51500 II TELEPHONE VERIFICATION SET OPERATOR'S GUIDE

Contents

Figure 1. Model 51500 II Telephone Verification Set.

1. Introduction

The 51500 II Telephone Verification Set (see Figure 1) quickly and easily tests the following telephone functions:

- Continuity
- Insulation Safety
- Transmission
- Dialing
- Ringing

In addition, the 51500 II tests the telephone's modular plug-in cords for opens, shorts, and crossed wiring.

This guide first describes each test offered by the test set, and then shows the location of the buttons, test result indicators, and other components used when testing telephones. This is followed by instructions for performing each test and for programming new settings for the Ringer or Dial test parameters.

For additional information, refer to the 51500 II Telephone Test Set Operation and Maintenance Manual.

2. Test Descriptions

The 51500 II offers the following tests:

- **Continuity test** checks for proper circuit conditions, off-hook resistance, opens and shorts that may cause transmission problems.

- **Insulation Safety test** checks for potentially hazardous current leakage paths from the incoming line to any outside metal surface on the telephone.

- **Transmission test** conducts objective testing of the transmit and receive characteristics of the telephone by the use of an IEEE 269 transmission test head.

- **Dial test** checks rotary/pulse dials and tone dials. Pulse dials are checked for digits dialed, and speed and ratio of each digit, on a pulse-by-pulse measurement basis. Tone dials are checked for digits dialed, frequency, and amplitude of both the high and low frequency components and twist.

- **Ringer test** provides a ringing signal of specified voltage, frequency, amplitude, and loop length. Checks both private and multi-party ringing. Also tests telephone for bell tap. Tip-to-ring leakage tests also check for faults that can cause line loss, dialing problems, and other undesirable effects.

- **Modular Cord test** checks 2, 4, or 6-conductor line cords, and 4-conductor handset cords, for opens, shorts, and crossed wiring.

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FAX: 206/885-3282 • MCI Mail: 3991080

3. Test Set Components

This section describes the switches, indicators, fixtures, and interconnections that are used during testing. (See Figure 2.)

- **Test Select Buttons**

The telephone function tests are initiated by pressing the appropriate test selection button; each time a test button is pressed, a tone will sound.

- **Alternate Function Buttons**

Used when programming optional parameter settings for the DIAL and RINGER tests. (For more information, refer to section 6, Programming Instructions.)

- **Modular Telephone Jack**

Connects 51500 II to telephone under test via modular line cord.

- **Transmission Test Fixture**

Acoustically couples telephone handset to the test set to check the transmit/receive functions of the telephone.

- **Instruction Window**

Provides operator prompts, instructions, test results, dialed digits, and other data.

- **Pass/Marginal/Fail Lamps**

Provides green 'Pass', yellow 'Marginal', and red 'Fail' indications.

- **Cord Verify Lamps**

Indicate the functional integrity of modular line and handset cords.

- **Modular Line Cord & Handset Cord Sockets**

Four modular sockets for interconnecting and testing 4-wire handset cords, and 2, 4, and 6-wire line cords.

- **Wall Telephone Jack**

Universal wall telephone modular socket with mounting studs.

- **4-Prong Telephone Jack**

Used to attach 4-prong telephone cords to test set.

- **Power Switch**

On/Off switch used to apply power to the test set.

4. Telephone Connections

This section describes how to connect a telephone to the 51500 II Test Set.

Warning

Whenever working with any electrical device or appliance, use caution to avoid electrical shock. While testing telephones with this device, various voltage levels are applied to the telephone input jacks. While the energy levels at these jacks are less than what can be found at standard home or business telephone jacks, common sense precautions should be observed, such as:

1. Never touch or insert any foreign object into the telephone jacks.

2. During INSULATION SAFETY and RINGER tests, keep hands clear of jacks, cables, and wiring.

4.1 Modular Jacks

Plug the telephone to be tested into the appropriate TELEPHONE input socket. (Also make sure the cord is fully inserted into the telephone.)

4.2 Modular Wall Telephone Jacks

Insert a wall-mounted telephone into the socket on the right-side panel mounting bracket. Lower the telephone downward over the studs. (It might be necessary to push in or pull out a lever on the side of the telephone to lock it into place; remember to operate the release lever when removing the telephone from the wall mount fixture.) Once the wall telephone is locked-in, testing can begin.

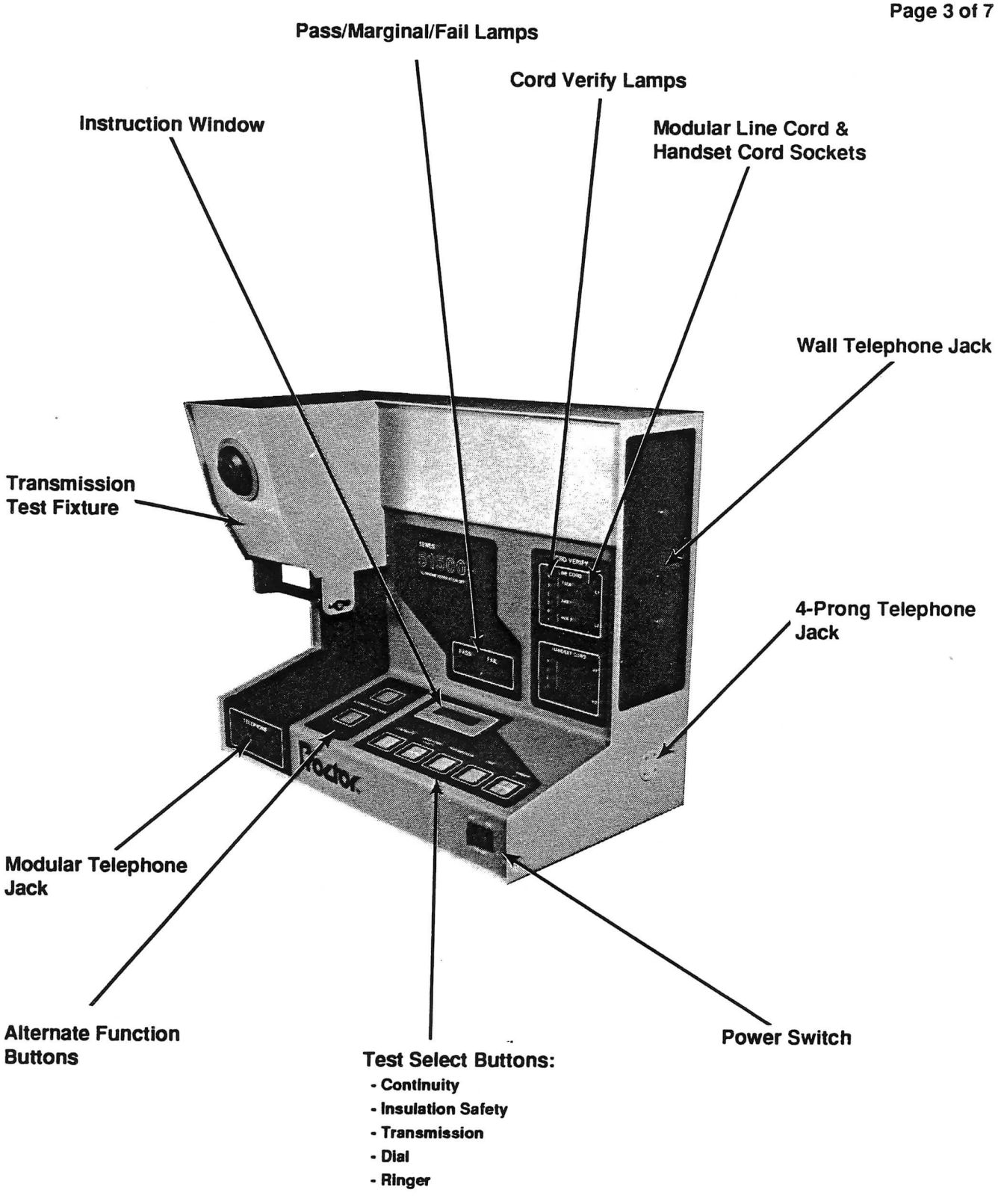

Figure 2. Front Panel Components.

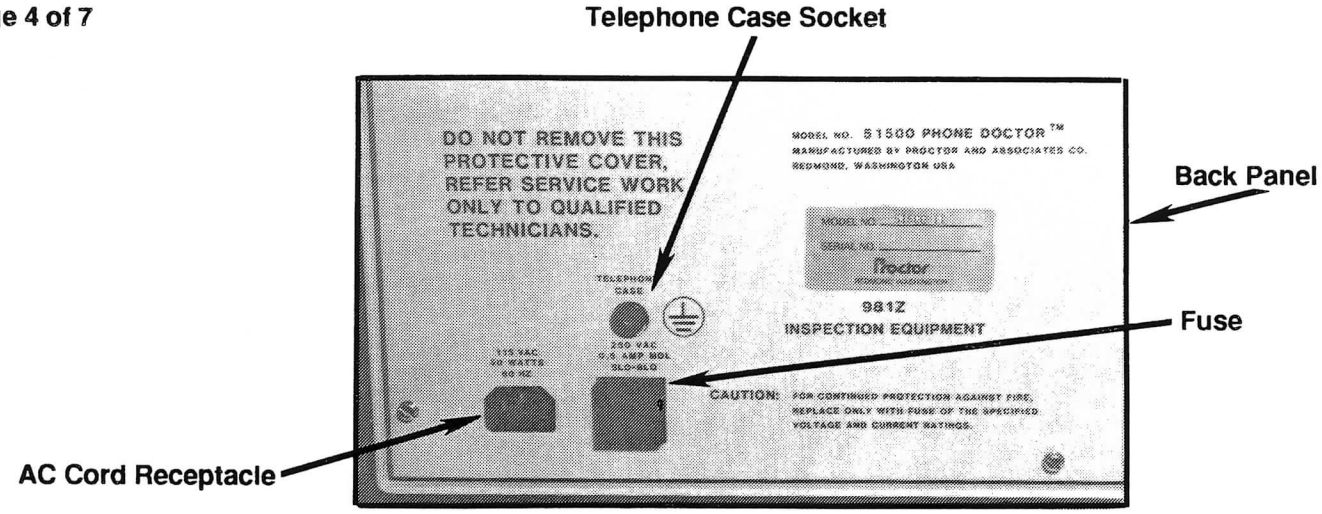

Figure 3. Back Panel Components.

4.3 4-Prong Telephones

To connect a telephone that has this type of cord, attach the 4-prong plug into the socket on the right-side panel of the test set.

5. Test Instructions

Refer to the appropriate instructions to perform the Continuity, Insulation Safety, Transmission, Dial, Ringer, or Cord Test.

5.1 Continuity Test

The CONTINUITY test verifies the operation of the telephone's hookswitch and simulates a complete circuit loop (from calling telephone to called telephone) to check resistance of the telephone's circuit path during normal operation.

(1) Press CONTINUITY button.

(2) Take telephone off-hook.

(3) Check result - PASS, MARGINAL/FAIL, or FAIL

5.2 Insulation Safety Test

Warning

While the INSULATION SAFETY test is in progress, keep hands clear of jacks, cables, and wiring.

The INSULATION SAFETY test should only be performed if there are metal parts or surfaces on the outside of the telephone; the test simulates a voltage surge across the telephone line to check the insulation of the telephone's circuit path and to verify that the telephone under test is a safe instrument.

(1) Press INSULATION SAFETY button.

(2) Watch for the warning message to appear in the display window.

(3) Attach the supplied Case Leakage Cord to the metal telephone base or the metal fingerstop on the dial, and insert the opposite end of the cord into the TELEPHONE CASE socket on the back panel of the unit, next to the fuse. (See Figure 3.)

(4) Take the telephone off-hook.

(5) Remove hand from telephone.

(6) Press INSULATION SAFETY button again.

(7) Check result - PASS or FAIL.

(8) Disconnect the Case Leakage Cord.

Warning

If a fail indication is given during this test, discontinue testing the telephone because further use could be dangerous.

5.3 Transmission Test

The TRANSMISSION test checks the circuits of the telephone to verify that they accurately receive and transmit sound.

(1) Press TRANSMISSION button.

(2) Place handset on fixture as shown in Figure 4.

(3) Press TRANSMISSION button again while holding the handset on the fixture. Maintain placement of handset until a test result is displayed.

(4) Check result - PASS, MARGINAL/FAIL, or FAIL.

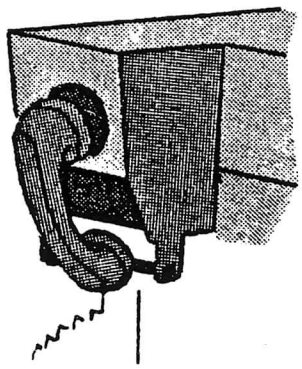

Figure 4. Transmission Test Fixture.

5.4 Dial Test

The DIAL test checks for problems associated with rotary dial or pushbutton telephones. (The test set automatically detects the type of dial for the telephone under test.)

(1) Pick up the telephone handset.

(2) Press the DIAL button.

(3) Dial the exact sequence of numbers indicated in the instruction window: 1-2-3-4-5-6-7-8-9-0.

(4) Check result - PASS, MARGINAL/FAIL, or FAIL. Type of dial (tone or rotary) is displayed in the instruction window.

(5) To test individual numbers, dial any of the numbers on a rotary dial telephone, or push any of the buttons on a tone dial telephone, including the star [*] or pound [#] buttons. The numbers or characters will be displayed in the instruction window in the same sequence in which they are dialed. If desired, auto-dialers or re-dial buttons can also be tested at this time. (It may be necessary to momentarily hang-up some telephones in order to initiate the re-dial feature.)

(6) Check test results - PASS, MARGINAL/FAIL, or FAIL.

(7) Hang up the handset when finished.

5.5 Ringer Test

Warning

While the RINGER test is in progress, keep hands clear of jacks, cables, and wiring.

The RINGER test simulates the ringing signals required to operate a telephone's ringer and measures the ringer's load on the telephone system. The telephone is also tested for bell taps, which are undesirable, short duration rings that may be heard at an on-hook telephone when another telephone sharing the line is pulse-dialed.

(1) While the telephone is on-hook, press the RINGER button.

(2) Watch for the warning message to appear in the display window.

(3) Press the RINGER button again.

(4) Listen for ringing.

(5) Listen for bell taps. (Telephone fails if bell taps are heard.)

(6) If an excessive ringer load exists, the red FAIL lamp will light to indicate too much load on the line. Otherwise, the test set prompts the user to plug in another telephone for further testing.

5.6 Modular Cord Test

The MODULAR CORD TEST checks the line and handset cords for shorts, opens, and crossed wiring. If either of these conditions exist, the LED associated with the defective wire(s) will fail to illuminate. If an intermittent problem exists, the LED associated with the defective wire will flicker. (Flickering may also indicate that the test jack is loose or defective.)

Note

When checking the line and handset cords, bend, twist, and flex the cord (without pulling on the cord or damaging the socket).

5.6.1 Checking Line Cords

Remove the line cord from the telephone and insert one end of the cord in the upper LINE CORD socket and the opposite end of the cord into the lower LINE CORD socket. Lamp pairs 4 & 3 should always light. Lamp pairs 5 & 2 and 6 & 1 may light if these wires are used in the cord. The lamps should always light in the pairings shown on the CORD VERIFY display.

5.6.2 Checking Handset Cords

Remove the handset cord from the telephone and insert one end of the cord in the upper HANDSET CORD socket and the opposite end of the cord into the lower HANDSET CORD socket. When testing handset cords, lamps 1 thru 4 should all light.

6. Programming Instructions

The 51500 II Test Set is equipped with programmable parameters for the Ringer Test and Dial Test. The programmable parameters can be changed to customize the test set for a range of different telephones and special test applications. Refer to Table 1 for a list of programmable options for the Ringer and Dial tests.

The 51500 II can be programmed with either "temporary" or "fixed" settings. Temporary settings automatically re-set back to their default values after each test is performed. Fixed settings, however, are maintained until the parameter is reprogrammed or the test set is turned off. This section includes programming instructions for both types of settings.

6.1 Programming "Temporary" Settings

To program temporary settings, perform the following steps:

(1) Refer to Table 1 and select the test parameter and setting to be programmed.

(2) Depending on the type of parameter to be changed, press and release either the DIAL or RINGER test button.

(3) Cycle through the parameter selections for the test by repeatedly pressing and releasing ALTERNATE FUNCTION button #1. Stop when the desired parameter is displayed.

(4) Cycle through the adjustment settings for the parameter selected in step 3 by repeatedly pressing and releasing ALTERNATE FUNCTION button #2. Stop when the desired setting is displayed.

(5) Press the DIAL or RINGER button again to enter the new setting.

(6) To run the test with the new setting, press the DIAL or RINGER button one final time.

(7) Following the test, the changed setting will automatically re-set to its default value.

6.2 Programming "Fixed" Settings

To program fixed settings, perform the following steps:

(1) Refer to Table 1 and select the test parameter and setting to be programmed.

(2) Depending on the type of parameter to be changed, press and ***hold down*** either the DIAL or RINGER test button.

(3) While holding down the test button, press the ALTERNATE FUNCTION #1 button.

(4) Release both buttons.

(5) Cycle through the parameter selections by repeatedly pressing and releasing ALTERNATE FUNCTION button #1. Stop when the desired parameter is displayed.

(6) Cycle through the adjustment settings for the parameter selected in step 5 by repeatedly pressing and releasing ALTERNATE FUNCTION button #2. Stop when the desired setting is displayed.

(7) Press the DIAL or RINGER button again to enter the test with the new setting.

(8) To run the test with the new setting, press the DIAL or RINGER button one final time.

(9) The programmed settings will be maintained until the parameter is reprogrammed or the test set is turned off (which re-sets the parameter to its default value).

Table 1. Programmable Ringer and Dial Test Options

Test	Programmable Parameter	Default Setting	Programmable Settings
Ringer Test	• Number of Rings	2 Rings	2 thru 20 Rings.
	• Ringer Hook-Up	Tip/Ring	Tip/Ring, Tip/Ground, or Ring/Ground.
	• Ringer Frequency (See Notes, Below)	20 Hz	Single Frequency: 16, 16.7, 20, 25, 30, 33.3, 40, 42, 50, 54, 60, 66, or 66.7 Hz. -or- Party Line Frequencies: - Harmonic, - Synchromonic, or - Decimonic.
Dial Test	• Line Polarity	Normal	Normal or Reversed Polarity.
	• Line Loop Length	Typical	Typical (simulates average loop length at 40mA), Minimum (simulates short loop length at 80mA), or Maximum (simulates long loop length at 20mA).

Notes: 1. If a single frequency is selected, that frequency will be applied to operate the ringer. Single frequencies are for activating tuned ringers which operate from a specific frequency.

2. An "Over-Ring Test" will automatically be applied when a single frequency is selected. (The Over-Ring Test includes application of each frequency above and below the selected frequency. However, only one above or below frequency will be applied if the selected frequency is the highest or lowest in the "family.")

3. When a party-line "Frequency Family" (i.e. Harmonic, Synchromonic, and Decimonic frequency groups) is selected, each frequency in the family is applied to the ringer. Party line frequencies are used for selective calling on party lines. Three families of selective ringing frequencies are offered:

- Synchromonic Frequencies: 16.0, 30.0, 42.0, 54.0, and 66.0 Hz.
- Decimonic Frequencies: 20.0, 30.0, 40.0, 50.0, and 60.0 Hz.
- Harmonic Frequencies: 16.7, 25.0, 33.3, 50.0, and 66.7 Hz.

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15050 Northeast 36th
Redmond, Washington 98052
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51500

TELEPHONE TEST SET

OPERATION & MAINTENANCE MANUAL

WARNING

Refer calibration and maintenance work only to qualified electronic service personnel.

WARNING

Do not disassemble the telephone while it is being checked. The 51500 must be used only by authorized and trained personnel. Electrical shock could result from misuse or misapplication of the 51500.

Level G, June 1989

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

1. INTRODUCTION

1.1 General

The 51500 Telephone Verification Set (the "Phone Doctor"®) can be used by non-technical personnel to quickly assess a telephone's operation. The front panel of the unit contains visual indicators which show if a phone passes or fails a test based on the test parameters entered in the 51500 operating program. The unit's front panel also contains a 2 x 16 Liquid Crystal Display (LCD) that provides operator prompts, test results, and other information. The 51500 performs the following telephone checks:

CONTINUITY: Verifies that the tip to ring resistance is between 50 and 400 ohms.

INSULATION SAFETY: Checks for leaking or arcing between the case and any other parts of the telephone.

TRANSMISSION: Measures the ability of the phone to transmit and receive sound.

DIAL: Automatically checks both rotary dial and pushbutton tone dial phones.

RINGER: A multi-mode ring generator (private or multi-party) activates the phone's ringer and applies belltaps. Also checks for leakage between the phone's line connections.

CORD: Checks for continuity and shorts in modular handset cords and in 2-, 4- or 6-wire modular line cords.

1.2 Equipment Description

1.2.1 The 51500 unit contains the main microprocessor-equipped circuit board, an alpha-numeric display, and 'Pass,' 'Fail,' and 'Marginal' lamps to provide diagnostic information to the operator. Figures 1 and 2 show the upper and lower panels as well as the telephone interconnection points on the 51500. (Refer to the 51500 Operator's Guide for operating instructions for the 51500 Telephone Verification Set.)

1.2.2 The 51500 is equipped with the "artificial ear and mouth" (microphone and speaker) used during the TRANSMISSION test. The set also contains modular sockets, a 4-prong socket, and a fixture for attaching modular wall phones for testing.

1.3 Warranty

Proctor and Associates Company warranties its products to be free of defects of material and workmanship for a period of one year from date of shipment. All items for repair under warranty are to be sent transportation prepaid to Redmond, Washington after you have called Proctor and Associates' Customer Service Department and received a Material Return Authorization (MRA). The equipment will be returned 'no charge' providing it has not been misused, installed improperly, altered without authorization, or accidentally damaged.

1.4 51500 Spare Parts

The items listed in Table 1 on Page 2 are available from Proctor as replaceable parts. Refer to the CLD-51500 in the drawings section of this manual for the location of these parts. Also, refer to the Maintenance section of this manual for parts replacement procedures.

1.5 Ordering Information

To order spare parts or additional 51500 Telephone Verification Sets, use the following address and telephone number:

PROCTOR & ASSOCIATES COMPANY
15050 Northeast 36th
Redmond, Washington 98052
Telephone: 206/881-7000
Telex: 15-2320
FAX: 206/885-3282

Part Name	Part Number
Main Circuit Board	51500-1
Cord Test Card	51500-4
Telephone Input Card	51500-5
Wall Phone Socket Card	51500-7
Pass/Fail Card	51500-8
Operating Program PROM (IC4)	840014
Triple Output Power Supply	460018
Acoustical Cup	590025
Case Leakage Cord Socket	240093
0.5A, Slow-blow, MDL Fuse	310016
Case Leakage Verify Cord	500067-05
4-Prong Socket	240163

Table 1. 51500 Spare Parts.

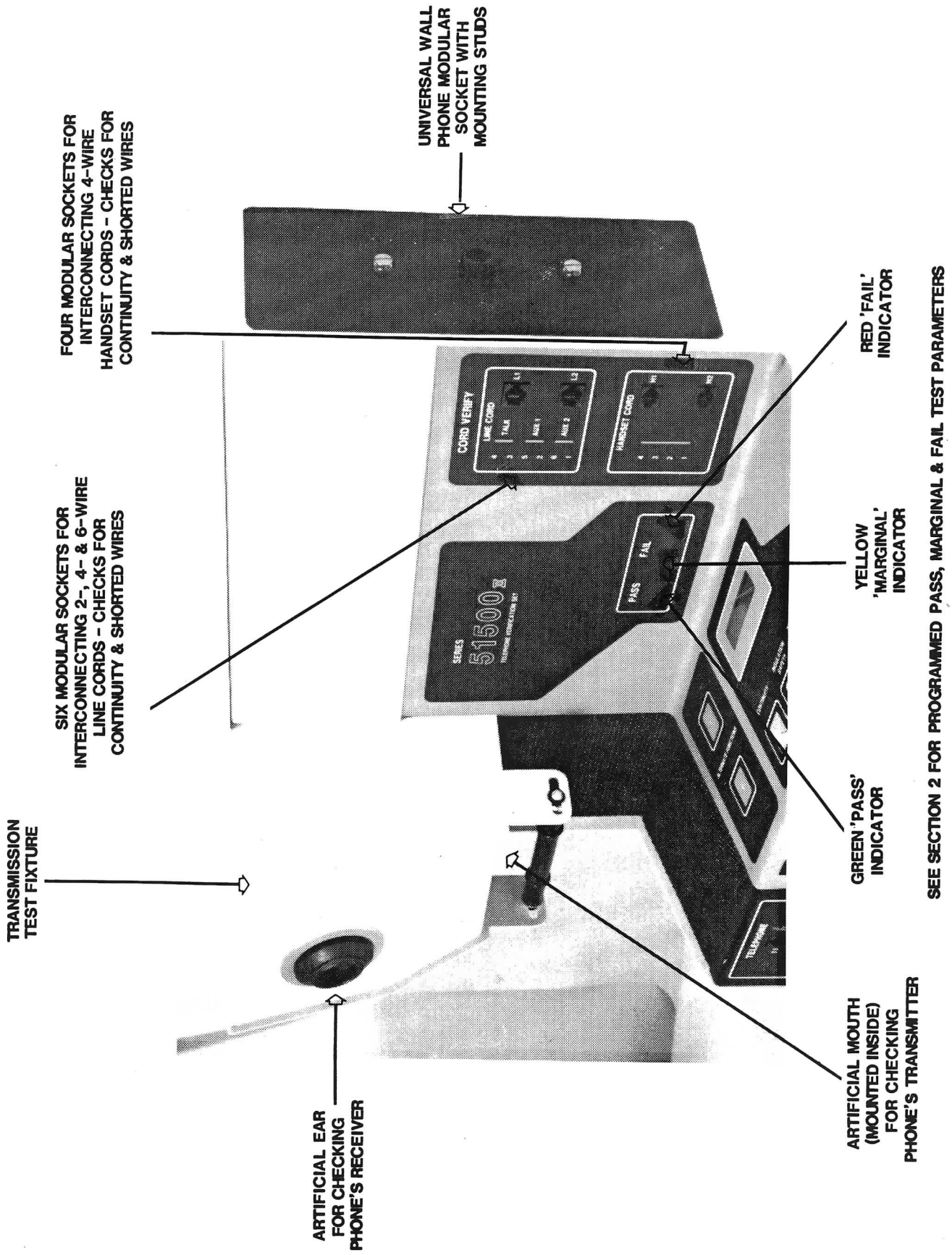


Figure 1. 51500 Upper Panel Controls, Interconnections and Displays.

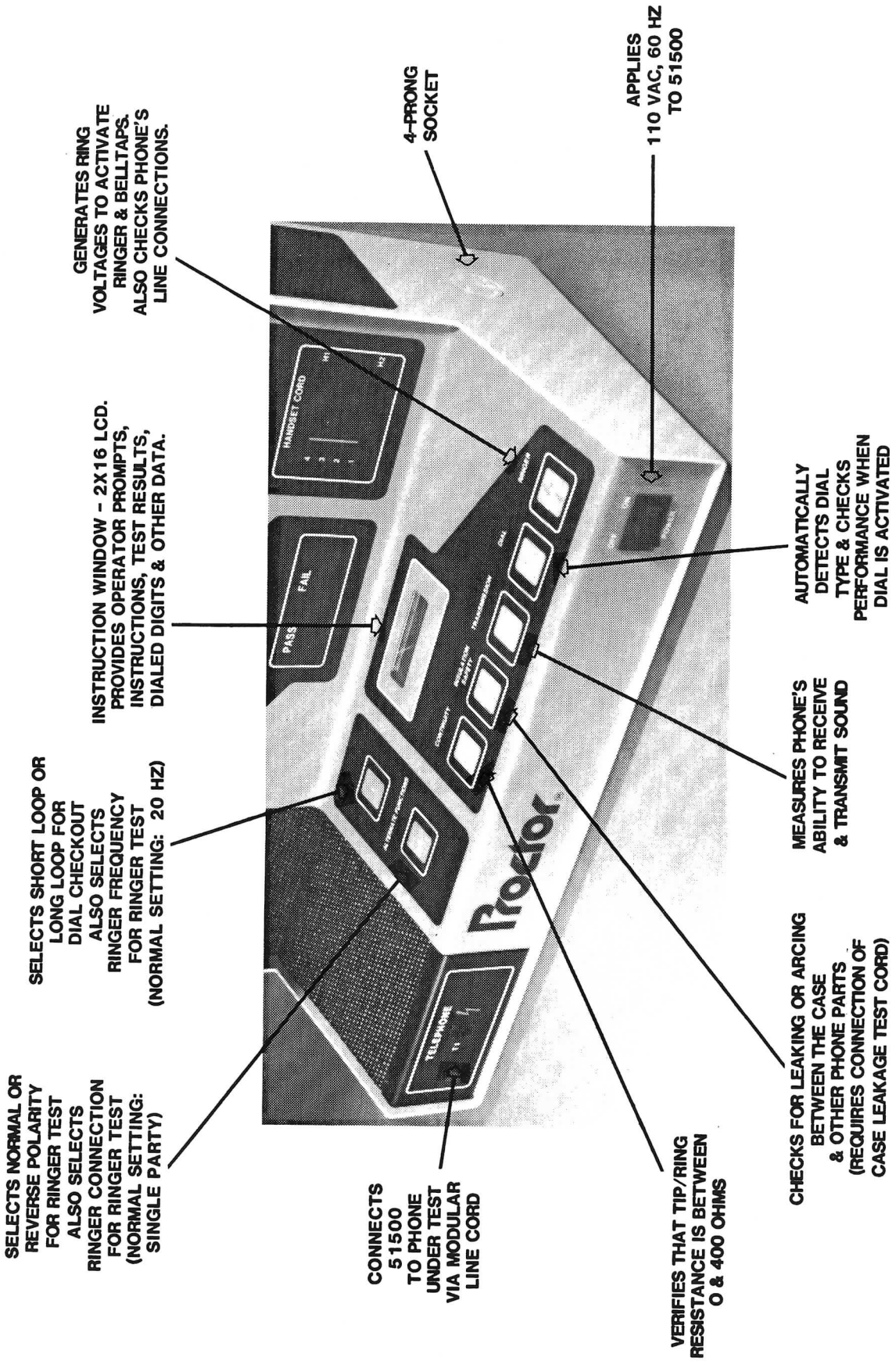


Figure 2. 51500 Lower Panel Controls, Interconnections and Displays.

2. SPECIFICATIONS

The following specifications are standard on the 51500F1 unit except where otherwise noted.

2.1 Electrical

Operating Voltage: 105 to 125 volts ac, 57 to 63 Hz
(European Model - 51500F3): 210 to 250 volts ac, 50 Hz

2.2 Continuity Test

Checks for tip-ring resistance of 50 to 400 ohms for 'Pass'; if 25-50 or 400-800 ohms are measured, a 'Fail/Marginal' indication is given; if tip-ring resistance is from 0 to 25 ohms or over 800 ohms, a 'Fail' indication is given.
Measurement Accuracy: +/-10%

2.3 Insulation Safety

Applies 1000 volts dc or 1500 volts dc (selectable by straps) from tip, ring, and ground connected together to case. Fails test if leakage is greater than 50 microamps ('Fail' 20-microamp parameter is strap-selectable for the 51500F2 configuration).
Measurement Accuracy: +/-5%

2.4 Ringer

Applies 200 Vdc or 500 Vdc (selectable by straps) to ringer. Fails test if leakage is greater than 50 microamps ('Fail' 20-microamp parameter is strap-selectable for the 51500F2 configuration).
Measurement Accuracy: +/-5%

The ringer frequencies of the 51500 are listed in Table 2.

Ringer Frequency	Voltage	Ringer Frequency	Voltage
16 Hz	90 Vrms	40 Hz	110 Vrms
16.7 Hz	90 Vrms	42 Hz	110 Vrms
20 Hz	90 Vrms	50 Hz	125 Vrms
25 Hz	100 Vrms	54 Hz	125 Vrms
30 Hz	100 Vrms	60 Hz	140 Vrms
33.3 Hz	125 Vrms	66.7 Hz	140 Vrms

Table 2. Ringer Specifications.

Connection: Tip-ring, tip-ground, or ring-ground.
Test Loop: 1600 ohms
Ringing Duration: 2 seconds; Frequency Accuracy: +/-2%; Voltage Accuracy: +/-5%
Fifteen belltap pulses are applied to the ringer after the last ringing. (Belltap wave form per EIA specification #S-1286.)

2.5 Transmission

TRANSMIT	504	651	822	1078	1359	1736	2232	2841
'Fail Low'	X	X	X	-34dBV	X	X	X	X
'Marginal-Fail Low'	X	X	X	-34 to -32dBV	X	X	X	X
'Pass Low'	-39	-38	-35	-32dBV	-32	-32	-35	-36
'Pass High'	-7	-9	-10	-10dBV	-7	-6	-3	-5
'Marginal-Fail High'	X	X	X	-10 to -8dBV	X	X	X	X
'Fail High'	X	X	X	-8dBV	X	X	X	X

RECEIVE	504	651	822	1078	1359	1736	2232	2841
'Fail Low'	X	X	X	75dB	X	X	X	X
'Marginal-Fail Low'	X	X	X	77 to 75dB	X	X	X	X
'Pass Low'	76	77	77	77dB	76	75	71	68
'Pass High'	100	100	99	98dB	99	99	98	98
'Marginal-Fail High'	X	X	X	100 to 98dB	X	X	X	X
'Fail High'	X	X	X	100dB	X	X	X	X

X = indicates 'skip'

NOTE: In order to fail Transmit or Receive tests, the phone must be outside the 'Marginal Fail' limits at 1078 Hz.

Transmit Accuracy:	+/-2dB at 1078 Hz +/-5dB at 504 Hz +/-5dB at 2841 Hz
Receive Accuracy:	+/-2dB at 1078 Hz +/-3dB at 504 Hz +/-6dB at 2841 Hz

Table 3. Transmission Specifications.

2.6 Rotary Dial

Speed: 8 to 11 PPS for 'Pass,' 7 to 12 PPS for 'Marginal'
Ratio: 58 to 64% for 'Pass,' 56 to 66% for 'Marginal'
Speed Accuracy: +/-0.05 PPS
Ratio Accuracy: +/-0.5% break

2.7 Tone Dial

2.7.1 Low Band

Frequency Limits - 'Pass' within 1.5% off-center
'Marginal' from 1.5% to 2.5% off-center
'Fail' greater than 2.5% off-center

Level Limits

Short Loop (80mA)

'Fail' Low: Less than 0.176 Vrms 'Marginal' Low: 0.176 - 0.224 Vrms
'Pass': 0.224 - 0.792 Vrms 'Marginal' High: 0.792 - 0.952 Vrms
'Fail' High: Greater than 0.952 Vrms

Typical Loop (40mA)

'Fail' Low: Less than 0.256 Vrms 'Marginal' Low: 0.256 to 0.320 Vrms
'Pass': 0.320 to 0.920 Vrms 'Marginal' High: 0.920 to 1.104 Vrms
'Fail' High: Greater than 1.104 Vrms

Long Loop (20mA)

'Fail' Low: Less than 0.320 Vrms 'Marginal' Low: 0.320 - 0.400 Vrms
'Pass': 0.400 - 1.024 Vrms 'Marginal' High: 1.024 - 1.232 Vrms
'Fail' High: Greater than 1.232 Vrms

2.7.2 High Band

Frequency Limits - 'Pass' within 1.5% off-center
'Marginal' from 1.5% to 2.5% off-center
'Fail' Greater than 2.5% off-center

Level Limits

Short Loop (80mA)

'Fail' Low: Less than 0.232 Vrms 'Marginal' Low: 0.232 - 0.288 Vrms
'Pass': 0.288 - 1.008 Vrms 'Marginal' High: 1.008 - 1.240 Vrms
'Fail' High: Greater than 1.240 Vrms

Typical Loop (40mA)

'Fail' Low: Less than 0.320 Vrms 'Marginal' Low: 0.320 to 0.416 Vrms
'Pass': 0.416 to 1.168 Vrms 'Marginal' High: 1.168 to 1.416 Vrms
'Fail' High: Greater than 1.416

Long Loop (20mA)

'Fail' Low: Less than 0.400 Vrms 'Marginal' Low: 0.400 - 0.504 Vrms
'Pass': 0.504 - 1.304 Vrms 'Marginal' High: 1.304 - 1.568 Vrms
'Fail' High: Greater than 1.568 Vrms

2.7.3 Twist

'Fail' Low: Less than -2dB
'Marginal' Low: -2dB to 0dB
'Pass': 0dB to +4dB
'Marginal' High: +4dB to +6dB
'Fail' High: Greater than +6dB

3. INSTALLATION

3.1 General

The 51500 Telephone Verification Set is delivered completely assembled from the factory. The unit is shipped in a container for protection from excessive shocks and vibration. If there is harm to the unit due to parts breakage, water leakage, or other accidental causes during transit, notify the carrier and file a claim for the damage.

3.2 Shipping Kit

The equipment in the 51500 shipping container should include the items listed in Table 4. If any of the items are missing, immediately contact Proctor and Associates at the address and phone number in Paragraph 1.5.

3.3 Equipment Set-Up

3.3.1 Once you've checked the contents and condition of the 51500 shipping package, place the unit on a flat, stable surface which will serve as the work site. Make sure that the 51500 power switch is OFF.

3.3.2 Check that the fuse is in its holder on the lower back panel. Push the PRESS button on the holder, pull the small door open, and remove the fuse. The fuse should be a 0.5-amp size. Reinsert the fuse.

3.3.3 Attach the power cord to the three-pronged jack on the 51500 back panel. Connect the other end to a nearby ac wall outlet. The 51500 is now ready for phone verification.

Description	Proctor P/N	Qty
Telephone Verification Set	51500	1
Power Cord (see Figure 3)	500046	1
*Case Leakage Cord (see Figure 3)	500067-05	1
51500 Operator's Guide	990307	1
51500 Installation & Maintenance Manual	990308	1

*Store this cord for use in Insulation Safety tests. Also note the cord configurations in Figure 3.

Table 4. Contents of Equipment in 51500 Shipping Kit.

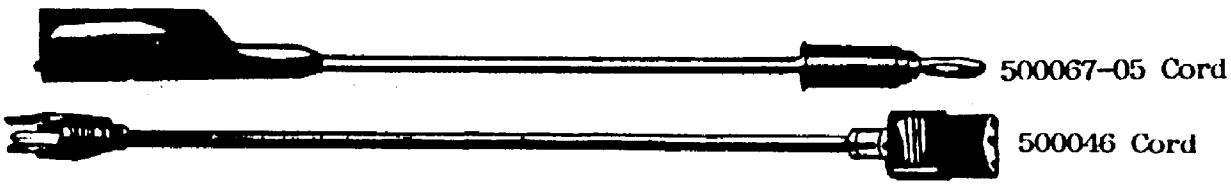


Figure 3. 51500 Power Cord and Case Leakage Test Cord.

4. CIRCUIT DESCRIPTION

4.1 General

The main 51500 circuit board (the 51500-1 board) is a programmed controller with the operational sequence and test limits stored in read-only memory. The card contains a microprocessor, 8K bytes of read-only memory, and a crystal-controlled clock. The microprocessor reads the operation and directs the related circuits to perform the required function. Figure 4 is a block diagram which shows the general circuit groups and their work flow. Also, refer to SD-51500-1 in the drawing section while reading this description.

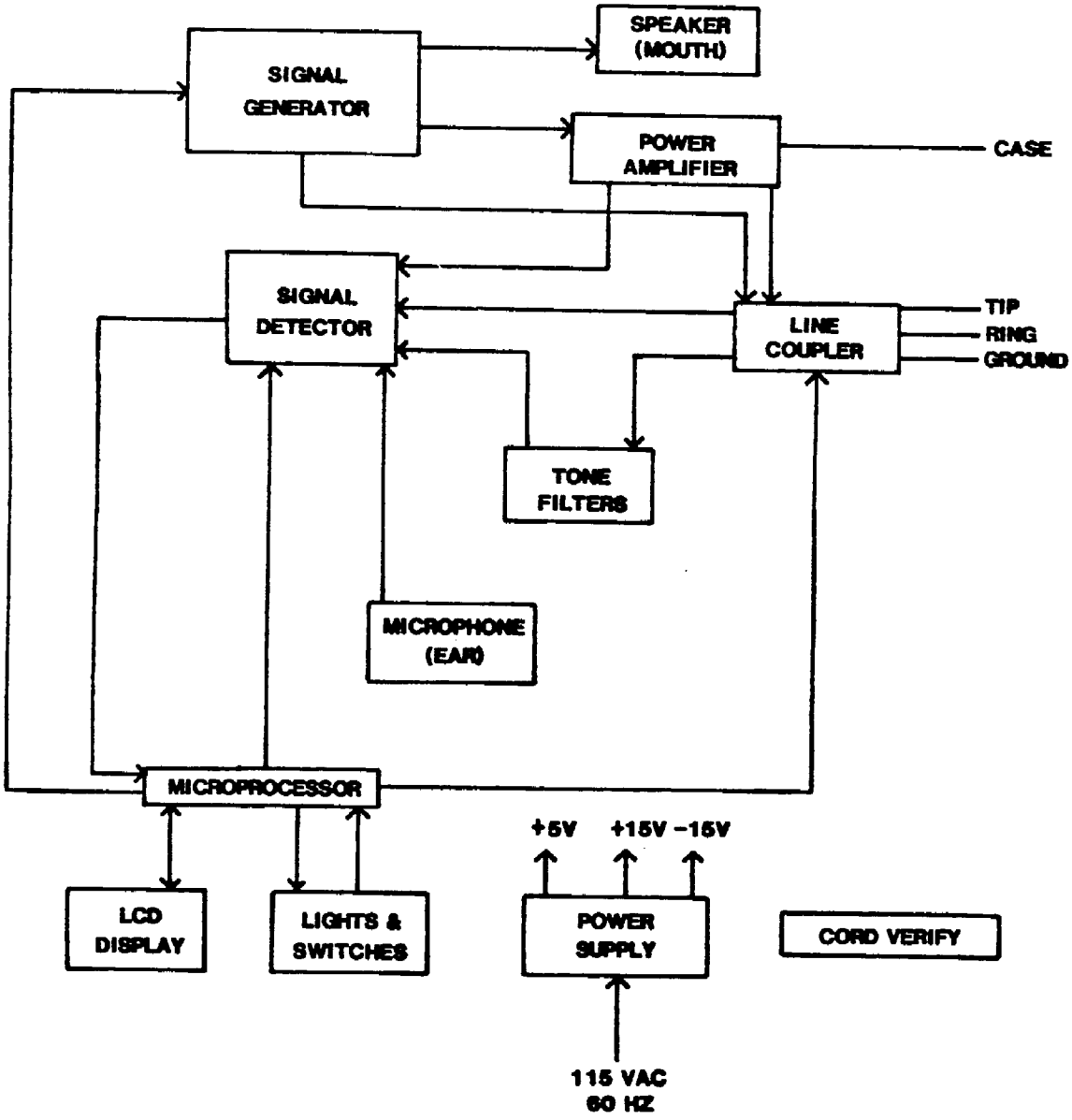


Figure 4. Block Diagram of 51500 Circuitry.

4.2 Power Supply

The 51500 unit contains power supplies which provide +15, -15, and +5 volts to the system.

4.3 Power On

4.3.1 Whenever the unit is first turned on, +5 volts go through C3 and IC2. This low pulse resets the system.

4.3.2 The sequence of operation and test limits are stored in the read-only memory of IC4. The Peripheral Interface Adapters (PIAs) IC6, IC7, and IC8 are initialized by the microprocessor. IC5 (the programmable timer) and the display are also initialized.

4.4 Signal Generation

4.4.1 Output 3 of IC5 gives a microprocessor-controlled clock rate which determines sine wave frequency. The clock-out of the timer runs to Pin 1 of IC11 which is wired as a 'divide by 32' counter. The output of this counter is used to address a PROM (IC12) which contains a sine wave programmed in the memory. The output (sine wave in memory) of IC12 is applied to the digital-to-analog (D/A) converter (IC14) which converts the digital information from IC12 into an analog sine wave of current at Pin 4 of IC14.

4.4.2 The amplitude of the sine wave is controlled by port B of IC7 which is applied to a D/A converter, IC13. This determines the amplitude of the sine wave out of IC14.

4.4.3 If port A5 of IC7 is high, the output of IC11 will be locked at 00000 and the output from the memory will be FF (all eight inputs will be high). This will provide a dc current into Pin 4 of IC14. The magnitude of IC14's Pin 4 current is controlled by the binary input into IC13.

4.4.4 The ac current generated at IC14, Pin 4, can be sent to the power amplifier via IC24, Switch A, or to the speaker or line coupler via IC24, Switches A and B. If dc signal select (IC24, Pin 11) is held low, the sine wave goes to IC25, Pin 1, and the sine wave of current is converted to a sine wave of voltage. The sine wave continues to IC24, Switch B. If mouth select (IC24, Pin 10) is held low, the sine wave continues on to the line coupler via IC25. (IC25 is a unity gain buffer with a 900-ohm termination.) The signal then passes through the line coupler to the Tip and Ring.

4.4.5 If mouth select is held high, the sine wave is applied to the speaker. IC26 is a power amplifier that sends ac voltage (which is converted to sound) to the speaker.

4.5 Breakdown (Insulation Safety)

4.5.1 If the dc signal is high, the current will go to IC15, Pin 9. To operate the inverter, there must be an output from Pin 3 of the timer, IC5, of 30K Hz. IC3, Pin 8, is the inverter frequency input. Pins 6 and 9 of IC3 must be held low; if Pins 6 and 9 receive a high logic level, the inverter will not operate. Outputs 4 and 10 of IC3 will alternately turn on Q1 and Q2 which allows current to flow through the primary windings of T1. A square wave of voltage will alternately turn on Q3 and Q4. Q3 and Q4 allow a current to flow through the primary windings of T2.

4.5.2 The secondary windings of T2 will provide an output which is rectified to give 500 volts dc at the collector of Q5.

4.5.3 Two voltage doubler circuits provide a 1000 volt output and 1500 volt output, either of which can be selected. This dc voltage is applied simultaneously to Tip, Ring, and Ground during the Insulation Safety test. Greater than the limit current during the Insulation Safety test will cause Pin 9 of IC15 to go greater than zero. This will cause Pin 10 of IC15 to go high. When Pin 10 of IC15 goes high, the change in polarity is detected at IC27, Pin 7, via IC9 and IC25, Pin 12. The microprocessor senses this voltage via IC7, Pin 40, and 'fails' the telephone. If there is less than the limit current, Pin 9 of IC15 will be negative and the microprocessor will 'pass' the phone.

4.6 Ringer Circuit

Initially, the inverter turns on as in the Insulation Safety test. If an ac current is applied to Pin 9 of IC15, IC15 and Q5 act as a power amplifier when an ac current is applied to Pin 9 of IC15. The ac signal is passed to the ringer via K4 (Pins 13 and 2) to Tip and Ring which causes ringing.

4.7 Signal Detector

4.7.1 The signal detector consists of IC9 (which can select any one of eight lines at a given time), IC25, IC27, IC10, IC20, and IC21. Whichever signal is selected, it is applied to Pin 14 of IC25. The signal is then applied to Pin 2 of IC27 (which is a comparator). The output of the comparator is a square wave with the same frequency as the signal in the signal detector. This square wave can be read by the microprocessor which senses the frequency.

4.7.2 The output of IC27 also controls IC24, Switch C. Switch C in IC24, along with IC25, op amp C, acts as a rectifier. The rectified signal is applied to a low-pass filter which consists of IC10B and its associated discrete components. Dc current is applied through R10 and RP1 to IC21, Pin 4, which is a D/A converter chip. IC21, IC20, and the microprocessor act together as a successive approximation analog-to-digital (A/D) converter which causes IC20, Pin 7, to go high when a high enough binary count has been applied to the input of IC21.

4.8 Microphone Circuitry

The microphone in the unit is associated with IC10D (the microphone pre-amplifier). This circuit can be switched into the signal detector to measure the sound level into the microphone.

4.9 Tone Filters

4.9.1 The tone filters take the signal from the line coupler through IC15D. The tone filters consist of high-pass and low-pass filters which separate the high tones from the low tones when testing a pushbutton tone dial phone. Once the tones are separated, either tone can be switched into the signal detector to measure the level. The frequency is measured by the microprocessor via IC27.

4.9.2 The tone filters may be bypassed via R38 when testing the phone's transmission.

4.10 Switches and Lights

Switch closure is detected by a low voltage on the switch data line which coincides with a particular address into IC23. A lamp is turned on by addressing IC8 and latching a "low" signal into the particular lamp driver.

4.11 Cord Verify

4.11.1 The Cord Verify circuit is separate from the microprocessor-related circuit. The Cord Verify test evaluates continuity in a 4-wire handset line cord and up to a 6-wire line cord with modular plugs on each end. Current enters from the main card continually and runs through each of the conductors which are in series.

4.11.2 If any of the conductors are open, the current will flow through a zener diode to the next conductor and the corresponding LED will go dark. Shorted wires will short out a LED which causes it to go dark. The handset verify cord circuit has no zener diodes and any open conductor will cause all lamps to go out.

5. CALIBRATION

5.1 Introduction

The 51500 Telephone Verification Set can be calibrated by adjusting eight trimpots on the main 51500-1 circuit board and setting the voltage adjustment pots on the two power supplies. (Note that some tests are not calibratable. Refer to Paragraph 6.2 for 51500 Checkout Procedures.) Correct 51500 calibration can be accomplished with the equipment listed in Paragraph 5.3. Only qualified electronics service personnel should calibrate the Verification Set. Refer to the Safety Considerations listed in Paragraph 5.2.

5.2 Safety Considerations

The following list of safety considerations will help prevent accidental equipment damage or personal harm to 51500 maintenance personnel. Specific 'CAUTION' and 'WARNING' statements are found in procedures where high voltage conditions require precautionary attention. (Note: CAUTION statements identify conditions or practices that could result in damage to equipment. WARNING statements denote potential conditions that could result in bodily injury.)

- The 51500 should be operated and maintained only by qualified personnel.
- The 51500 operates from a 105 to 125 volt ac power source (210 to 250 volt ac for European models). The 51500 power cord should be securely fastened to the jack on the back of the unit and to the wall outlet.
- Particular care should be taken during the Insulation Safety and Ringer tests. Do not contact any metal parts on the phone while these tests are being conducted.
- Do not contact any exposed wiring or connectors of a phone when it is under test.
- Verify that the 51500 is properly fused (0.5 amp) before powering up the system.
- Do not operate the 51500 in an explosive atmosphere.
- Never remove 51500 covers or panels when power is on.
- The 51500-1 circuit board contains static sensitive components. Follow these precautionary electrostatic discharge steps when handling this circuit board:

1. Use a grounded wrist strap.
2. Grip the components and circuit board by their edges and do not touch components, traces, or connectors unless it is necessary to repair or replace them.
3. When repairing cards, do so on a grounded conductive mat. Use a grounded soldering iron.
4. Store spare 51500-1 circuit boards in metallized anti-static bags.

- When calibrating, functional testing, or replacing parts, show extreme caution while power is on and do not contact electronic components.
- When replacing parts, whether active or passive, always turn the 51500 power off.
- Always follow the procedures in this manual. If there are questions regarding an operation, technical statement, or safety procedure in this manual, please contact Proctor & Associates for clarification.

5.3 Equipment Required

° 51500 Field Calibration PROM

° 1 henry (minimum) inductor

° ac voltmeter

° dc voltmeter

° dc milliammeter

° signal generator

° frequency counter

° sound level meter (GR 1982)

° 94dB sound level calibrator (B & K Type 4230)

° calibration bracket (Proctor P/N 352004)

° modular plug-to-banana jack adapter or similar (i.e., spade lugs, wires, etc.)

WARNING

There are potentially hazardous voltages applied to the 51500 circuit boards. Use caution when calibrating with power on.

5.4 Install Field Calibration PROM

Turn the 51500 off. Remove IC4 (the 51500 Operating Program) from the 51500-1 circuit board. See Figure 5. Insert the 51500 Field Calibration PROM in its place. Turn power on. Verify that the instruction window reads "51500II CLIBRATION PROM". No other lamps should be on.

5.5 Power Supply Calibration

5.5.1 Attach a dc voltmeter to the +15 Volt Power Supply and check for +15 volts. If +15 volts is not read, adjust the +15 volt potentiometer on the +15 Volt Power Supply circuit board until +15 volts (+/-0.05V) is measured on the voltmeter.

5.5.2 Attach the dc voltmeter to the -15 Volt Power Supply and check for -15 volts. If -15 volts is not read, adjust the -15 volt potentiometer on the 15 Volt Power Supply until -15 volts (+/-0.05V) is measured on the voltmeter.

5.5.3 Attach the dc voltmeter to the +5 Volt Power Supply and check for +5 volts. If +5 volts is not read, adjust the pot on the power supply circuit board until 5 volts (+/-0.05V) is measured.

5.6 L.C.D. Display Adjustment

Adjust RP8 (see Figure 5) on the 51500-1 board for best readability of the instruction window. Good readability should be determined from a seated position directly in front of the unit.

5.7 A/D Converter Offset Calibration

5.7.1 Connect a dc voltmeter from Pin 4 of IC10 to 0V. Use an IC clip if necessary to connect the voltmeter.

NOTE

For accurate calibration, the 0V reference should be physically close to IC10.

5.7.2 Using a jumper wire, connect Pin 4 of IC24 to the 0V reference chosen in the previous step.

5.7.3 Adjust RP7 (see Figure 5) until the dc voltmeter reads as close to 0V as possible.

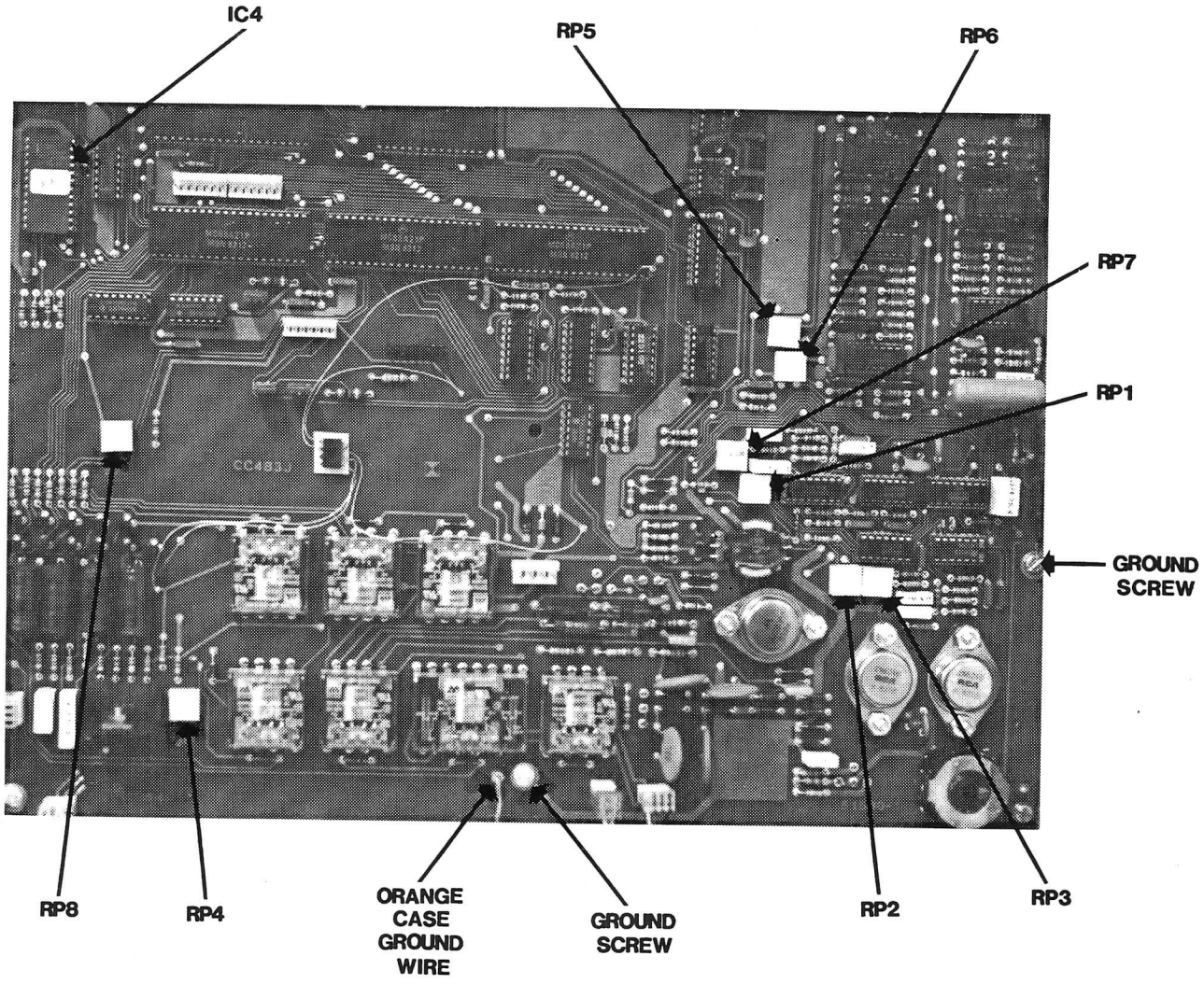


Figure 5. Locations of Adjustment Pots and IC4 on 51500-1 Board.

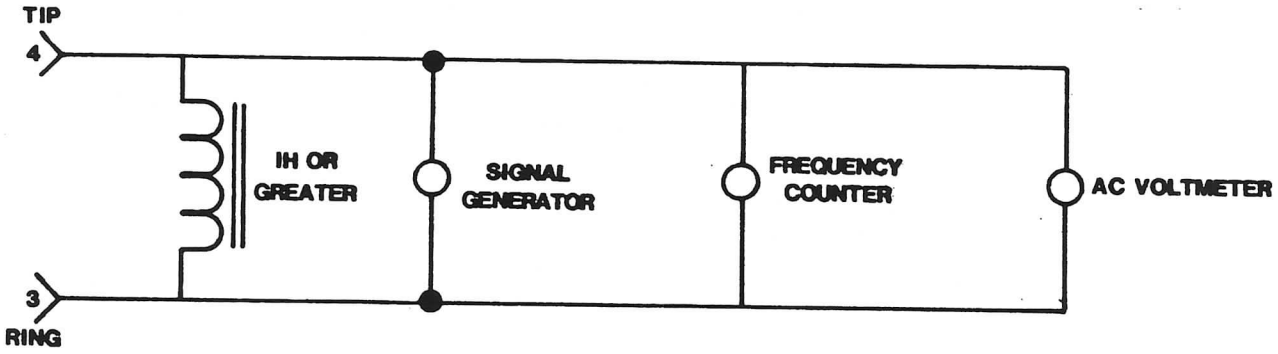


Figure 6. Connections on the Tip and Ring Loop.

5.8 Loop Current Calibration

5.8.1 Connect the dc milliammeter to Pins 3 and 4 of the TELEPHONE input socket via a modular plug adapter. See Figure 6.

5.8.2 Press CONTINUITY. Adjust RP4 on the main circuit board (see Figure 5) until 20mA is measured. Once RP4 is set, disconnect the milliammeter.

5.9 Filter Calibration

5.9.1 Connect a 1 henry inductor, signal generator, frequency counter, and ac voltmeter to the tip and ring loop (Pins 3 and 4 of the TELEPHONE input socket) via a modular jack adapter. See Figure 6.

5.9.2 Push INSULATION SAFETY.

5.9.3 Set the signal generator to 0.5 Vrms, 1000 Hz.

5.9.4 Adjust RP1 on the main circuit board (see Figure 5) until the PASS indicator lights.

5.9.5 Once RP1 is calibrated, press TRANSMISSION, then set the signal generator to 1.0 Vrms, 850 Hz.

5.9.6 Adjust RP6 (see Figure 5) until the PASS indicator lights.

5.9.7 After RP6 is calibrated, press DIAL then set the signal generator to 1.0 Vrms 1400 Hz.

5.9.8 Adjust RP5 (see Figure 5) until the PASS indicator lights.

5.9.9 After RP5 is adjusted, disconnect the inductor, signal generator, frequency counter, and ac voltmeter from the tip and ring loop.

5.10 'Ear' and 'Mouth' Calibration

> **NOTE**
>
> A quiet room is required to assure accuracy of the 'ear' and 'mouth' calibration. There should be no sound reflecting surfaces within six feet of the front, sides and back of the 51500.

5.10.1 Adjust the Handset Resting Bar to an intermediate position between a Type 500 handset and a 'dial-in-handset' style phone (approximately two-thirds to three-quarters of the way back).

5.10.2 Hold the sound level calibrator to the acoustical cup on the 51500 artificial ear. (Note that the artificial ear is a one-inch microphone. If applicable, remove the one-half inch adapter from the calibrator before performing this procedure.)

5.10.3 Press ALTERNATE FUNCTION 1. Adjust RP3 on the main circuit board (see Figure 5) until the PASS indicator lights. When PASS is indicated, remove the sound level calibrator from the artificial ear.

5.10.4 Connect the calibrating microphone to the sound level meter.

5.10.5 Mount the microphone in the 352004 Calibration Bracket so that the grill of the microphone is flush with the fixture surface. Tighten the lockscrew. See Figure 7.

5.10.6 Mount the Calibration Bracket with the microphone on the transmission fixture so that the face of the bracket is pressed firmly against the face of the artificial ear. Centralize the calibrating microphone under

the artificial mouth, then tighten the securing screw to lock the bracket in position. Center the calibrating microphone between the resting bar mounting brackets. See Figure 7.

5.10.7 Press ALTERNATE FUNCTION 2. Adjust RP2 on the main circuit board (see Figure 5) until 90dB is measured on the meter.

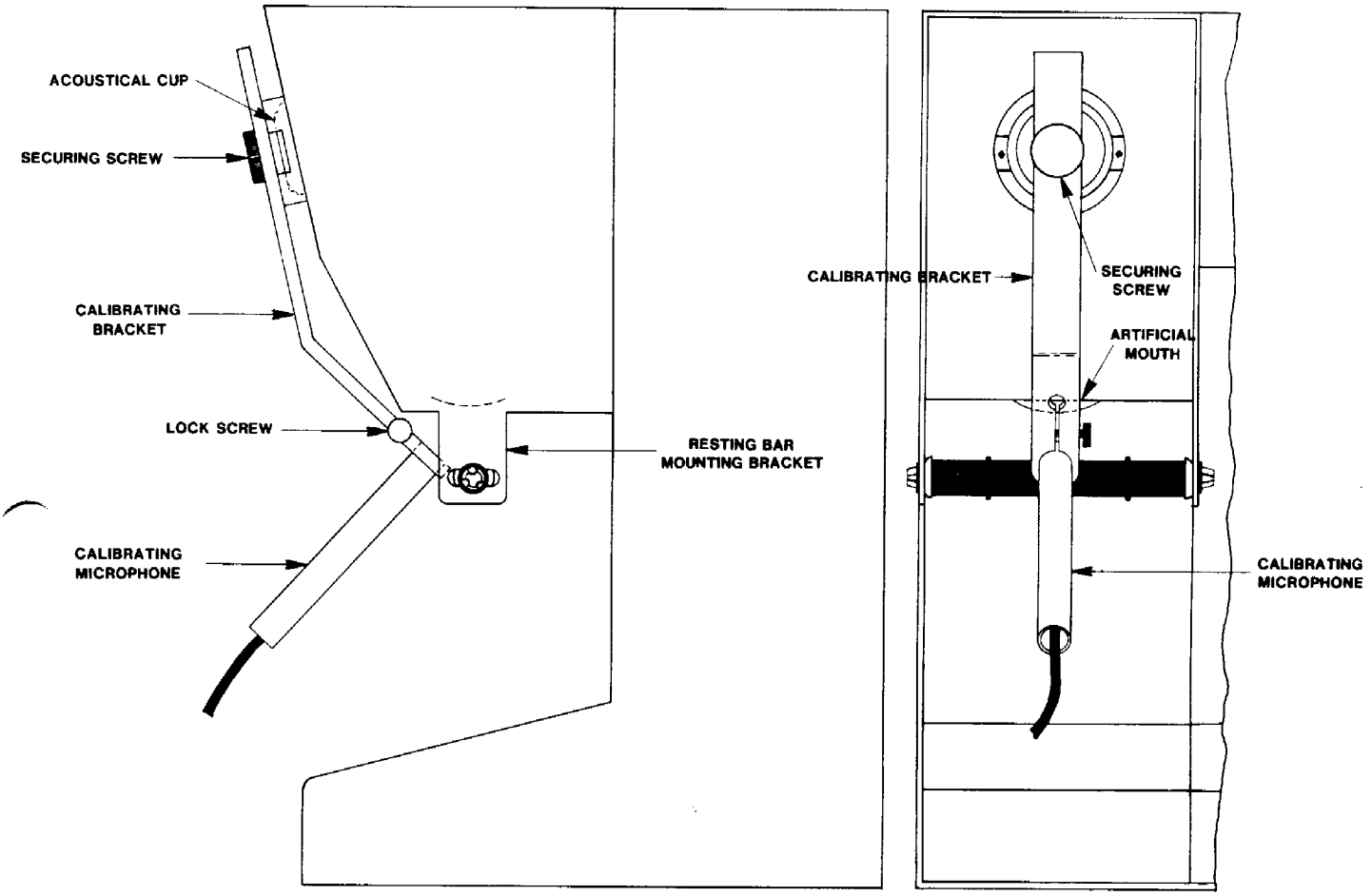


Figure 7. Equipment Set-Up for 'Ear' and 'Mouth' Calibration.

End of Calibration Procedures. Remove the calibration equipment from the 51500. Turn the unit's power off. Remove the Calibration PROM and re-insert the operating program PROM into the socket of IC4.

6. MAINTENANCE

6.1 General

This section contains Functional Checkout and Parts Replacement procedures for the 51500 Telephone Verification Set. (See Table 1 for a listing of the 51500 Spare Parts.) Before performing any procedures in this section, read and follow the Safety Considerations listed in Paragraph 5.2.

6.2 51500 Functional Checkout Procedures

6.2.1 General

The procedures in this section describe how to verify that the operating parameters of the non-calibratable 51500 tests are correct.

6.2.2 Equipment Required

- 2-, 4- and 6-conductor line cords
- 4-wire handset cord
- modular plug-to-banana jack adapter or similar (i.e., spade lug, wires, etc.)
- oscilloscope
- digital pulsing standard (Proctor model 52101 or equivalent)
- resistors of the following values: 27 megohms, 33 megohms, 22, 30, 43, 56, 100, 360, 470, 750, 910, 1600, 2700, and 3900 ohms

NOTE

The resistor values given are for the model 51500F1. For model 51500F2, replace the 27 and 33 megohm resistors with:

51500F2 - 40 megohm resistor replaces the 27 megohm resistor. 100 megohm resistor replaces the 33 megohm resistor.

6.2.3 Insulation Safety Checkout

1. Disconnect the 51500 power cable.
2. Remove the back panel (8 screws).
3. Strap the insulation voltage to 1500 volts. Refer to CLD-51500-1 in the drawings section.
4. Reassemble the unit and turn power on.
5. Check the Cord Verify routine. The LEDs should read as shown in Table 5.
6. Turn power off and connect a modular cable to a spade lug or break-out box adapter to the TELEPHONE socket. This allows access to the 51500 tip, ring, and ground leads.
7. Connect a 27 megohm resistor from the tip lead to the TELEPHONE CASE socket on the back panel of the 51500. See note on resistors required for different 51500 models. Also connect a 100 ohm resistor from tip to ring.

		Line Cord						Handset Cord			
								1	2	3	4
Cords	LEDs	1	2	3	4	5	6	7	8	9	10
Line Cords											
2-wire		OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
4-wire		OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
6-wire		ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF
Handset Cord											
4-wire		OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON

Table 5. Proper Routine Used During Cord Verify Checkout.

WARNING

Make sure your hands do not contact the electronic components used for testing the tip, ring, and ground leads while these checkout procedures are in progress.

8. Turn power on and press INSULATION SAFETY. A FAIL indication should result.

9. Turn power off and replace the 27 megohm resistor with a 33 megohm resistor. (See the note on resistors required for different 51500 models.)

10. Turn power on and heed the warning above and perform Step 8 again. A PASS indication should result.

6.2.4 Continuity Checkout

1. Turn the 51500 off.

2. Connect a 360 ohm resistor from tip to ring.

3. Turn the power on.

4. Press CONTINUITY. A PASS indication should result.

5. Turn the 51500 off and remove the 360 ohm resistor. Put a 470 ohm resistor in its place.

6. Turn the 51500 on and press CONTINUITY. A 'Marginal' indication should result.

7. Using a 720 ohm resistor, repeat Steps 5 and 6. A 'Marginal' indication should result.

8. Using a 910 ohm resistor, repeat Steps 5 and 6. A FAIL indication should result.

9. Using a 22 ohm resistor, repeat Steps 5 and 6. A FAIL indication should result.

10. Using a 30 ohm resistor, repeat Steps 5 and 6. A 'Marginal' indication should result.

11. Using a 43 ohm resistor, repeat Steps 5 and 6. A 'Marginal' indication should result.

12. Using a 56 ohm resistor, repeat Steps 5 and 6. A PASS indication should result.

6.2.5 Party Ground Checkout

1. Turn the 51500 off. Connect a 2700 ohm resistor from tip to ground and connect a telephone from tip to ring.

2. Turn the 51500 on and press DIAL.

3. Go off-hook. "PARTY GROUND OK" should be displayed in the instruction window.

4. Repeat Steps 1 through 3 using 1600 and 3900 ohm resistors. No indications of party ground should be given.

6.2.6 Rotary Dial Checkout

1. Turn the 51500 off. Connect a digital pulsing standard to the tip and ring leads. Set the generator for 10 pulses.

2. Turn the 51500 on. Vary the speed from 8 to 11 PPS and the ratio from 58% break to 64% break.

3. Press DIAL. Allow a train of 10 pulses to occur. Within the limits indicated, the unit should pass. Outside the limits, the unit should fail.

6.2.7 Ringer Frequencies & Voltages Checkout

1. Connect an oscilloscope to the tip and ring leads of the 51500.

2. Press RINGER.

3. Using the ALTERNATE FUNCTION buttons as described in the Operator's Guide, select the correct frequency.

4. Press RINGER again. Initially, a 200 or 500 Vdc level (depending upon the straps installed) of one second duration will occur. This will be followed by the ringing waveform. Following this, 15 belltap pulses (per EIA Spec. #S-1286) will occur. Check the ringing waveform for the correct frequency and voltage. The frequency accuracy should be +/-2%. The voltage accuracy should be +/-5%.

6.3 51500 Parts Replacement Procedures

6.3.1 General

The procedures in this section detail steps for replacing parts in the 51500. Note that only those parts described in this section should be replaced. 51500 sets should be returned to the factory for suspected defective parts not defined for replacement in this section. Figure 8 shows the locations of the 51500 circuit cards and power supplies.

6.3.2 51500-1 Main Circuit Board Replacement

CAUTION

Follow the static-discharge precautionary steps in Paragraph 5.2.

1. Disconnect the 51500 power cable from the wall outlet.

2. Remove the back cover of the 51500 (8 screws).

3. Remove the cabling and screws attached to the 51500-1 board.

NOTE

There are designated positions for the cables and screws attached to the 51500-1 circuit board. Refer to Figure 5 for the grounding screw positions (all other mounting screws for the 51500-1 board are interchangeable). Also, refer to CLD-51500 (sheet 4) in the drawings section for correct cable connections.

4. De-solder the Orange case ground wire from the 51500-1 board. (See Figure 5 for the position of the Orange case ground wire.) Be sure the soldering iron is grounded.

5. Remove the old 51500-1 board and attach the new board using existing screws. Refer to Figure 5 for grounding screw locations.

6. Attach cabling to new circuit board. Refer to CLD-51500 (sheet 4) in the drawings section for cabling locations.

7. Solder the Orange case ground wire onto the board. See Figure 5.

8. Install the 51500 back cover.

6.3.3 51500-4 Cord Verify Card Replacement

> **CAUTION**
>
> Follow the static-discharge precautionary steps in Paragraph 5.2.

1. Disconnect the 51500 power cable from the wall outlet.

2. Remove the 51500 back cover (8 screws). Note the location of the 51500-4 card in Figure 8.

3. Remove the cable from P22 on the 51500-4 card.

4. Remove the five lock nuts securing the -4 card.

5. Remove the -4 card.

6. Insert the new -4 card making sure that the LEDs on the card fit securely into the holes in the front panel.

7. Replace the two right-side lock nuts making sure the standoffs are in place between the -4 card and the metal chassis.

8. Replace the three left-side lock nuts.

> **CAUTION**
>
> Do not overtighten the lock nuts as the 51500-4 card will warp.

9. Connect the cable to P22.

10. Install the 51500 back panel.

6.3.4 51500-5 Telephone Input Card Replacement

> **CAUTION**
>
> Follow the static-discharge precautionary steps in Paragraph 5.2 before performing this procedure.

1. Disconnect the 51500 power cable from the wall outlet.

2. Remove the two lower front left (Transmission Test Fixture end) screws on the bottom panel. See Figure 9.

3. Lift off the Telephone Input Socket panel.

4. Detach the cable from the P8 connector on the 51500-5 card.

5. Remove the two screws holding the -5 card in place. Remove the -5 card.

6. Install the new -5 card and connect the cable into P8.

7. Re-install the Telephone Jack panel (2 screws) on the 51500 bottom panel.

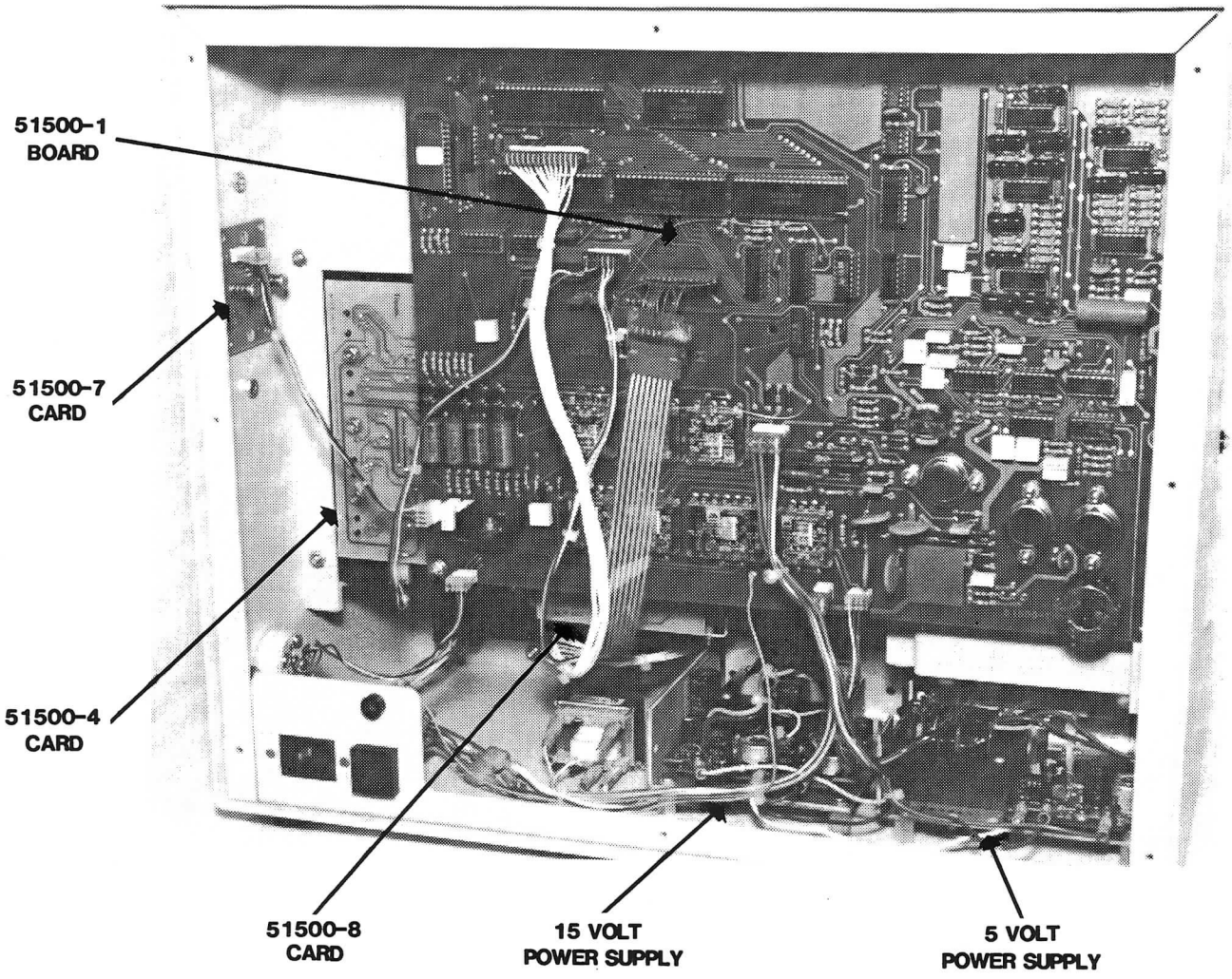


Figure 8. Locations of 51500 Circuit Cards and Power Supplies.

6.3.5 51500-7 Wall Phone Socket Card Replacement

> **CAUTION**
>
> Follow the static-discharge precautionary steps in Paragraph 5.2 before performing this procedure.

1. Disconnect the 51500 power cable from the wall outlet.
2. Remove the 51500 back cover (8 screws).
3. Note the location of the 51500-7 card. See Figure 8. Remove the cable from P19 on the -7 card.
4. Remove the two screws and attached springs holding the -7 card.

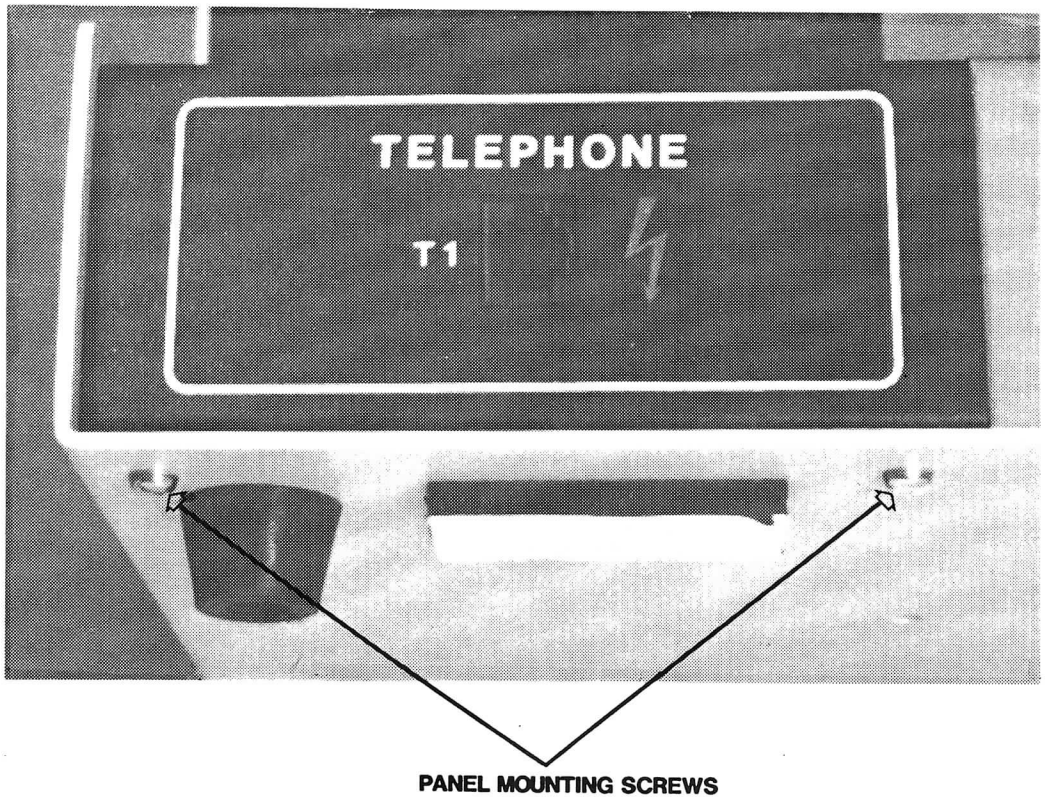


Figure 9. Locations of Telephone Input Socket Panel and Screws.

5. Install the new -7 card with the two screws and springs. Make sure that the lock washers stay in place when re-inserting the screws.

6. Install the 51500 back cover.

6.3.6 51500-8 Pass/Fail Card Replacement

> **CAUTION**
>
> Follow the static-discharge precautionary steps in Paragraph 5.2 before performing this procedure.

1. Disconnect the 51500 power cable from the wall outlet.

2. Perform the 51500-1 Main Board Replacement Procedure in Section 6.3.2. (It may not be necessary to remove all cables connected to the 51500-1 board. Remove cables only as necessary to gain access to the -8 card. See Figure 8 and CLD-51500, sheet 4, for cabling on the 51500-1 board.)

3. Remove the cable connected to P21 on the -8 card.

4. Remove the four lock nuts securing the -8 card and remove the card.

5. Install the new -8 card making sure that the four standoffs are in place between the -8 card and metal 51500 chassis.

6. Connect the cable to P21.

7. Install the 51500-1 board (refer to Paragraph 6.3.2).

8. Install the 51500 back cover.

6.3.7 5V Power Supply Replacement

> **CAUTION**
>
> Follow the static-discharge precautionary steps in Paragraph 5.2 before performing this procedure.

1. Disconnect the 51500 power cable from the wall outlet.

2. Remove the 51500 back panel (8 screws).

3. Remove the three wires (attached to ring terminals) on the front edge of the 5V Power Supply and insert the screws with lock washers back into the power supply.

4. De-solder the brown and white wires connected into the 5V power supply transformer primary.

5. Remove the four screws (on the underside of the 51500 chassis) attaching the 5V power supply.

6. Remove the four screws (on the inside of the 51500) and standoffs securing the power supply circuit board. Remove the old power supply.

7. Install the new 5V Power Supply. Make sure that the old standoffs, screws, and lock washers are complete for use on the new power supply.

8. Re-solder the brown and white wires on the 5 volt power supply transformer. See CLD-51500, sheet 3.

9. Re-connect the three wires on the new power supply. See CLD-51500, sheet 3. Make sure that the lock washers are in place for these connections.

10. Replace the 51500 back cover.

6.3.8 15V Power Supply Replacement

> **CAUTION**
>
> Follow the static-discharge precautionary steps in Paragraph 5.2 before performing this procedure.

1. Disconnect the 51500 power cable from the wall outlet.

2. Remove the 51500 back cover (8 screws).

3. Remove the three wires with the ring terminals on the front edge of the 15V power supply.

4. Re-insert the ring terminal screws and lock washers in the power supply.

5. De-solder the brown and white wires connected to the primary of the 15 volt Power Supply transformer.

6. Remove the four screws (on the underside of the 51500) attaching the power supply.

7. Remove the four screws (on the inside of the 51500) and standoffs securing the power supply circuit board. Remove the old power supply.

8. Install the new unit with existing screws, standoffs, and lock washers.

9. Re-solder the brown and white wires on the transformer. See CLD-51500, sheet 3.

10. Reattach the wires on the screw terminals with the lock washers as shown in CLD-51500, sheet 3.

11. Attach the 51500 back cover.

6.3.9 Acoustical Cup Replacement

Replace the black rubber Acoustical Cup on the 51500 Transmission Fixture when it has become brittle or worn.

1. Grip the cup with your fingertips and pull outward to remove.

2. Place the new cup around the aluminum mounting ring and gently press it into place.

6.3.10 Case Leakage Cord Socket Replacement

Perform this replacement procedure if the "Telephone Case" socket is damaged or faulty.

1. Disconnect the 51500 power cable from the wall outlet.

2. Remove the back panel of the 51500 (8 screws).

3. Remove the wire connected internally to the "Telephone Case" socket.

4. Remove the nut on the inside of the panel securing the socket in the metal chassis. Remove the socket.

5. Insert the new socket with the existing nut.

6. Reattach the "Telephone Case" wire and 51500 back panel.

6.3.11 Fuse Replacement

Perform this procedure whenever replacing the 0.5 amp fuse in the 51500.

1. Push the PRESS button on the holder.

2. Pull the small door open and remove the old fuse.

3. Insert the new 0.5 amp fuse.

6.3.12 4-Prong Socket Replacement

Perform this procedure whenever the 4-prong socket on the end panel of the 51500 is damaged or faulty.

1. Disconnect the 51500 power cable from the wall outlet.

2. Remove the 51500 back panel (8 screws).

3. Detach the wires connected to the back of the 4-prong socket via screw terminals.

4. Remove the two lock nuts securing the socket to the side panel.

5. Install the new 4-prong socket with the existing lock nuts.

6. Reattach the four wires to the screw terminals on the back of the socket. Follow the wire color guides next to the screw terminals on the back of the 4-prong socket.

7. Install the 51500 back panel.

7. ASSOCIATED DRAWINGS

The drawings in this section should serve as reference documents and as troubleshooting and maintenance aids for the 51500. The drawings include:

CLD-51500-1 Main Circuit Board Component Location Diagram

CLD-51500-5 Telephone Input Socket Circuit Card Component Location Diagram

CLD-51500-7 Wall Phone Socket Circuit Card Component Location Diagram

CLD-51500-8 Pass/Fail Circuit Card Component Location Diagram

SD-51500-8 Pass/Fail Circuit Card Schematic Diagram

SD-51500-4 Cord Test Circuit Card Schematic Diagram

SD-51500-5 Telephone Input Socket Circuit Card Schematic Diagram

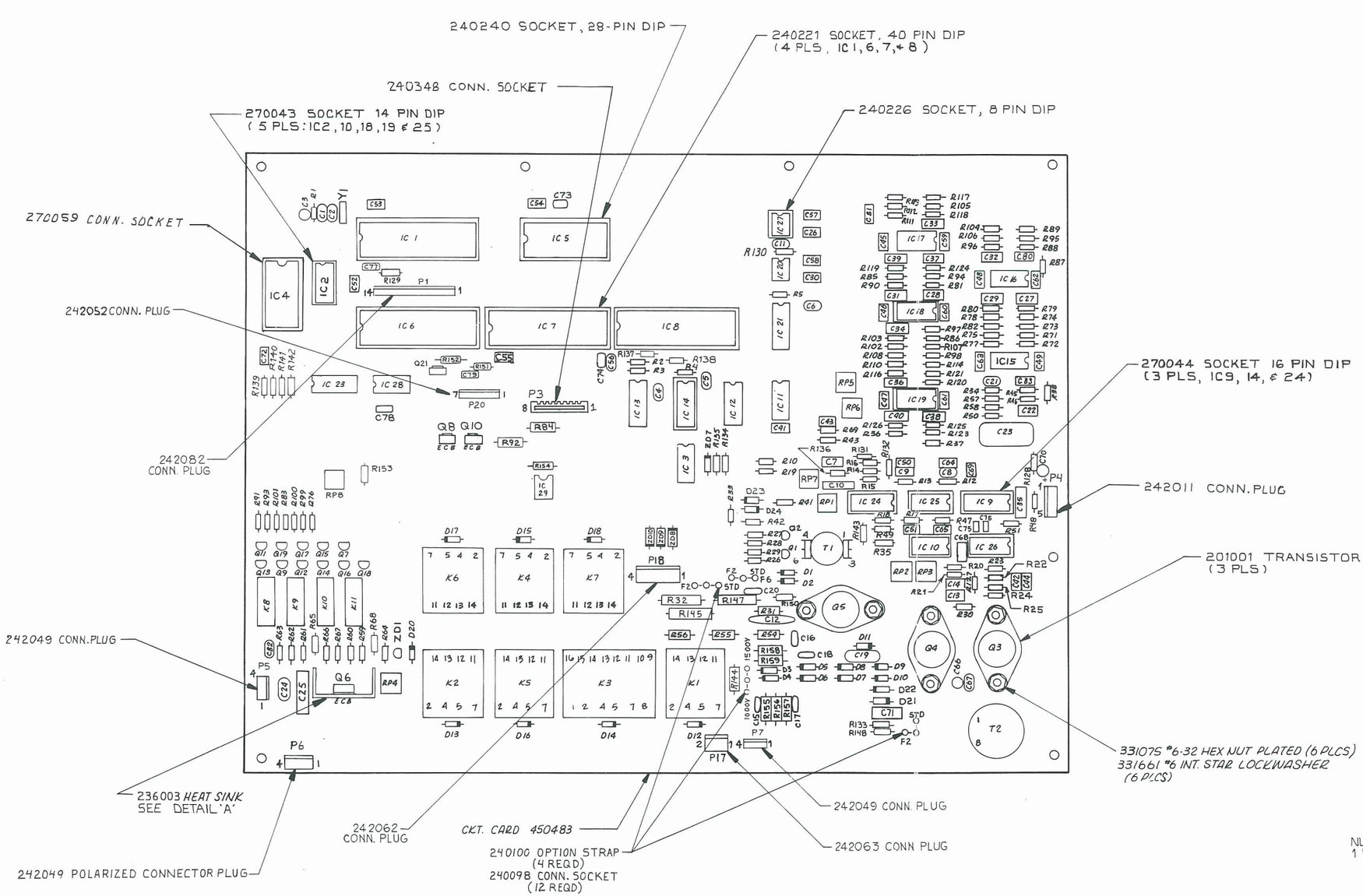
SD-51500-7 Wall Phone Socket Circuit Card Schematic Diagram

CLD-51500-4 Cord Test Circuit Card, Component Location Diagram

CLD-51500 Component Location Diagram

SD-51500-1 Main Circuit Board Schematic Diagram

LTR	ISS	REVISION	CK'D
X1		PROTO KG 4-24-80	
X2		PILOT NS 8-19-80	
NEW	1	RELEASED TG 11-4-80	KB.
A	11	INC ACN 15, 14 KB 11/6/81	
B	12	INC ACN 18 BRP 12-28-81	PDL
C	13	ACN 21 RD 1-17-82	PDL
D	14	ACN 28 CB 3-23-82	PDL
E	15	INC ACN 29 BRP 4-16-82	PDL
F	17	ACN 30-33 KB 5/4/82	PDL
H	18	ACN 34 KB 5/7/82	PDL
J	19	ACN 36 5-13-82	PDL
K	23	ACN 38,43,47,49 8-26-82	BRP
L	27	ACN 51, 53 KB 10-22-83 ACN IF2	PRH
M	27	ACN 53 CAG 8-29-83	KL
N	28	ACN 58 11-14-83 CB	PRH
P	30	ACN 61, 65 KB 12/16/83	PRH
R	32	ACN # 76, 77 DSO TBL NINH KB	PRH
S	33	ACN 86 KB 11/7/84	
T	33	ACN 92 PRH 12-19-84	CAG
U	34	ACN 98 CAG 2-7-85	PRH



CLD-51500-1-34U

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS (INCHES). TOLERANCES ARE: .X = ± .XX = ± ANGLES = ± HOLE DIA =

		DATE
DWN	K Cobar	4-24-80
CK'D	T Rodan	11-4-80
ELECT		3-5
MECH		9-19-85
FOR REL		11-6-80

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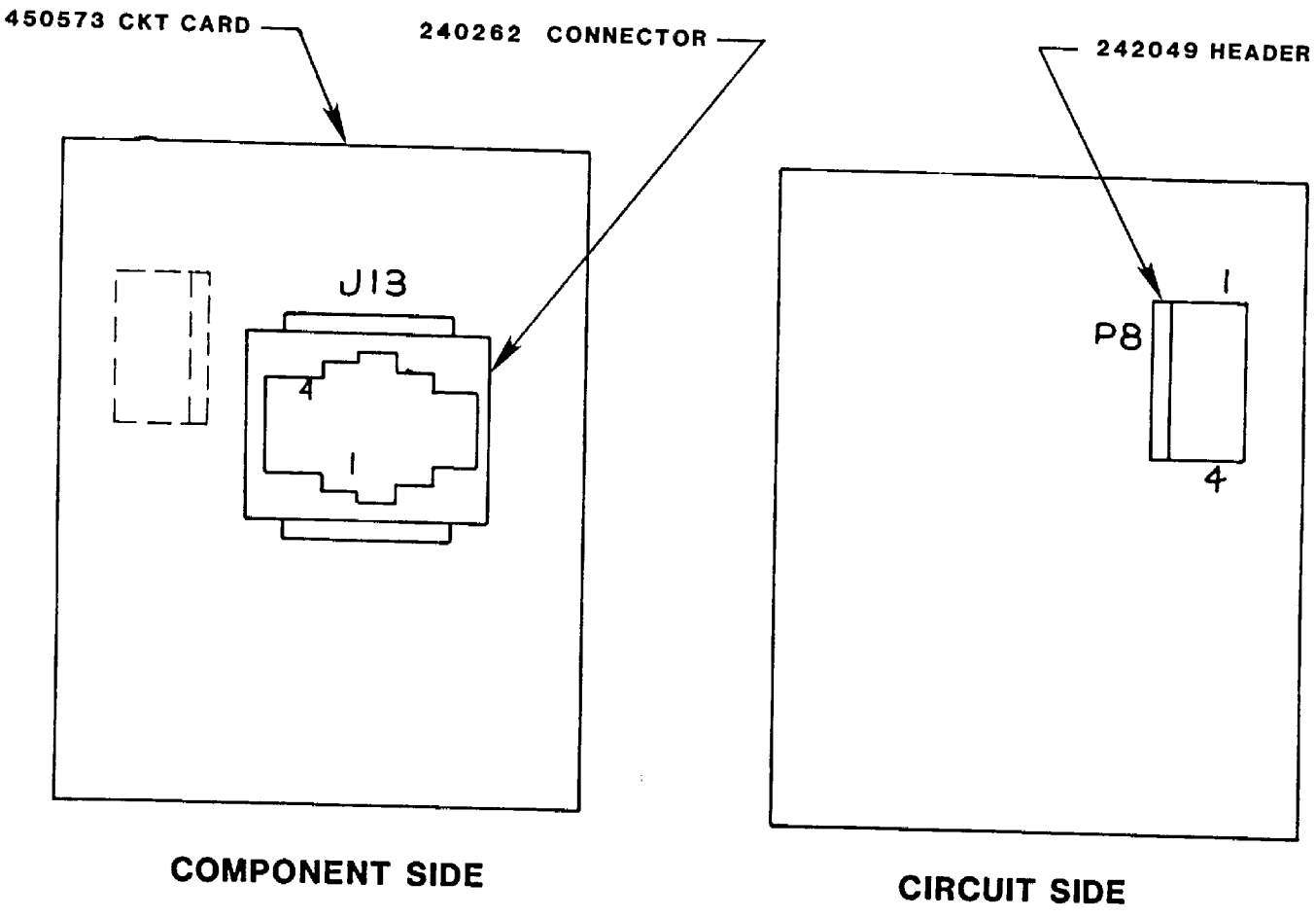
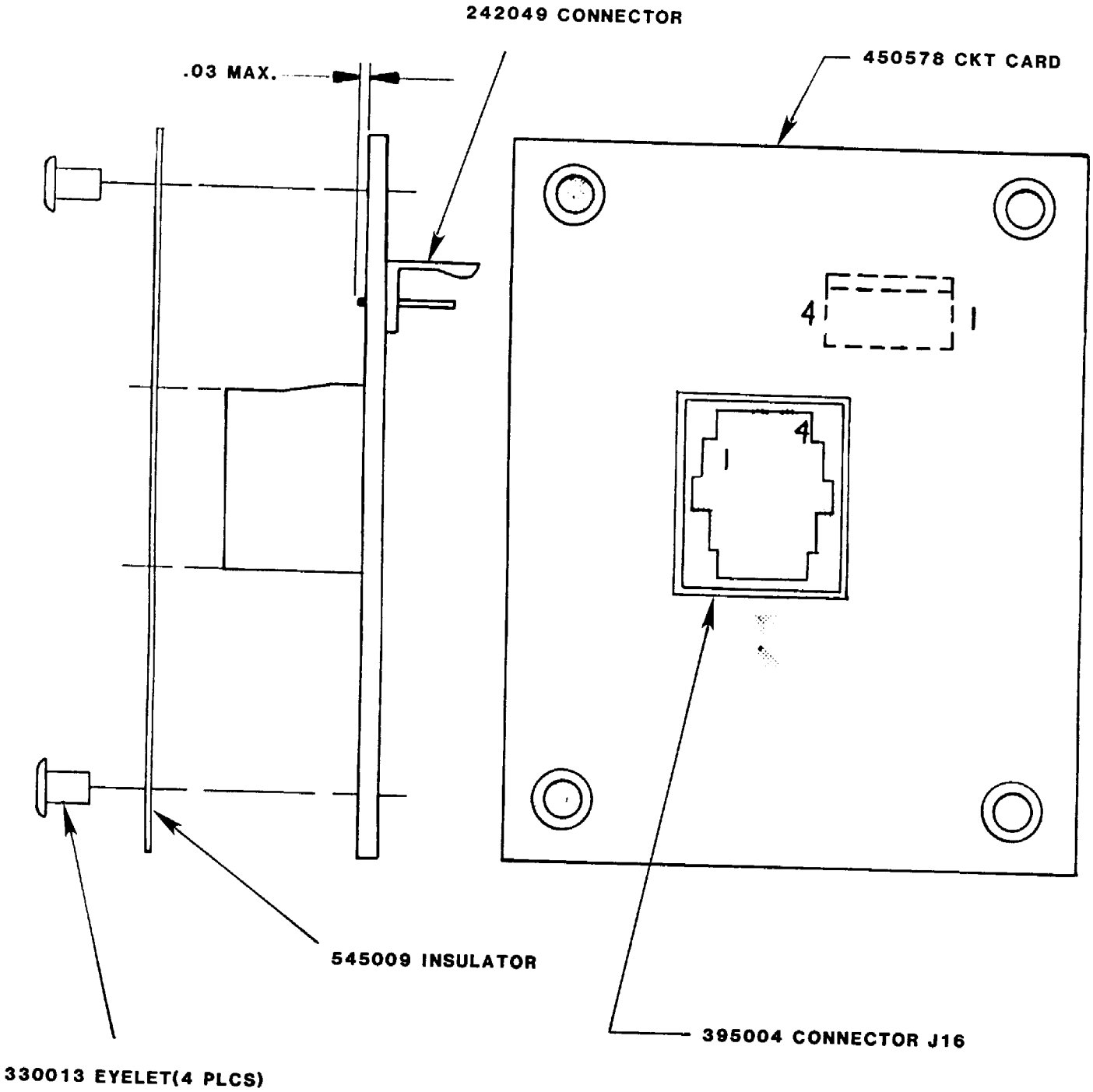
51500-5 COMPONENT LOCATION DIAGRAM



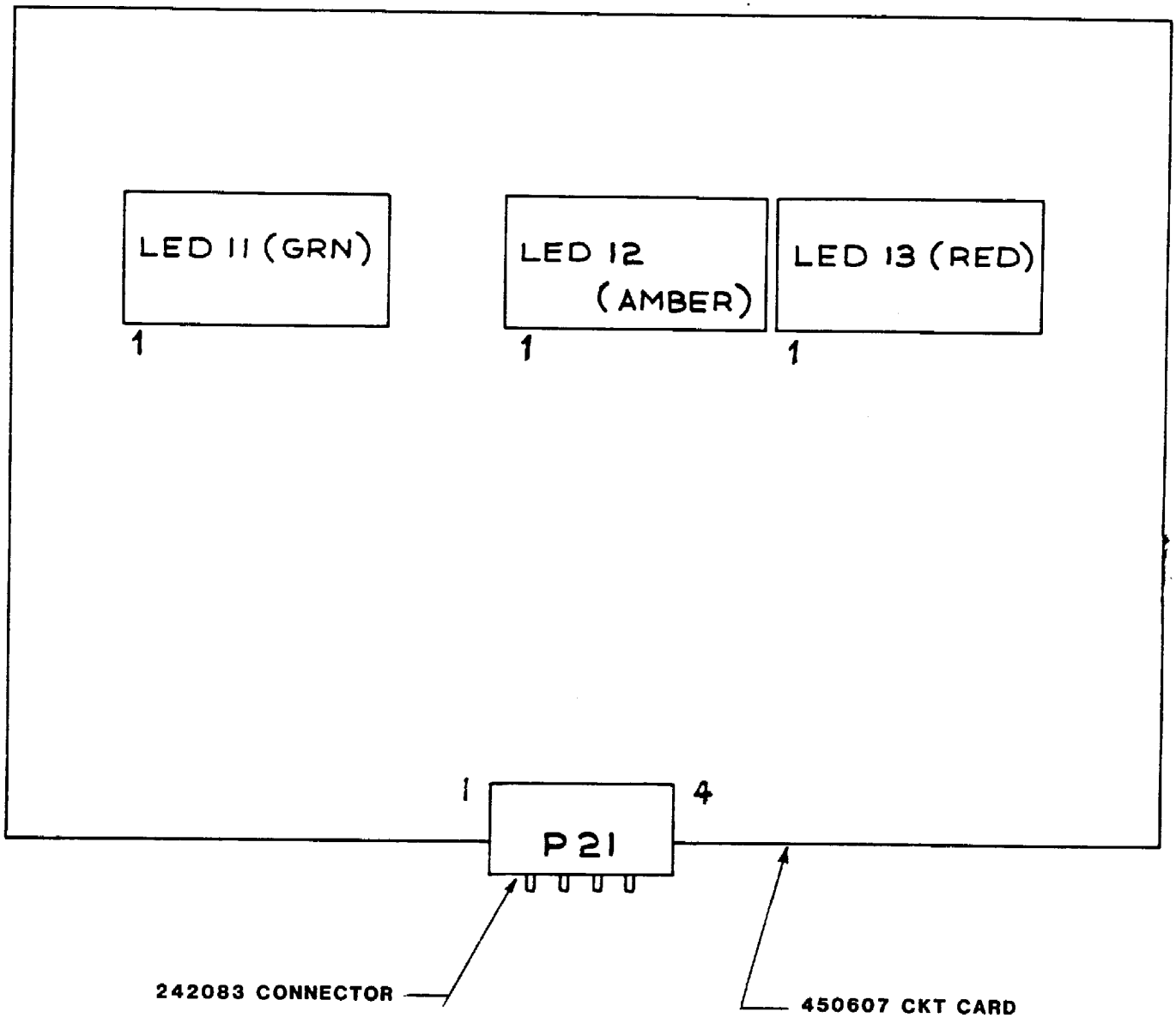
CLD-51500-5-34E

51500-7 COMPONENT LOCATION DIAGRAM

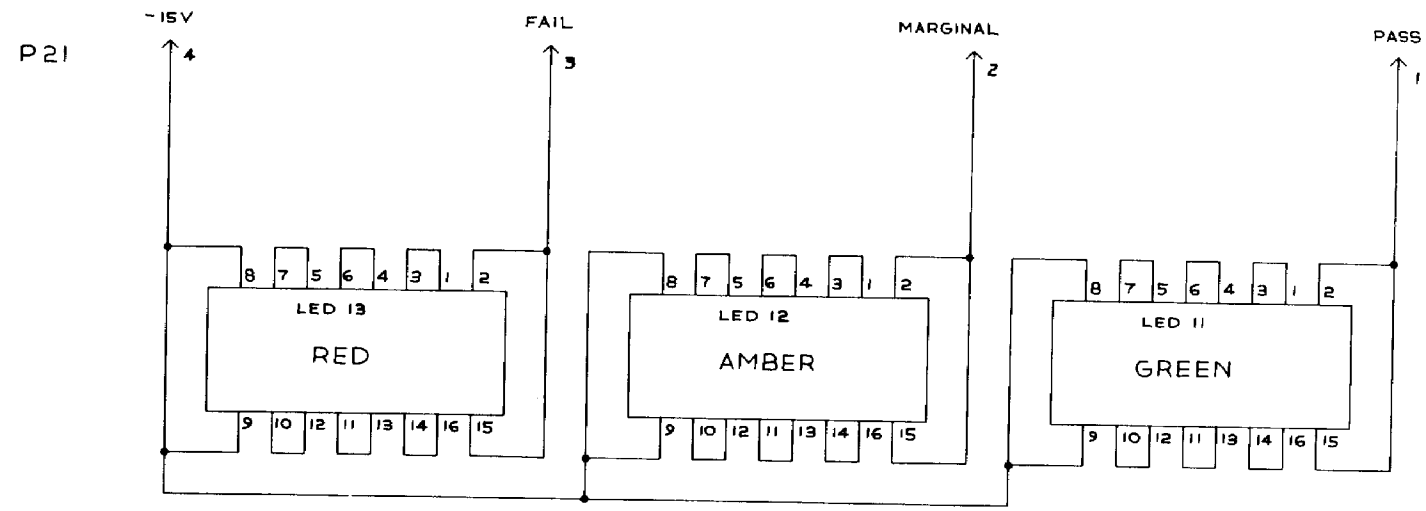


CLD-51500-7-34E

51500-8 COMPONENT LOCATION DIAGRAM



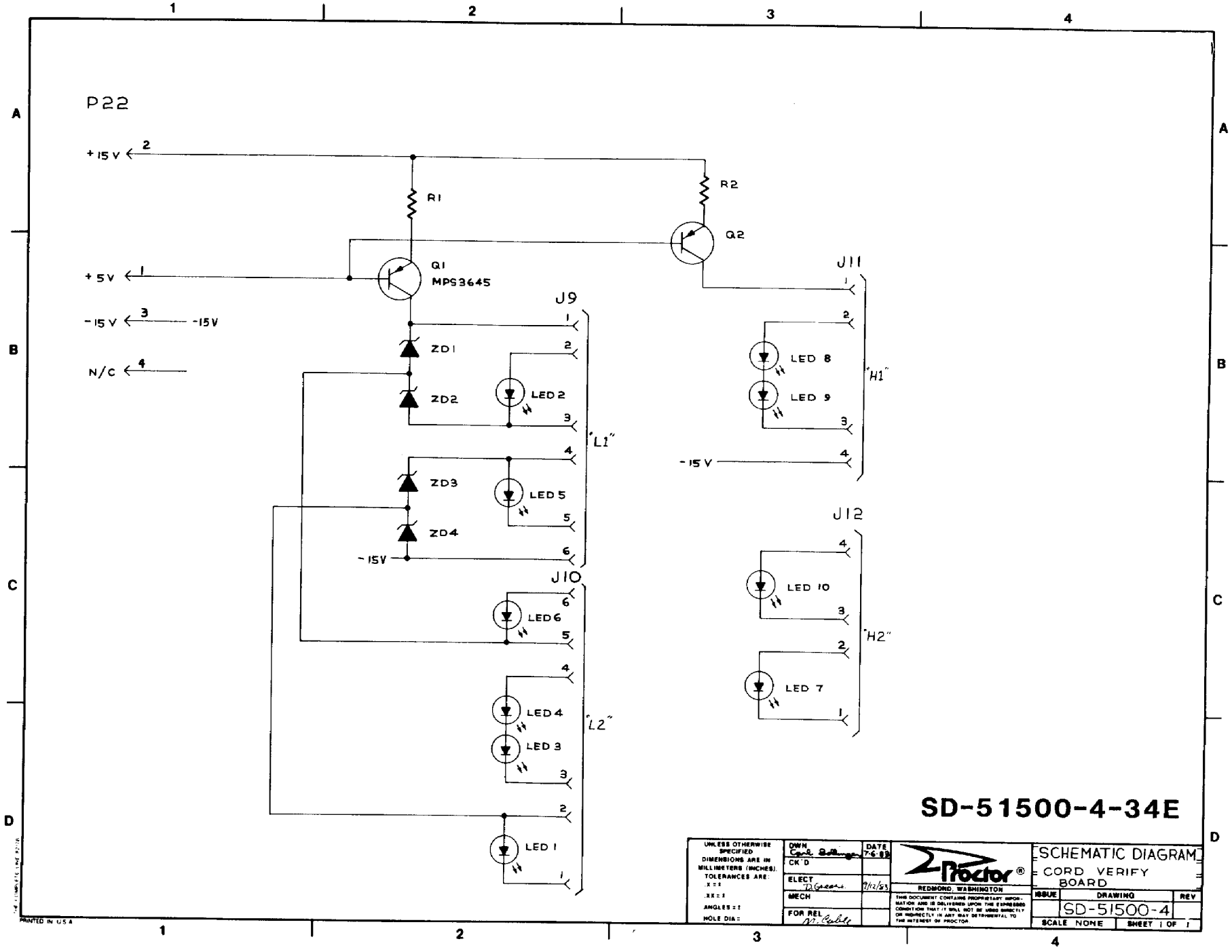
CLD-51500-8-34D



SD-51500-8-34D

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS (INCHES) TOLERANCES ARE: .X ± ; .XX ± ; ANGLES ± ; HOLE DIA ±	DWN Carl B. Ott	DATE 7-12-84	Proctor® REDMOND, WASHINGTON	SCHEMATIC DIAGRAM PASS - FAIL DISPLAY BOARD
	CK'D			
	ELECT J.D. Greene	7/13/84		
	MECH			
	FOR REL M. Cobb	9/12/84		

ISSUE	DRAWING	REV
	SD-51500-8	
SCALE NONE	SHEET 1 OF 1	


P22
+15 V
2
R1
R2
Q2
Q1
MPS3645
+5 V
1
-15 V
3
-15V
N/C
4
J9
ZD1
ZD2
LED 2
"L1"
ZD3
LED 5
ZD4
-15V
J10
LED 6
LED 4
LED 3
"L2"
LED 1
J11
LED 8
LED 9
"H1"
-15 V
J12
LED 10
"H2"
LED 7
SD-51500-4-34E
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS (INCHES)
TOLERANCES ARE:
.X = ±
.XX = ±
ANGLES = ±
HOLE DIA =
DWN
CK'D
ELECT
MECH
FOR REL
DATE
7-6-83
7/12/83
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ISSUE
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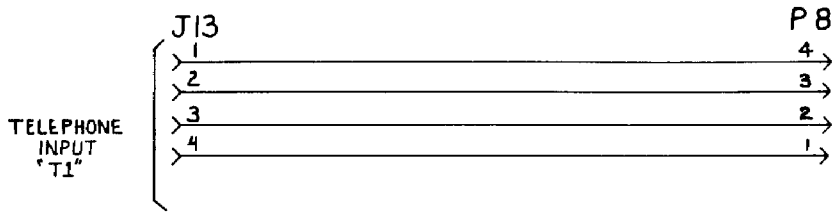

SD-51500-5-34E

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS (INCHES). TOLERANCES ARE: .X = ± .XX = ± ANGLES = ° HOLE DIA =	DWN Rendall	DATE 7-22-82	Proctor® REDMOND, WASHINGTON
	CK'D [illegible]	8-26-82	
	ELECT D. Greene	9/12/83	
	MECH		
	FOR REL M Cable	9/15/83	

SCHEMATIC DIAGRAM
ISOLATED JACK MODULE
BOARD 51500

ISSUE	DRAWING	REV
	SD 51500-5	

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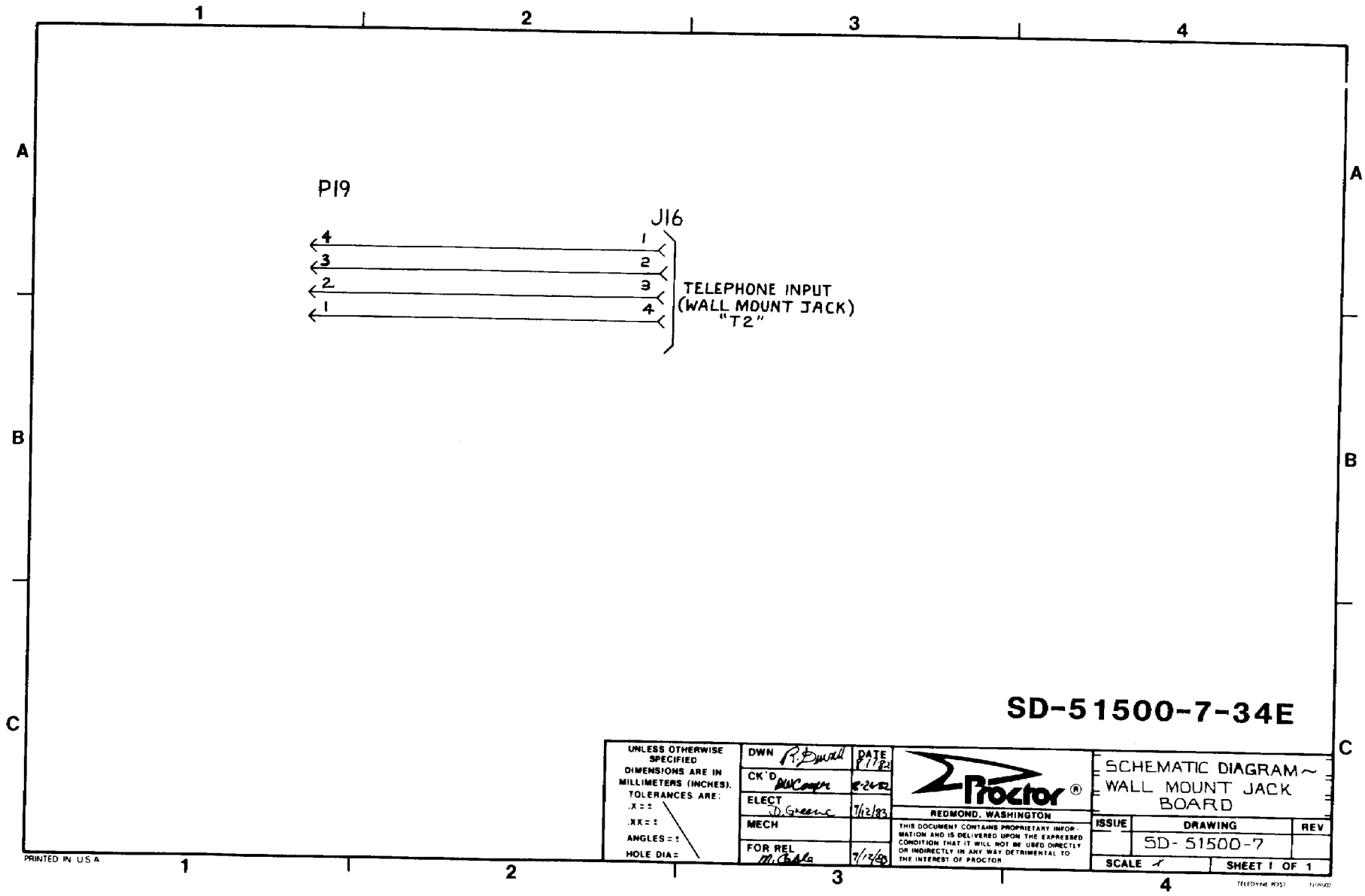

SD-51500-7-34E

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS (INCHES). TOLERANCES ARE: .X = ± .XX = ± ANGLES = ± HOLE DIA =	DWN P. Bissell	DATE 8/17/82	Proctor® REDMOND, WASHINGTON	SCHEMATIC DIAGRAM ~ WALL MOUNT JACK BOARD
	CK'D D.W. Cooper	8-26-82		
	ELECT J.D. Greene	7/12/83		
	MECH			
	FOR REL M. Sable	7/12/83		

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	SD-51500-7	

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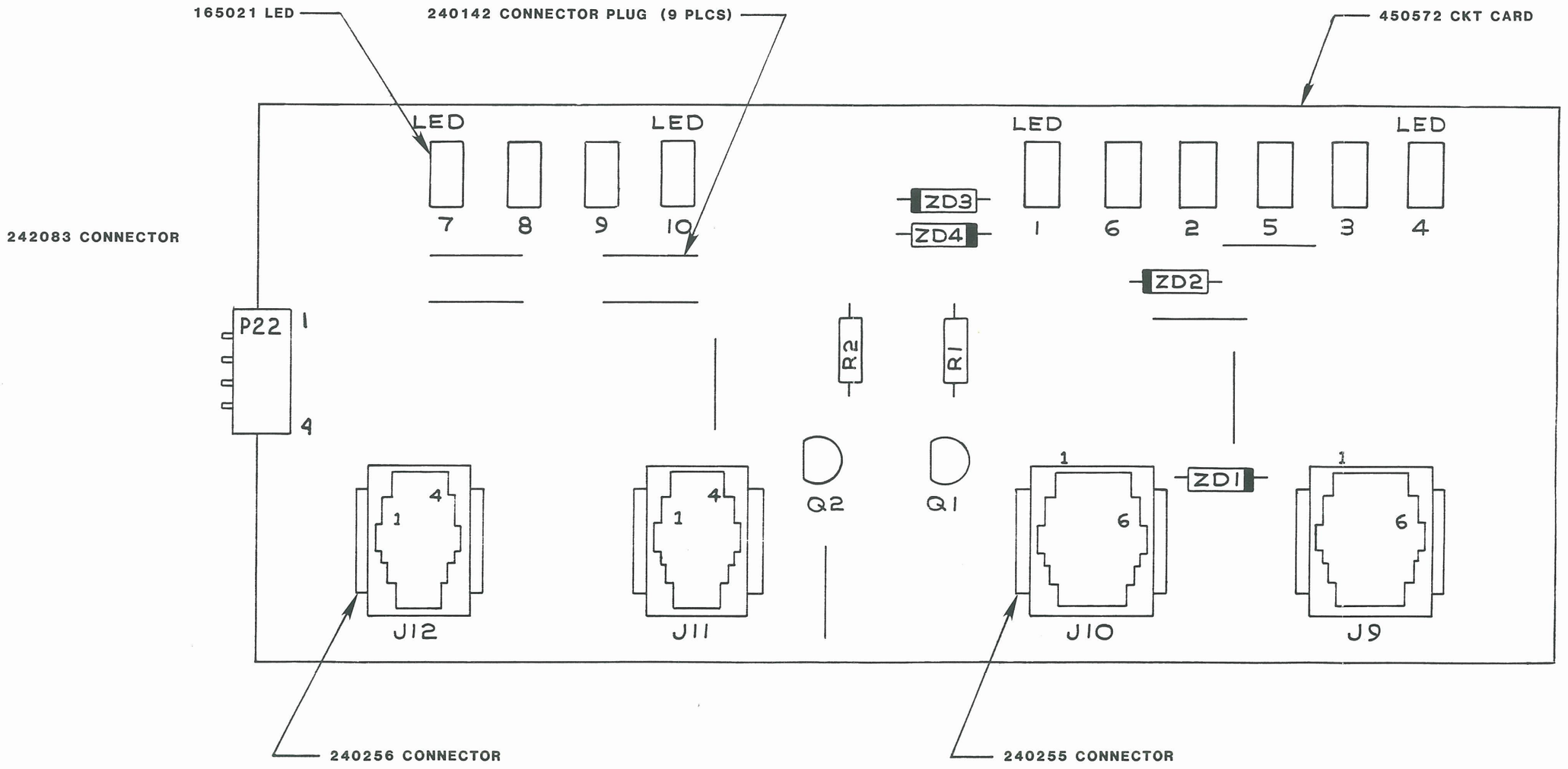
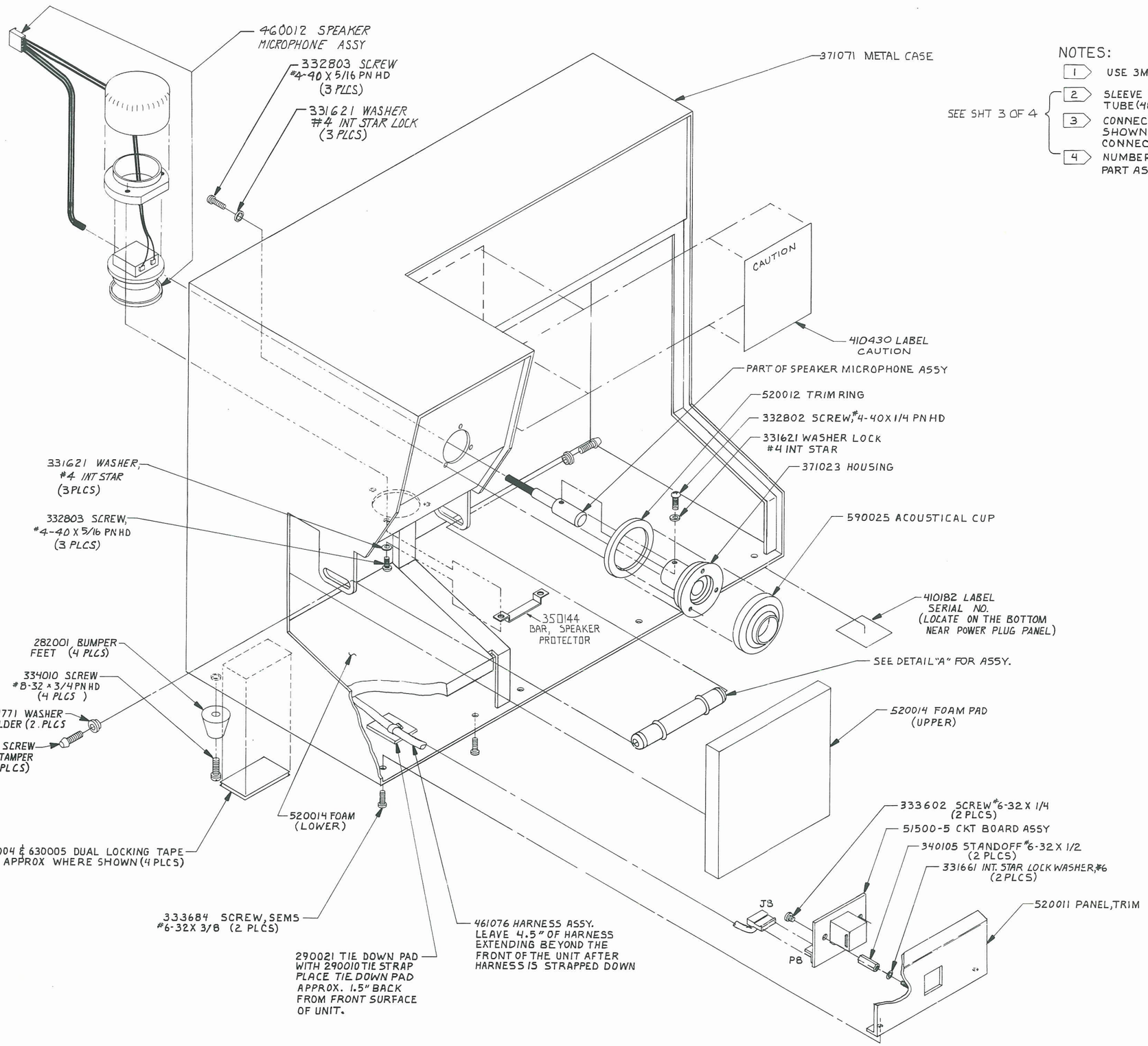
51500-4 COMPONENT LOCATION DIAGRAM



CLD-51500-4-34E

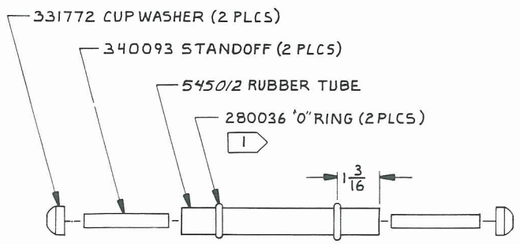


NOTES:

1. USE 3MCA7 GLUE TO SET IN PLACE.
2. SLEEVE TABS 3,4 & 7 WITH .5 IN. EA OF HEATSHRINK TUBE (480021).
3. CONNECT WIRE HARNESSES 461051 AND 461052 AS SHOWN ON WIRING DETAIL. FOR ALL OTHER CONNECTIONS REFER TO WIRING TABLE.
4. NUMBERS ACTUALLY APPEAR UP-SIDE DOWN ON PART AS VIEWED.

SEE SHT 3 OF 4

LTR	ISS	REVISION	CK'D
NEW	~	RELEASED 11-5-80 MP	
A	4	INC ACN 4 BC 4-22-81	
B	8	INC ACN 8,10 DS 6-1-81	
C	12	INC ACN 17 18 & RPD 2-2-81	RPD
D	13	ACN 21 23 & 25 RD 2-23-82	RPD
E	14	INC ACN 26 & 27 RD 3-8-82	RPD
F	15	INC ACN 29 & RP 4-19-82	
G	19	INC ACN 36 5-13-82	PRH
H	23	ACN 44 RD 7-30-82 ACN 47, 48 RD 45 & 49 8-23-82	PRH
J	27	ACN 53 RD 4-19-83	MC
K	27	ACN 56 RD 10-19-83	PRH
L	30	ACN 65 MB 1/3/84	PRH
M	30	ACN # 69 NINH 01/18/84	PRH
N	30	ACN # 73 PRH 2-8-84	MSC
P	32	ACN'S 76, 77, 79 MB 5/4/84	PRH
R	32	ACN 80 RD 6-25-84	PRH
S	33	ACN 85, 86 MB 11/5/84	PRH
T	33	ACN 88, 90 CAG 12-6-84	PRH
U	34	ACN 93, 98 CAG 2-7-85	PRH
V	34	ACN 100 MC 3-4-85	PRH



DETAIL A
SCALE: NONE

CLD-51500-34V

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN ~~MILLIMETERS~~ (INCHES). TOLERANCES ARE: .X = ± .XX = ± ANGLES = ± HOLE DIA =	DWN M PATTEE	DATE 2-13-81	Proctor® REDMOND, WASHINGTON
	CKD Patricia Allen	3-2-82	
	ELECT	3-5	
	MECH		
	FOR REL		

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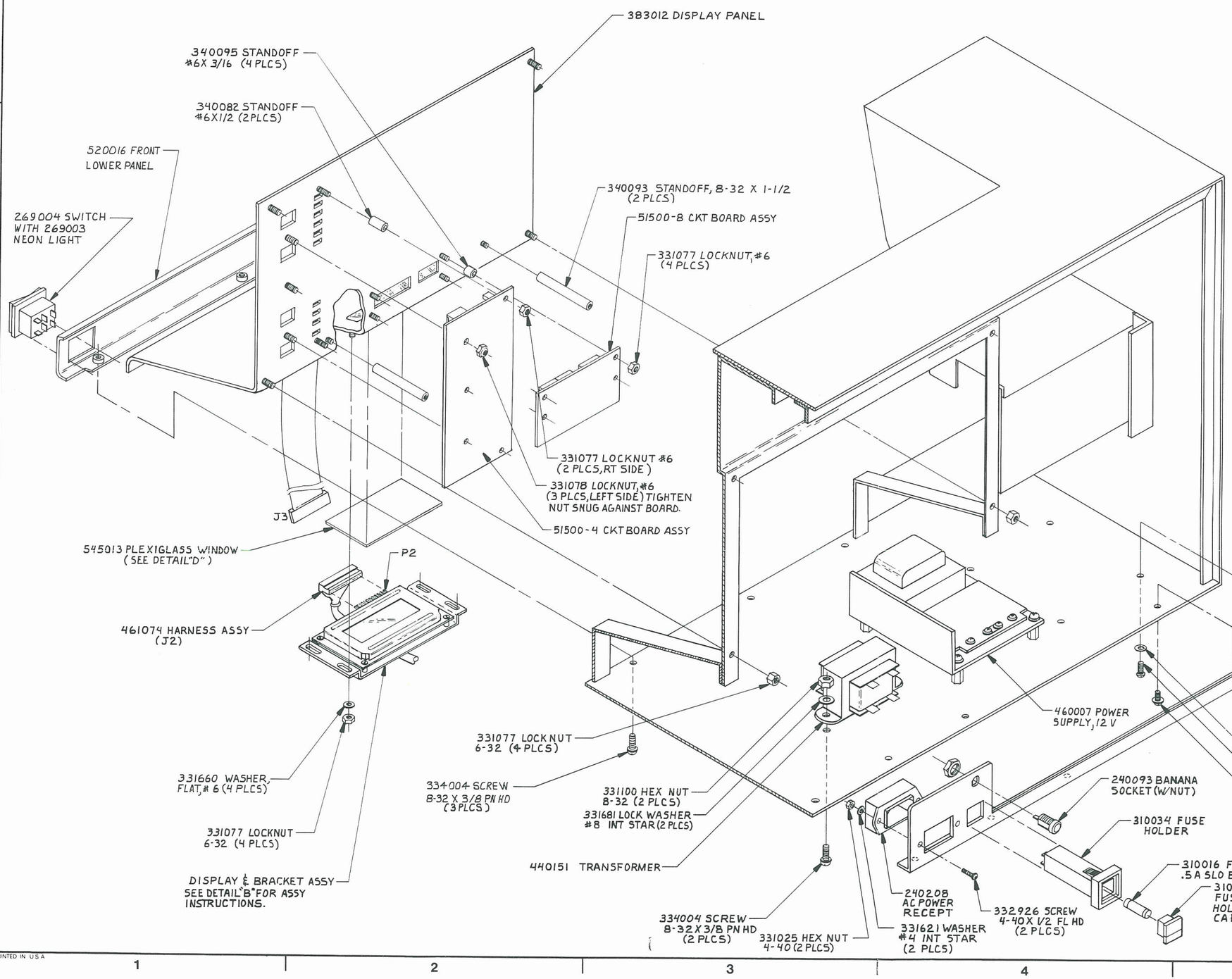
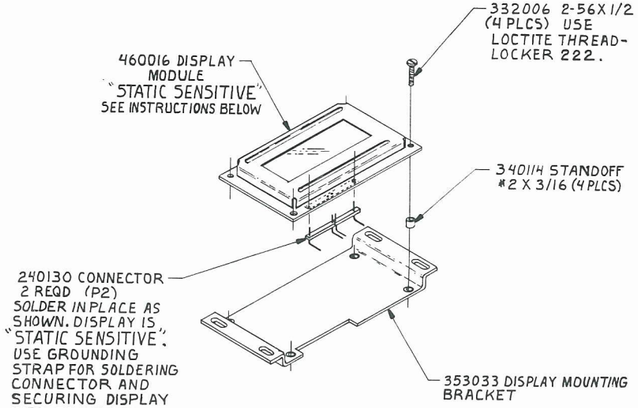
FINAL ASSEMBLY 51500

ISSUE	DRAWING	REV
34	CLD-51500	V
SCALE NONE	SHEET 1 OF 4	

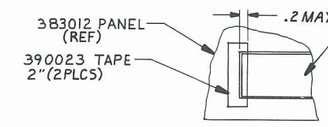
MF04

REV	ISS	REVISION	CK'D
		SEE SHT 1	





DETAIL B
SCALE: NONE



DETAIL D
SCALE: NONE

CLD-51500-34V

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN ~~MILLIMETERS~~ (INCHES). TOLERANCES ARE: .X = ± .XX = ± ANGLES = ± HOLE DIA =	DWN RBrandt	DATE 3-24-83
	CK'D	
	ELECT	
	MECH	
	FOR REL	

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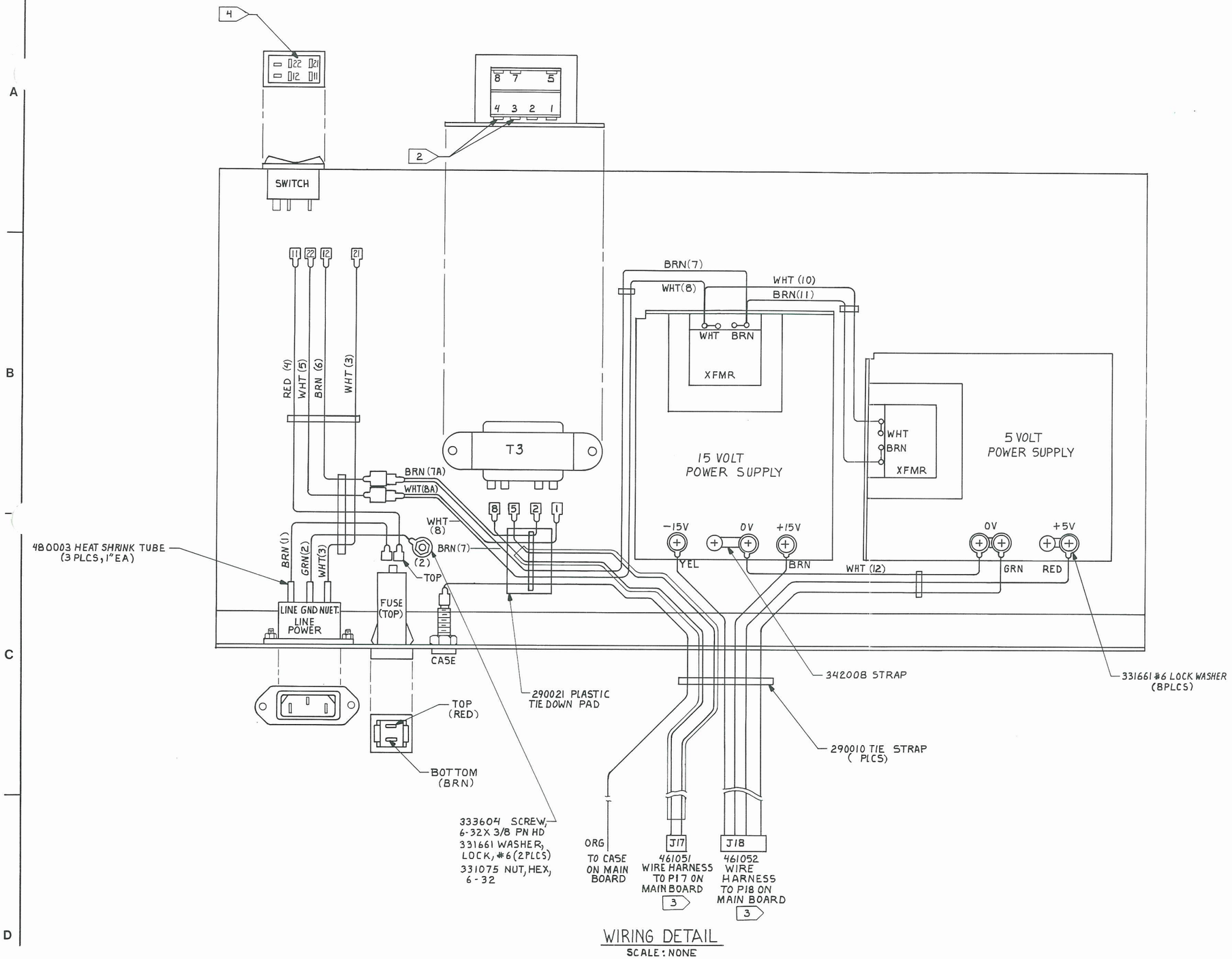
FINAL ASSEMBLY
51500

SIZE	DRAWING	REV
	CLD-51500	
SCALE NONE	SHEET 2 OF 4	

REV	ISS	REVISION	CK'D
		SEE SHT 1	



WIRING DETAIL
SCALE: NONE

WIRING TABLE

WIRE NO.	FROM	TERMINATION	TO	TERMINATION	WIRE SIZE	LENGTH	COLOR
1	LINE POWER (LINE)	SOLDER	FUSE (BOTTOM)	301019	20	5.5	BRN
2	LINE POWER (GND)	SOLDER	CHASSIS GND SCREW	301002		6	GRN
3	LINE POWER (NUETRAL)	SOLDER	SWITCH (21)	301018		8	WHT
4	FUSE (TOP)	301019	SWITCH (11)	301018		7	RED
5	SWITCH (22)	301018	CONNECTOR JUNCTION	301020		7	WHT
6	SWITCH (12)	301018	CONNECTOR JUNCTION	301020		7	BRN
7	CONNECTOR JUNCTION	301017	15 VOLT POWER SUPPLY XFMR	SOLDER		15.5	BRN
7A	CONNECTOR JUNCTION	301017	T3-PIN 2	301018		4.5	BRN
8	CONNECTOR JUNCTION	301017	15 VOLT POWER SUPPLY XFMR	SOLDER		15.5	WHT
8A	CONNECTOR JUNCTION	301017	T3-PIN 1	301018		4.5	WHT
9	CASE GND CONNECTOR	301018	MAIN BOARD CASE	SOLDER		14.5	ORG
10	15 VOLT POWER SUPPLY XFMR	SOLDER	5 VOLT POWER SUPPLY XFMR	SOLDER		8	WHT
11	15 VOLT POWER SUPPLY XFMR	SOLDER	5 VOLT POWER SUPPLY XFMR	SOLDER	20	8	BRN
12	15 VOLT POWER SUPPLY (0V)	301002	5 VOLT POWER SUPPLY (0V)	301002	18	6.5	WHT

CLD-51500-34V

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	ELECT			SCALE NONE SHEET 3 OF 4
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	FOR REL			

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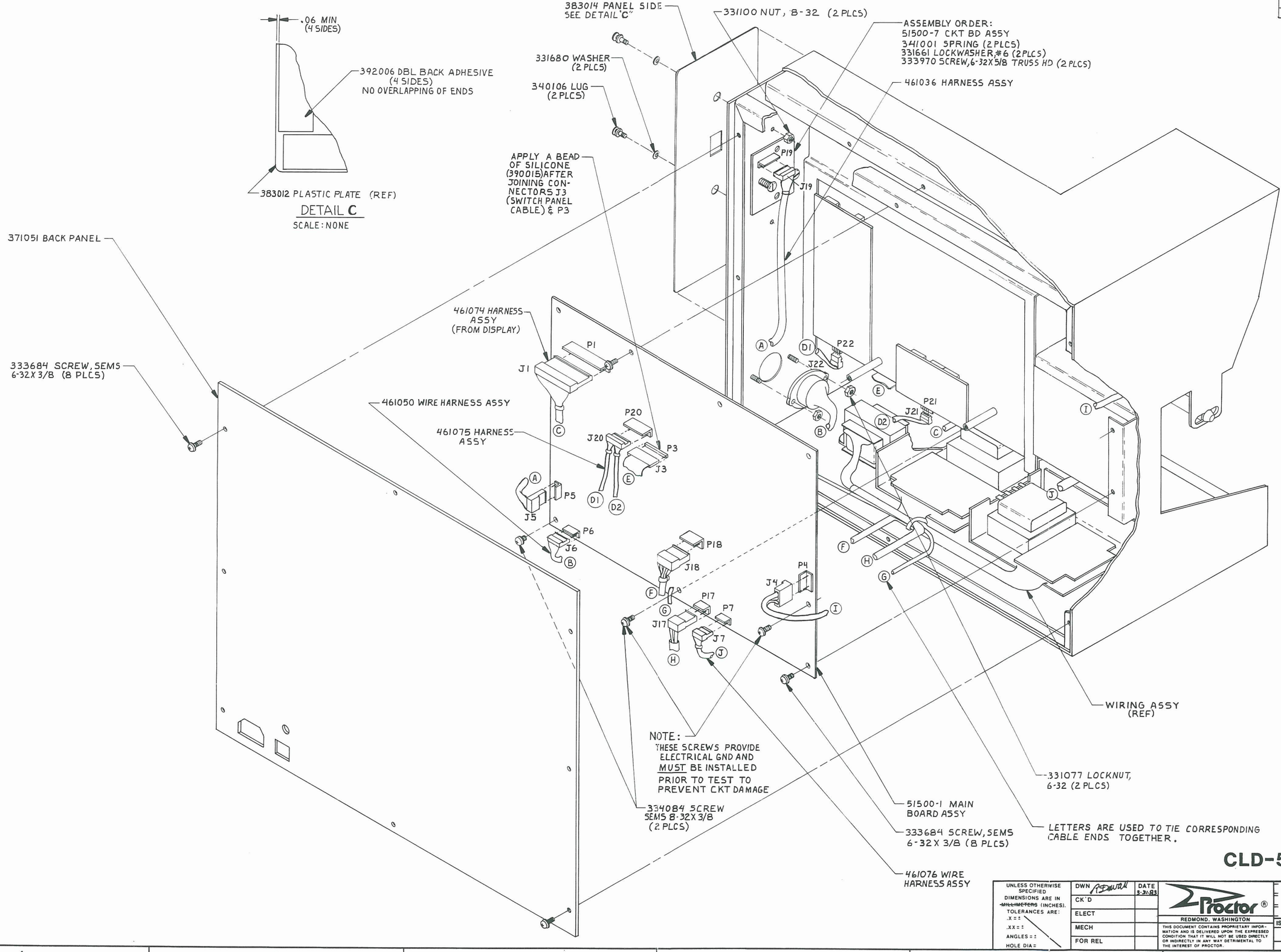
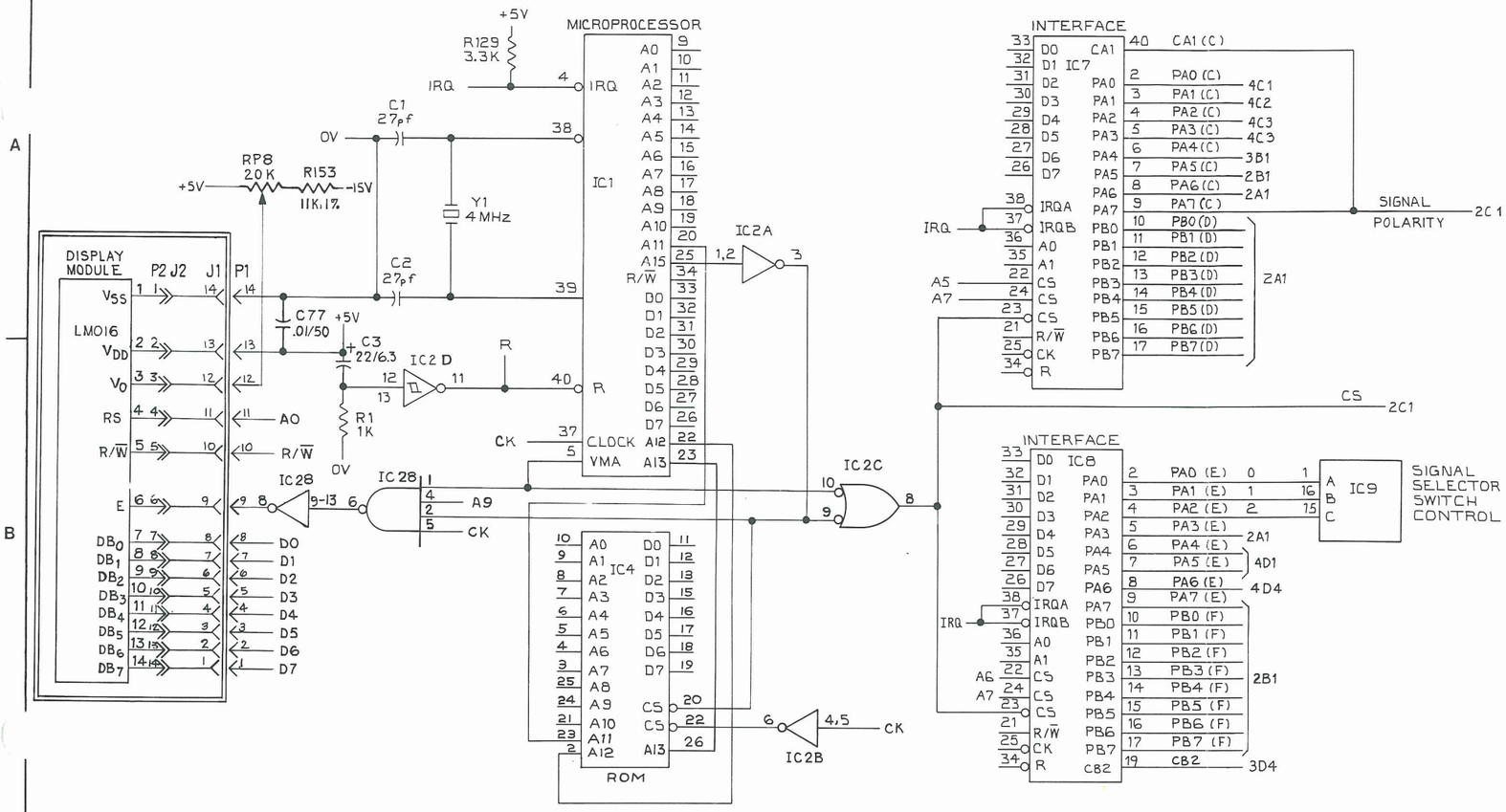
REV	ISS	REVISION	CK'D
		SEE SHT 1	



CLD-51500-34V

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN ~~MILLIMETERS~~ (INCHES). TOLERANCES ARE: .X = ± .XX = ± ANGLES = ± HOLE DIA =	DWN RSDavis	DATE 5-31-83	Proctor® REDMOND, WASHINGTON	FINAL ASSEMBLY 51500	
	CK'D				
	ELECT				
	MECH				
	FOR REL				

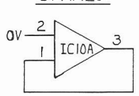
ISSUE	DRAWING	REV
	CLD-51500	
SCALE NONE	SHEET 4 OF 4	



HIGHEST DESIGNATION			
COMP.	DESIG	COMP.	DESIG
INT. CKT	IC29	CRYSTAL	Y1
CAPACITOR	C83	SWITCH	SW11
RELAY	K11	DIODE	D22
TRANSISTOR	Q21	ZENER	ZD10
RESISTOR	R154	POT	RP8
L.E.D.	LED27	DISPLAY	MSD
TRANSFORMER	T2	DISPLAY	LSD

UNUSED DESIGNATORS	
COMP.	DESIGNATION
RESISTOR	R6-R9, R11, R39, R40, 44, 52, 53, 70, 109, 115, 122
DIODE	D19, ZD6
TRANSISTOR	Q20

SPARES



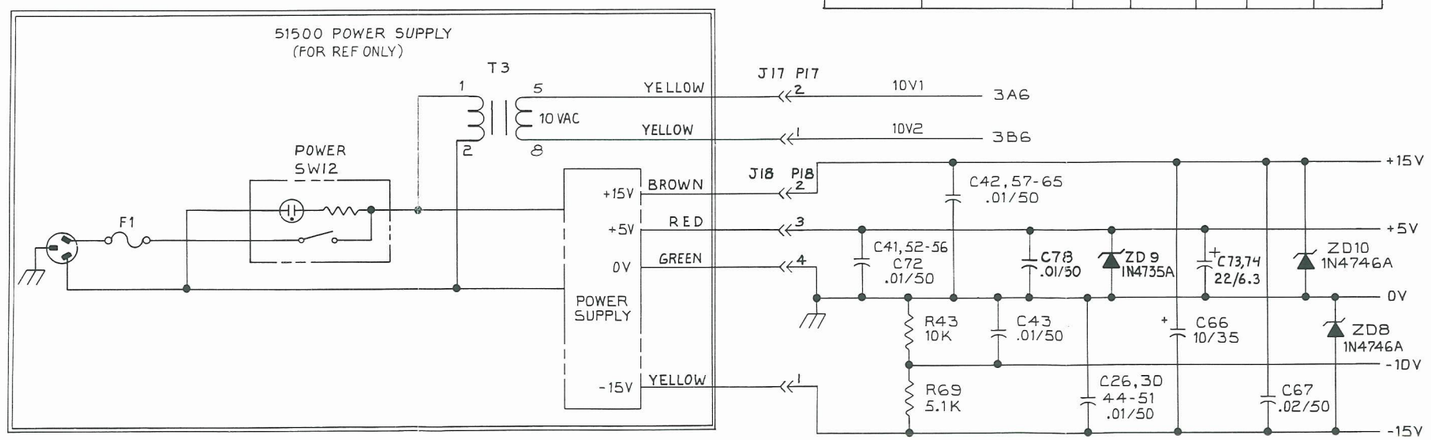
POWER AND GROUND						
TYPE	DESIGNATION	0V	+5V	+15V	-15V	-10V
6802	IC1	1, 21	2, 3, 6, 8, 35, 36			
74LS132	IC2	7	14			
74LS02	IC3	7	14			
2764 [7.]	IC4	14	1, 27, 28			
6840	IC5	1, 4, 5, 7, 26	14			
6821	IC6, 7, 8	14	20			
IH6108CDP	IC9	14	2	13	3	
RC4136	IC10, 15, 16, 17, 18, 19, 25			11	7	
74LS393	IC11	7	14			
74LS288	IC12	8, 15	16			
3408	IC13, 14, 21	2	13		3	
LM311N	IC20, 27, 29	1		8	4	
74LS20	IC28	7	14			
7445	IC23	8	16			
4053	IC24	6, 8	16			7
LM378N	IC26			14	3, 4, 5, 10, 11, 12	

REV	ISS	REVISION	CK'D
M	23	INC ACN 38 DWC 8-3-82 REDRAWN; INC ACN 41 REF SD-51500, SHT 1, FOR PREVIOUS REV'S. TGP 7-19-82 INC ACN 47 TGP 8-24-82 ACN 49	DWC
N	27	INC ACN 47, 51, 53, ACN 1 F2 TGP 9-13-83	PRH
P	27	INC ACN 53 CAG 9-19-83	MC
R	28	ACN 58 11-3-83 CB	PRH
S	30	ACN 61, 65 DWC 12/16/83	PRH
T	30	ACN #69 NINH 01/18/84	PRH
U	32	ACN'S 76, 77, 78, 5/4/84 NINH NB	PRH
V	33	ACN 86 DWC 11/7/84	PRH
W	34	ACN 98 CAG 2-7-85	PRH

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTORS ARE 1/4W, 5%, IN OHMS.
2. ALL CAPACITORS ARE uf / WVDC.
3. ALL DIODES ARE 1N4448.
4. ALL TRANSISTORS ARE MPS3645.
5. ALL .001 CAPS ARE 500V.
6. C26, 30, 41-65, 68 AND 72 ARE .01/50 BYBASS CAPACITORS ACROSS POWER AND GROUND.

[7.] CIRCUIT WILL ACCEPT 27128 EPROM FOR 16K CAPCITY.



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	CK'D	8-26-82	
	ELECT	9/12/83	
	MECH		
	FOR REL	9/12/83	

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SCHEMATIC DIAGRAM - MAIN BOARD 51500

ISSUE	DRAWING	REV
34	SD-51500-1	W
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REV	ISS	REVISION	CK'D
		SEE SHT 1	

1A4 PA6(C) DC SIGNAL SELECT
1A4 PA3(E) MOUTH SELECT

SIGNAL GENERATOR 1A4 LEVEL
PB0(D)
PB1(D)
PB2(D)
PB3(D)
PB4(D)
PB5(D)
PB6(D)
PB7(D)

D/A IC13
D/A IC14
D/A IC21

C4 20pF/1000 -15V
C5 20pF/1000 -15V
C6 20pF/1000 -15V
R2 2.49K,1% +5V
R3 1.24K,1% 0V
R4 1.24K,1% 0V
R5 2.49K 1% +5V

GENERATOR I FREQUENCY
COUNTER IC11A
COUNTER IC11B
NC
MEMORY IC12

1A4 PA5(C) 2mA LOCK
1B4 PA7(E) A/D CONVERTER ERROR POLARITY

IC20
R10 523Ω 1%
RP1 1K
RP7 100K
R136 10M
C7 .1/100 0V
-15V
IC10B
C10 .15/100
R14 8.2K
R15 7.5K
IC24C

R12 4.12K,1%
C8 .001/50
IC24A
IC25A
C9 .1/100
R13 60.4K,1%
A 3B1
B 3C1

IC24 SWITCH CONTROL
SIGNAL POLARITY
R19 470Ω +5V

R17 60.4K 1%
IC25C
R18 60.4K 1%
IC27
R130 1M
C11 .001/50
R16 10K
C 3C1

ANALOG TO DIGITAL CONVERTER 1B4
PB0(F)
PB1(F)
PB2(F)
PB3(F)
PB4(F)
PB5(F)
PB6(F)
1C4 PB7(F)

TIMER IC5
SIGNAL POLARITY
INVERTER FREQUENCY 3B1
1B4 CS
PA7(C)
CA1(C) 1A4 SIGNAL POLARITY

INTERFACE IC6
IRQ
A4
A7

IC23 DECODER

IC3A IC3D
R135 1K
R134 1K +5V
ZD7 IN4735A 0V

P3
J3
MEMBRANE SWITCH (FOR REF ONLY)
SW1 CONTINUITY
SW2 INSULATION SAFETY
SW3 TRANMISSION
SW4 DIAL
SW5 RINGER
SW6 OPTION ONE
SW7 OPTION TWO
FAR LEFT COMMON

P20
+15V 6
7
-15V 4
+5V 5
C79 .01/50 0V

4D4 MARGINAL 2
4D1 PASS 1
4D1 FAIL 3

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS (INCHES). TOLERANCES ARE: .X = ± .XX = ± ANGLES = ± HOLE DIA =	DWN R. Duvall	DATE 7-23-82
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Proctor® REDMOND, WASHINGTON

SCHEMATIC DIAGRAM MAIN BOARD 51500

ISSUE	DRAWING	REV
34	SD 51500-1	W
SCALE ~	SHEET 2 OF 4	

LTR	ISS	REVISION	CK'D
		SEE SHEET 1	

CASE
0V
ORANGE J14 TELEPHONE CASE

PART OF SPEAKER MICROPHONE ASSY 460012
PART OF J4
4
5
SPKR
(FOR REF ONLY)

C75 330pf 50V
R23 806K 1%
R22 31.6K 1%
C14 .1/100
RP2 5K
C13 .1/100
R25 806K 1%
R24 31.6K 1%
C76 330pf 50V
IC26A
IC26B

1A4 PA4(C) INV. ON
2C2 INVERTER FREQ
IC3B
IC3C
R26 1.3K
R27 1.3K
Q1 2N3645
Q2 2N3645
T1
Q3 2N6248
Q4 2N6248
R30 2Ω
R42 1K 1/4W
+15V
-15V
0V
T2

2A6 A
IC 24 B
R28 6.8K
R29 6.8K
D1
D2
R143 10K
C71 .1/100
D21 IN4937
D22
IC10C

2A6 B
D23
D24

R33 1MEG
R34 39K
IC15C
C21 .001/50
R41 1.8K

D3 IN4937
D4 IN4937
D5 IN4937
D6 IN4937
D7 IN4937
D8 IN4937
D9 IN4937
D10 IN4937
D11
C15 .02/1000
C16 .02/1000
C17 .02/1000
C18 .02/1000
C19 .500
R54 56K ½W
R55 56K ½W
R56 56K ½W
K1
C12 .1/500
R31 1.6K 1/2W 5%
R145 1.24K 1W 1%
STD
F2
Q5 MJ12002

R158 160K 1/2W
R159 160K 1/2W
1500 V
1000 V
R144 160K 1/2W
R157 160K 1/2W
R156 160K 1/2W
R155 160K 1/2W
K5
K4
+15V

P5
IC5 10V2
TIP
RING
GND
TO WALL TELEPHONE INPUT "T2"
K3
K6
K7
IC5 10V1
DZ0 IN4005
R61 261Ω 1%
C24 .33/100 10%
K2
R62 2.32K 1%
C25 .47/100
R63 261Ω 1%
P6
TO TELEPHONE INPUT "T3" (4 PRONG JACK)
Q6 TIP 31C

R148 750K 1/4W 1%
R133 301K 1/4W 1%
R147 121K 1W 1%
R150 10K
C20 270pf 1000
R32 80.6K 1W 1%
K5
K8

IC25B
R58 909Ω 1%
C23 .2/100
R57 60.4K 1%

R64 2.2K
R65 78.7 1%
R66 140 1%
R67 205 1%
RP4 100Ω
R68 422Ω 1%
K9
K10
K11
K ZD1 TLC430 R A
-15V

C69 100pf 1000
R47 60.4K 1%
R132 6.8K
R131 3.3K
IC25D
IC9
R50 180K
R36 20.0K 1%
RP5 10K
R37 20.0K 1%
RP6 10K
R38 17.4K 1%
R51 487K 1%
NC
SIGNAL SELECTOR
(SEE SHEET 4)
HIGH (4A6)
LOW (4B6)
TONE INPUT FILTERS (4B1)

R45 60.4K 1%
R46 196K 1%
C83 .01/100
C22 .1/100
C82 .002 50V
IC15C
R59 28K 1%
R60 24.9K 1%

PART OF SPEAKER MICROPHONE ASSY. 460012 PART OF J4
1
2
3
MICRO-PHONE
(FOR REF ONLY)
PART OF P4
+5V
R128 10K
C68 .01 16V
C70 22/6.3V
R20 8.2K
R21 56K
R127 300K
R35 60.4K 1%
RP3 100K
R49 4.12K 1%
IC10D
R48 5.49K 1%
C35 .33/100

1C4 C82
R154 1K
IC29

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REDMOND, WASHINGTON
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SCHEMATIC DIAGRAM MAIN BOARD (51500)

ISSUE	DRAWING	REV
34	SD - 51500-1	W
SCALE —	SHEET 3 OF 4	

MF04

LTR	ISS	REVISION	CK'D
		SEE SHT 1	

TO 3C3 INPUT R71 21.0K 1% IC15A R72 82.5K 1% R73 324K 1% R74 147K 1% C27 .001 IC16D C29 .001 R80 133K 1% IC16C R78 82.5K 1% R79 113K 1% R87 165K 1% C80 18pF IC16A R88 82.5K 1% R89 21.0K 1% R95 93.1K 1% R96 137K 1% C32 .001 IC16B R106 78.7K 1% C81 18pF HIGH TONE OUTPUT TO 3C3 R105 82.5K 1% R104 113K 1% C33 .001 IC17A R111 232K 1% IC17B R112 82.5K 1% R113 21.0K 1% R117 21.0K 1% R118 95.3K 1% C37 .001 IC17D R119 82.5K 1% R124 82.5K 1% C39 .001 IC17C 0V

R75 21.0K 1% IC15B A R77 82.5K 1% R82 324K 1% R81 165K 1% C28 .001 IC18A R90 154 1% C31 .001 IC18B R85 82.5K 1% R86 165K 1% R94 113K 1% IC18D R97 82.5K 1% R98 21.0K 1% R102 93.1K 1% R103 196K 1% C34 .001 IC18C R110 232K 1% R107 82.5K 1% R108 162K 1% C36 .001 IC19B R114 78.7K 1% IC19A R120 82.5K 1% R116 21.0K 1% R121 21.0K 1% R123 267K 1% C38 .001 IC19D R125 82.5K 1% R126 232K 1% C40 .001 IC19C LOW TONE OUTPUT TO3C3 0V

RELAY DRIVERS (5)

1A4 +5V PA0(C) R76 4.7K Q7 K1 D12 -15V

2D2 +5V PA0(A) R83 4.7K Q9 K2 D13 -15V

2D2 +5V PA1(A) R91 4.7K Q11 K3 D14 -15V

1A4 +5V PA1(C) R93 4.7K Q13 K4 D15 -15V

1A4 +5V PA2(C) R99 4.7K Q15 K5 D16 -15V

2D2 +5V PA2(A) R100 4.7K Q17 K6 D17 -15V

1A4 +5V PA3(C) R101 4.7K Q19 K7 D18 -15V

1B4 +5V PA4(E) R137 1.2K R84 68 1/2W Q8 MJE700 PASS 2D4

1B4 +5V PA5(E) R138 1.2K R92 91 1/2W Q10 MJE700 FAIL 2D4

2D2 +5V PA3(A) K8 R139 1.2K Q12 0V

2D2 +5V PA4(A) K9 R140 1.2K Q14 0V

2D2 +5V PA5(A) K10 R141 1.2K Q16 0V

2D2 +5V PA6(A) K11 R142 1.2K Q18 0V

1B4 +5V PA6(E) R151 1.2K R152 91 1/2W Q21 MJE700 MARGINAL 2D4

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SCHEMATIC DIAGRAM MAIN BOARD (51500)

ISSUE	DRAWING	REV
34	SD-51500-1	W

SCALE — SHEET 4 OF 4

MF04

Proctor

PSP/MANUAL ADDENDUM

PSP/Manual 51500 Manual

Addendum # 1

Date of PSP/Manual March 1985

Revision Level G

Addendum Date 19 June, 1989

Section(s) Affected Sections 1 & 7

Page(s) Affected Pages 2 & 26

Drawing(s) Affected (if applicable) CLD-51500 (Sht 3)

NOTE

Retain this Addendum with the related document. The information contained in this Addendum serves as an interim method for conveying changes in the text and drawings of issued PSPs and Manuals. This Addendum will be incorporated into the next revision level of the PSP or Manual upon future printing or issuance of that document.

51500II F3 - 220V, 50/60 Hz Conversion Information

This addendum contains information that details the differences between the 110V, 60Hz version (as described in the 51500 Installation & Maintenance Manual) and the 51500II F3 model, which is rewired for use on 220V, 50 Hz power systems.

NOTE

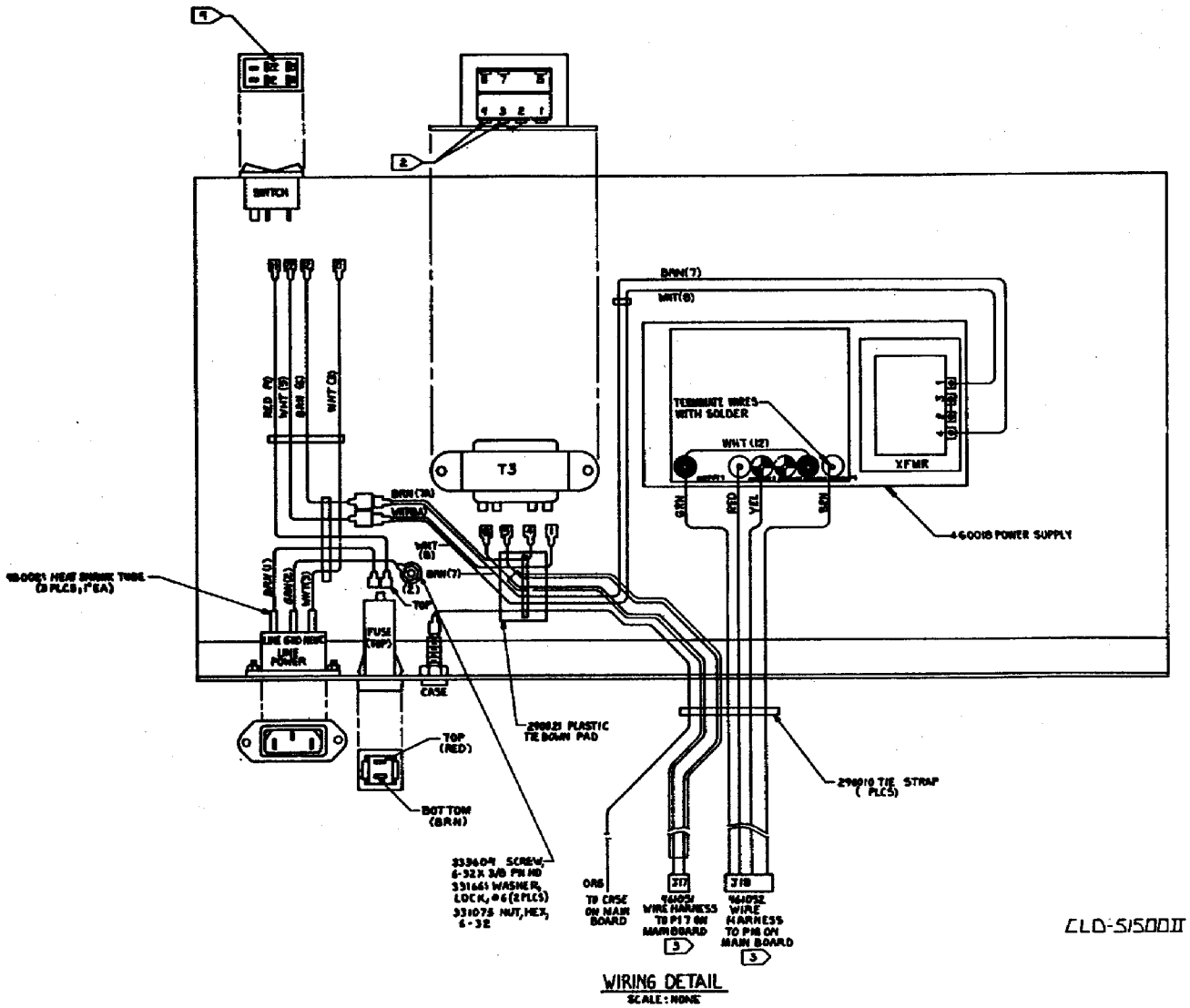
The three changes below are the only items that differ from the documents included in the 51500 Installation & Maintenance Manual. Refer to the manual included with the unit for all 51500II service and maintenance information. (In addition, there are no changes to the 51500II Operator's Guide.)

51500II F3 Changes

1. The 51500II F3 model is equipped with a 0.25 amp, MDL, slow-blow fuse (Proctor part number 310015). Ref: Table 1, Page 2.

2. The wiring on the transformers inside the 51500II has been modified for 220V, 50/60 Hz operation. Replace Sheet 3 of CLD-51500 in the service manual with the attached sheet. Ref: Section 7, Page 26.

3. The Proctor part number for the back panel on the 51500II F3 is 371067.



WIRING TABLE

WIRE NO.	FROM	TERMINATION	TO	TERMINATION	WIRE SIZE	LENGTH	COLOR
1	LINE POWER (LINE)	SOLDER	FUSE (BOTTOM)	301019	20	5.5	BRN
2	LINE POWER GND	SOLDER	CHASSIS GND SCREW	201002	18	6	GRN
3	LINE POWER (NEUTRAL)	SOLDER	SWITCH (12)	301018		8	WHT
4	FUSE (TAP)	301019	SWITCH (11)	301018		7	RED
5	SWITCH (22)	301018	CONNECTOR JUNCTION	301020		7	WHT
6	SWITCH (12)	301018	CONNECTOR JUNCTION	301020		7	BRN
7	CONNECTOR JUNCTION	301017	DC POWER SUPPLY XFMR	SOLDER		23.5	BRN
7A	CONNECTOR JUNCTION	301017	T3-PIN 2	301018		9.5	BRN
8	CONNECTOR JUNCTION	301017	DC POWER SUPPLY XFMR	SOLDER		23.5	WHT
8A	CONNECTOR JUNCTION	301017	T3-PIN 1	301018		9.5	WHT
9	CASE GND CONNECTOR	301018	MAIN BOARD CASE	SOLDER	20	14.5	GRN
12	COMMON	SOLDER	COMMON	SOLDER	18	3.5	WHT

CLD-S1500II F3

51500II F3 220V Conversion Instructions

Perform the following procedure when converting 110V, 60 Hz 51500II sets to 220V, 50/60 Hz units. (Refer to the drawing included with this procedure which shows the parts that must be rewired by the appropriate step in this procedure.)

NOTE

These instructions are for versions using a triple output power supply. Versions using separate 5V and +/- 15V supplies need instruction Rev A.

1. Remove the back panel (8 screws).

NOTE

Back panel replaced by #371067, with "220 VAC" markings.

2. Remove the four screws (on the underside of the 51500) attaching the power supply.

3. Carefully move the power supply toward you to avoid breaking any wires.

4. Cut and remove the two jumper wires connected to terminals 1 - 3 and 2 - 4 on the transformer. Solder a length of bus wire 493003 between the two middle terminals (2 - 3) on the transformer. (See attached drawing.)

5. Unsolder the white wire if connected to the inside right terminal on the transformer and solder it to the outside right terminal. Unsolder the brown wire if connected to the inside left terminal on the transformer and solder it to the outside left terminal. (NOTE: This may already be done on new units.)

6. Reinstall the power supply with existing screws and lock washers.

7. Remove the brown wire connected to pin 2 of transformer T3 and solder it to pin 4 of T3.

8. Solder jumper wire 493003 between pins 2 and 3 on transformer T3.

9. Replace fuse F1 with 1/4-amp slow-blow fuse, #310015.

10. This completes the wiring modificatons for 51500II F3. When reattaching the back cover, use panel #371067, which contains the appropriate 220V, 50 Hz silk-screened information.

Proctor® Document Addendum

Document: 51500 Telephone Verification Test Set Manual **Addendum No.:** 2

Date of Document: June 1989 **Revision Level:** G

Date of Addendum: Original Date: January 1984; Revised Date: April 1991

Section(s) Affected: 1 & 2

Page(s) Affected: 1, 5, 6, 7

Drawing(s) Affected: None

NOTE

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Proctor & Associates, Inc.
15050 N.E. 36th St.
Redmond, WA 98052-5317

Telephone: 206/881-7000
FAX: 206/885-3282

8 Pages

Addendum Instructions

This addendum contains change pages that contain information unique to the 51500II F2 Telephone Verification Set specially programmed for G.T.E. Remove the corresponding pages in the 51500 Operation & Maintenance Manual and insert the pages attached to this addendum.

1. INTRODUCTION

1.1 General

The 51500 Telephone Verification Set (the "Phone Doctor"®) can be used by non-technical personnel to quickly assess a telephone's operation. The front panel of the unit contains visual indicators which show if a phone passes or fails a test based on the test parameters entered in the 51500 operating program. The unit's front panel also contains a 2 x 16 Liquid Crystal Display (LCD) that provides operator prompts, test results, and other information. The 51500 performs the following telephone checks:

CONTINUITY: Verifies that the tip to ring resistance is between 50 and 400 ohms.

INSULATION SAFETY: Checks for leaking or arcing between the case and any other parts of the telephone.

TRANSMISSION: Measures the ability of the phone to transmit and receive sound.

DIAL: Automatically checks both rotary dial and pushbutton tone dial phones.

RINGER: A multi-mode ring generator (private or multi-party) activates the phone's ringer and applies belltaps. Also checks for leakage between the phone's line connections.

CORD: Checks for continuity and shorts in modular handset cords and in 2-, 4- or 6-wire modular line cords.

1.2 Equipment Description

1.2.1 The 51500 unit contains the main microprocessor-equipped circuit board, an alpha-numeric display, and 'Pass,' 'Fail,' and 'Marginal' lamps to provide diagnostic information to the operator. Figures 1 and 2 show the upper and lower panels as well as the telephone interconnection points on the 51500. (Refer to the 51500 Operator's Guide for operating instructions for the 51500 Telephone Verification Set.)

1.2.2 The 51500 is equipped with the "artificial ear and mouth" (microphone and speaker) used during the TRANSMISSION test. The set also contains modular sockets, a 4-prong socket, and a fixture for attaching modular wall phones for testing.

1.3 Warranty

Proctor and Associates Company warranties its products to be free of defects of material and workmanship for a period of one year from date of shipment. All items for repair under warranty are to be sent transportation prepaid to Redmond, Washington after you have called Proctor and Associates' Customer Service Department and received a Material Return Authorization (MRA). The equipment will be returned 'no charge' providing it has not been misused, installed improperly, altered without authorization, or accidentally damaged.

1.4 51500 Spare Parts

The items listed in Table 1 on Page 2 are available from Proctor as replaceable parts. Refer to the CLD-51500 in the drawings section of this manual for the location of these parts. Also, refer to the Maintenance section of this manual for parts replacement procedures.

1.5 Ordering Information

To order spare parts or additional 51500 Telephone Verification Sets, use the following address and telephone number:

Proctor & Associates Company
15050 N.E. 36th
Redmond, WA 98052
Telephone: 206/881-7000
Telex: 32-8882

Part Name	Part Number
Main Circuit Board	51500-1
Cord Test Card	51500-4
Telephone Input Card	51500-5
Wall Phone Socket Card	51500-7
Pass/Fail Card	51500-8
Operating Program PROM (IC4)	840010
5-Volt Power Supply	460006
15-Volt Power Supply	460007
Acoustical Cup	590025
Case Leakage Cord Socket	240093
0.5A, Slow-blow, MDL Fuse	310016
Case Leakage Verify Cord	500067-05
4-Prong Socket	240163

Table 1. 51500 Spare Parts.

2. SPECIFICATIONS

The following specifications are standard on the 51500F2 unit.

2.1 Electrical

Operating Voltage: 105 to 125 volts ac, 57 to 63 Hz
(European Model): 210 to 250 volts ac, 50 Hz

2.2 Continuity Test

Checks for tip-ring resistance of 50 to 400 ohms for 'Pass'; if 25-50 or 400-800 ohms are measured, a 'Fail/Marginal' indication is given; if tip-ring resistance is from 0 to 25 ohms or over 800 ohms, a 'Fail' indication is given.
Measurement Accuracy: +/-10%

2.3 Insulation Safety

Applies 1000 volts dc or 1500 volts dc (selectable by straps) from tip, ring, and ground connected together to case. Fails test if leakage is greater than 50 microamps ('Fail' 20-microamp parameter is strap-selectable).
Measurement Accuracy: +/-5%

2.4 Ringer

Applies 200 Vdc or 500 Vdc (selectable by straps) to ringer (51500F2 model is strapped at 200 Vdc at factory). Fails test if leakage is greater than 20-microamps.
Measurement Accuracy: +/-5%

The ringer frequencies of the 51500 are listed in Table 2.

Ringer Frequency	Voltage	Ringer Frequency	Voltage
16 Hz	72 Vrms	40 Hz	83 Vrms
16.7 Hz	72 Vrms	42 Hz	83 Vrms
20 Hz	72 Vrms	50 Hz	89 Vrms
25 Hz	78 Vrms	54 Hz	89 Vrms
30 Hz	78 Vrms	60 Hz	94 Vrms
33.3 Hz	89 Vrms	66.7 Hz	94 Vrms

Table 2. Ringer Specifications.

Connection: Tip-ring, tip-ground, or ring-ground.
Test Loop: 51500F2 strapped for 1600 ohms with three parallel ringers.
Ringing Duration: 2 seconds; Frequency Accuracy: +/-2%; Voltage Accuracy: +/-5%
Fifteen belltap pulses are applied to the ringer after the last ringing. (Belltap wave form per EIA specification #S-1286.)

2.5 Transmission

TRANSMIT	504	651	822	1078	1359	1736	2232	2841
'Fail Low'	X	X	X	-36.5dBV	X	X	X	X
'Marginal-Fail Low'	X	X	X	-36.5 to -32dBV	X	X	X	X
'Pass Low'	-40	-40	-38	-32dBV	-34	-34	-35	-36.5
'Pass High'	-10.5	-10.5	-8.5	-8dBV	X	X	-6.5	-8
'Marginal-Fail High'	X	X	X	-8 to -4dBV	X	X	X	X
'Fail High'	X	X	X	-4dBV	X	X	X	X

RECEIVE	504	651	822	1078	1359	1736	2232	2841
'Fail Low'	X	X	X	74dB	X	X	X	X
'Marginal-Fail Low'	X	X	X	75.5 to 74dB	X	X	X	X
'Pass Low'	75.5	75	75	75.5dB	73	72	69.5	68
'Pass High'	101.5	101	100.5	99.5dB	101.5	102	100	99
'Marginal-Fail High'	X	X	X	102 to 99.5dB	X	X	X	X
'Fail High'	X	X	X	102dB	X	X	X	X

X = indicates 'skip'

NOTE: In order to fail Transmit or Receive tests, the phone must be outside the 'Marginal Fail' limits at 1078 Hz.

Table 3. Transmission Specifications.

Transmit Accuracy: +/-2dB at 1078 Hz
+/-5dB at 504 Hz
+/-5dB at 2841 Hz

Receive Accuracy: +/-2dB at 1078 Hz
+/-3dB at 504 Hz
+/-6dB at 2841 Hz

2.6 Rotary Dial

Speed: 8 to 11 PPS for 'Pass,' 7 to 12 PPS for 'Marginal'
Ratio: 58 to 64% for 'Pass,' 56 to 66% for 'Marginal'
Speed Accuracy: +/-0.05 PPS
Ratio Accuracy: +/-0.5% break

2.7 Tone Dial

2.7.1 Low Band

Frequency Limits - 'Pass' within 1.5% off-center
'Marginal' from 1.5% to 2.5% off-center
'Fail' greater than 2.5% off-center

Level Limits

Short Loop (80mA)

'Fail' Low: Less than 0.184 Vrms 'Marginal' Low: 0.184 to 0.232 Vrms
'Pass': 0.232 to 0.816 Vrms 'Marginal' High: 0.816 to 1.024 Vrms
'Fail' High: Greater than 1.024 Vrms

Typical Loop (40mA)

'Fail' Low: Less than 0.256 Vrms 'Marginal' Low: 0.256 to 0.320 Vrms
'Pass': 0.320 to 0.952 Vrms 'Marginal' High: 0.952 to 1.184 Vrms
'Fail' High: Greater than 1.184 Vrms

Long Loop (20mA)

'Fail' Low: Less than 0.320 Vrms 'Marginal' Low: 0.320 to 0.400 Vrms
'Pass': 0.400 to 1.064 Vrms 'Marginal' High: 1.064 to 1.328 Vrms
'Fail' High: Greater than 1.328 Vrms

2.7.2 High Band

Frequency Limits - 'Pass' within 1.5% off-center
'Marginal' from 1.5% to 2.5% off-center
'Fail' Greater than 2.5% off-center

Level Limits

Short Loop (80mA)

'Fail' Low: Less than 0.232 Vrms 'Marginal' Low: 0.232 to 0.288 Vrms
'Pass': 0.288 to 0.982 Vrms 'Marginal' High: 0.982 to 1.232 Vrms
'Fail' High: Greater than 1.232 Vrms

Typical Loop (40mA)

'Fail' Low: Less than 0.320 Vrms 'Marginal' Low: 0.320 to 0.408 Vrms
'Pass': 0.408 to 1.136 Vrms 'Marginal' High: 1.136 to 1.416 Vrms
'Fail' High: Greater than 1.416

Long Loop (20mA)

'Fail' Low: Less than 0.400 Vrms 'Marginal' Low: 0.400 to 0.512 Vrms
'Pass': 0.512 to 1.264 Vrms 'Marginal' High: 1.264 to 1.584 Vrms
'Fail' High: Greater than 1.584 Vrms

2.7.3 Twist

'Fail' Low: Less than -2dB
'Marginal' Low: -2dB to 0dB
'Pass': 0dB to +4dB
'Marginal' High: +4dB to +6dB
'Fail' High: Greater than +6dB

3. INSTALLATION

3.1 General

The 51500 Telephone Verification Set is delivered completely assembled from the factory. The unit is shipped in a container for protection from excessive shocks and vibration. If there is harm to the unit due to parts breakage, water leakage, or other accidental causes during transit, notify the carrier and file a claim for the damage.

3.2 Shipping Kit

The equipment in the 51500 shipping container should include the items listed in Table 4. If any of the items are missing, immediately contact Proctor and Associates at the address and phone number in Paragraph 1.5.

3.3 Equipment Set-Up

3.3.1 Once you've checked the contents and condition of the 51500 shipping package, place the unit on a flat, stable surface which will serve as the work site. Make sure that the 51500 power switch is OFF.

3.3.2 Check that the fuse is in its holder on the lower back panel. Push the PRESS button on the holder, pull the small door open, and remove the fuse. The fuse should be a 0.5-amp size. Reinsert the fuse.

3.3.3 Attach the power cord to the three-pronged jack on the 51500 back panel. Connect the other end to a nearby ac wall outlet. The 51500 is now ready for phone verification.

Description	Proctor P/N	Qty
Telephone Verification Set	51500	1
Power Cord (see Figure 3)	500046	1
*Case Leakage Cord (see Figure 3)	500067-05	1
51500 Operator's Guide	990307	1
51500 Installation & Maintenance Manual	990308	1

*Store this cord for use in Insulation Safety tests. Also note the cord configurations in Figure 3.

Table 4. Contents of Equipment in 51500 Shipping Kit.

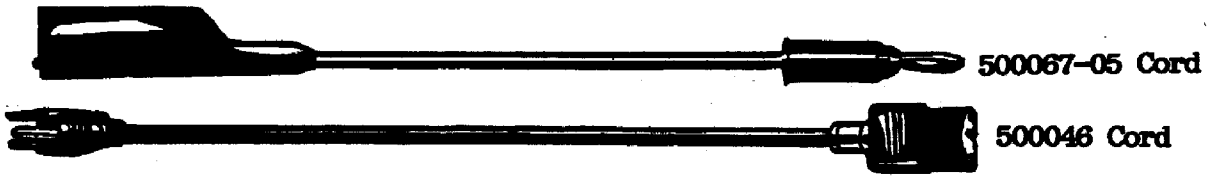

Figure 3. 51500 Power Cord and Case Leakage Test Cord.