



HEWLETT  
PACKARD

# 4937A

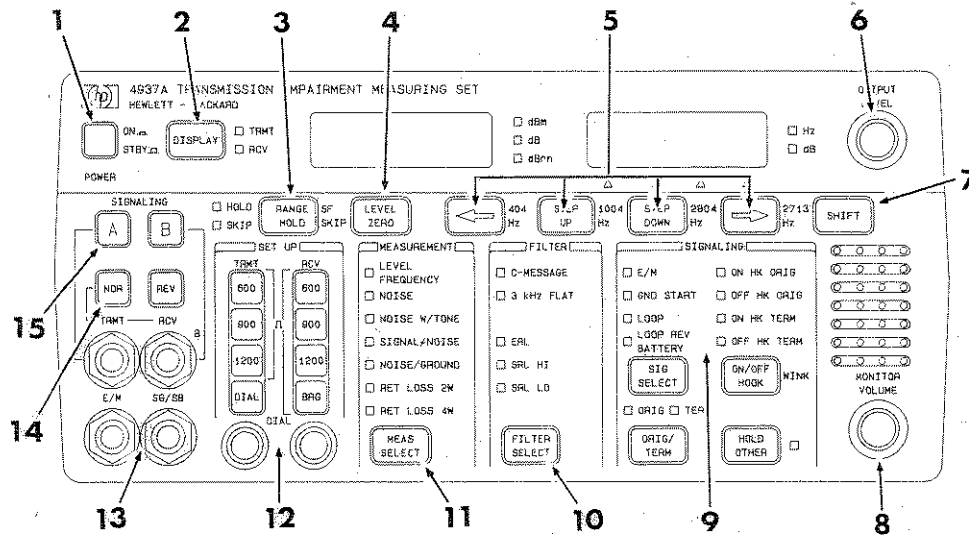
## TRANSMISSION IMPAIRMENT TEST SET



## Quick Reference Guide

04937-90004

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1. **POWER button.** Switches power to instrument when in ON position. In STBY position internal battery pack is charged (option 001 only).
2. **DISPLAY key.** TRMT-RCV. Selects either the transmitted or the received signal to be displayed. Corresponding LED will light.
3. **RANGE HOLD and SF SKIP key.**  
 RANGE HOLD: Prevents the autorange from changing during a measurement within a 15 dB window.  
 SF SKIP: Prevents the transmitter from transmitting within  $\pm 150$  Hz of 2600 Hz.
4. **LEVEL ZERO key.** Sets a 0dB reference in RCV LEVEL FREQUENCY mode. All subsequent measurements will be made in dB relative to this reference.
5. **STEP UP, STEP DOWN, — AND — keys.** In TRMT mode and LEVEL FREQUENCY, — or — selects the position of digit to be increased or decreased. Digit value is incremented by pressing STEP UP and decremented by pressing STEP DOWN. Pressing SHIFT key sets output frequency to 404, 1004, 2804, or 2713 Hz.
6. **OUTPUT LEVEL control.** Adjusts the transmitter output level from -40 to +13 dBm.
7. **SHIFT key.** Used to activate any of the functions labeled in blue.
8. **MONITOR VOLUME control.** Permits adjustable volume for listening to the circuit under test or to the Test Set Transmitter.

9. **SIGNALING keys and indicators.**

SIG SELECT key. Selects the type of signaling required. Lighted LED indicates type selected.

ORIG/TERM key. Selects which end of the trunk to be simulated for a given signaling type.

ON/OFF HOOK key. Controls the on-hook and off-hook states of the end of the trunk being simulated.

HOLD OTHER key. Puts a hold coil on the jack not being used for signaling. Hold coil will be placed on the "A" jack if the B signaling key is pressed.

STATUS LEDs. The four status LEDs indicate the on-hook states for each end of the line under test.

10. **FILTER SELECT key.** Selects desired weighting filter for noise measurements and the type of return loss for return loss measurements.

11. **MEAS SELECT key.** Selects measurements to be made. Lighted LED indicates selected measurement.

12. **SET UP switches and DIAL binding posts.**

TRMT: 600 $\Omega$ , 900 $\Omega$ , 1200 $\Omega$ : Provides terminating impedance to match the lines' characteristic impedance. (150 $\Omega$ , 600 $\Omega$ , 1200 $\Omega$  option 002).

DIAL switch: Connects handset to line and disables transmitter.

RCV: 600 $\Omega$ , 900 $\Omega$ , 1200 $\Omega$ : Provides termination impedance to match the lines' characteristic impedance (150 $\Omega$ , 600 $\Omega$ , 1200 $\Omega$  option 002).

BRG: Connects the RCV-TRMT 310 jack through high impedance when the 4937A bridges the circuit under test instead of terminating the line.

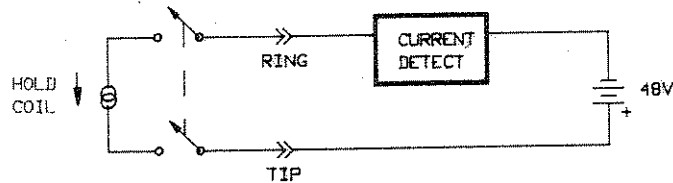
DIAL jacks: Handset can be connected to binding posts to access a line through the 310 jacks.

13. **E/M and SG/SB jacks.** These jacks are used to provide supervisory signaling for E/M signaling types I, II, and III.

14. **NOR and REV switches.** NOR switch depressed connects the left 310 jack to the transmitter and the right 310 jack to the receiver. REV switch depressed exchanges these connections.

15. **A and B switches.** "A" switch depressed connects the left 310 jack to the signaling circuitry and the right 310 jack to the hold coil ("hold other"). "B" switch depressed exchanges these connections.

# LOOP SIGNALING



## ORIGINATE (Drop)

### Seizing The Line

1. Connect the line under test to either 310-jack A or B and select signaling for that line.
2. Using SIG SELECT key select Loop Signaling.
3. Using ORIG/TERM key select ORIG.
4. To seize line press ON/OFF HOOK key.
5. Verify the following LEDs:
  - ON HK ORIG - off
  - OFF HK ORIG - lighted
6. The line is seized. You can now
  - Establish Talk Condition
  - Perform transmission measurements
  - Release the line

### Establishing Talk Condition

1. Seize the line as described above.
2. Connect handset to DIAL jacks.
3. Press DIAL key. OFF HK ORIG LED should light.
4. The line is now ready to accept dial pulses, tones, or voice.
5. To perform transmission measurements, release DIAL key.

### Releasing The Line

1. Press ON/OFF HOOK key and verify LEDs:
  - ON HK ORIG - lighted
  - OFF HK ORIG - off
2. Pressing the ON/OFF HOOK key again will re-seize the line.

## TERMINATE (Line)

### Seizing The Line

1. Connect the line under test to either 310-jack A or B and select signaling for that line.
2. Using SIG SELECT key select Loop Signaling.
3. Using Orig/TERM key select TERM.
4. Office battery is now provided on the line.
5. The status LEDs indicate the condition of the far (originate) end of the line. When the originate end goes off hook, you may proceed to one of the following:
  - Establish Talk Condition
  - Perform transmission measurements
  - Release the line

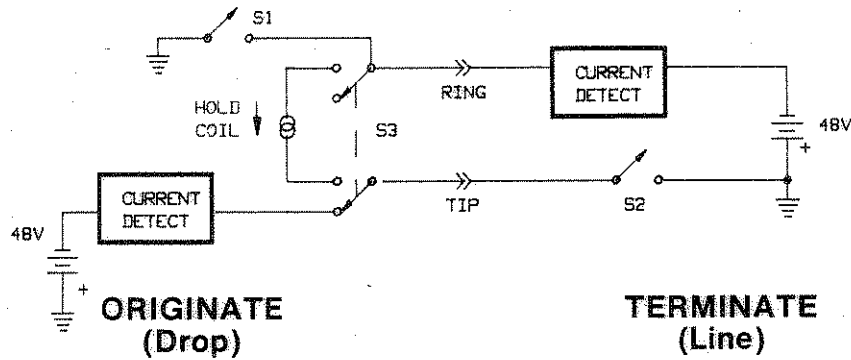
### Establishing Talk Condition

1. Seize the line as described above.
2. Connect handset to DIAL jacks.
3. Press DIAL key. Talk battery will be provided by HP 4937A.
4. The line is now ready to accept tones or voice.
5. To perform transmission measurements, release DIAL key.

### Releasing The Line

1. Loop Start Terminate always provides office battery. To remove battery, use SIG SELECT key to turn off signaling.

# GROUND START SIGNALING



## Seizing The Line

1. Connect the line under test to either 310-jack A or B and select signaling for that line.
2. Using SIG SELECT key select Ground Start Signaling.
3. Using ORIG/TERM key select ORIG.
4. To seize line press ON/OFF HOOK key.
5. Verify the following LEDs:
  - ON HK ORIG - off
  - OFF HK ORIG - lighted
  - ON HK TERM - off
  - OFF HK TERM - lighted
6. The line is seized. You can now
  - Establish Talk Condition
  - Perform transmission measurements
  - Release the line

## Establishing Talk Condition

1. Seize the line as described above.
2. Connect handset to DIAL jacks.
3. Press DIAL key. OFF HK ORIG LED should light.
4. When the terminate end responds by going off-hook, the line is ready to accept dial pulses, tones, or voice.
5. To perform transmission measurements, release DIAL key.

## Releasing The Line

1. Press ON/OFF HOOK key and verify that status LEDs go to the on-hook state.
2. Pressing ON/OFF HOOK key again will re-seize the line.

## Seizing The Line

1. Connect the line under test to either 310-jack A or B and select signaling for that line.
2. Using SIG SELECT key select Ground Start Signaling.
3. Using ORIG/TERM key select TERM.
4. To seize line press ON/OFF HOOK key.
5. Verify the following LEDs:
  - ON HK ORIG - off
  - OFF HK ORIG - lighted
  - ON HK TERM - off
  - OFF HK TERM - lighted
6. The line is seized. You can now
  - Establish Talk Condition
  - Perform transmission measurements
  - Release the line

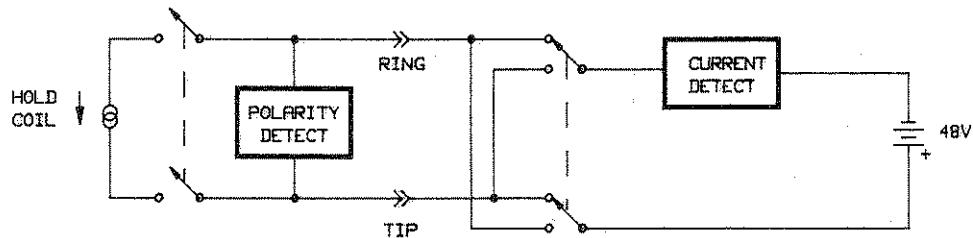
## Establishing Talk Condition

1. Seize the line as described above.
2. Connect handset to DIAL jacks.
3. Press DIAL key. OFF HK TERM LED should light.
4. When the originate end responds by going off-hook, the line is ready to accept tones or voice.
5. To perform transmission measurements, release DIAL key.

## Releasing The Line

1. Press ON/HOOK key and verify that status LEDs go to on-hook state.
2. Pressing ON/OFF HOOK key again will re-seize the line.

# LOOP REVERSE BATTERY SIGNALING



## ORIGINATE (Line)

### Seizing The Line

1. Connect the line under test to either 310-jack A or B and Select signaling for that line.
2. Using SIG SELECT key select Loop Reverse Battery Signaling.
3. Using ORIG/TERM key select ORIG.
4. To seize line press ON/OFF HOOK key.
5. Verify the following LEDs:
  - ON HK ORIG - off
  - OFF HK ORIG - lighted
  - ON HK TERM - off
  - OFF HK TERM - lighted
6. The line is seized. You can now
  - Establish Talk Condition
  - Perform transmission measurements
  - Release the line

### Establishing Talk Condition

1. Seize the line as described above.
2. Connect handset to DIAL jacks.
3. Press DIAL key. OFF HK ORIG LED should light.
4. When the terminate end responds by going off-hook, the line is ready to accept dial pulses, tones, or voice.
5. To perform transmission measurements, release DIAL key.

### Releasing The Line

1. Press ON/OFF HOOK key and verify that status LEDs go to on-hook state.
2. Pressing the ON/OFF HOOK key again will re-seize the line.

## TERMINATE (Drop)

### Seizing The Line

1. Connect the line under test to either 310-jack A or B and select signaling for that line.
2. Using SIG SELECT key select Loop Reverse Battery Signaling.
3. Using ORIG/TERM key select TERM.
4. To seize line press ON/OFF HOOK key.
5. Verify the following LEDs:
  - ON HK ORIG - off
  - OFF HK ORIG - lighted
  - ON HK TERM - off
  - OFF HK TERM - lighted
6. The line is seized. You can now
  - Establish Talk Condition
  - Perform transmission measurements
  - Release the line

### Establishing Talk Condition

1. Seize the line as described above.
2. Connect handset to DIAL jacks.
3. Press DIAL key. OFF HK TERM LED should light.
4. When the originate end responds by going off-hook, the line is ready to accept tones or voice.
5. To perform transmission measurements, release DIAL key.

### Releasing The Line

1. Press ON/OFF HOOK key and verify that status LEDs go to on-hook state.
2. Pressing ON/OFF HOOK key again will re-seize the line.

# E/M SIGNALING

## ORIGINATE

### Seizing The Line

1. Connect the line to 310-jack A or B.
2. Connect E/M leads (for types II and III connect SG/SB also).
3. Set rear panel toggle switch to E/M type desired. This switch must be set before E/M signaling is selected.
4. Using SIG SELECT key select E/M.
5. Using ORIG/TERM key select ORIG.
6. To seize line press ON/OFF HOOK key.
7. Verify the following LEDs:
  - ON HK ORIG - off
  - OFF HK ORIG - lighted
  - ON HK TERM - off
  - OFF HK TERM - lighted
8. The line is seized. You can now
  - Establish Talk Condition
  - Perform transmission measurements
  - Release the line

### Establishing Talk Condition

1. Seize the line as described above.
2. Connect handset to DIAL jacks.
3. Select signaling key A or B corresponding to the 310-jack in use.
4. Press DIAL key. 4937A will provide talk battery and couple handset to line. Dial pulses will be sent over E/M leads.
5. To perform transmission measurements, release DIAL key.

### Releasing The Line

1. Press ON/OFF HOOK key and verify that status LEDs go to on-hook state.
2. Pressing ON/OFF HOOK key again will re-seize the line.

## TERMINATE

### Seizing The Line

1. Connect the line to 310-jack A or B.
2. Connect E/M leads (for types II and III connect SG/SB also).
3. Set rear panel toggle switch to E/M type desired. This switch must be set before E/M signaling is selected.
4. Using SIG SELECT key select E/M.
5. Using ORIG/TERM key select TERM.
6. To seize line press ON/OFF HOOK key.
7. Verify the following LEDs:
  - ON HK ORIG - off
  - OFF HK ORIG - lighted
  - ON HK TERM - off
  - OFF HK TERM - lighted
8. The line is seized. You can now
  - Establish Talk Condition
  - Perform transmission measurements
  - Release the line

### Establishing Talk Condition

1. Seize the line as described above.
2. Connect handset to DIAL jacks.
3. Select signaling key A or B corresponding to the 310-jack in use.
4. Press DIAL key. 4937A will provide talk battery and couple handset to line. Dial pulses will be sent over E/M leads.
5. To perform transmission measurements, release DIAL key.

### Releasing The Line

1. Press ON/OFF HOOK key and verify that status LEDs go to on-hook state.
2. Pressing ON/OFF HOOK key again will re-seize the line.

# TRANSMISSION IMPAIRMENT MEASUREMENTS

## OPERATING ERRORS

- E-01** Indicates that the receive level is greater than the upper limit for the selected measurement.
- E-02** Indicates that the receive level is less than the lower limit for the selected measurement.
- E-07** Indicates loss of the 1004 Hz hold tone.
- E-09** The level measurement currently being made needs to auto-range and the Range Hold is set.
- E-10** An illegal return loss impedance has been selected.
- E-30** Illegal setup for wink signaling must be on-hook and in any signaling mode except loop start or loop reverse battery originate.
- E-31** Indicates office battery is reversed (only displays momentarily when Loop Originate signaling is entered).

## SET UP

### Normal-Reverse

1. Press the NOR button in to connect the left 310-jack to the transmitter and the right 310-jack to the receiver.
2. Press the REV button in to reverse the jacks.

### A-B

1. Press the A button to place signaling on the left 310-jack, or press B to select the 310-jack.

### Impedance

1. Press correct TRMT impedance button.
2. Press correct RCV impedance button. For bridged received mode press BRG button also.

### Dial

Dial button is used in conjunction with signaling. See specific signaling mode.

## MEASUREMENTS

**Note:** If signaling is in use, the line must be seized before any measurements can be made.

### Level and Frequency

1. Use MEAS SELECT key to select LEVEL FREQUENCY.

### To Transmit

1. Press DISPLAY key to select TRMT.
2. Turn OUTPUT LEVEL knob to adjust transmitter level (left display).
3. To change frequency, press — or — keys to move cursor. Press STEP UP or STEP DOWN keys to change digit.
4. Press SHIFT then SF SKIP to prevent transmitting 2600 Hz  $\pm$  150 Hz.

### To Receive

1. Press DISPLAY key to display RCV level. (level is in left display, frequency is in right display).
2. Press LEVEL ZERO key to make relative level measurements in dB. Pressing LEVEL ZERO a second time reverts to absolute level in dBm.

### Noise

1. Press MEAS SELECT key to select NOISE.
2. Press DISPLAY key to select RCV.
3. Press FILTER SELECT key to select noise filter.

### Noise with Tone

1. Adjust transmit level of 1004 Hz tone with OUTPUT LEVEL knob.
2. Follow general NOISE procedure.

### Signal to Noise Ratio

1. Adjust transmit level of 1004 Hz tone with OUTPUT LEVEL knob.
2. Press DISPLAY key to select RCV. Receive level is in left display and S/N ratio is in right display.

### Noise to Ground

1. Connect CHASSIS GROUND on rear panel to a known good ground and follow general noise procedure.



## RETURN LOSS

### Return Loss 2-Wire

1. Press MEAS SELECT key to select RET LOSS 2W.
2. Press FILTER SELECT key to select one of the following:
  - ERL (echo return loss - middle band)
  - SRL HI (singing return loss - upper band)
  - SRL LO (singing return loss - lower band)
3. Connect the line under test to the A 310-jack and press NOR key.
4. Select TRMT and RCV impedance.
5. Press DISPLAY key to select TRMT mode.

#### Note

The 4937A must be in the transmit mode before adjusting the output level.

6. Using OUTPUT LEVEL control adjust the transmit level to desired level.
7. Press DISPLAY key to select RCV and view results.
8. Using FILTER SELECT key select the remaining tests as listed in step 2.

### Return Loss 4-Wire

1. Press MEAS SELECT key to select RET LOSS 4W.
2. Press FILTER SELECT key to select one of the following:
  - ERL (echo return loss - middle band)
  - SRL HI (singing return loss - upper band)
  - SRL LO (singing return loss - lower band)
3. Connect the 4-wire circuit to the transmit and receive jacks.
4. Select TRMT and RCV impedance.
5. Press DISPLAY key to select TRMT mode.

#### Note

The 4937A must be in the transmit mode before adjusting the output level.

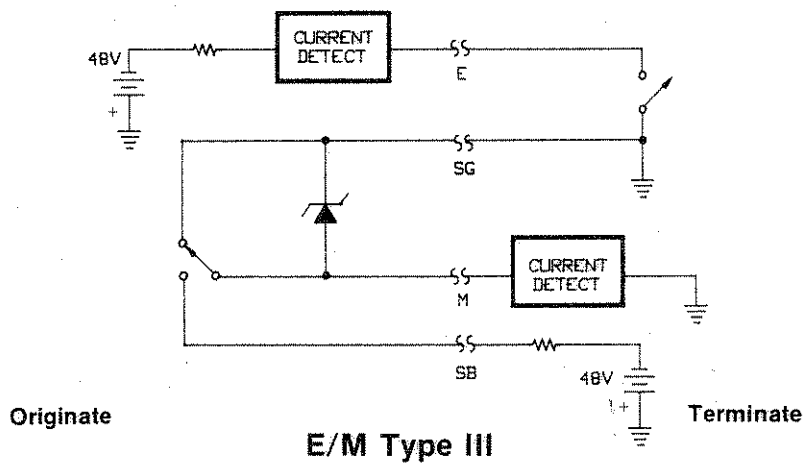
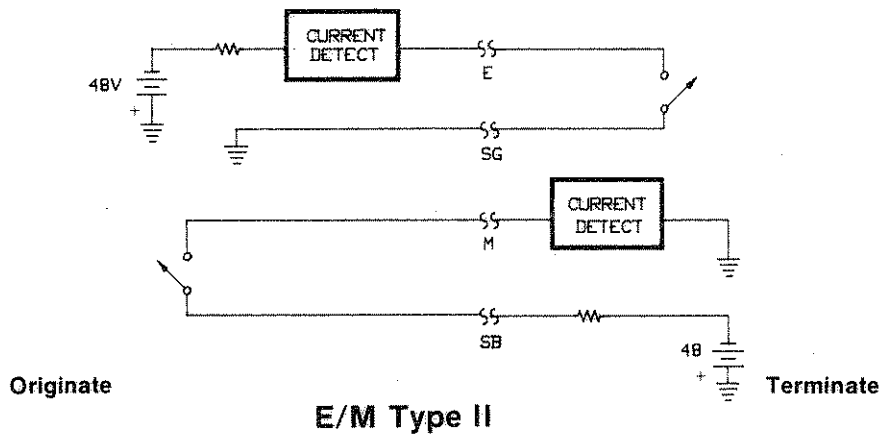
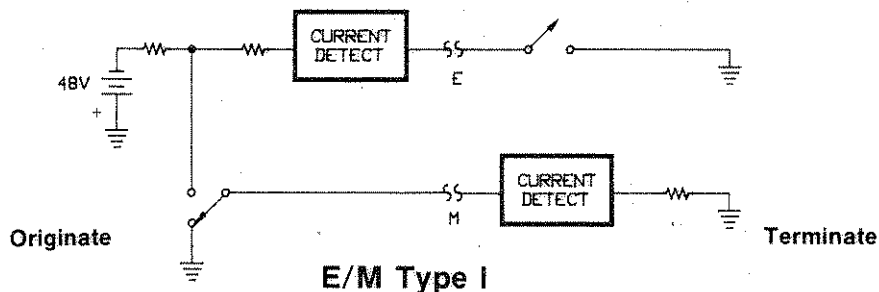
6. Using OUTPUT LEVEL control adjust the transmit level to desired level.
7. Press DISPLAY key to select RCV mode.
8. Enter the transhybrid loss correction factor using the STEP UP, STEP DOWN and arrow keys.

#### Note

If the transhybrid loss factor is not known, perform steps 9 through 13. The 4937A will measure the value.

9. Short the 2-wire side of the hybrid.
10. Press LEVEL ZERO key to measure the loss. It will be shown in the right display.
11. Disconnect the short on the 2-wire side of the hybrid.
12. Return loss is shown in the left display.
13. Using FILTER SELECT key select the remaining tests as listed in step 2.

# E/M CIRCUIT DIAGRAMS



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**E/M CIRCUIT  
DIAGRAMS**