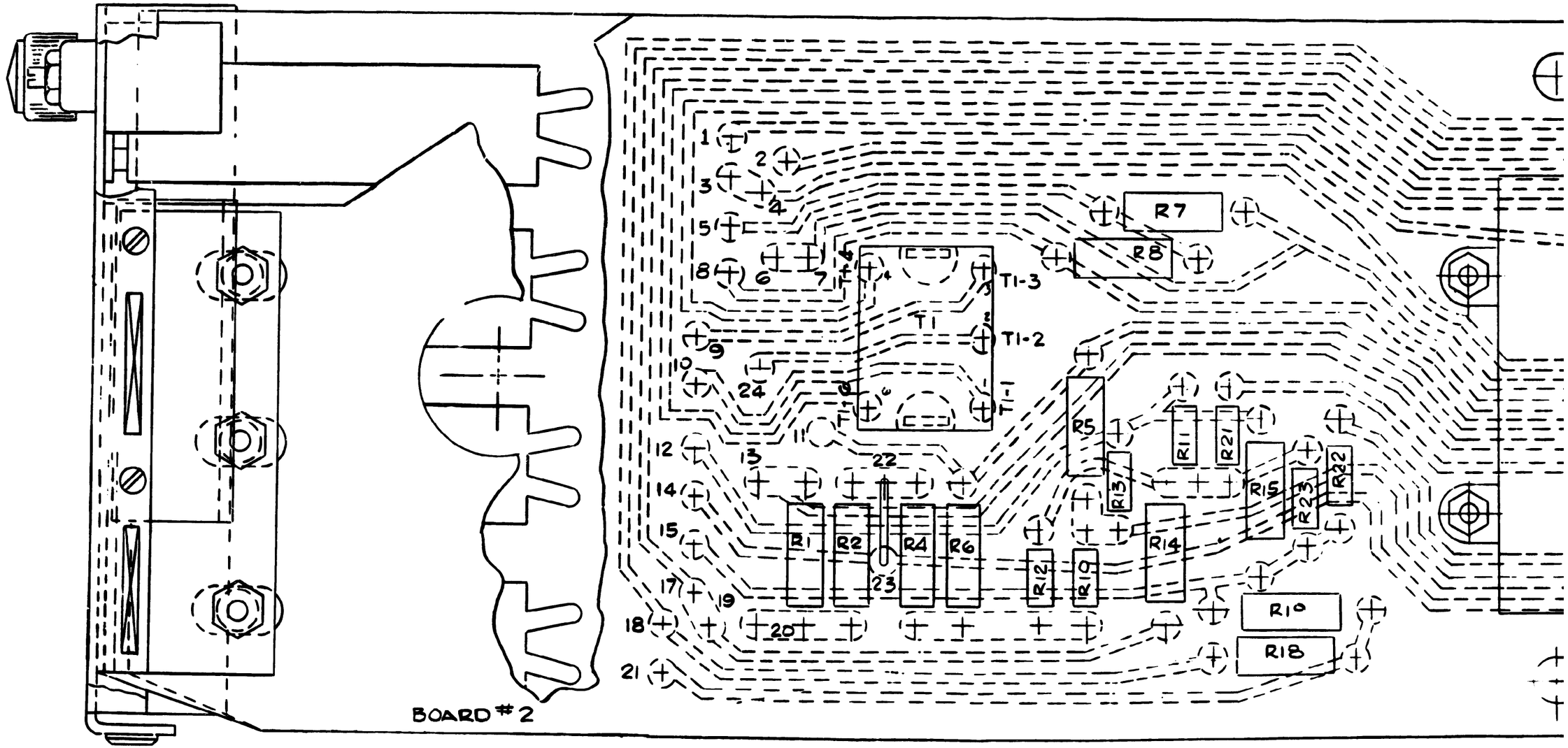


Figure 4. 4-Wire Telephone NUS 5165-45, Parts Location

(Sheet 2 of 2)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T1-2
T1-1
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R6
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R22
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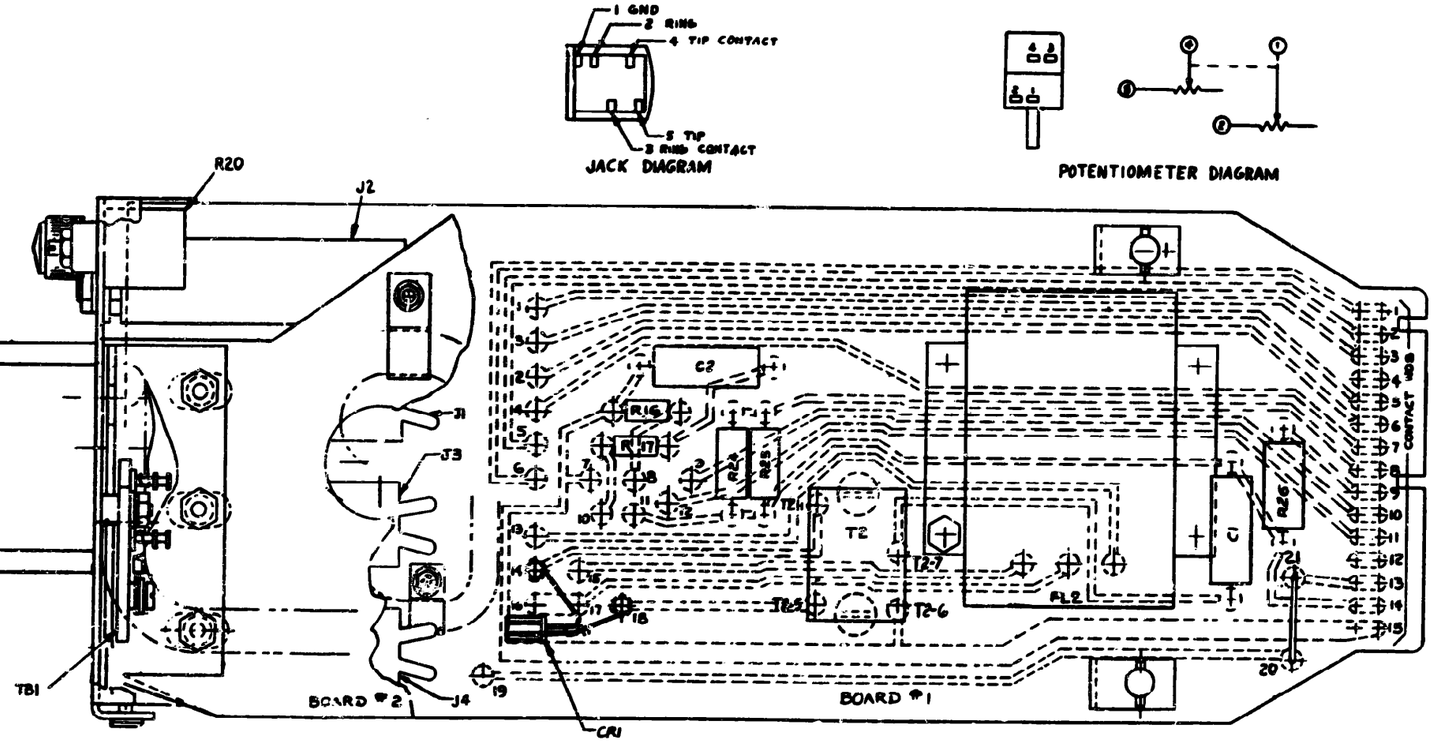
BOARD #2



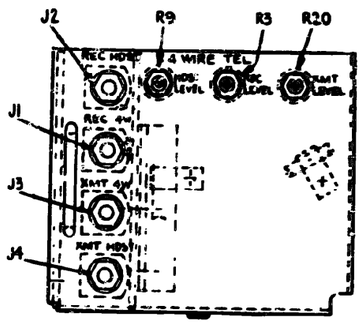


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Figure 4. 4-Wire Telephone NUS 5165-45, Parts Location

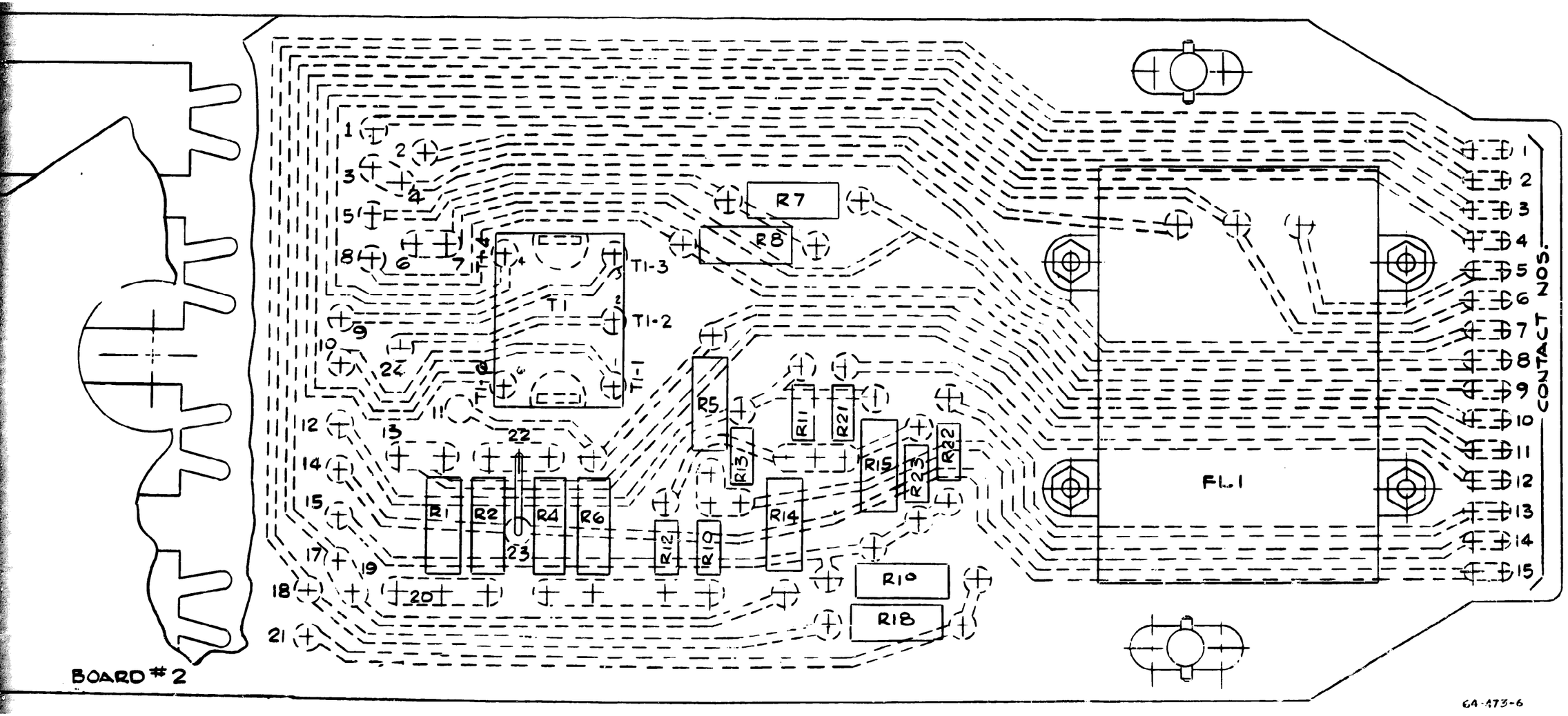


Figure 4. 4-Wire Telephone NUS 5165-45, Parts Location (Sheet 2 of 2)

POWER SUPPLY NUS 5165-27G1 THROUGH G5

DESCRIPTION

Power supply NUS 5165-27 furnishes dc and, in some types, ac operating voltages for external equipment. The G1 through G4 configurations contain an alarm circuit that provides an indication at a remote point in the event of failure of the dc supply. (The G5 configuration is the NUS 5165-4G2 power supply modified by modification kit A2388033.) The required input voltage is 115 vac. Five different power supply configurations are used. The five types and the output voltages provided are:

a. Type NUS 5165-27G1 - -48 vdc

b. Type NUS 5165-27G2 - 24 vac and -48 vdc

c. Type NUS 5165-27G3 - -24 vdc

d. Type NUS 5165-27G4 - 24 vac and -24 vdc

e. Type NUS 5165-27G5 - 24 vac and -48 vdc

CIRCUIT DESCRIPTION

Overall Equipment Operation (Figures 1 through 6). The 115-vac input is applied through POWER switch S1 and fuse F1 to the input terminals of power supply subassembly A1 and, in those types that provide an ac output, to the primary winding of step-down transformer T1. (Transformer T1 is not included in those types that provide only a dc output.) Power supply subassembly A1 is a plug-in subassembly that contains all circuit parts required to convert the 115-vac input to the required dc output voltage. Different plug-in subassemblies are used for 24- and 48-vdc outputs. In configurations G1 and G2, the output dc from power supply subassembly A1 is routed through fuse F2 and jumper II to the -48 vdc output terminal. In configurations G3 and G4, the output dc is routed from power supply subassembly A1 through jumpers III and I to the -24 vdc output terminal. Configuration G5 routes the dc power from power supply subassembly A1 through fuse F2 to the -48 vdc output terminal. Relay K1 is connected across the dc output terminals of power supply subassembly A1 to control the operation of an alarm circuit and the front panel indicator lamp. The circuit arrangement is identical for G1 through G4 configurations; only the voltage rating of the relay differs. With a normal dc output, relay K1 is energized, one set of contacts connects front panel indication lamp DS1 across the 115-vac input lines, and a second set of contacts provides a remote indication that the power supply is operating. The G5 configuration does not include the relay K1 alarm circuit.

Power Supply Subassembly A1 (Figure 3). Subassembly A1 is a plug-in, regulated dc power supply assembly. Two types are available. One type provides an output of 24 vdc, and the second an output of 48 vdc. Except for the value of detail parts, both types are identical.

The 115-vac input is stepped down to 34 vac by power transformer T1. The 34-vac output of transformer T1 is rectified by a bridge rectifier composed of silicon rectifiers CR1 through CR4, and the resulting dc is filtered by capacitor C1. The filtered dc is applied to the output terminals through a regulator circuit of transistor Q1 through Q6 and associated circuit parts.

Transistor Q2 functions as a series voltage regulator. The effective resistance of transistor Q2 is varied by a control circuit composed of transistors Q3 through Q6 and associated parts to compensate for variations in the output voltage of the power supply subassembly. If the output voltage tends to decrease, the effective resistance of transistor Q2 is reduced by the control circuit. The voltage drop across transistor Q2 is decreased, raising the output voltage, and thus compensating for the original change. Conversely, if the output of the power supply subassembly tends to increase, the effective resistance of transistor Q2 is increased by the control circuit.

Input voltage to the control circuit is provided from a voltage divider composed of resistor R10, potentiometer R11, and resistor R12. Potentiometer R11 establishes the initial conditions for the control circuit and, through the control circuit, for transistor Q2. The potentiometer is adjusted for an output voltage of 24-vdc or 48-vdc, depending upon the type of power supply subassembly in use. Any variations in the dc output voltage are applied through the voltage divider to the base of transistor Q6. Transistor Q6 functions as an amplifier connected in a common emitter configuration. The emitter voltage is maintained at a fixed dc level by a Zener diode that is an integral part of the transistor. The output of transistor Q6 is further amplified by transistors Q5 and Q4, which are both connected in common emitter configurations, and by transistor Q3, which functions as an emitter follower. The output of transistor Q3 is applied as a control voltage to the base of series regulator transistor Q2.

To illustrate the regulating action, assume that the output voltage tends to increase. The increase in output voltage results in a positive change in voltage at the base of transistor Q6. This positive signal is amplified and inverted in the first amplifier stage, resulting in a negative change in voltage at the base of transistor Q5. This change is amplified and inverted in each of the stages utilizing transistors Q5 and Q4, resulting in an amplified negative change in voltage at the base of transistor Q3. Since transistor Q3 is connected as an emitter follower, the control voltage applied to the base of transistor Q2 from the emitter circuit of transistor Q3 is a negative signal. This control signal effectively increases the resistance of transistor Q2, the voltage drop across transistor Q2 increases, and the increased voltage drop compensates for the original increase in output voltage. If the output voltage tends to decrease, the operation of the circuit is reversed.

Transistor Q1 and its associated circuit are used to protect the power supply from damage in the event of a short-circuited output. If a short circuit should occur, the voltage across the output terminals would drop to zero, and the control circuit would fail to function because zero voltage would be applied to transistors Q3 through Q6. The full output voltage of the rectifier circuit, therefore, would be developed across transistor Q2 and potentiometer R8, tending to cause a heavy

current flow through the transistor and possible damage. The current flow is limited by the action of transistor Q1 and Zener diode CR6, which are connected across the terminals of transistor Q2 and potentiometer R6. When the voltage developed across transistor Q2 and potentiometer R6 increases as a result of a short-circuited output, Zener diode CR6 conducts through transistor Q1, and the base of transistor Q3 is maintained at a fixed potential of +4.3 volts by the Zener diode. With a fixed potential applied to its base, transistor Q3 develops a control voltage in its emitter circuit which, when applied to the base of transistor Q2, limits the output current through transistor Q2 to a safe value. Potentiometer R6 provides a means for adjusting this short-circuit current.

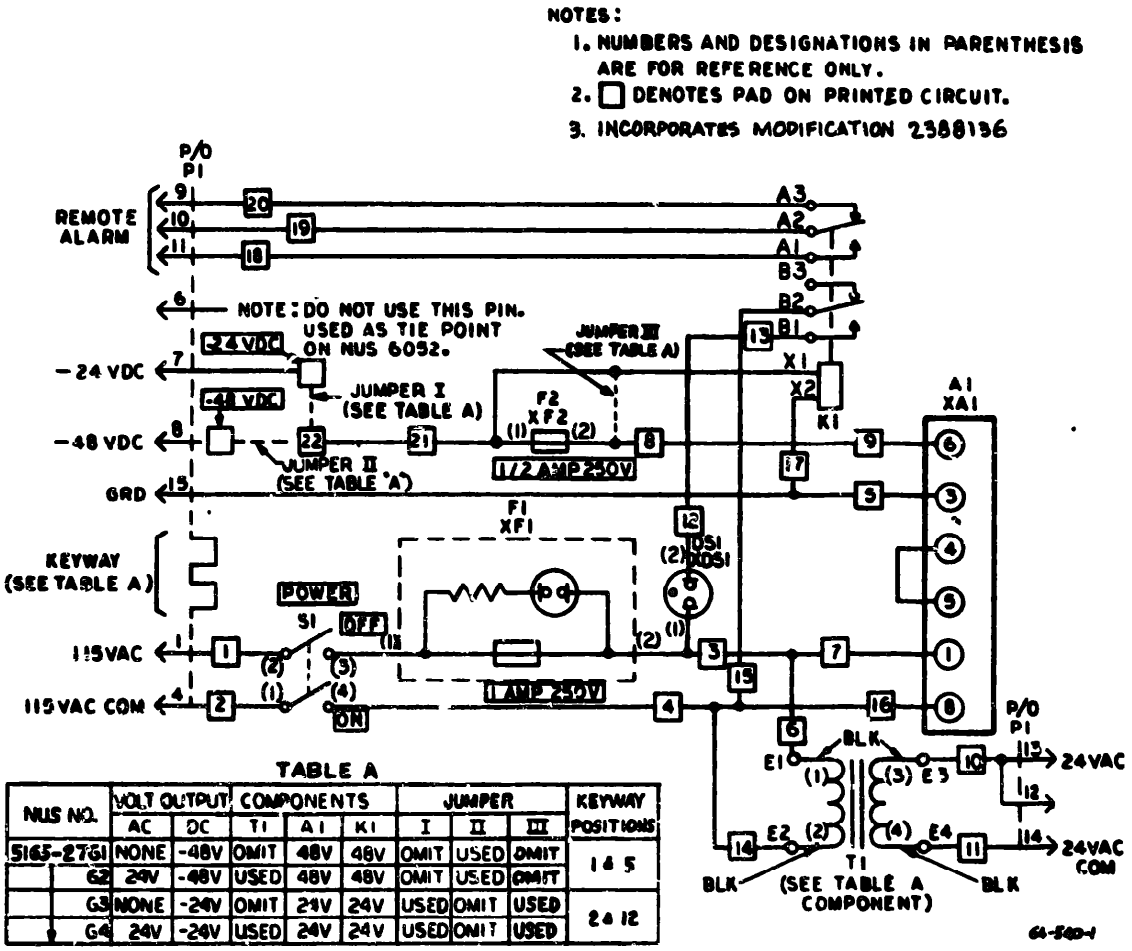
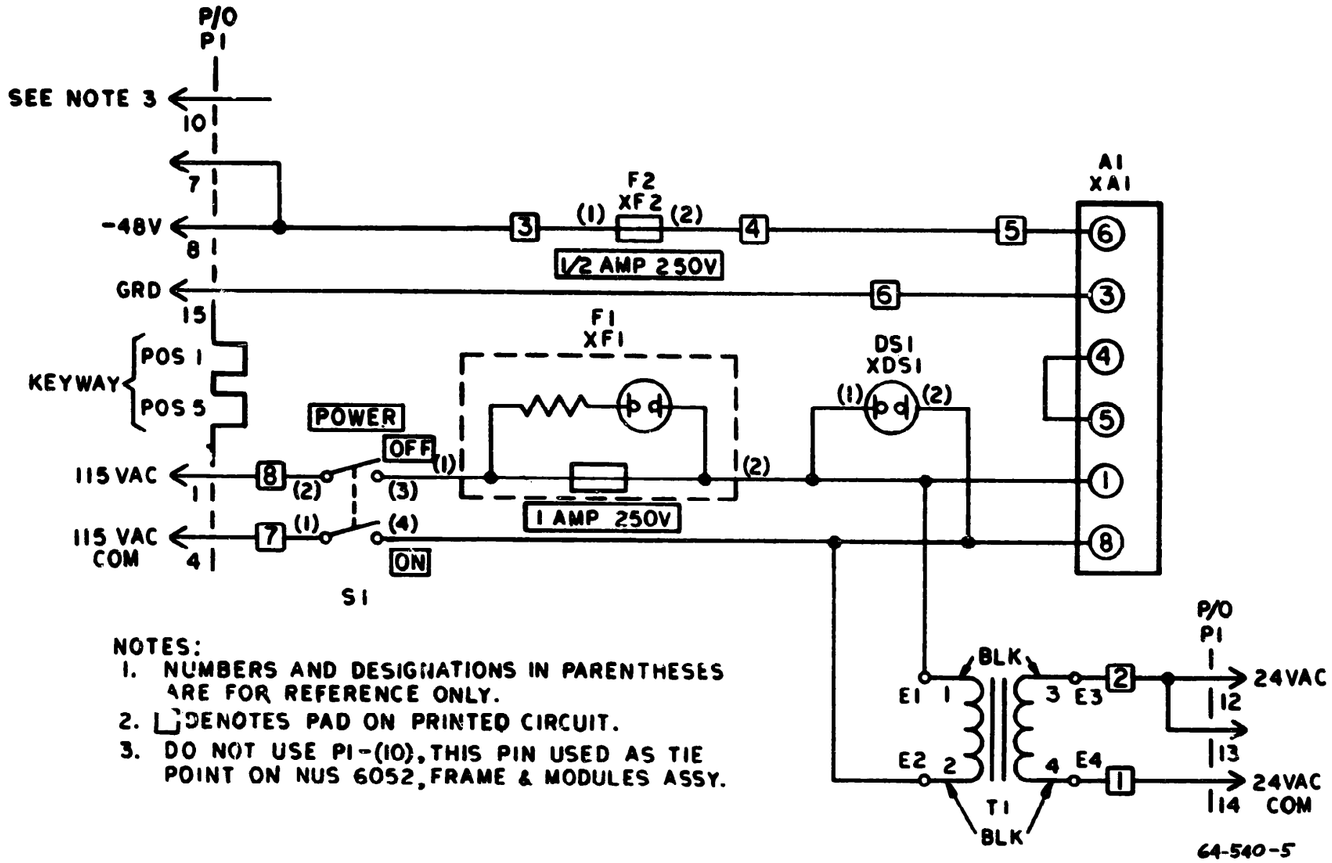


TABLE A

NUS NO.	VOLT OUTPUT AC	VOLT OUTPUT DC	COMPONENTS T1	COMPONENTS A1	COMPONENTS K1	JUMPER I	JUMPER II	JUMPER III	KEYWAY POSITIONS
5165-27G1	NONE	-48V	OMIT	48V	48V	OMIT	USED	OMIT	1 4 5
G2	24V	-48V	USED	48V	48V	OMIT	USED	OMIT	
G3	NONE	-24V	OMIT	24V	24V	USED	OMIT	USED	2 4 12
G4	24V	-24V	USED	24V	24V	USED	OMIT	USED	

Changed July 1975

Figure 1. Power Supply NUS 5165-27G1 through G4, Overall Schematic Diagram



NOTES:

1. NUMBERS AND DESIGNATIONS IN PARENTHESES ARE FOR REFERENCE ONLY.
2. ⊔ DENOTES PAD ON PRINTED CIRCUIT.
3. DO NOT USE P1-(10), THIS PIN USED AS TIE POINT ON NUS 6052, FRAME & MODULES ASSY.

Figure 2. Power Supply NUS 5165-27G5, Overall Schematic Diagram

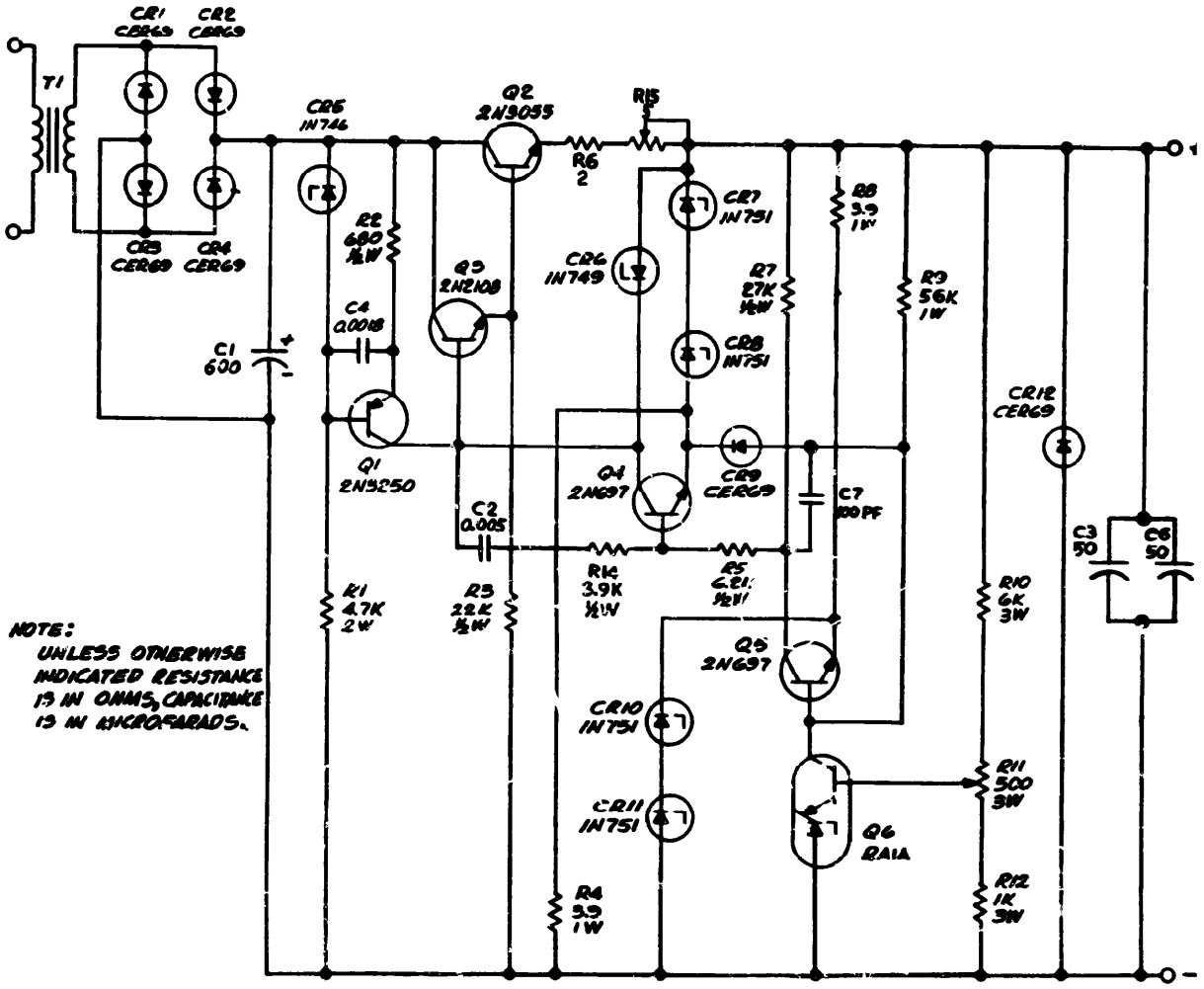


Figure 3. Power Supply Subassembly A1 (48V), Schematic Diagram

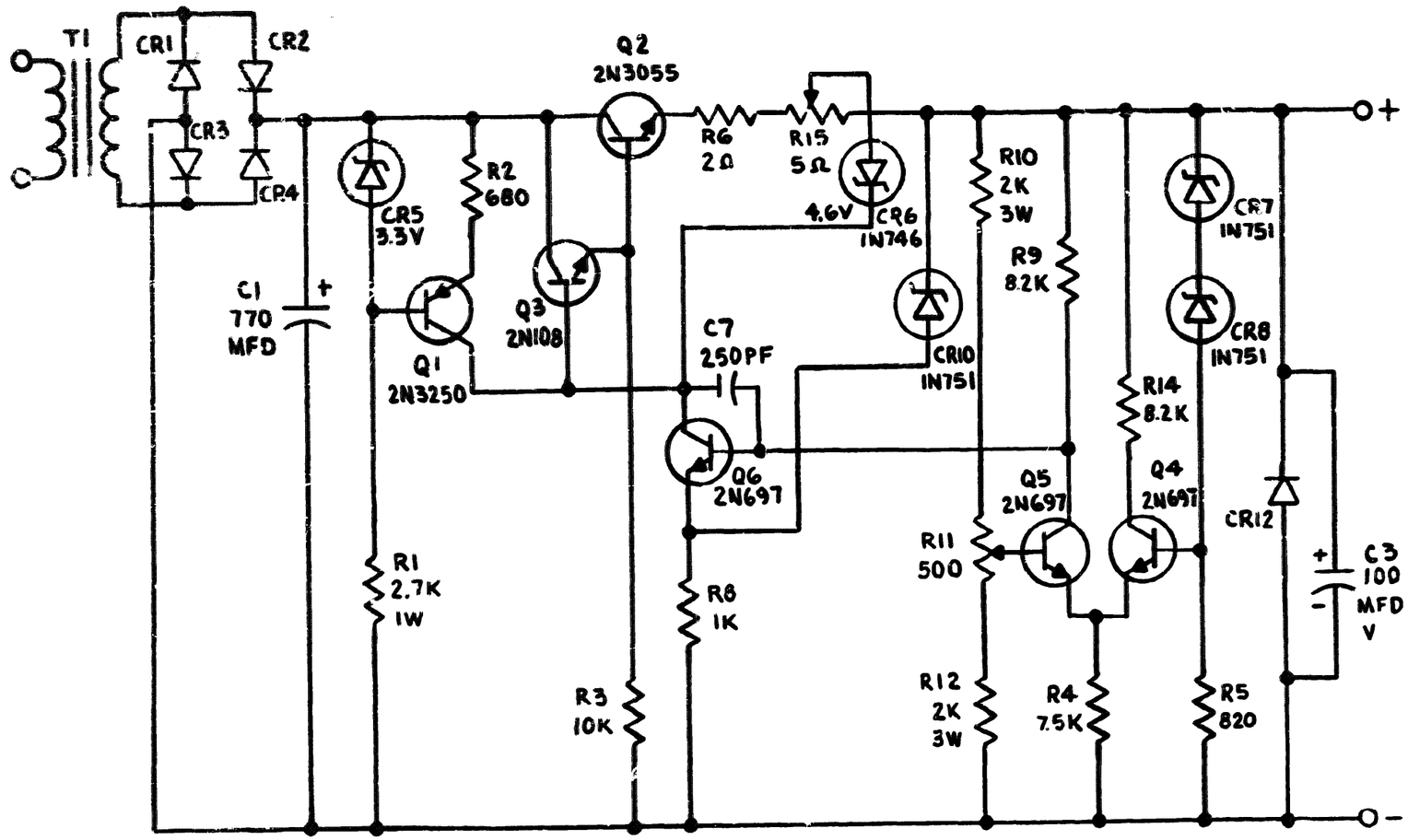


Figure 4. Power Supply Assembly A1 (24V), Schematic Diagram

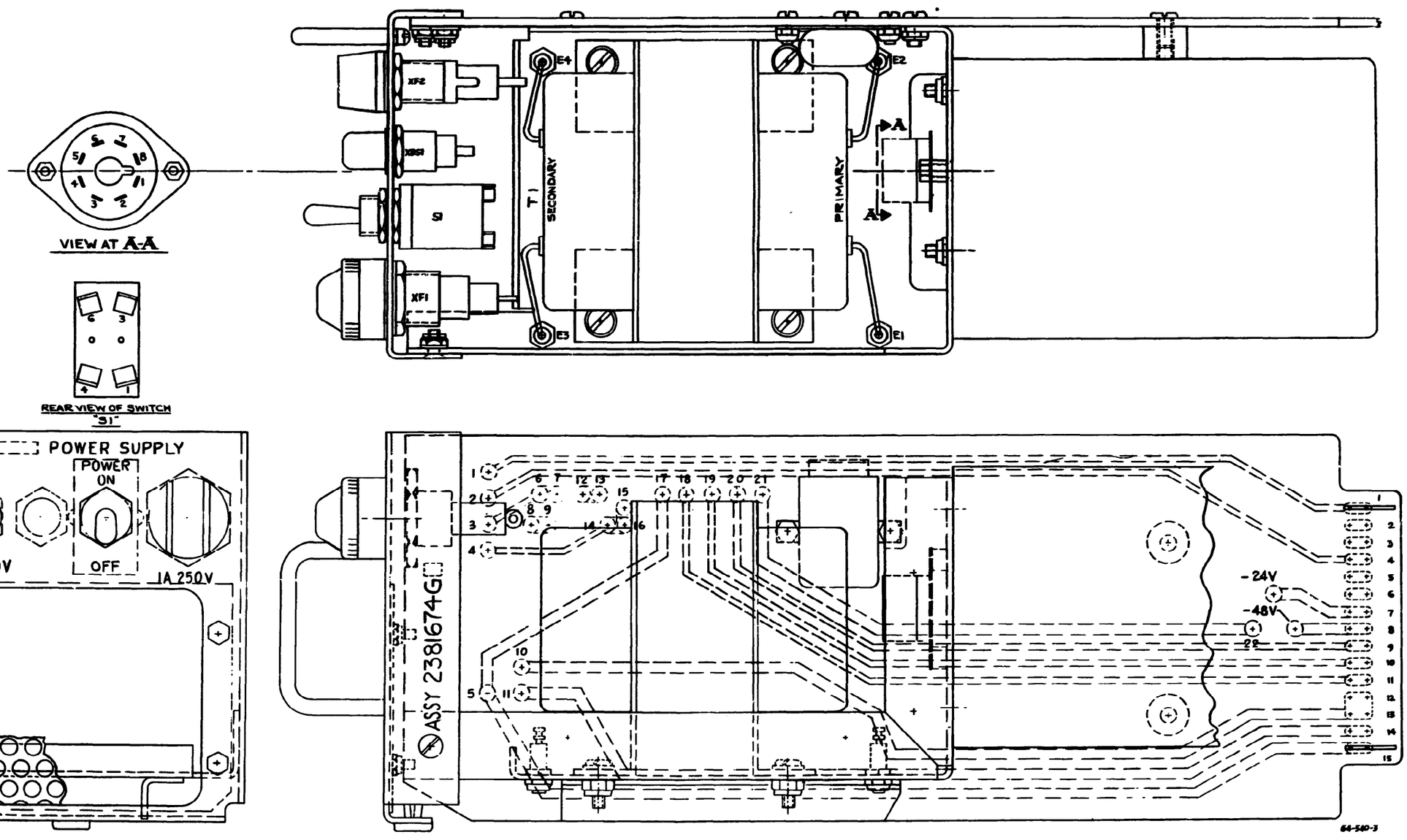


Figure 5. Power Supply NUS 5165-27G1 through G4, Parts Location

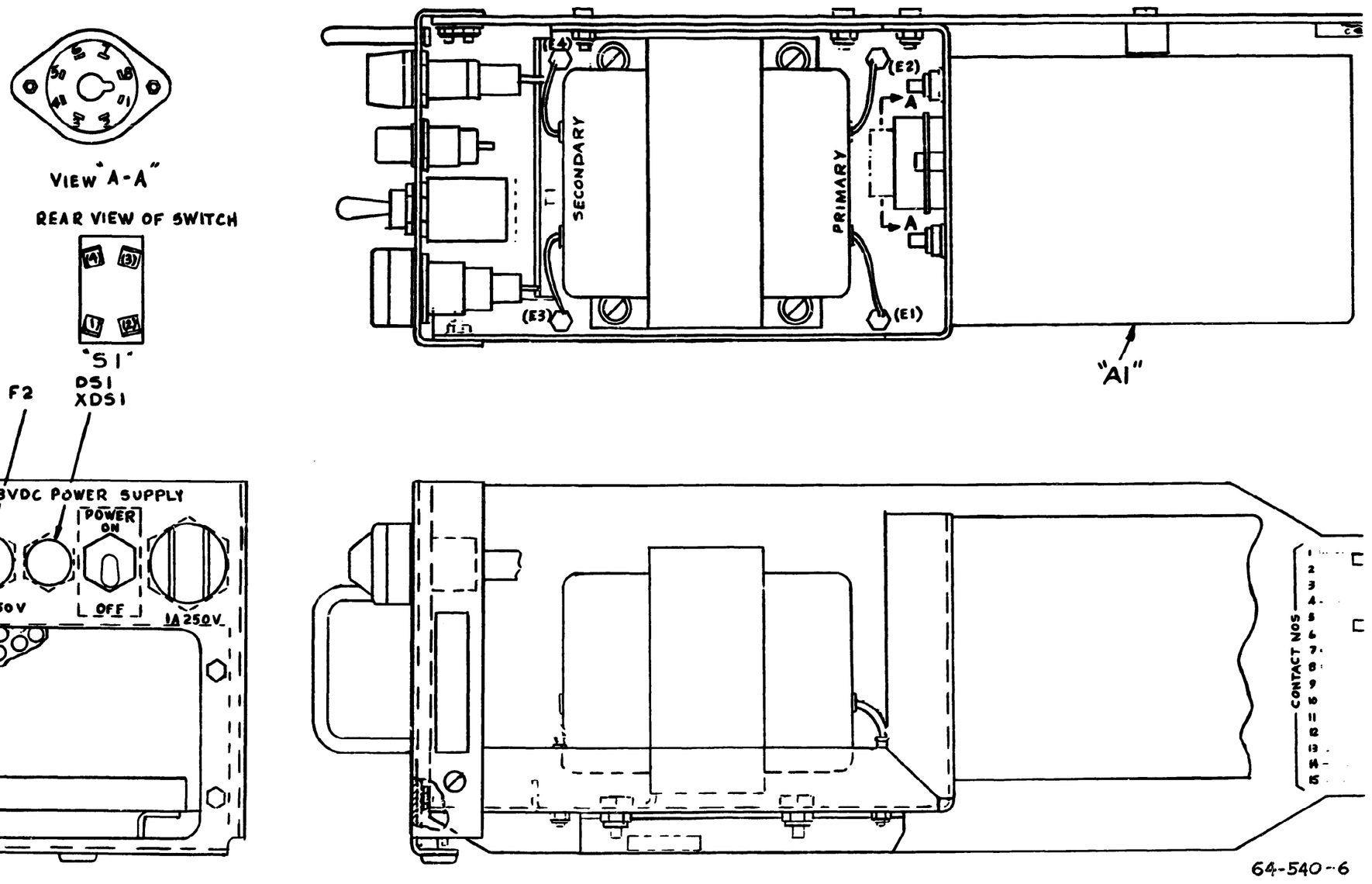


Figure 6. Power Supply NUS 5165-27G5
Parts Location

1600 CPS TONE GENERATOR
NUS 5165-30G1

DESCRIPTION

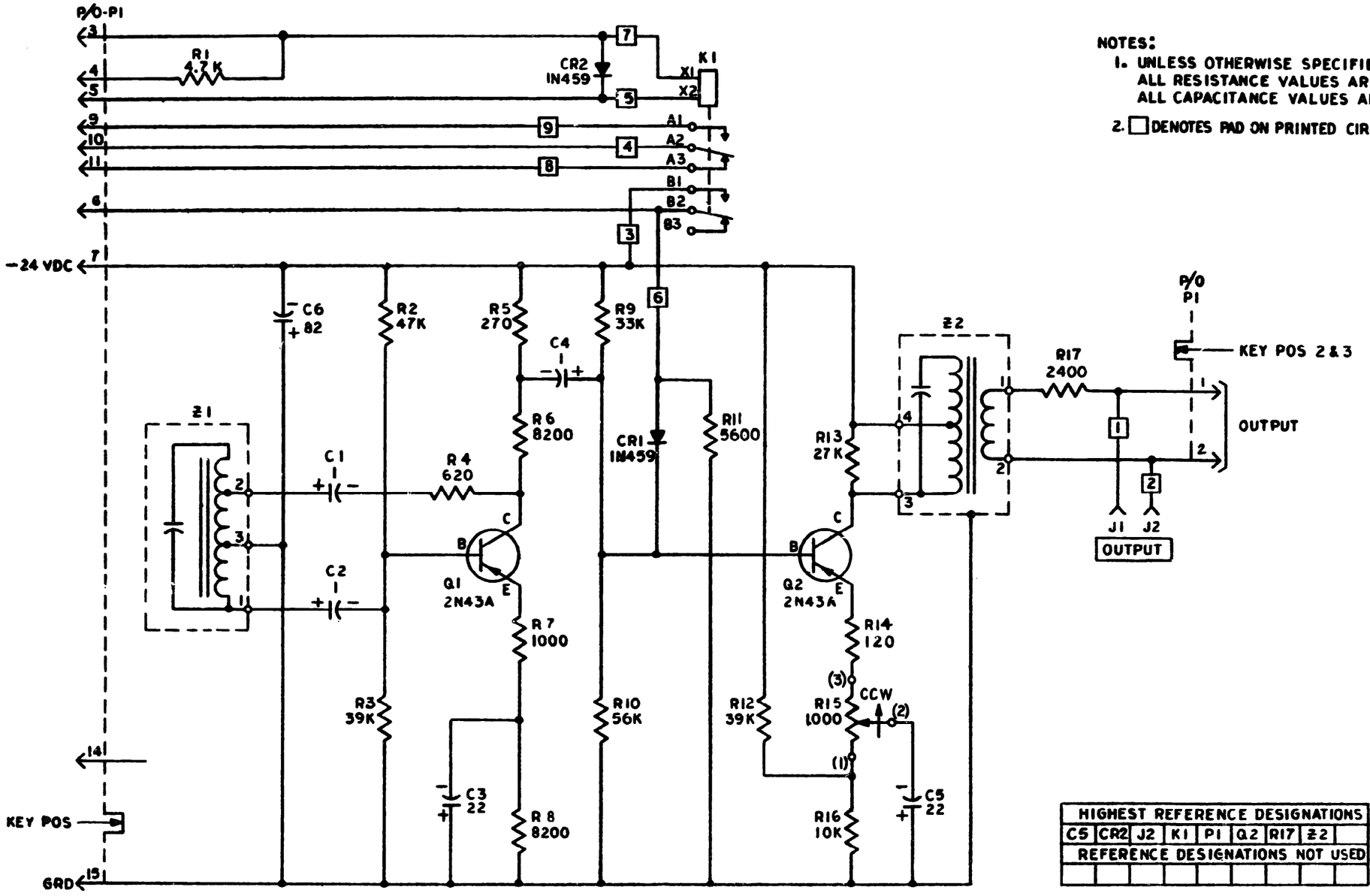
The 1600 cps tone generator provides an order-wire signaling frequency to contact a remote site. The tone generator consists of a shunt-fed oscillator, amplifier, output impedance matching network, and relay. The module characteristics are as follows:

Input power requirements	-24 vdc
Output frequency	1600 ± 25 cps
Output level	-16 dbm

CIRCUIT DESCRIPTION (Figures 1 and 2)

Oscillator. The signal is generated by transistor Q1 and tuned circuit Z1. The output from the collector of Q1 is coupled to the tuned circuit by resistor R4 and capacitor C1. The grounded tap (3) of Z1 provides an in-phase feedback through C2 to the base of Q1. The voltage-divider resistors R2 and R3 provide the proper dc bias for the base of Q1. Similarly, R7 and R8 provide emitter bias. Resistor R7 in the emitter circuit is a means for degeneration to improve oscillator stability.

Amplifier. A portion of the output of the oscillator is coupled to the base of amplifier Q2 by capacitor C4. The bias for the base of Q2 and, thereby, the gain of this transistor stage is controlled by relay K1. When K1 is deenergized the bias for Q2 is developed across R9, CR1, and R11, making the base more positive than the emitter whose fixed bias is taken from the junction of R12 and R16. This back biasing of Q2 reduces the output to a minimum. Maximum output from the module is produced when K1 is energized. At this time CR1 is back biased by the -24 VDC applied to it by the closing of relay contacts B2 and B1. With CR1 back biased, the base of Q1 becomes more negative due to the voltage division across R9 and R10. Under this condition Q2 conducts, providing maximum signal to the output. The output level of the amplifier is set to the desired value by use of potentiometer R15. The primary winding of the tuned transformer network Z2 (tuned to 1600 cps) provides a load for transistor Q2. The output of the module is conveyed from the secondary of Z2 to pins 1 and 2 of plug P1. Front-panel jacks J1 and J2 also afford access to the output of the tone generator.



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT.
   ALL CAPACITANCE VALUES ARE IN MICROFARADS.
2. ☐ DENOTES PAD ON PRINTED CIRCUIT BOARD

HIGHEST REFERENCE DESIGNATIONS								
C5	CR2	J2	K1	P1	Q2	R17	Z2	
REFERENCE DESIGNATIONS NOT USED								

64-594-1

Figure 1. 1600 CPS Tone Generator NUS 5165-30G1, Schematic Diagram

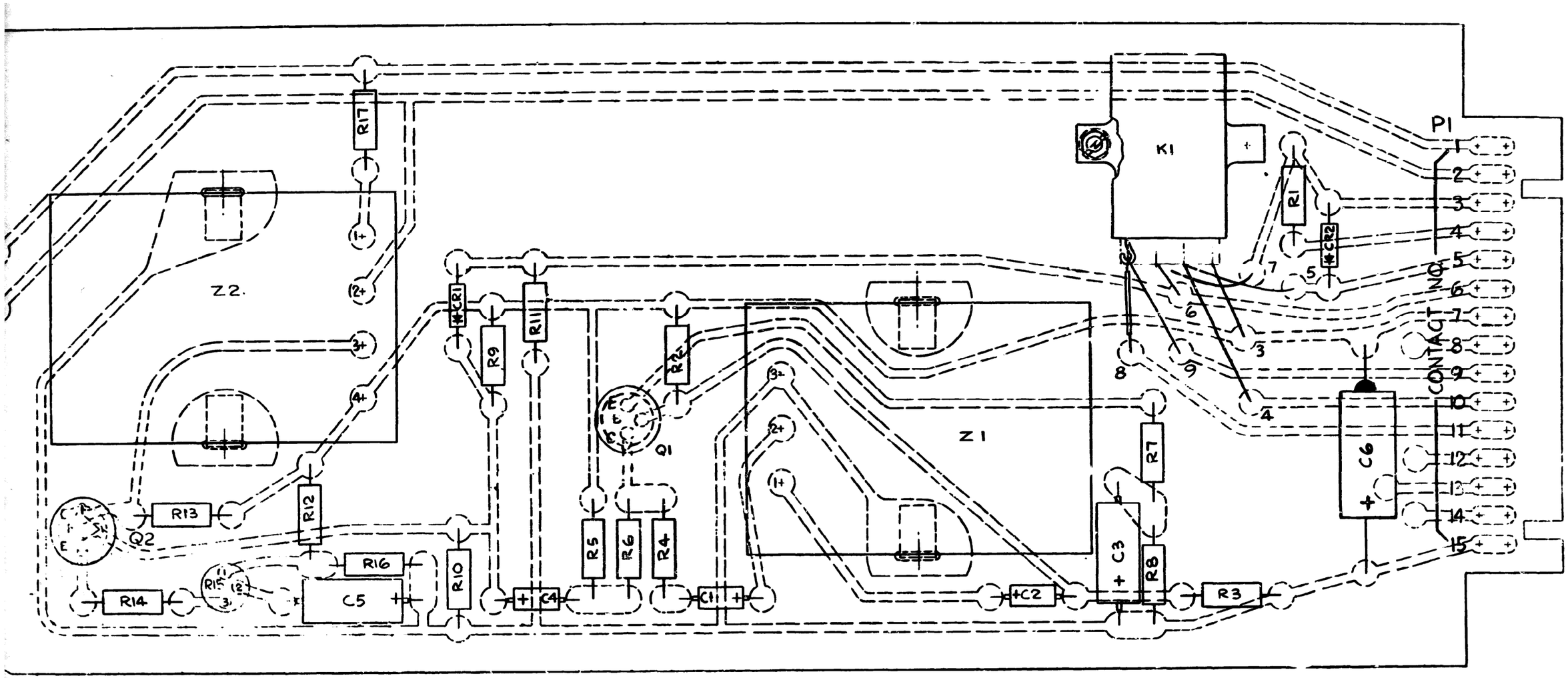
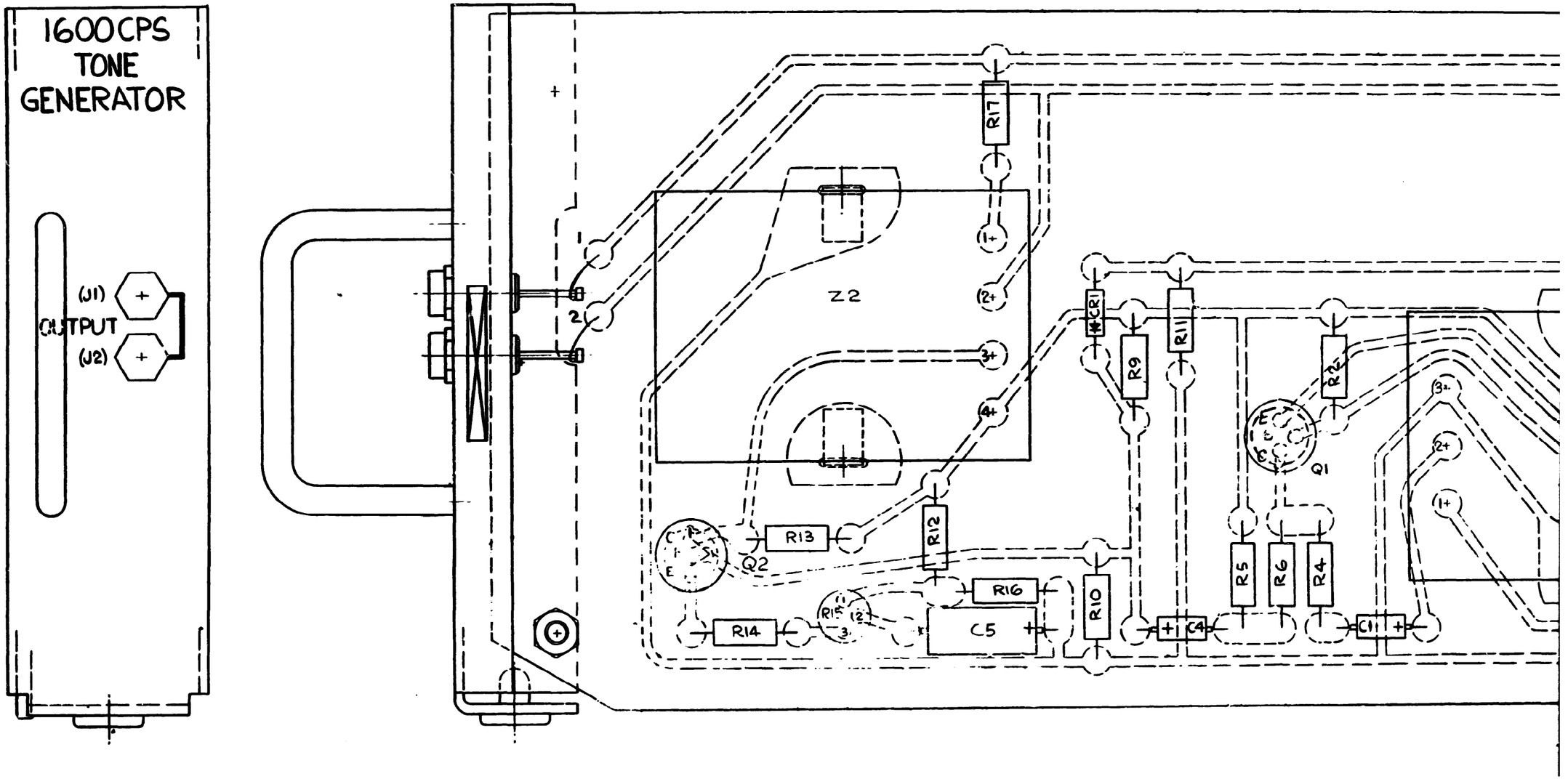


Figure 2. 1600 CPS Tone Generator
NUS 5165-30G1
Parts Location


1600CPS
TONE
GENERATOR
(J1)
OUTPUT
(J2)
+
+
2
Z2
R17
1+
2+
3+
4+
CR1
R9
R11
R12
Q1
3+
2+
1+
R13
Q2
R12
R16
R15
R14
C5
R10
C4
R5
R6
R4
C1

1600 CPS TONE RECEIVER
NUS 5165-37G1

DESCRIPTION

The 1600 cps tone receiver provides an audible and a visual indication, by means of a buzzer and a lamp, when a 1600 cps tone signal is applied to the receiver. The receiver's front panel contains input (IN) test jacks, an output test (DC TEST) jack, a potentiometer control (SENSITIVITY ADJUST), and an indicator lamp (INCOMING CALL). Pertinent characteristics of this receiver are as follows:

Input impedance	10 kilohms (minimum)
Operating frequency	1600 cps
Input sensitivity for relay operation	Adjusted for -20 dbm
Output	Continuity or open circuit for external circuit
Power requirement	-24 vdc

CIRCUIT DESCRIPTION (Figures 1 and 2)

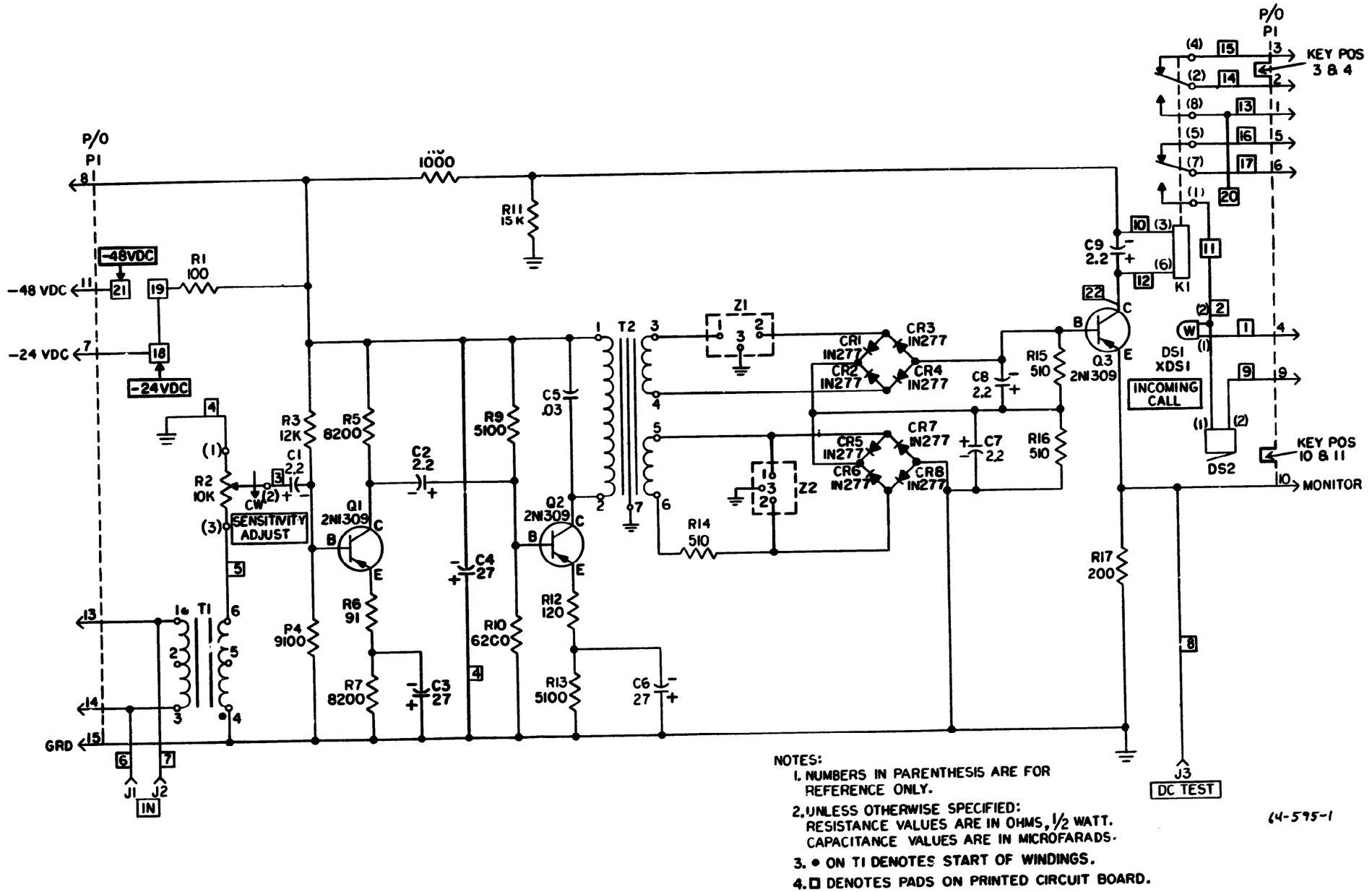
The input signal is coupled through impedance-matching transformer T1 to the base of transistor Q1. SENSITIVITY ADJUST potentiometer R2 is provided to control the amplitude of the input signal. The signal is amplified by two common-emitter amplifier stages (Q1 and Q2) and coupled through transformer T2 to tuned circuits Z1 and Z2. The circuits, each consisting of an inductance and capacitance in series, are tuned to resonate at 1600 cps and offer a relatively high impedance to frequencies other than 1600 cps. Tuned circuit Z1 is connected in series with the top bridge rectifier circuit (diodes CR1 thru CR4) and tuned circuit Z2 is connected in parallel with the bottom bridge rectifier circuit (diodes CR5 thru CR8). The two bridge rectifier circuits develop a net dc voltage that is applied to the base of transistor Q3. The value of voltage developed is dependent upon the frequency of the signals entering the receiver. When this net voltage is negative, and of sufficient level, it will cause transistor Q3 to conduct enough to energize relay K1. When the net voltage becomes less negative, or positive, Q3 will not conduct sufficiently to energize relay K1.

If a pure 1600 cps tone signal (even in the presence of voice-frequency signals) enters the receiver, more current flows into the top bridge rectifier circuit than into the bottom bridge rectifier circuit. A negative voltage of sufficient level appears at the base of Q3 so that Q3 conducts enough to energize relay K1. Consequently, the buzzer and INCOMING CALL lamp are activated.

Speech and other voice-frequency range signals have components which are predominantly at other than 1600 cps, even though some may lie close to this frequency. When such signals enter the receiver, more current flows in the bottom bridge rectifier circuit than in the top bridge with the result that there is dc voltage in the output of the bottom bridge. Thus, the net voltage at the base of Q3 becomes less negative or even positive (depending upon the frequency content of the input signal) and Q3 does not conduct heavily enough to energize relay K1. Consequently, the buzzer and the INCOMING CALL lamp are not activated.

Capacitors C7 and C8 reduce the ripple in the outputs of the diode bridges. Capacitor C9 shunts the windings of relay K1 to delay the operation of the relay and to prevent chatter resulting from pulsation in the current flowing through transistor Q3.

The minimum level of the 1600 cps signal at which relay K1 operates can be set by means of SENSITIVITY ADJUST potentiometer R2. This control limits the signal applied to the base of transistor Q1 which, in turn, limits the magnitude of the dc voltage applied to the base of transistor Q3. The 1600 cps input signal can be measured between IN test jacks J1 and J2. The emitter voltage of transistor Q3 can be measured from the DC TEST jack J3 to ground.



NOTES:
1. NUMBERS IN PARENTHESIS ARE FOR REFERENCE ONLY.
2. UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS, 1/2 WATT. CAPACITANCE VALUES ARE IN MICROFARADS.
3. • ON T1 DENOTES START OF WINDINGS.
4. □ DENOTES PADS ON PRINTED CIRCUIT BOARD.

64-595-1

Figure 1. 1600 CPS Tone Receiver NUS 5165-37G1, Schematic Diagram

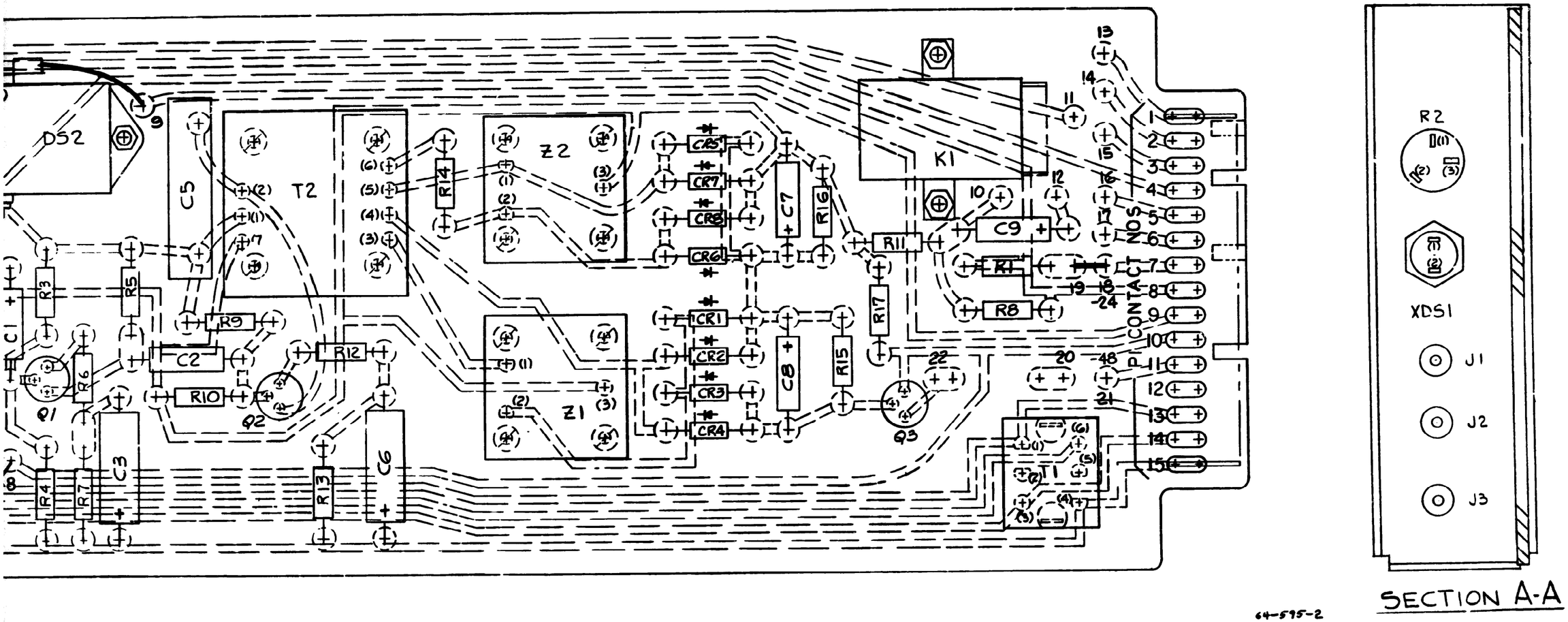
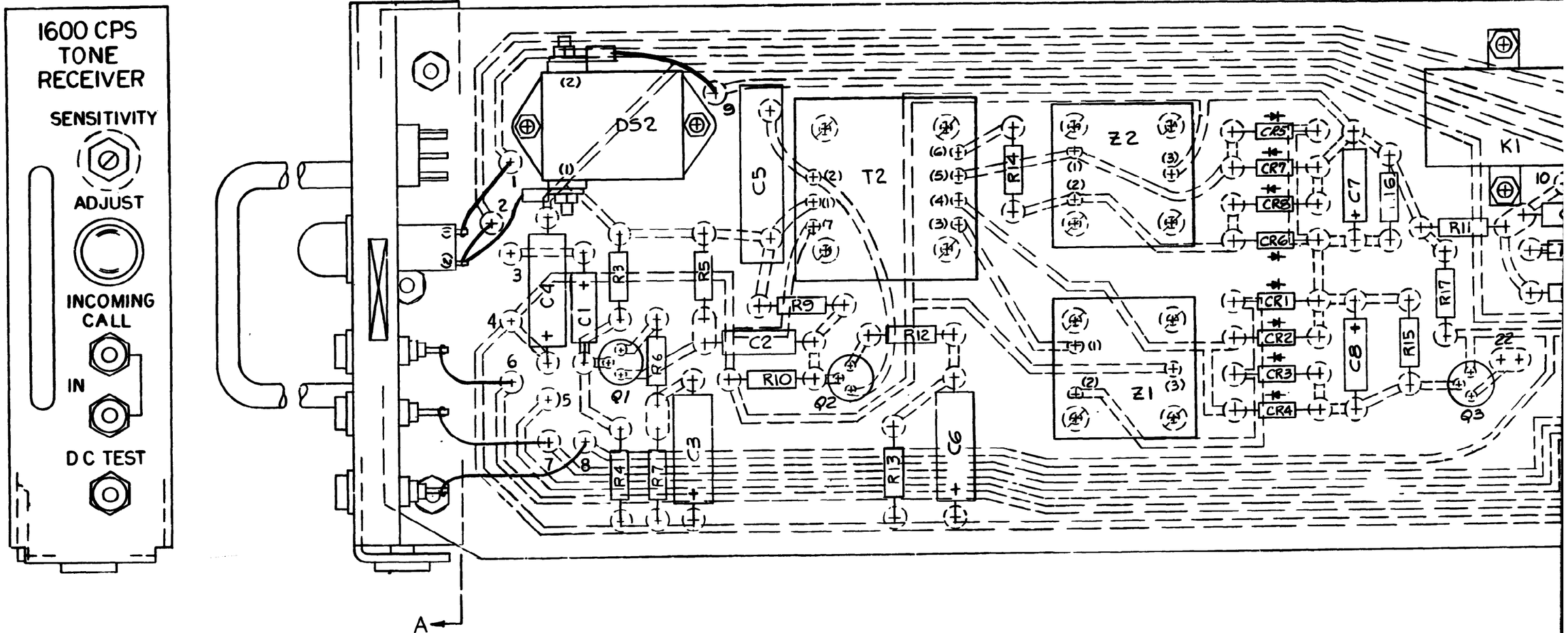


Figure 2. 1600 CPS Tone Receiver NUS 5165-37G1, Parts Location


1600 CPS
TONE
RECEIVER
SENSITIVITY
ADJUST
INCOMING
CALL
IN
DC TEST
A
A
DS2
T2
Z2
Z1
K1
C5
C4
C1
C2
C3
C6
C7
C8
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
Q1
Q2
Q3

AUDIO AMPLIFIER

NUS 5165-40G1 AND G2

DESCRIPTION

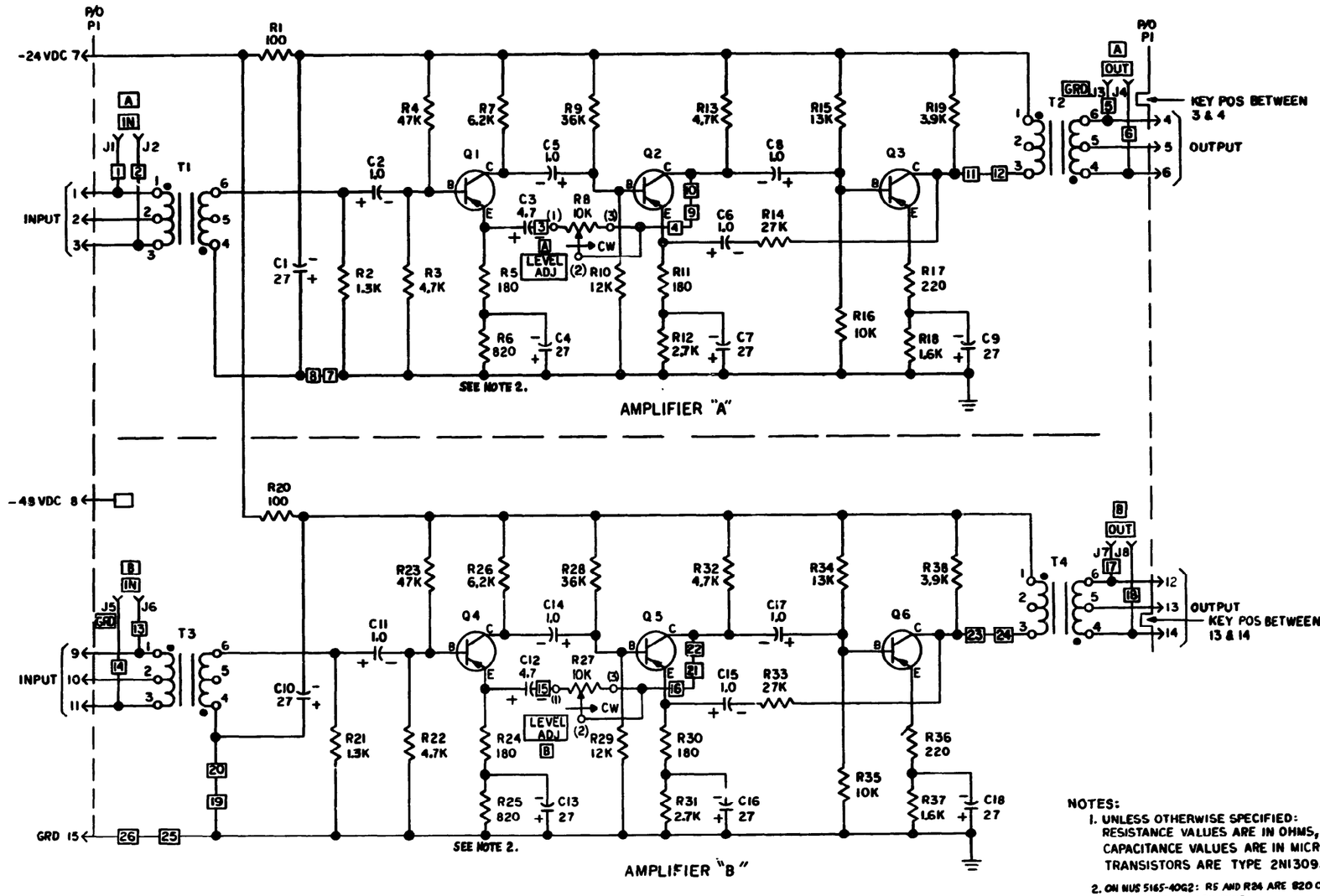
The audio amplifier is used in the central equipment cabinet to amplify order-wire, pilot tone, or other af signals. The audio amplifier contains two independent amplifier channels mounted on a single printed-circuit board. Each amplifier channel consists of an input transformer, two common emitter transistors providing audio amplification with negative feedback, a common emitter power output stage also with negative feedback, and an output transformer. The printed-circuit board is fastened to a front panel where phone jacks are mounted for testing the inputs and outputs of both amplifier channels. Pertinent characteristics of the module are as follows:

Input impedance	150 or 600 ohms (each channel)
Output impedance	150 or 600 ohms (each channel)
Gain	40 db min (each channel)
Frequency range	300 to 4000 cps
Power requirements	-24 vdc at 25 ma

CIRCUIT DESCRIPTION (Figures 1 and 2)

Voltage Amplifiers Q1 and Q2. Two complete amplifiers (A and B) are mounted on a single printed circuit board. Since amplifiers A and B contain identical circuits and function identically, only amplifier A is described. Amplifiers Q1 and Q2 are connected in common emitter configurations. The balanced input, depending on the line input impedance, is applied to the primary of input transformer T1. The 150-ohm input is connected to P1-1 and 2, while the 600-ohm input is connected to P1-1 and 3. Test points J1 and J2 provide means for checking the 600-ohm input. Transformer T1 matches the input line to the input circuitry of Q1. The bias for common emitter transistor Q1 is derived from voltage divider R3 and R4. The input is coupled by C2, amplified by Q1, and applied to the base of Q2. Capacitor C4 bypasses signal voltage across R6 to ground. The output of Q1 is coupled by C5, amplified by Q2, and applied to the base of Q3. The bias for Q2 is derived from voltage divider R9 and R10. Variable negative feedback providing output amplitude adjustment of the amplifier, and minimizing waveform distortion, is accomplished by potentiometer R8 and capacitor C3. Capacitor C7 bypasses signal voltage across R12 to ground.

Output Amplifier Q3. Amplifier Q3 is also connected in a common emitter configuration. The collector circuit output of Q2 is coupled by C8, amplified by Q3, and applied to the primary of transformer T2. The bias for Q3 is derived from voltage divider R15, R16. Negative feedback to minimize distortion is accomplished by R14 and C6. Capacitor C9 bypasses signal voltage across R18 to ground. The output signal of the amplifier is coupled by output transformer T2 to P1-5 and -6, for 150-ohm matching, and P1-4 and 6 for 600-ohm matching. Test points J3 and J4 provide means for checking the 600-ohm output.



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE VALUES ARE IN OHMS, 1/2 WATT.
   CAPACITANCE VALUES ARE IN MICROFARADS.
   TRANSISTORS ARE TYPE 2N1309.
2. ON NUS 5165-40G2: R5 AND R24 ARE 820 OHMS; R6 AND R25 ARE 180 OHMS.

64-551-1

Figure 1. Audio Amplifier NUS 5165-40G1, Schematic Diagram

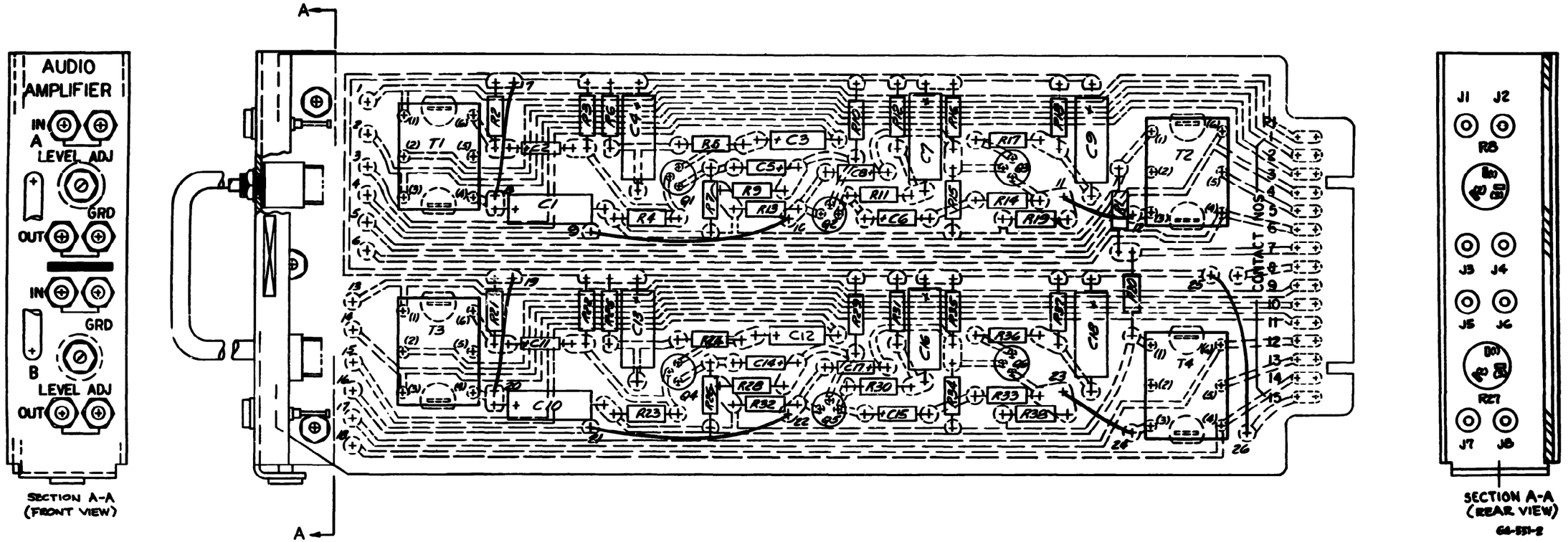


Figure 2. Audio Amplifier NUS 5165-40G1, Parts Location

STATUS INDICATOR
NUS 5165-44G1

DESCRIPTION

The status indicator is part of the Tributary Maintenance Control Center NUS 6284G1 and provides the capability to monitor the overall status of the site. Four pushbutton-indicators are located on the front panel of the status indicator module. The indicators monitor the status of the site equipment. The status indicator also contains an audible alarm for monitoring purposes. Pertinent characteristics for the status indicator are as follows:

Ac power requirements	24 vac at 0.5 amp
Dc power requirements	-24 vdc at 120 ma (regulated)
Output	-24 vdc (unregulated)

CIRCUIT DESCRIPTION (Figures 1 through 3)

Pushbutton-Indicator Circuits. The pushbutton-indicator circuits consist of pushbutton-indicators S1 through S4 and associated relays K1 through K4 respectively. Each pushbutton-indicator consists of a pushbutton and four lamps (two red and two green). The two green lamps are connected in parallel and the two red lamps are connected in parallel. The pushbuttons are alternate-hold type switches (push to operate-push to release). The relays and pushbuttons control the application of unregulated -24 vdc power to the indicator lamps. Lamps may be steady on or flashing, depending upon the state of the associated relay and pushbutton. (The unregulated -24 vdc power circuit and the flashing circuit are described in later paragraphs.) The relays and pushbuttons also control the application of 24 vac power to the audible alarm DS1. In the normal state (no faults present), all relays are energized and all pushbuttons are released. This causes all indicators to be steady green and the audible alarm to be de-activated. When a fault occurs, the associated relay deenergizes and causes its indicator to change to flashing red and the audible alarm to sound. Momentarily depressing the pushbutton (containing the flashing red lamp) acknowledges the fault. The indicator turns to steady red and the audible alarm is de-activated. If the fault is corrected, the relay will energize causing the indicator to change to flashing green and the audible alarm to sound. Momentarily depressing the pushbutton again changes the indicator to steady green and de-activates the audible alarm. The circuit is now returned to the normal state.

Unregulated -24 vdc Power Circuit. The unregulated -24 vdc power circuit supplies the operating voltage for the indicator lamps. The circuit consists of diodes CR1 through CR6, capacitors C1 through C5, and C7, and resistors R1 through R4. The diodes are arranged to form two bridge rectifier circuits. Diodes CR3 through CR6 form one circuit (bridge rectifier #1) and diodes CR1, CR2, CR4, and CR6 form the other circuit (bridge rectifier #2). 24 vac is applied across the two bridge rectifier circuits. The unregulated -24 vdc output of bridge rectifier #1 is filtered by resistors R2, R3, R4 and capacitors C1, C3, C4, C5, and C7 and is applied to the indicator lamps. The unregulated output of bridge rectifier #2 is filtered by resistor R1 and capacitor C2 and is applied to transistor stages Q1 and Q2 (part of the flashing circuit). The unregulated -24 vdc return (positive side) is common to both bridge rectifier circuits and may be connected to the indicator lamps in either of two ways (depending upon the state of the relays and pushbuttons). One way is from the positive side of the bridge rectifier through relay and pushbutton switch contacts to the indicator lamps. The other way is from the positive side of the bridge rectifier, through transistor Q4 (part of flashing circuit) and then through relay and pushbutton switch contacts to the indicator lamps.

Flashing Circuit. The flashing circuit enables the indicator lamps to flash on and off by interrupting the unregulated -24 vdc return. The circuit consists of transistor stages Q1 through Q4. Transistor stages Q1 and Q2 form a free-running multivibrator circuit. Each stage alternately conducts for 0.5 seconds and then cuts-off for 0.5 seconds. The multivibrator output is taken from the collector of Q2 and provides the bias voltage at the base of common emitter stage Q3. Thus the multivibrator circuit controls the conduction and cut-off time of transistor Q3. The output of Q3 is applied to the base of switching transistor Q4. When transistor Q3 conducts, transistor Q4 is biased into conduction and the unregulated -24 vdc return is applied to the indicator lamps. When transistor Q3 is cut-off, transistor Q4 is also cut-off and the unregulated -24 vdc return is removed from the indicator lamps.

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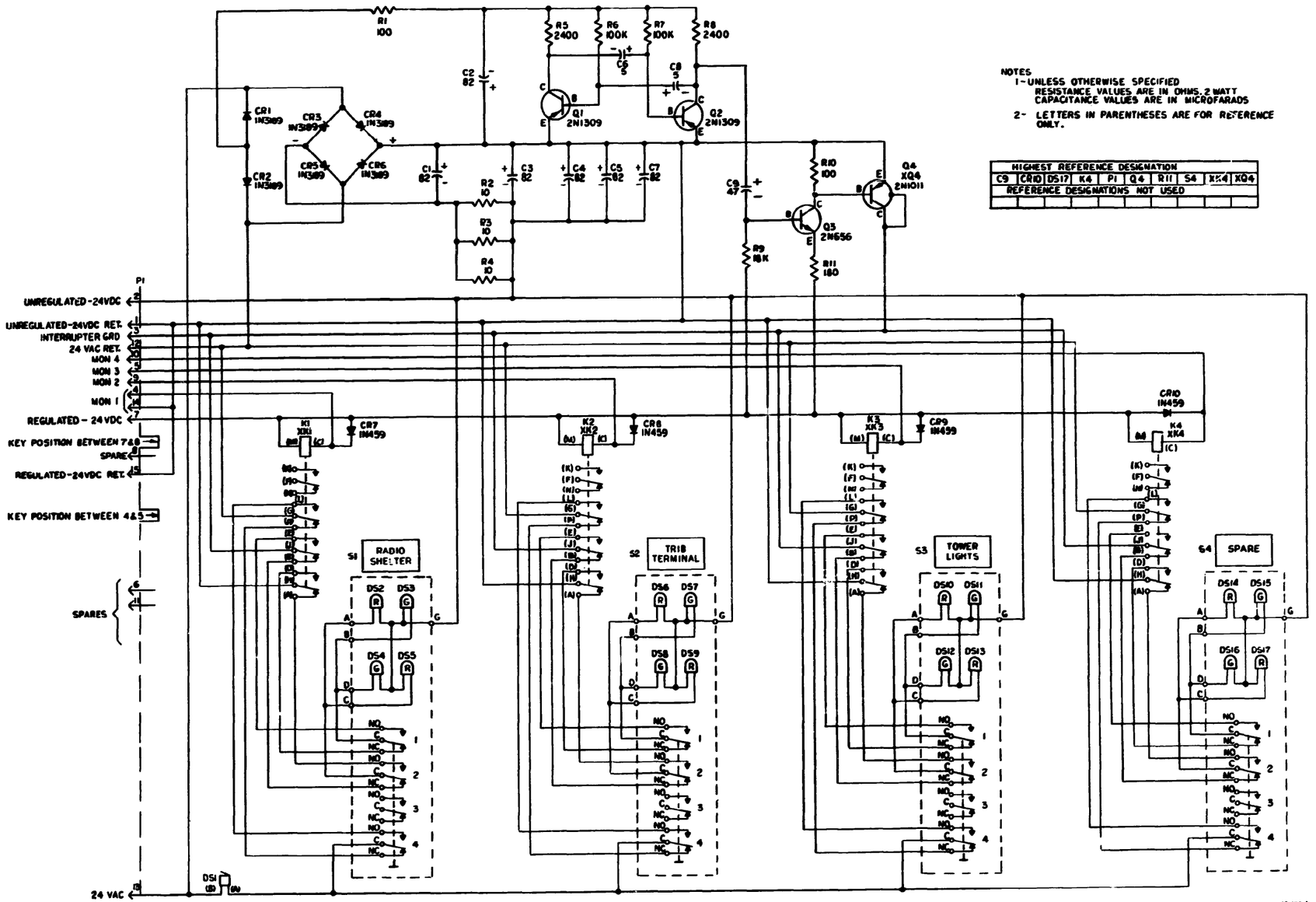


Figure 1. Status Indicator NUS 5165-44G1, Schematic Diagram

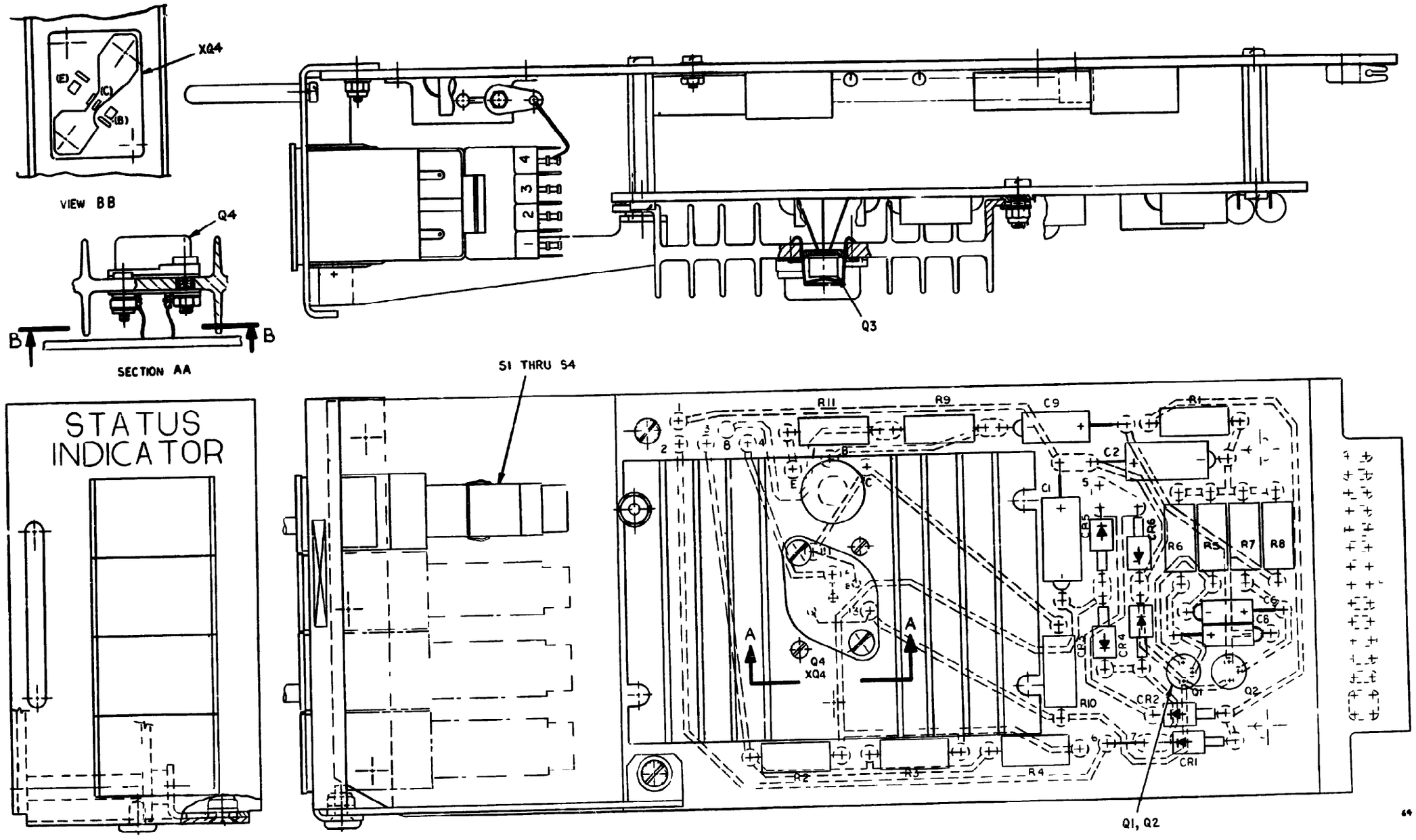


Figure 2 Status Indicator NUS 5165-44G1 Parts Location (Sheet 1 of 2)

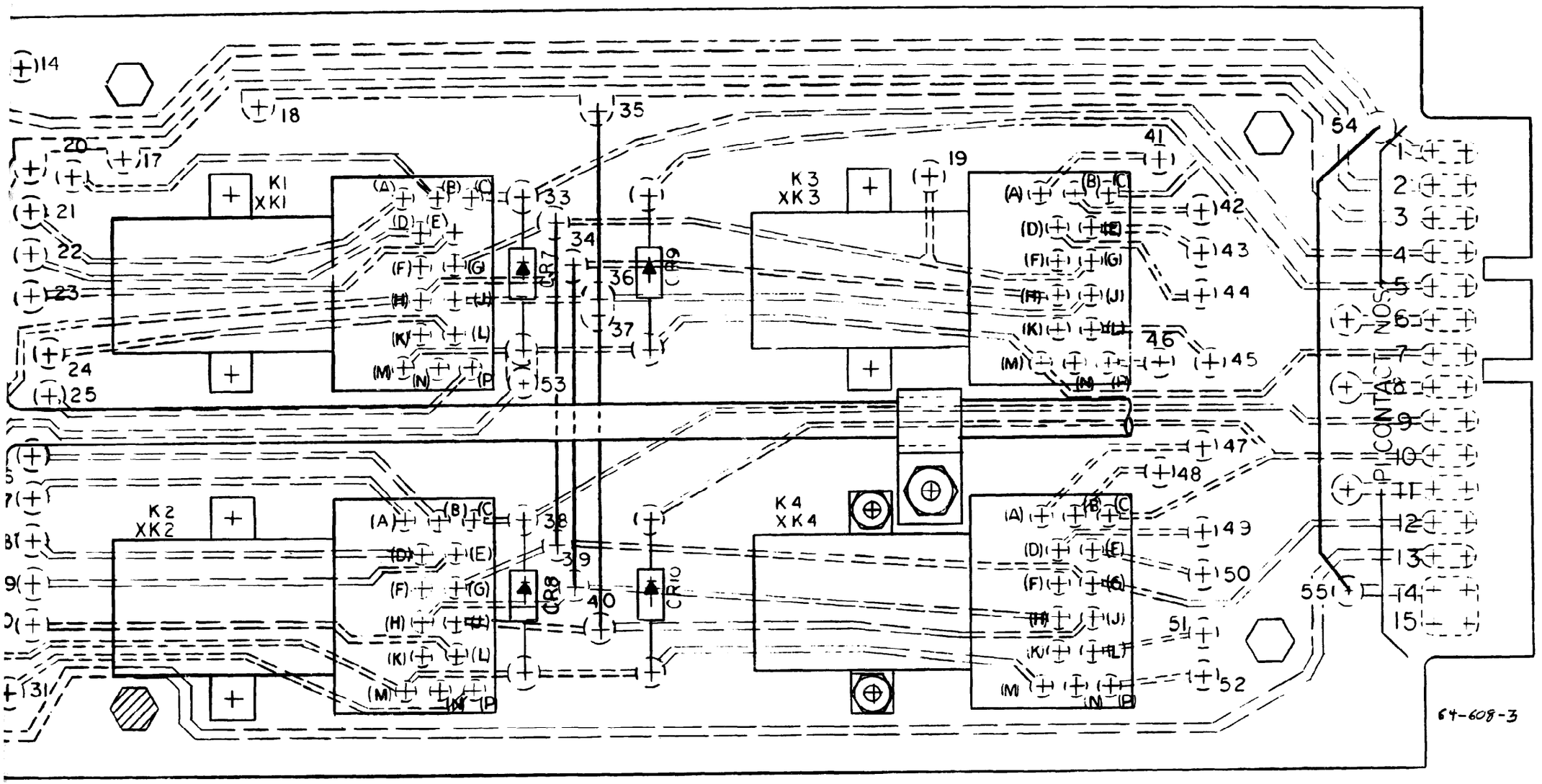
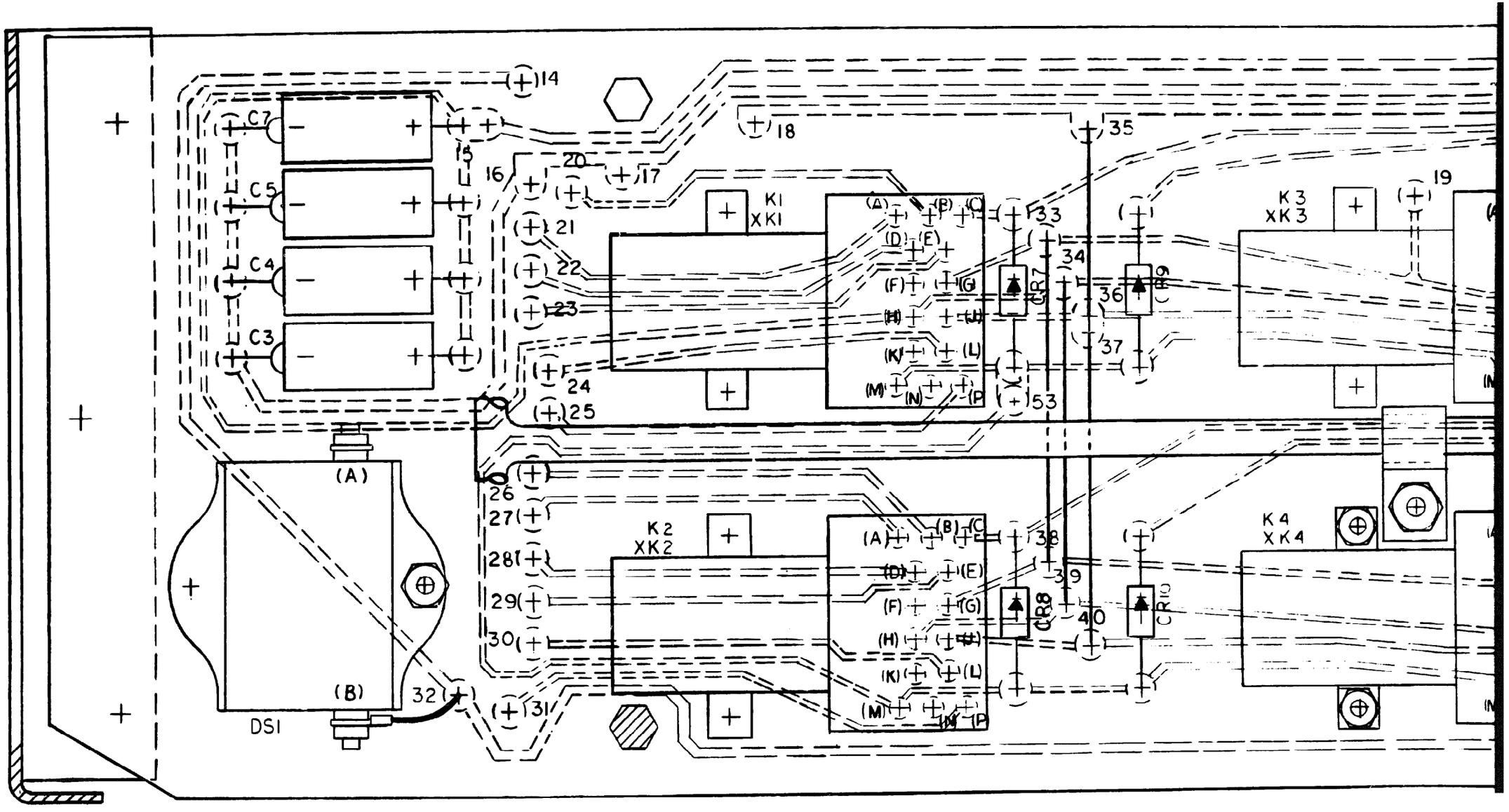


Figure 2. Status Indicator NUS 5165-44G1, Parts Location (Sheet 2 of 2)


C7
C5
C4
C3
14
15
16
17
18
20
21
22
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24
25
26
27
28
29
30
31
32
35
19
33
34
36
37
53
K1
XK1
K2
XK2
K3
XK3
K4
XK4
(A)
(B)
(C)
(D)
(E)
(F)
(G)
(H)
(J)
(K)
(L)
(M)
(N)
(P)
CR7
CR8
CR9
CR10
38
39
40
DS1

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  Ft Gordon (10)
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  Ft Carson (5)
  SAAD (30)
  LBAD (14)
  TOAD (14)
  SHAD (3)
HISA (Ft Monmouth) (33)
Ft Richardson (ECOM Ofc) (2)
Svc Colleges (1)
USASESS (5)
USAICS (3)
USAADS (2)
USAFAS (2)
USAARMS (2)
USAIS (2)
USAES (2)
MAAG (1)
USARMIS (1)
USAERDAA (1)
USAERDAW (1)
Sig FLDMS (1)

ARNG & USAR: None

For explanation of abbreviations used, see AR 310-50.

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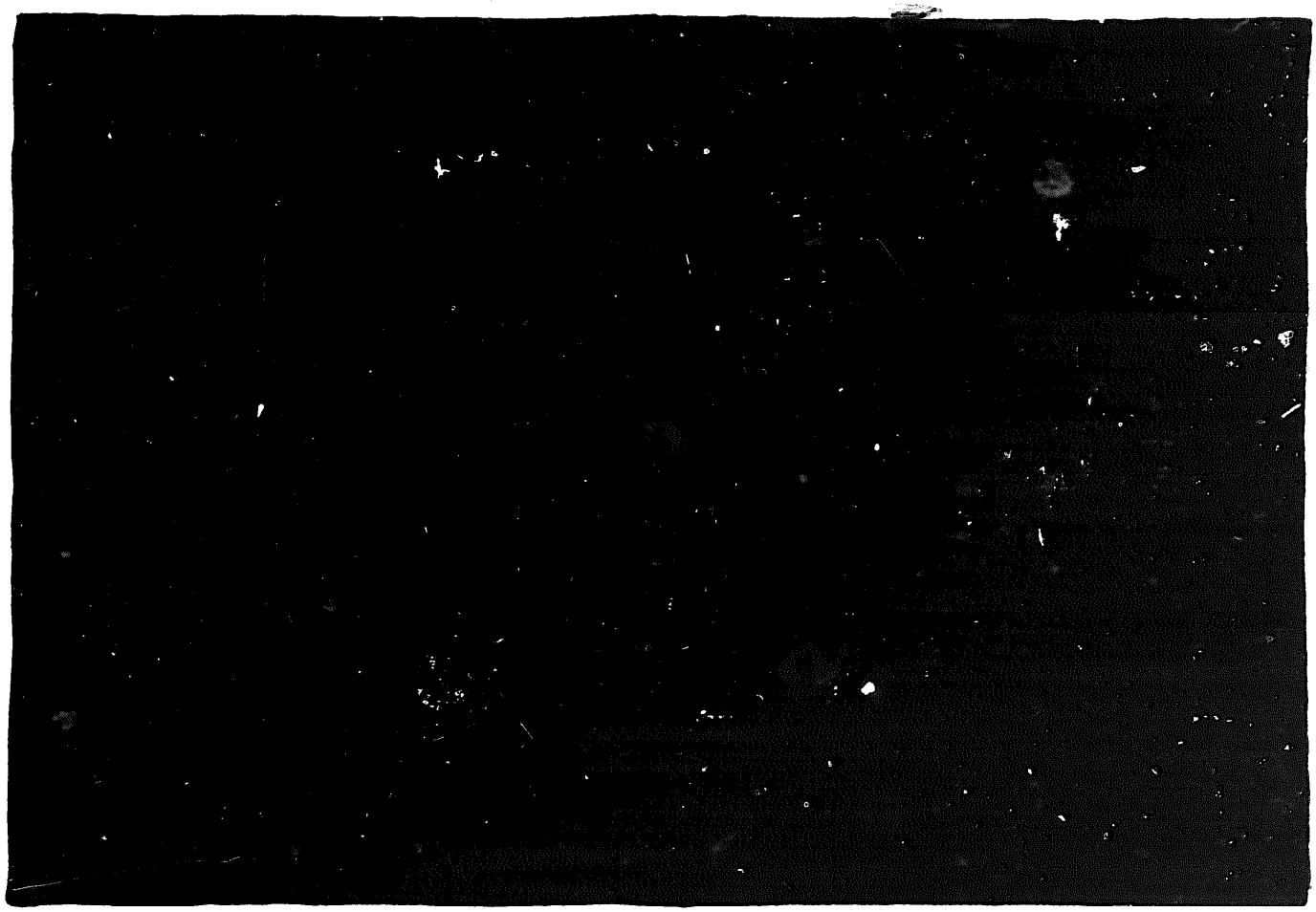
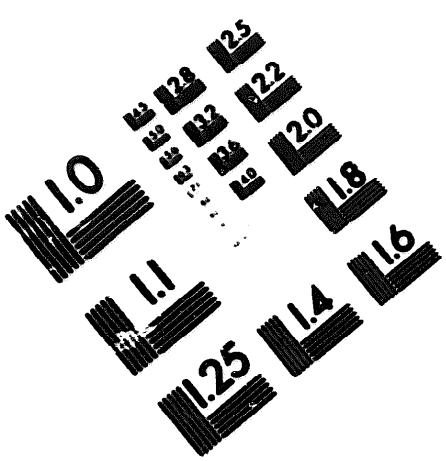
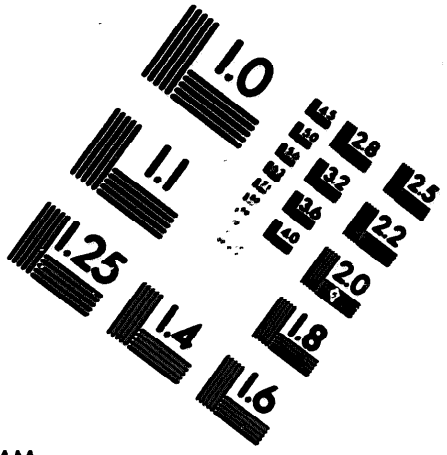


DEPARTMENT OF THE ARMY

MICROFORM
TEST TARGET





150 MM

1.5 mm (e= 1.09 mm)

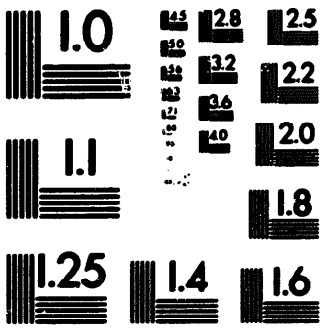
ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz¢£/%#½¼¾—=+×&@*

2.0 mm (e= 1.37 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*



1.5 mm (e= 1.09 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz¢£/%#½¼¾—=+×&@*

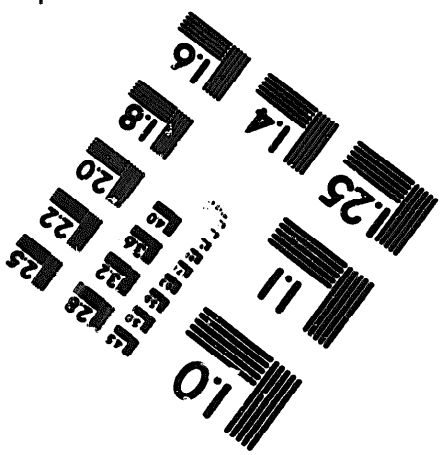
2.0 mm (e= 1.37 mm)

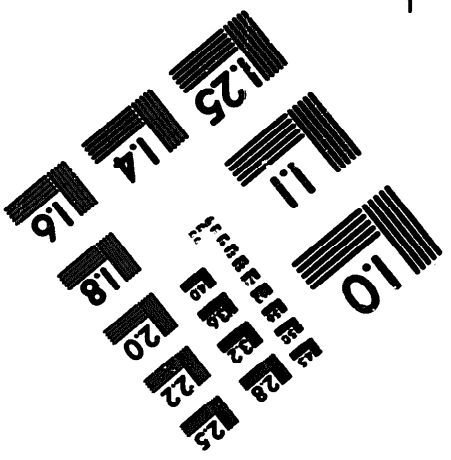
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

200 MM





250 MM