# SECTION IV
# PERFORMANCE TESTS

## 4-1. INTRODUCTION.

4-2. This section provides the check procedures to verify the 4262A specifications listed in Table 1-1. All tests can be performed without access to the interior of the instrument. A simpler operational test is presented in Section III under Self Test (paragraph 3-5). The performance test procedures in this section can also be used to do an incoming inspection of the instrument and to verify whether the instrument meets its specified performance after troubleshooting or making adjustments. If specifications are found to be out of limits, check that controls are properly set, and then proceed to adjustments or troubleshooting.

Note

Allow a 15-minute warm-up and stabilization period before conducting any performance test.

## 4-3. EQUIPMENT REQUIRED.

4-4. Equipment required for the performance tests is listed in Table 1-4 Recommended Test Equipment in Section I. Any equipment whose characteristics equal the critical specifications given in the table may be substituted for the recommended model(s).

Accuracy checks in this section use standard LCR components as the samples to be connected to the 4262A. Accessories 16361A and 16362A can be utilized for this purpose. These accessory models are DUT (device under test) boxes from which the desired component can be selected and connected to the 4262A through cables by use of a rotary switch. If models 16361A/16362A are unavailable, use the discrete components recommended in Table 4-1.

Note

All components used as standards should be calibrated by an instrument whose specifications are traceable to NBS, PTB, LNE, NRC, JEMIC, or equivalent standards group; or all components should be calibrated directly by an authorized calibration organization such as NBS. The calibration cycle should be determined by the stability specification for each component.

## 4-5. TEST RECORD.

4-6. Results of the performance tests may be tabulated on the Test Record at the end of these procedures. The Test Record lists all the tested specifications and their acceptable limits. Test results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting and after repairs or adjustments.

## 4-7. CALIBRATION CYCLE.

4-8. This instrument requires periodic verification of performance. Depending on the use and environmental conditions, the instrument should be checked with the following performance tests at least once every year. To maximize the "up time" of the instrument, the recommended preventive maintenance frequency for the 4262A is twice a year.

## PRELIMINARY OPERATIONS

Before beginning performance test, adjustment, or calibration of 4262A, check fundamental operating conditions of the instrument and perform display ZERO adjustments in accord with the following procedures:

1) Confirm that power line power voltage in use is appropriate for the instrument operating power voltage.

2) Depress LINE pushbutton and confirm that all the front panel displays and indicators momentarily illuminate. The 4262A functions are automatically set to capacitance measurement mode.

3) ZERO offset adjustment should be made whenever a test fixture or DUT box is connected to 4262A UNKNOWN terminals. Adjust C ZERO ADJ and L ZERO ADJ controls so as to fully compensate for stray capacitance and residual inductance of equipment connected to UNKNOWN terminals. Adjustment procedures to adjust for individual test equipment used are provided in steps 3-a and 3-b which follow.

   3-a) 16361A/16362A or user built DUT box.

   1. Disconnect shorting bars from 4262A UNKNOWN terminals. Connect test leads between 4262A UNKNOWN terminals and DUT box.

   2. Set 4262A FUNCTION to C. Set TEST SIGNAL frequency as appropriate to DUT box being used.

   3. Set range control of DUT box to open-circuit position (2pF range on 16361A or 1pF range on 16362A). The 4262A is automatically set to its lowest capacitance measurement mode range.

   4. Adjust C ZERO ADJ control so that capacitance readout on 4262A LCR display is identical to calibrated value of DUT box range.

   5. Set 4262A FUNCTION to L.

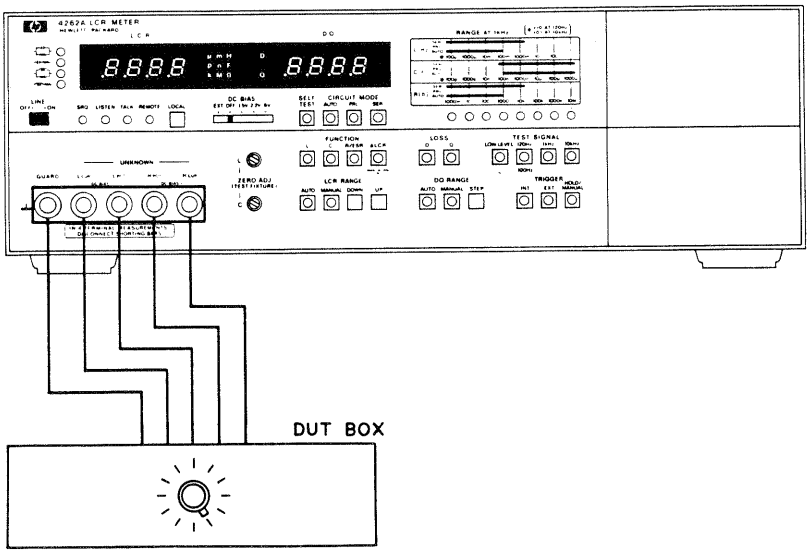
   6. Set range control of DUT box to short-circuit position (20mΩ range on 16361A or on 16362A).

   7. Adjust L ZERO ADJ control for 000 counts on LCR display.

Note

To permit easy adjustment of ZERO ADJ controls for an individual DUT box, each DUT box should be equipped with short and open circuit ranges which provide 0μH and 0pF (practical values), respectively.

## PRELIMINARY OPERATIONS




3-b) 16061A or other test fixtures.

1. Disconnect shorting bars from 4262A UNKNOWN terminals and attach test fixture to UNKNOWN.

2. No DUT should be connected to the test fixture.

3. The 4262A is automatically set to lowest capacitance range in measurement mode. Set 4262A TEST SIGNAL frequency to 10kHz.

4. Adjust C ZERO ADJ control for 000 counts on LCR display.

5. Set 4262A FUNCTION to L.

6. Connect a shorting lead to test fixture to short-circuit the measurement terminals.

7. Adjust L ZERO ADJ control for 000 counts on LCR display.

Note

When positions or mutual distance between Test Fixture contacts are changed, or contacts are changed to a different type, again perform ZERO adjustments.

## CALIBRATION OF DUT'S

Either user built DUT's or substitution standards with accuracies which satisfy the requirements may be used for performance testing and calibration of the 4262A. The DUT's recommended for making the tests and adjustments can be accuracy certified in accord with the calibration procedure detailed below. This calibration procedure applies to all alternate DUT's which do not carry public or testing laboratory certification.

### [CAPACITANCE CALIBRATION]

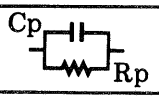
Measure the DUT or substitution standard capacity with a precision capacitance bridge that meets the calibration accuracy and frequency requirements. For testing or calibrating dissipation factor of DUT, use equipment with required dissipation measuring capability and verify the exact calibration frequency to permit compensating D value for the difference in measuring frequency between individual Model 4262A's and the calibration equipment. If the frequency error is less than 3%, compensation is not required for dissipation factors of 0.01 and below.

### [RESISTANCE CALIBRATION]

Use a metal film resistor of appropriate value for each DUT to maintain a constant resistance over a wide range of frequencies. Measure the resistance with a high accuracy DMM. When measuring 1kΩ and below, use a 4 terminal measurement configuration.

### [DISSIPATION FACTOR CALIBRATION]

DUT's used as D standards can be built with precisely measured components. The dissipation factor of the DUT is determined by an exact calculation from the calibrated values of each components in accord with the following equations:

| Circuit Mode | Derivation of D |
|---|---|
|   | $D = 1/\omega CpRp$ |
|   | $D = \omega CsRs$ |

Note

For easier calibration of dissipation, use accurately calibrated resistors rather than capacitors.

## CALIBRATION OF DUT'S

To minimize the calculation error, the inherent dissipation of the capacitor should be 0.001 or below. When using polystyrene or silvered mica type capacitors (dissipation factor is generally very low), the residual factors will not affect the derivation of accurate dissipation factors. If dissipation of capacitor alone is greater than 0.001, the effective value of the DUT is calculated in accord with the following equation:

$$Ds = Dc + Dr \qquad (Dr \ll Dc, Dr < 0.01)$$

where, Ds is actual dissipation factor of DUT.
Dc is calculated D value (excludes inherent dissipation).
Dr is inherent dissipation of capacitor.

Compensate the dissipation factor for the measuring frequencies of individual 4262A being tested or calibrated. Convert the D value of the calibration frequency to that of the actual 4262A measuring frequency in accord with the following equations:

| | | | |
|---|---|---|---|
| $Dm = X \cdot Ds$ |  | $x = \frac{fc}{fm}$ | Dm: D value at 4262A measuring frequency.<br>Ds: D value at calibration frequency.<br>fm: 4262A measuring frequency<br>fc: Calibration frequency. |
| |  | $x = \frac{fm}{fc}$ | |

Note

To accurately measure frequencies fm and fc, use a reciprocal counter or calculate reciprocal number of period.

[CALIBRATION EQUIPMENT]

The recommended model and required performance of calibration equipment is listed below:

| Instrument | Required Performance | Recommended Model |
|---|---|---|
| Capacitance Bridge | Capacitance Accuracy: 0.1%<br>Dissipation Factor Accuracy: 0.1% (Resolution 0.0001) | GR 1620-A |
| DMM | Resistance Accuracy: 0.02% | HP 3490A<br>HP 3455A |
| Freq. Counter | Reciprocal counter<br>Resolution: 0.01Hz | HP 5300A/5307A<br>HP 5323A |

Table 4-1. Recommended Components for Accuracy Checks.

| Component *1 | | HP Part Number | Alternate Source | Required Calibration Accuracy |
|---|---|---|---|---|
| Capacitor | 100pF | 0160-0336 | HP Model 4440B<br>GR Type 1413 | 0.05% |
| | 1000pF | 0160-3766 | | |
| | 10nF | 0160-0408 | | |
| | 100nF | 0160-1571 | | |
| | 1000nF | 0160-3645 | | |
| | 10μF | 0160-3563 | SOSHIN TM-520C | |
| | 1000μF | ——— | GR Type 1417 | 0.2% |
| | 10mF | ——— | | 0.25% |
| Resistor: | 1kΩ | 0698-3491 | GR Type 1433-Y | 0.05% |
| | 10kΩ | 0698-6360 | | |
| | 100kΩ | 0698-4158 | | |
| | 10MΩ | 0698-8194 | | |
| Inductor: | 100mH | ——— | GR Type 1482-L | 0.05% |
| Dissipation Factor: | | | | **2 |
| 1000nF in parallel with 887Ω | | 0160-3645 | (D=1/ωCR) | Capacitors . . . 0.1%<br>Resistors . . . 0.02% |
| (D≈1.50 at 120Hz) | | 0698-4464 | | |
| 100nF in parallel with 887Ω | | 0160-1571 | | |
| (D≈1.79 at 1kHz) | | 0698-4464 | | |
| 10nF in parallel with 887Ω | | 0160-3171 | | |
| (D≈1.79 at 10kHz) | | 0698-4464 | | |

*1 The components listed above or used as standards should be calibrated before they are utilized.

**2 For easier calibration of dissipation to the required accuracy (0.1%), use accurately calibrated resistors rather than capacitors (use a high accuracy DMM to measure resistors).

Proper method and procedure for calibrating the DUT's is given in "Calibration of DUT's" (Page 4-4).

## 4-9. MEASUREMENT FREQUENCY TEST.

DESCRIPTION:

This test verifies the accuracy of the measurement frequencies that are applied to an unknown sample connected to the 4262A.

SPECIFICATIONS:

Measurement Frequencies: 120Hz ± 3%
1kHz ± 3%
10kHz ± 3%

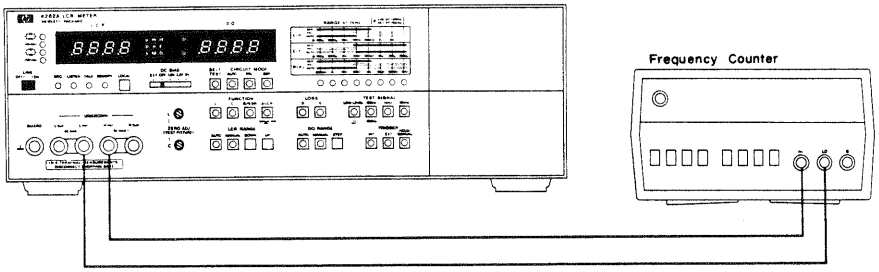



Figure 4-1. Measurement Frequency Test Setup.

EQUIPMENT:

Frequency Counter . . . . . .HP 5300A/w 5306A

PROCEDURE:

1. Connect frequency counter to the 4262A UNKNOWN terminals as shown in Figure 4-1.

2. Set range of frequency counter as appropriate for measuring 4262A test frequencies of 120Hz, 1kHz and 10kHz.

3. Read display output of frequency counter when 4262A TEST SIGNAL is set to 120Hz, 1kHz or 10kHz.

4. Frequency readouts must be within the following limits (record measured frequency in table below as the data is used in paragraph 4-12):

| TEST SIGNAL | Test Limits | Counter Readout |
|---|---|---|
| 120Hz | 116.4 - 123.6Hz | |
| 1kHz | 970 - 1030 Hz | |
| 10kHz | 9700 - 10300 Hz | |

Note

Test limits in table above do not take into account reading error caused by measurement error in test equipment.

Note

If this test fails, refer to Service Sheet 11 in Section VIII for troubleshooting.

## 4-10. CAPACITANCE ACCURACY TEST.

DESCRIPTION:

This test checks capacitance measurement accuracy for zero and full scale displays at three test frequencies and at two signal levels. The test is made by connecting a stable capacitor more accurate than the 4262A to the instrument and reading the display to verify that the 4262A meets its measurement accuracy specifications. Check all ranges in Cp mode and one range in Cs mode at each frequency (120Hz, 1kHz and 10kHz) to guarantee C measurement accuracy since all variable elements (range resistors and detecting phases) needed for C measurement are thus checked. In this test, almost all ranges, from the lowest through the highest ranges, are being verified.

Note

If the following tests satisfy the accuracy specifications, all the accuracy specifications listed in Table 1-1 are guaranteed.

Capacitance Accuracy Test Ranges

| TEST SIGNAL | | CIRCUIT MODE | RANGE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Freq. | Level | | 10.00pF | 100.0pF | 1000pF | 10.00nF | 100.0nF | 1000nF | 10.00μF |
| 120Hz | LOW LEVEL | PRL | X | X | | | | | |
| | normal | PRL | X | X | | | | | |
| | | SER | X | X | X | X | X | | |
| 1kHz | LOW LEVEL | PRL | X | | | | | | X |
| | normal | PRL | X | | | | | | X |
| | | SER | X | X | X | X | | | |
| 10kHz | LOW LEVEL | PRL | | | | | | X | X |
| | normal | PRL | | | | | | X | X |
| | | SER | X | X | X | | | | |

TEST SIGNAL level:

LOW LEVEL . . . . . .50mV
normal . . . . . 1V

Tests for dissipation factor accuracy with above capacitance standards should be done at the same time as capacitance tests

Check all parallel (PRL) mode ranges. It is sufficient to check any one range in series (SER) mode.

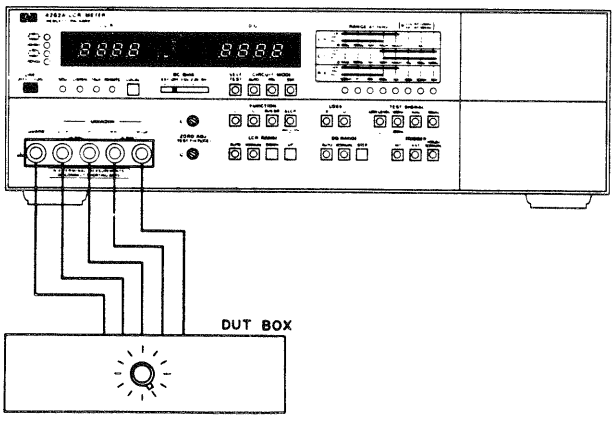



Figure 4-2. Capacitance Accuracy Test Setup.

## PERFORMANCE TESTS

SPECIFICATIONS:

C-D/Q MEASUREMENT ACCURACIES.

| Range | 120Hz / 1kHz / 1kHz / 10kHz | 1000pF / 100.0pF / 10.00pF | 10.00nF / 1000pF / 100.0pF | 100.0nF / 10.00nF / 1000pF | 1000nF / 100.0nF / 10.00nF | 10.00μF / 1000nF / 100.0nF | 100.0μF / 10.00μF / 1000nF | 1000μF / 100.0μF / 10.00μF | 10.00mF / 1000μF / 100.0μF |
|---|---|---|---|---|---|---|---|---|---|
| C Accuracy*1 | | 0.2% + 1 count (Test signal level: 1V) | | | | | | | |
| | | 0.5% + 3 counts | 0.3% + 2 counts (Test signal level: 50mV) | | | | | | |
| | | (At 120Hz, 1kHz) | 0.3% + 2 counts | | | | 0.5% + 2 counts | 1% + *2 2 counts | |
| | | (At 10kHz) | 0.3% + 2 counts | | | | 1% + 2 | 5% + 2 | |
| | AUTO | Same as Mode | | | | Same as Mode | | | |
| D (1/Q) Accuracy*1 | | 0.2% + (2 + 200/Cx) counts (At 120Hz, 1kHz (Test signal level: 1V) At 10kHz | | | | | | | |
| | | 0.5% + (2 + 200/x) counts | | | | | | | |
| | | 0.3% + (2 + 1000/Cx) counts (At 120Hz, 1kHz (Test signal level: 50mV) At 10kHz | | | | | | | |
| | | 1.0% + (2 + 1000/Cx) counts | | | | | | | |
| | | (At 120Hz, 1kHz) | 0.3% + (2 + Cx/500) counts | | | | | 1% + (5 + Cx/500) | |
| | | (At 10kHz) | 0.5% + (2 + 200/Lx) counts | | | | 1% + (5 + Cx/500) | 5% + (5 + Cx/500) | |
| | AUTO | Same as Mode | | | | Same as Mode | | | |

*1 ±(% of reading + counts). Cx is capacitance readout in counts. This accuracy only applies for D values to 1.999.
*2 (5% +2 counts) at 1kHz.

Accuracy applies over a temperature range of 23°C ±5°C (at 0°C to 55°C, error doubles).

EQUIPMENT:

DUT Box..... HP 16361A/16362A
Test Leads.....HP P/N 16361-61605

Note

User built test fixture or DUT box may be used instead of those HP provides. If user supplied, the residual impedance and stray capacitance of the fixture and box must be taken into account.

PROCEDURE:

1. Connect Test Leads (HP P/N 16361-61605) between 4262A UNKNOWN terminals and HP 16361A DUT Box (see Figure 4-2). When TEST SIGNAL frequency is 10kHz, use HP 16362A in place of HP 16361A.

2. Set 4262A controls as follows:

DC BIAS.....OFF
FUNCTION..... C
LCR RANGE ..... AUTO
LOSS..... D
D/Q RANGE..... AUTO
TRIGGER..... INT

3. Confirm that the table on page 4-11 is satisfied when the measurements are made by changing TEST SIGNAL, CIRCUIT MODE and DUT as given in the table. Record capacitance and dissipation factor readings in blank spaces provided in table.

Note

Error caused by stability of standard component is not taken into account for test limits in the table.

Test limits in parentheses are those for dissipation factor measurement value.

If tests fail, proceed to Section V ADJUSTMENTS or Section VIII SERVICE.

## PERFORMANCE TESTS

| TEST SIGNAL | | CIRCUIT | 16361A/16362A RANGE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. | level | MODE | 10pF*1 | 100pF | 1000pF | 10nF | 100nF | 1000nF | 10μF | 100μF | 1000μF | 10mF |
| 120Hz | LOW LEVEL | PRL | | C. V. ±4 counts (———) | C. V. ±8 counts (———) | C. V. ±5 counts (±3 counts) | C. V. ±5 counts (±3 counts) | C. V. ±5 counts (±3 counts) | C. V. ±5 counts (±3 counts) | | | |
| | normal | PRL | | C. V. ±2 counts (±4 counts) | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | | | |
| | | SER | | | | | | C. V. ±5 counts (±4 counts) | C. V. ±5 counts (±4 counts) | C. V. ±5 counts (±4 counts) | C. V. ±7 counts (±4 counts) | C. V. ±12 counts (±7 counts) |
| 1kHz | LOW LEVEL | PRL | | C. V. ±8 counts (———) | C. V. ±5 counts (±3 counts) | C. V. ±5 counts (±3 counts) | C. V. ±5 counts (±3 counts) | C. V. ±5 counts (±3 counts) | | | | |
| | normal | PRL | | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | | | | |
| | | SER | | | | | C. V. ±5 counts (±4 counts) | C. V. ±5 counts (±4 counts) | C. V. ±5 counts (±4 counts) | C. V. ±7 counts (±4 counts) | C. V. ±52 counts (±7 counts) | |
| 10kHz | LOW LEVEL | PRL | C. V. ±8 counts (———) | C. V. ±5 counts (±4 counts) | C. V. ±5 counts (±3 counts) | C. V. ±5 counts (±3 counts) | C. V. ±5 counts (±3 counts) | | | | | |
| | normal | PRL | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | C. V. ±3 counts (±3 counts) | | | | | |
| | | SER | | | | C. V. ±5 counts (±4 counts) | C. V. ±5 counts (±4 counts) | C. V. ±5 counts (±4 counts) | C. V. ±12 counts (±7 counts) | C. V. ±52 counts (±7 counts) | | |

TEST SIGNAL level: LOW LEVEL . . . . . .50mV
normal . . . . . 1V

*1 HP 16362A Only
**2 C. V. = Calibrated Value of Standard Component.

## 4-11. RESISTANCE/**ESR ACCURACY TEST.

DESCRIPTION:

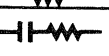
This test verifies that resistance measurement accuracies for 4262A tested meets the specifications listed below. Although R measurement accuracies are actually guaranteed when C measurement accuracies meet the specifications, almost all ranges in Rp mode are checked in this test.

Note

Resistance accuracy has only to be proved for one resistor of about full scale value on any one range to verify specifications for 120Hz, 1kHz and 10kHz.

SPECIFICATION:

RESISTANCE/ESR ACCURACY SPECIFICATIONS

| Ranges | 120Hz<br>1kHz<br>10kHz | 1000mΩ | 10.00Ω | 100.0Ω | 1000Ω | 10.00kΩ | 100.0kΩ | 1000kΩ | 10.00MΩ |
|---|---|---|---|---|---|---|---|---|---|
| Accuracy *1 |  | 0.3% + 2 counts *2 | | | | | | | |
| |  | 0.2% + 2 counts | | | | | | | |
| | AUTO | Same as  Mode | | | | Same as  Mode | | | |

*1 ±(% of reading + counts).
*2 (5% +2 counts) on 10.00MΩ range at 10kHz.

** Measurement range for ESR (equivalent series resistance) is from 1mΩ to 19.99kΩ (typical), which varies with series capacitance or inductance value . . . . . refer to "REFERENCE DATA" on page 1-6.

Accuracy applies over a temperature range of 23°C ±5°C. (at 0°C to 55°C, error doubles).

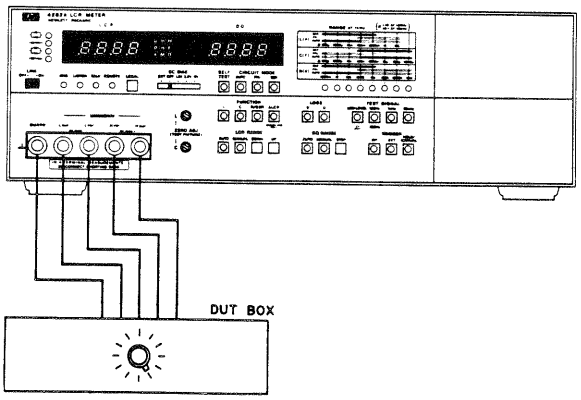



Figure 4-3. Resistance Accuracy Test Setup

EQUIPMENT:

DUT Box. . . . . HP 16361A
Test Leads. . . . . .HP P/N 16361-61605

Note

User built fixture/leads or DUT box can be used. If user supplied, the residual resistance must be considered.

PROCEDURE:

1. Connect Test Leads (HP P/N 16361-61605) between 4262A UNKNOWN terminals and HP 16361A DUT Box (see Figure 4-3).

2. Set 4262A controls as follows:

DC BIAS . . . . . OFF
CIRCUIT MODE . . . . . PRL
FUNCTION . . . . . R/ESR
LCR RANGE . . . . . AUTO
TEST SIGNAL . . . . . 1kHz
TRIGGER . . . . . INT

3. Check that the resistance measurement accuracies meet specifications according to table below:

| DUT | 1kΩ | 10kΩ | 100kΩ | 10MΩ |
|---|---|---|---|---|
| Test Limits | C. V. ±5 counts | C. V. ±5 counts | C. V. ±5 counts | C. V. ±5 counts |
| R Readout | | | | |

C. V. = Calibrated Value of Standard Component

Note

Error caused by stability of standard component is not taken into account for test limits in table above.

Note

If this test fails, go to Section V or Section VIII for the troubleshooting.

## 4-12. DISSIPATION FACTOR CONFIRMATION CHECK

DESCRIPTION:

This test verifies that a tested 4262A satisfies dissipation factor measurement accuracies. Only one Dissipation Factor (D = 1.8) is checked for 120Hz, 1kHz and 10kHz in this check because only one detecting phase needs to be checked. All other factors influencing D accuracy were checked in paragraph 4-10.

Note

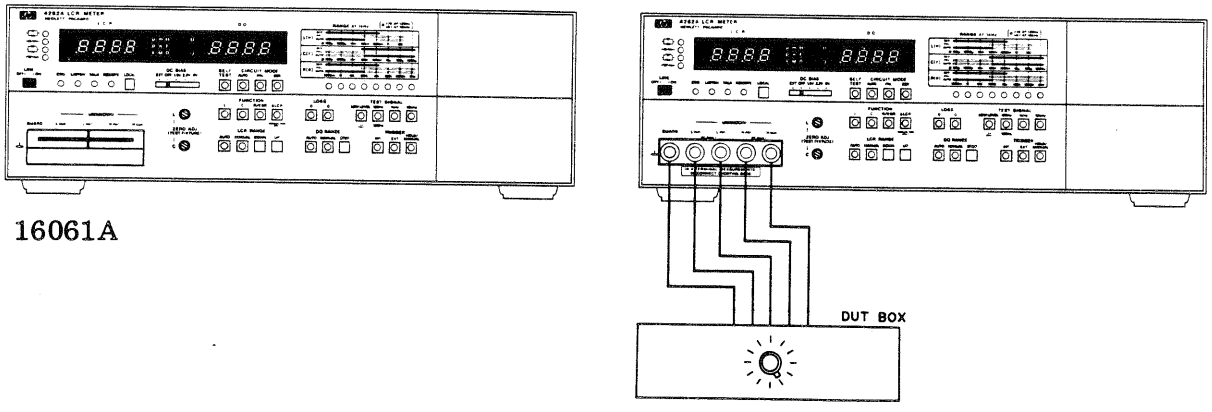
Dissipation factor accuracy for only one D standard which has a D value of approximately 1.8 need be proved to guarantee D accuracy. This test also verifies that 4262A correctly calculates Q factor as a reciprocal number of Dissipation Factor. Only one Q factor corresponding to a D value of approximately 1.8 is checked in this test. D accuracy in measuring inductance does not need to be checked because detecting phase accuracy is equated with that for capacitance measurement.

C-D ACCURACY SPECIFICATIONS

| Range | 120Hz<br>1kHz<br>10kHz | 1000pF<br>100.0pF<br>10.00pF | 10.00nF<br>1000pF<br>100.0pF | 100.0nF<br>10.00nF<br>1000pF | 1000nF<br>100.0nF<br>10.00nF | 10.00μF<br>1000nF<br>100.0nF | 100.0μF<br>10.00μF<br>1000nF | 1000μF<br>100.0μF<br>10.00μF | 10.00mF<br>1000μF<br>100.0μF |
|---|---|---|---|---|---|---|---|---|---|
| D (1/Q) Accuracy *1 |  | 0.2% + (2 + 200/Cx) counts | | | | | At 120Hz, 1kHz (Test signal level: 1V) At 10kHz | | |
| | | 0.5% + (2 + 200/Cx) counts | | | | | | | |
| | | 0.3% + (2 + 1000/Cx) counts | | | | | At 120Hz, 1kHz (Test signal level: 50mV) At 10kHz | | |
| | | 1.0% + (2 + 1000/Cx) counts | | | | | | | |
| |  | (At 120Hz, 1kHz) 0.3% + (2 + Cx/500) counts | | | | | 1% + (5 + Cx/500) | | |
| | | (At 10kHz) 0.5% + (2 + Cx/500) counts | | | | | 1% + (5 + Cx/500) | 5% + (5 + Cx/500) | |
| | AUTO | Same as  Mode | | | | | Same as  Mode | | |

*1 ±(% of reading + counts). Cx is capacitance readout in counts.

Accuracy applies over temperature range of 23°C ±5°C. (At 0°C to 55°C, error doubles)
This accuracy only applies for D values to 1.999.




(a) (b)

Figure 4-4. Dissipation Factor Accuracy Test Setups.

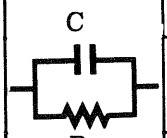
## PERFORMANCE TESTS

EQUIPMENT:

Test Fixture ..... HP 16061A
DUT ..... HP 16361A/16362A
Test Leads.....HP P/N 16361-61605

Note

HP 16361A and HP 16362A DUT Boxes are equipped with D standards (D = 1.8) calibrated at 1kHz and 10kHz frequencies, respectively. For the test at 120Hz frequency or if DUT box is not available, it is recommended that the following DUT's be used as D standards:

| DUT | Freq. | Values of components | Calculated D | Tolerance* |
|---|---|---|---|---|
|   | 120Hz | C : 1000nF (HP P/N 0160-3645)<br>R : 887Ω (HP P/N 0698-4464) | 1.495 | ±0.030 |
| | 1kHz | C : 100nF (HP P/N 0160-1571)<br>R : 887Ω (HP P/N 0698-4464) | 1.794 | ±0.036 |
| | 10kHz | C : 10nF (HP P/N 0160-3171)<br>R : 887Ω (HP P/N 0698-4464) | 1.794 | ±0.036 |

* After calibrating capacitance C to within 0.1% and resistance R to within 0.02%, the dissipation factor tolerance is ±0.002 for each DUT.

PROCEDURE:

1. Connect DUT to 4262A.

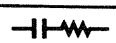
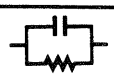
Note

To facilitate connecting recommended DUT's, attach HP 16061A Test Fixture to 4262A UNKNOWN terminals [see Figure 4-4 (a)]. When HP 16361A/16362A DUT Box is used for this test, connect Test Leads (HP P/N 16361-61605) between 4262A UNKNOWN terminals and DUT Box as shown in Figure 4-4 (b).

2. Set 4262A controls as follows:

DC BIAS.....OFF
CIRCUIT MODE.....PRL
FUNCTION.....C
LOSS.....D
LCR RANGE .....AUTO
D/Q RANGE.....AUTO
TRIGGER.....INT

3. Check D accuracies according to following table:

| Freq | Circuit Mode | Test Level | D Test Limits | D Reading |
|---|---|---|---|---|
| 120Hz |  | Low Level | Calibrated Value X ± 8 counts | |
| | | normal | Calibrated Value X ± 6 counts | |
| |  | normal | Calibrated Value X ± 8 counts | |
| 1kHz |  | Low Level | Calibrated Value X ± 8 counts | |
| | | normal | Calibrated Value X ± 6 counts | |
| |  | normal | Calibrated Value X ± 9 counts | |
| 10kHz |  | Low Level | Calibrated Value X ± 21 counts | |
| | | normal | Calibrated Value X ± 11 counts | |
| |  | normal | Calibrated Value X ± 13 counts | |

Note

X in above table is produced by test frequency error and may be determined from the following equations:

| | |
|---|---|
|  | $x = \frac{fn}{fx}$ |
|  | $x = \frac{fx}{fn}$ |

· · · where fn is nominal measurement frequency and fx is measurement frequency from paragraph 4-9.

Note

Error caused by stability of standard component is not taken into account for test limits in table above.

4. Set 4262A TEST SIGNAL frequency to 1kHz and connect appropriate DUT to 4262A (Set 16361A LCR RANGE to D = 1.8). Note dissipation readout on D/Q display.

5. Push 4262A LOSS Q button.

6. Confirm that displayed Q factor is correct reciprocal number of dissipation.

Note

The 4262A rounds fractions of 5 or greater below the LSD to the next higher digit and drops any fractions of 4 or less. For example, if the actual dissipation is .0135, the display will read .014. If the actual dissipation is .0134, the display will read .013. If the test fails, refer to Section VIII Service.

## 4-13. INDUCTANCE ACCURACY TEST.

DESCRIPTION:

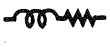
This test verifies that inductance measurement accuracy satisfies the specifications listed below. L accuracy is proved to meet the specification when the results obtained in the accuracy checks of paragraphs 4-9 through 4-12 satisfy the specifications. This test is performed to confirm the L accuracy specification.

Note

Inductance accuracy has only to be proved for one inductor of about full scale value on any one range to verify specifications for all three test frequencies (120Hz, 1kHz and 10kHz).

SPECIFICATIONS:

INDUCTANCE ACCURACY SPECIFICATIONS

| Range | | 120Hz<br>1kHz<br>10kHz | 1000μH<br>100.0μH<br>10.00μH | 10.00mH<br>1000μH<br>100.0μH | 100.0mH<br>10.00mH<br>1000μH | 1000mH<br>100.0mH<br>10.00mH | 10.00H<br>1000mH<br>100.0mH | 100.0H<br>10.00H<br>1000mH | 1000H<br>100.0H<br>10.00H |
|---|---|---|---|---|---|---|---|---|---|
| L Accuracy *1 |  | (At 120Hz, 1kHz) | | | | 0.3% + 2 counts | | 1% + 2 counts | |
| | | (At 10kHz) | | | | 0.3% + 2 counts | | 1% + 2 | 5% + 2 |
| |  | 0.2% + 2 counts | | | | | | (At 120Hz, 1kHz) | |
| | | 0.3% + 2 | 0.2% + 2 counts | | | | | (At 10kHz) | |
| | AUTO | Same as  Mode | | | | | | Same as  Mode | |

*1 ±(% of reading + counts).
Accuracy applied over temperature range of 23°C ±5°C (at 0°C to 55°C, error doubles).
This accuracy only applies for D values to 1.999.

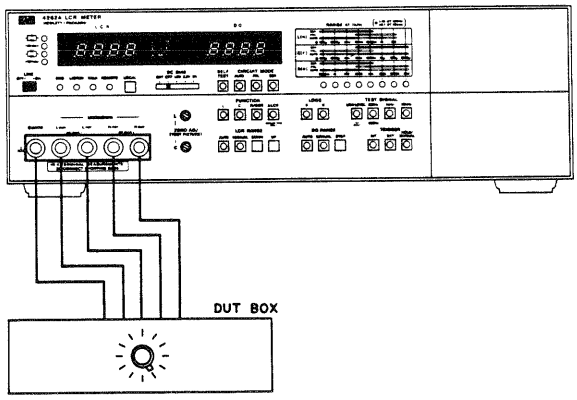



Figure 4-5 Inductance Accuracy Test Setup.

## PERFORMANCE TESTS

EQUIPMENT:

DUT Box. . . . . HP 16361A/16362A
Test Leads. . . . . .HP P/N 16361-61605

Note

User built test fixture/leads or DUT box must take residual impedance into consideration.

PROCEDURE:

1. Connect Test Leads (HP P/N 16361-61605) between 4262A UNKNOWN terminals and HP 16361A DUT Box (see Figure 4-5). When TEST SIGNAL frequency is 10kHz, use HP 16362A in place of HP 16361A.

2. Set 4262A controls as follows:

DC BIAS. . . . . .OFF
FUNCTION. . . . . L
LOSS. . . . . D
LCR RANGE . . . . . AUTO
D/Q RANGE. . . . . AUTO
TRIGGER. . . . . INT

3. Set HP 16361A/16362A LCR RANGE to 100mH.

4. Confirm that L accuracy is within the test limits shown in table below:

Note

Test limits below are given for 100mH inductance measurement. If another inductance value is measured, refer to SPECIFICATIONS above.

| TEST SIG Freq. | CIRCUIT MODE | TEST Limits | L Readout |
|---|---|---|---|
| 120Hz | PRL | Calibrated Value ± 3 counts | |
| | SER | Calibrated Value ± 4 counts | |
| 1kHz | PRL | Calibrated Value ± 5 counts | |
| | SER | Calibrated Value ± 4 counts | |
| 10kHz | PRL | Calibrated Value ± 5 counts | |
| | SER | Calibrated Value ± 4 counts | |

Note

Error caused by stability of standard component is not taken into account for test limits in table above. If this test fails, refer to Section VIII,Service.

## 4-14. INTERNAL DC BIAS SOURCE TEST.

DESCRIPTION:

This test verifies that the internal dc bias source will apply the specified bias values to the device under test.

SPECIFICATIONS:

DC bias, Internal Source: 1.5V ±5%, 2.2V ±5%, 6V ±5%

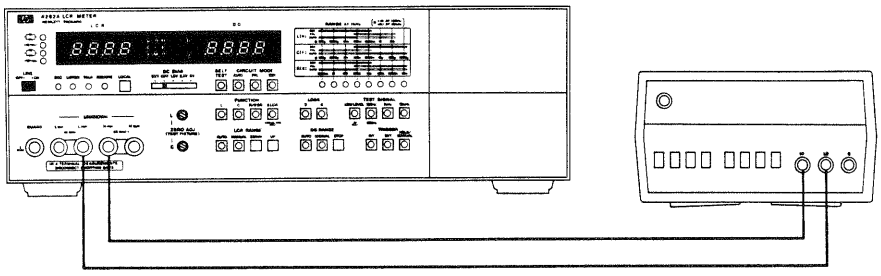


Figure 4-6. Internal DC Bias Source Test Setup.

EQUIPMENT:

DC Voltmeter . . . . . HP 5300A/w5306A

PROCEDURE:

1. Connect DC Voltmeter to 4262A UNKNOWN terminals as shown in Figure 4-6.

2. Set 4262A controls as follows:

FUNCTION. . . . . C
CIRCUIT MODE. . . . . PRL
Other Controls . . . . . any position

Note

Do not connect anything to UNKNOWN terminals.

3. Test limits are shown below. Read dc voltmeter output with DC BIAS switch set as follows:

| DC BIAS Switch Setting | Test Limits | Voltmeter Readout |
|---|---|---|
| 1.5V | 1.425V thru 1.575V | |
| 2.2V | 2.09 V thru 2.31 V | |
| 6 V | 5.7 V thru 6.3 V | |

Note

Reading error caused by measurement error of test equipment is not taken into account for test limits in table above.

4. If tests fail, proceed to Troubleshooting in Section VIII.

## 4-15. OFFSET ADJUSTMENT TEST.

DESCRIPTION:

This test checks that both C and L ZERO ADJ controls can be set (over their specified ranges) to respectively offset the stray capacitance and residual inductance of test jig.

SPECIFICATIONS:

| | |
|---|---|
| Offset Adjustment: | C:up to 10pF<br>L:up to 1$\mu$H |

EQUIPMENT:

DUT Box. . . . . HP 16362A (19pF)
Test Leads. . . . . .HP P/N 16361-61605

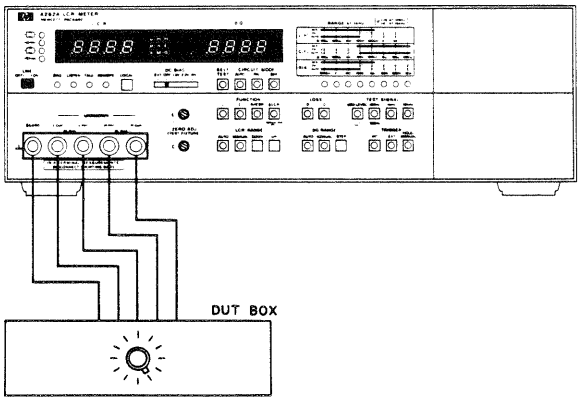



Figure 4-7. Offset Adjustment Test Setup.

PROCEDURE:

(1) C ZERO ADJ test.

1. Connect shorting bars at 4262A UNKNOWN terminals for doing a two terminal measurement. Connect no DUT to unknown terminals (open).

2. Set 4262A controls as follows:

DC BIAS . . . . . .OFF
CIRCUIT MODE. . . . . AUTO
FUNCTION. . . . . C
LOSS. . . . . D
TEST SIGNAL . . . . . 10kHz
LCR RANGE . . . . . .MANUAL
(Set to 10pF range)
DQ RANGE . . . . . AUTO
TRIGGER. . . . . INT

3. Rotate C ZERO ADJ control fully cw.

4. Verify that capacitance readout on 4262A LCR display is within 0.00 to 0.30 counts.

5. Disconnect shorting bars from 4262A UNKNOWN terminals and connect Test Leads (HP P/N 16361-61605) between 4262A UNKNOWN terminals and 16362A DUT Box as shown in Figure 4-7.

Note

If 16362A is not available, connect an 18pF capacitor (HP P/N 0160-2263) directly to UNKNOWN terminals (without disconnecting shorting bars).

6. Set 16362A LCR RANGE to 19pF.

7. Note capacitance readout on 4262A LCR display.

8. Rotate C ZERO ADJ control fully ccw.

9. Verify that capacitance readout on 4262A LCR display reduces count more than 10.30 counts as compared to count obtained in step 7.

10. Remove Test Leads (or DUT) from UNKNOWN terminals.

(2) L ZERO ADJ test

11. Set 4262A FUNCTION to L.

12. Connect shorting bars on 4262A UNKNOWN terminals for doing a two terminal measurement. Connect a shorting lead to UNKNOWN terminals so that H and L terminals are short circuited.

13. Rotate L ZERO ADJ control fully cw.

14. Verify that inductance readout on 4262A LCR display is within 0.00 and 0.02 counts.

15. Disconnect shorting lead from 4262A UNKNOWN terminals and connect a 5.6μH inductor (HP P/N 9100-1618) directly to UNKNOWN terminals as a DUT (without disconnecting shorting bars).

16. Note inductance readout on 4262A LCR display.

17. Rotate L ZERO ADJ control fully ccw.

18. Verify that inductance readout on 4262A LCR display reduces count more than 1.02 counts as compared to count obtained in step 16.

## 4-16. COMPARATOR TEST (OPTION 004 ONLY).

DESCRIPTION:

This test verifies that the built-in 5 digit digital comparator makes the correct comparison between the digits set into the thumbwheel switch and the displayed counts. Comparison output data at COMPARATOR OUTPUT connector (rear panel) is also checked by this test.

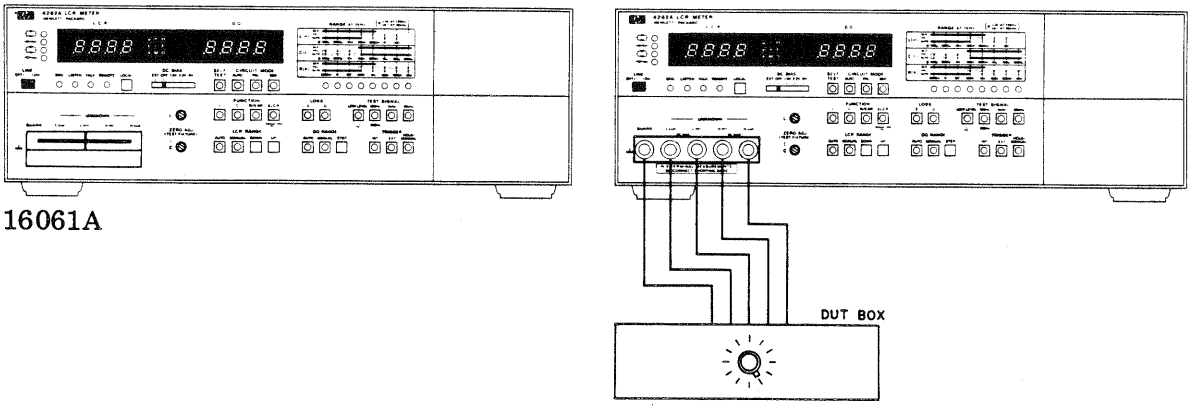



Figure 4-8. Comparator Test Setup.

EQUIPMENT:

| | |
|---|---|
| DUT Box | HP 16361A (100pF) |
| Test Leads | HP P/N 16361-61605 |

PROCEDURE:

1. Connect Test Leads (HP P/N 16361-61605) between 4262A UNKNOWN terminals and 16361A DUT Box as shown in Figure 4-8. If DUT Box is not available, attach 16061A Test Fixture to 4262A UNKNOWN terminals and use a 100pF capacitor as a DUT.

2. Set 4262A controls as follows:

| | |
|---|---|
| DC BIAS | OFF |
| CIRCUIT MODE | AUTO |
| FUNCTION | C |
| TEST SIGNAL | 1kHz |
| LCR RANGE | AUTO |
| TRIGGER | INT |

3. Set 16361A LCR RANGE to 100pF.

4. Push COMPARATOR ENABLE button (simultaneously, the LCR RANGE and DQ RANGE will be automatically changed to MANUAL).

5. Set LCR HIGH LIMIT switch to "1000" and LOW LIMIT switch to "0950".

6. Verify HIGH and LOW LIMIT settings by pushing and holding upper LIMIT CHECK pushbutton.

7. Adjust ZERO ADJ C control for a display reading of "949" (or less) counts.

8. LOW lamp should be lit. Verify circuit configuration on COMPARATOR OUTPUT connector (J6) according to Figure 4-9.

9. Adjust ZERO ADJ C control cw for a display reading of "950" (up to "999").

10. IN lamp should be lit. Verify relay contact and TTL output as in step 8.

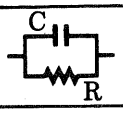
11. ADJUST ZERO ADJ C control cw for a display reading of "1000" or more.

12. HIGH lamp should be lit. Verify relay contact and TTL output as in step 8.

13. Set 16361A LCR RANGE to D = 1.8 and 4262A LCR RANGE manually to 1μF.

Note

If HP 16361A is not available, use a D factor sample as shown below.

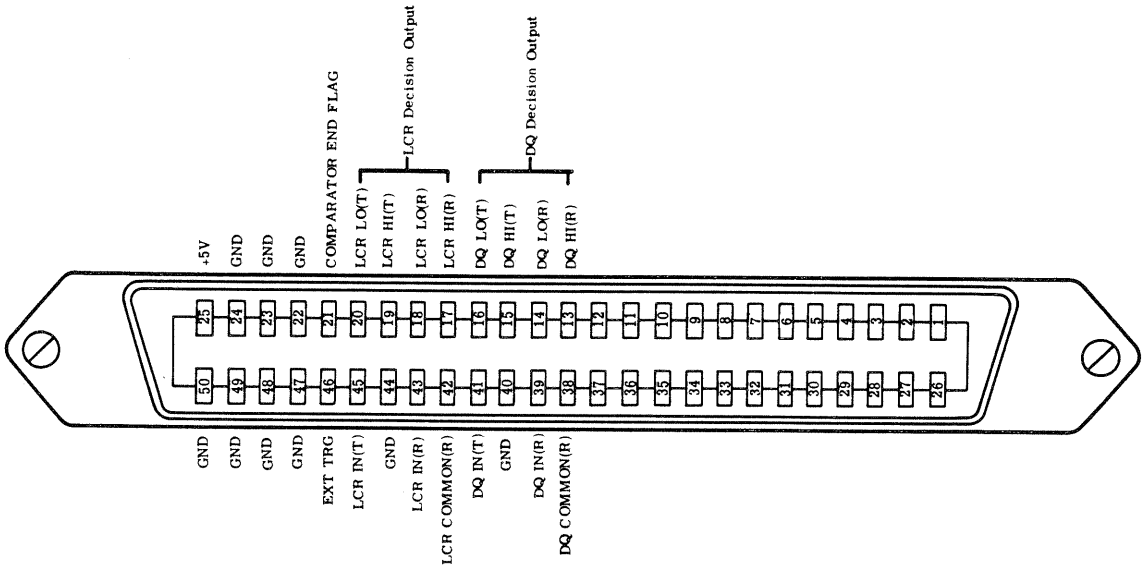
| | |
|---|---|
|   | C: 100nF (HP P/N 0160-4113) |
| | R: 887Ω (HP P/N 0698-4464) |

14. Push D/Q RANGE AUTO button.

Note

The 4262A D/Q RANGE is automatically set to an appropriate range and successively reset to MANUAL.

15. Set appropriate numbers into D/Q LIMIT switches. Change the set numbers and check comparison outputs with Figure 4-9.




| Comparison | Relay output pins | | | TTL output pins * | | |
|---|---|---|---|---|---|---|
| LCR | 17 - 42 | 18 - 42 | 43 - 42 | 19 - 44 | 20 - 44 | 45 - 44 |
| HIGH | Short | Open | Open | O.C. | LOW | LOW |
| IN | Open | Open | Short | LOW | LOW | O.C. |
| LOW | Open | Short | Open | LOW | O.C. | LOW |
| DQ | 13 - 38 | 14 - 38 | 39 - 38 | 15 - 40 | 16 - 40 | 41 - 40 |
| HIGH | Short | Open | Open | O.C. | LOW | LOW |
| IN | Open | Open | Short | LOW | LOW | O.C. |
| LOW | Open | Short | Open | LOW | O.C. | LOW |

* TTL low-level output is indicated as LOW, and open-collector turn-off state is indicated as O.C.

Figure 4-9. DATA OUTPUT (J6) comparator output data format.

## 4-17. HP-IB INTERFACE TEST (OPTION 101 ONLY).

DESCRIPTION:

This test verifies that the HP-IB circuitry has the capability to correctly communicate between external HP-IB devices and the 4262A through the interface bus cable.

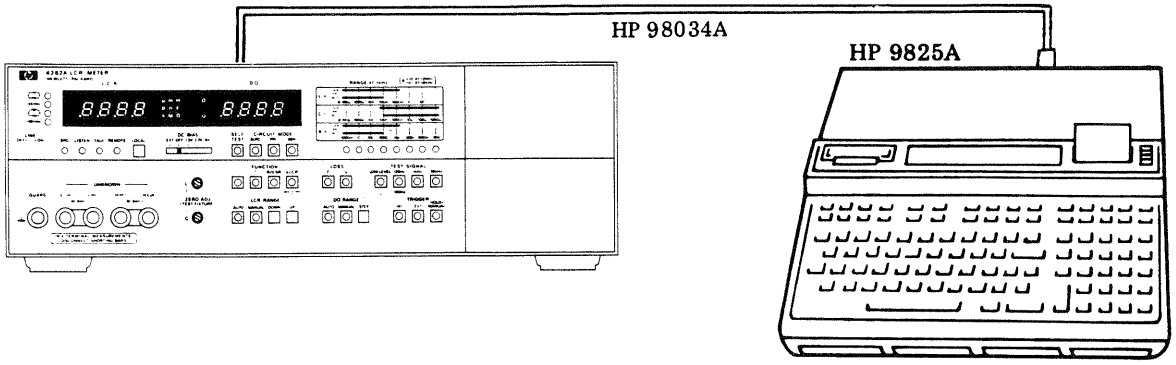



Figure 4-10. HP-IB Interface Test Setup.

EQUIPMENT:

| | |
|---|---|
| Calculator | HP 9825A |
| ROM | HP 98210A, 98213A or 98214A |
| Interface Card with cable | HP 98034A |

PROCEDURE:

1. Connect 98034A Interface Card with cable between 9825A I/O slot and 4262A rear panel HP-IB connector. Install required ROM blocks in 9825A ROM slots.

2. Set 98034A Select Code Switch dial to select code 7 (using a screwdriver).

3. Set 4262A rear panel ADDRESS switch to address number 17 in binary code (refer to Paragraph 3-68).

4. Load test program (shown on Pages 4-26 through 4-35) in calculator.

5. Execute the program. Check that 4262A display, calculator display, and printed data are consistent with the results described for each program.

6. Perform steps 4 and 5 with respect to individual test programs and verify that 4262A and calculator correctly communicate through the HP-IB interface.

Note

Connect appropriate sample(s) to 4262A UNKNOWN terminals as necessary (and observe whether printout is correct).

## TEST PROGRAM 1

[PURPOSE]

This test verifies that system controller remotely sets 4262A TEST SIGNAL and TRIGGER and successively accesses the measured data for printing.

[PROGRAMMING]

```
0: prt "MEASURED DATA
   RECEIVED";spc 3
1: dev "4262A",717
2: rem 7
3: cli 7
4: clr "4262A"
5: wrt "4262A","H3T3";wait 1000
6: trg "4262A"
7: red "4262A",A,B
8: flt 3
9: prt "LCR DATA=",A,
   "DQ DATA=",B
10: spc 3
11: end
*32657
```

0) Commands calculator to print MEASURED DATA RECEIVED and successively to space three lines.

1) Defines 717 (= Interface Select Code 7, address 17) as address code for 4262A in the programming.

2) Sets REN (Remote Enable) line of the Bus line to "1". Enables remote control.

3) Sets IFC (Interface Clear) line of Bus line to "1". Sets interface select code 7 to its initial conditions.

4) Sets 4262A to its initial conditions. (Device Clear: ref to Para 3-72).

5) Addresses calculator to talk and 4262A to listen. Program code string sets device: TEST SIGNAL 10kHz, and TRIGGER to HOLD/MANUAL (ref to Para 3-69).

6) Triggers 4262A (ref to Para 3-73).

7) Addresses calculator to listen and 4262A to talk. Takes incoming data and stores LCR measurement data in register A and DQ data in register B (ref to Para 3-67).

8) Designates printer print format and floating decimal point (3 digits below decimal point).

9) Prints LCR and DQ data.

10) Commands printer to line space three vertical lines to put entire recording into proper cutting position.

[RESULTS]

The 4262A REMOTE lamp lights. LISTEN and TALK lamps alternately light once. Calculator prints measured LCR and DQ values.

## TEST PROGRAM 2

[PURPOSE]

This test verifies that system controller sets 4262A TEST SIGNAL and TRIGGER and prints the measured data along with the 4262A functional status codes.

[PROGRAMMING]

```
0: prt " MEASURED DATA  RECEIVED ";spc 3
1: rem 7
2: cli 7
3: clr 717
4: wrt 717,"H3P1T3";wait 1000
5: trg 717
6: fmt 4b,f,2b,f
7: red 717,A,B,C,D,E,F,G,H
8: fxd 0;prt "S=",A,"F=",B,
   "C=",C,"F=",D
9: flt 3;prt "N=",E
10: fxd 0;prt "S=",F,"F=",G
11: flt 3;prt "N=",H
12: spc 3
13: end
*15961
```

3) Sets device address code 717 (4262A) for initial conditions.

4) Addresses calculator to talk and device of address code 717 (4262A) to listen. Program code string sets device TEST SIGNAL to 10kHz, LOW LEVEL, and TRIGGER to HOLD/MANUAL (ref to Table 3-60).

6) Designates format for data in program step 7.

7) Addresses calculator to listen and 4262A to talk. Takes incoming data A, B, C, D, F and G in binary code and translates them into decimal code. Takes data E and H in free field format. Stores data items in the registers specified in the variable lists.

8-11) Prints data in fixed or floating decimal point format. Data items are:

| | |
|---|---|
| A: Status, | B: Function, |
| C: Circuit Mode, | D: Frequency, |
| E: LCR Data, | F: DQ Status, |
| G: DQ Function, | H: DQ Data. |

Refer to Paragraph 3-67 and Table 3-60.

[RESULTS]

The 4262A REMOTE lamp lights. LISTEN and TALK lamps alternately light once. Calculator prints 4262A functional codes along with the measured LCR and DQ data.

## TEST PROGRAM 3

[PURPOSE]

This test verifies that 4262A notifies system controller of the Request Status (RQS) and that demands of the Service Request (SRQ) are processed according to programmed service routing.

[PROGRAMMING]

```
0: prt "MEASURED DATA RECEIVED -DATA READY RQS MODE";spc 3
1: oni 7,"SRQ"
2: rem 7
3: cli 7
4: clr 717
5: wrt 717,"H3D1T3";wait 1000
6: trg 717
7: "LOOP":eir 7,128
8: if bit(0,B)=1;gto "READ"
9: gto "LOOP"
10: "SRQ":rds(717)→B
11: if bit(6,B)=1;jmp 2
12: prt "OTHER DEVICE SRQ";spc 3
13: "IRET":eir 7,128
14: iret
15: "READ":red 717,A,B
16: flt 3;prt "LCR DATA=",A,
    "DQ DATA=",B
17: spc 3
18: end
*22913
```

1) Designates label (SRQ) for service routing to be performed when an interrupt is set by a device on select code 7 Bus Line.

5) Addresses calculator to talk and 4262A to listen. Program code string set device: TEST SIGNAL 10kHz, Data Ready RQS Mode to ON (ref to Para 3-70), and TRIGGER to HOLD/MANUAL.

7) Labels LOOP. Enables Service Request to be sent from device on select code 7 Bus Line. Checks status of SRQ line on the Bus Line.

8) If the last bit of Status Byte (corresponding to Data Ready — ref to Para 3-70) is 1, goes to program step 15 labeled READ.

Note

When status of the SRQ line becomes 1, the programming sequence phase changes from cycling through steps 7, 8, and 9 and successively goes to step 10. Steps 10 through 14 comprise the service routing to process interrupt (Service Request) phase. See Figure 4-11 for programming flow diagram.

10) Labels SRQ. Takes Status Byte responding to serial poll of calculator and stores data in register B.

11) Verifies that SRQ YES/NO line of Status Byte is actually 1 (ref to Para 3-70).

13) Again enables acceptance of SRQ from device because SRQ is disabled when Status Byte signal transfer is completed (re to Para 3-70).

14) After service subroutine is completed, return to the step that follows step 7, 8, or 9 as appropriate to main programming sequence.

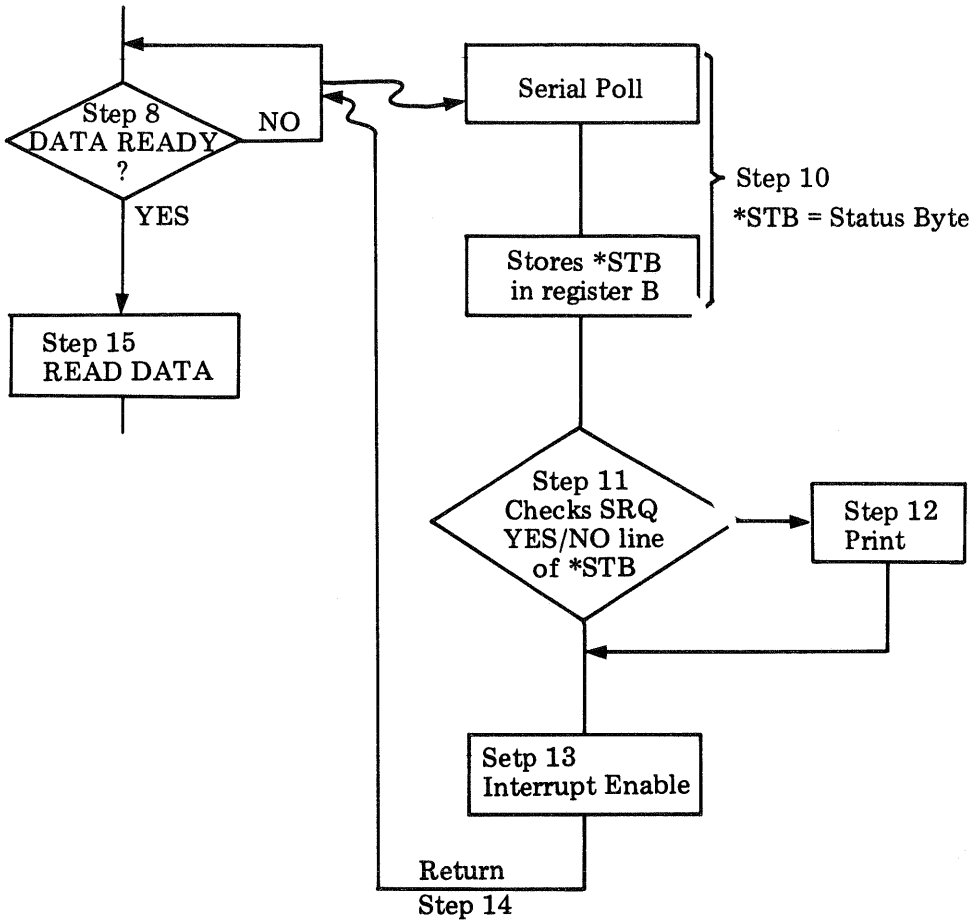



Figure 4-11 SRQ Service Routing.

[RESULTS]

Calculator prints LCR and DQ values of the sample measured by 4262A (test frequency 10kHz). Verifies that 4262A SRQ lamp lights momentarily. Press calculator RUN button again to repeat checks. If calculator prints OTHER DEVICE SRQ, interface is faulty.

## TEST PROGRAM 4

[PURPOSE]

This test confirms that 4262A FUNCTION, LOSS, and TEST SIGNAL functions are fully controlled by system controller.

[PROGRAMMING]

Annotation is omitted.

```
0: prt "ENTER REMOTE PROGRAM CODE ";spc 3
1: fmt 1,4f1.0
2: rem 7
3: cli 7
4: clr 717
5: ent "FUNCTION?(1,2,3)",A
6: ent "LOSS?(1,2)",B
7: ent "FREQUENCY?(1,2,3)",C
8: wrt 717.1,"F",A,"L",B,"H",C,"T3";wait 1000
9: trg 717
10: red 717,D,E
11: flt 3;prt "LCR DATA=",D,"DQ DATA=",E
12: spc 3
13: end
*31495
```

[RESULT]

The 4262A REMOTE lamp lights. LISTEN and TALK lamps alternately light once. Calculator prints LCR and DQ values. Confirms that 4262A functions were correctly set (check the printed data).

## TEST PROGRAM 5

[PURPOSE]

This test verifies that 4262A self test function can be remotely controlled.

[PROGRAMMING]

```
0: prt "REMOTE SELF TEST";spc 3
1: oni 7,"SRQ"
2: rem 7
3: cli 7
4: clr 717
5: wrt 717,"S1"
6: "LOOP":eir 7,128
7: if bit(2,A)=1;dsp "PASS"
8: if bit(3,A)=1;dsp "FAIL 1"
9: if bit(4,A)=1;dsp "FAIL 2"
10: if bit(5,A)=1;dsp "FAIL 3"
11: gto "LOOP"
12: "SRQ":beep;rds(717)→A
13: if bit(6,A)=1;gto "IRET"
14: prt "OTHER DEVICE
    SRQ";spc 3
15: "IRET":eir 7,128
16: iret
17: end
*14058
```

5) Addresses calculator to talk and 4262A to listen. Sets device to SELF TEST mode.

7, 8, 9, 10) Checks status of the third through sixth bit of Status Byte signal and displays its contents (ref to Para 3-70).

12) Labels SRQ. Takes Status Byte responding to serial poll of calculator and stores data in register A. Simultaneously beeps in announcement.

[RESULT]

The 4262A performs self test. Letters "PASS" flash on both 4262A and calculator displays.

## TEST PROGRAM 6

[PURPOSE]

This test verifies that system controller takes the incoming data in character (ASCII) code and prints the data in accord with the format shown in Paragraph 3-67.

[PROGRAMMING]

```
0: prt "RECEIVING MEASURED DATA when using STRING-ADV. ROM";spc 3
1: dim A$[25]
2: rem 7
3: cli 7
4: clr 717
5: wrt 717,"H3T3";wait 1000
6: trg 717
7: red 717,A$
8: prt A$
9: spc 3
10: end
*671
```

1) Establish dimension of 25 character memory capacity for using string variables.

7) Takes incoming data (measured data) in character (ASCII) code.

8) Prints data in character code.

[RESULT]

The measured data and 4262A functional status code are printed in accord with the format shown in Paragraph 3-67.

## TEST PROGRAM 7

[PURPOSE]

This test verifies that 4262A FUNCTION, FREQUENCY and TRIGGER can be controlled in character (ASCII) code and that the measured data is printed in accord with the format shown in Paragraph 3-67.

[PROGRAMMING] Annotation is omitted.

```
0: prt "ENTER REMOTE PROGRAM CODE when using STRING-ADV ROM";spc 3
1: dim A$[20],B$[25]
2: rem 7
3: cli 7
4: ent "PROGRAM CODE ? (as F2H3T3)",A$
5: wrt 717,A$;wait 1000
6: trg 717
7: red 717,B$
8: prt B$
9: spc 3
10: end
*3337
```

[RESULTS]

The 4262A REMOTE lamp lights. LISTEN and TALK lamps alternately light once. Calculator prints LCR and DQ values. Confirms that 4262A functions were correctly set (check the printed data).

## TEST PROGRAM 8

[PURPOSE]

This program checks function of 4262A ADDRESS switch (rear panel) and verifies that the address code set into the switch provides access to the 4262A by the system controller.

Note

To perform this test, set ADDRESS switch (ref to Para 3-68) according to calculator display and, after setting the switch, press calculator CONT button.

[PROGRAMMING]

Annotation is omitted.

```
0: prt "REM ADDRESS TEST";spc 3
1: dsp "Set up SW *ADDRESSABLE ";beep;stp
2: rem 7
3: cli 7;clr 7
4: dsp "Set up A5-A1=00000";beep;stp
5: 700→A;gsb "CHK"
6: dsp "Set up A5-A1=00001";beep;stp
7: 701→A;gsb "CHK"
8: dsp "Set up A5-A1=00010";beep;stp
9: 702→A;gsb "CHK"
10: dsp "Set up A5-A1=00100";beep;stp
11: 704→A;gsb "CHK"
12: dsp "Set up A5-A1=01000";beep;stp
13: 708→A;gsb "CHK"
14: dsp "Set up A5-A1=10000";beep;stp
15: 716→A;gsb "CHK"
16: dsp "Set up A5-A1=10001";beep;stp
17: 717→A;gsb "CHK"
18: prt "TEST END";spc 3
19: end
20: "CHK":dsp "Check  *LISTEN=1  *REMOTE=1";beep;wrt A;wait 2000
21: dsp "Check  *TALK=1    *REMOTE=1";beep;red A;wait 2000
22: cli 7
23: ret
*11359
```

[RESULT]

Both 4262A LISTEN and REMOTE lamps illuminate for two seconds. Successively, both TALK and REMOTE lamps light for two seconds. Calculator prints TEST END.

## TEST PROGRAM 9

Checks that 4262A functions change at intervals of 1 second as follows:

```
0: prt "REMOTE/LOCAL TEST";spc 3
1: cli 7
2: rem 7
3: llo 7
4: beep;clr 717;wrt 717,"F1H1";
   wait 1000
5: beep;lcl 717;wait 1000
6: beep;wrt 717,"F2C2H2L2T2";
   wait 1000
7: beep;lcl 7;wait 1000
8: rem 7
9: beep;wrt 717,"F3C3H3T3";
   wait 1000
10: clr 717
11: cli 7
12: lcl 7
13: prt "TEST END";spc 3
14: end
*15032
```

1) FUNCTION: L, TEST SIGNAL: 120Hz.

2) FUNCTION: C, CIRCUIT MODE: PRL, TEST SIGNAL: 1kHz, LOSS: Q, TRIGGER: EXT.

3) FUNCTION: R/ESR, CIRCUIT MODE: SER, TEST SIGNAL: 10kHz, TRIGGER: HOLD/MANUAL.

Calculator prints TEST END.

Note

llo in step 3: Local Lockout; causes 4262A LOCAL function to be invalid.

## TEST PROGRAM 10

Checks that 4262A range indicator lamps light (in turn) each for 1 second.

```
0: prt "REMOTE RANGING TEST";spc 3
1: fmt 1,f1.0
2: rem 7
3: cli 7
4: clr 717
5: 1→A
6: "LOOP":wrt 717.1,"R",A
7: beep;wait 1000
8: if (A+1→A)#9;gto "LOOP"
9: clr 717
10: prt "TEST END";spc 3
11: end
*6328
```

Hewlett-Packard
Model 4262A
LCR METER
Serial No._____

Tested by_____

Data_____

| Paragraph Number | Test | Results | | |
|---|---|---|---|---|
| | | Minimum | Actual | Maximum |
| 4-9 | MEASUREMENT FREQUENCY TEST | | | |
| | 120Hz | 116.4 | _____ | 123.6 |
| | 1kHz | 970 | _____ | 1030 |
| | 10kHz | 9700 | _____ | 10300 |
| 4-10 | CAPACITANCE ACCURACY TEST | | | |
| | 120Hz PRL LOW LEVEL | | | |
| | 100pF | C. V. * - 4 counts | _____ | C. V. + 4 counts |
| | 1000pF | C. V. - 8 counts | _____ | C. V. + 8 counts |
| | 10nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | 100nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | 1000nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | 10μF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | 120Hz PRL 1V 100pF | C. V. - 2 counts | _____ | C. V. + 2 counts |
| | 1000pF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | 10nF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | 100nF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | 1000nF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | 10μF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | 120Hz SER 1V 100nF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | 1000nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | 10μF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | 100μF | C. V. - 7 counts | _____ | C. V. + 7 counts |
| | 10mF | C. V. - 12 counts | _____ | C. V. + 12 counts |
| | 1kHz PRL LOW LEVEL | | | |
| | 100pF | C. V. -8 counts | _____ | C. V. + 8 counts |
| | 1000pF | C. V. -5 counts | _____ | C. V. + 5 counts |
| | 10nF | C. V. -5 counts | _____ | C. V. + 5 counts |
| | 100nF | C. V. -5 counts | _____ | C. V. + 5 counts |
| | 1000nF | C. V. -5 counts | _____ | C. V. + 5 counts |

*C. V. = Calibrated Value.

| Paragraph Number | Test | | Results | | |
|---|---|---|---|---|---|
| | | | Minimum | Actual | Maximum |
| 4-10 | CAPACITANCE ACCURACY TEST (Continued) | | | | |
| | 1kHz PRL 1V | 100pF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | 1000pF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | 10nF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | 100nF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | 1000nF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | 1kHz SER 1V | 10nF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | 100nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 1000nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 10μF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 1000μF | C. V. - 52 counts | _____ | C. V. + 52 counts |
| | 10kHz PRL LOW LEVEL | | | | |
| | | 10pF | C. V. - 8 counts | _____ | C. V. + 8 counts |
| | | 100pF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 1000pF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 10nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 100nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | 10kHz PRL 1V | 10pF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | 100pF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | 1000pF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | 10nF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | 100nF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | 10kHz SER 1V | 1000pF | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | 10nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 100nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 1000nF | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 10μF | C. V. - 12 counts | _____ | C. V. + 12 counts |

*C. V. = Calibrated Value.

| Paragraph Number | Test | | Results | | |
|---|---|---|---|---|---|
| | | | Minimum | Actual | Maximum |
| 4-11 | RESISTANCE ACCURACY TEST | | | | |
| | | 1kΩ | C. V.* - 5 counts | _____ | C. V. + 5 counts |
| | | 10kΩ | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 100kΩ | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | 10MΩ | C. V. - 5 counts | _____ | C. V. + 5 counts |
| 4-13 | INDUCTANCE ACCURACY TEST (100mH) | | | | |
| | 120Hz | PRL | C. V. - 3 counts | _____ | C. V. + 3 counts |
| | | SER | C. V. - 4 counts | _____ | C. V. + 4 counts |
| | 1kHz | PRL | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | SER | C. V. - 4 counts | _____ | C. V. + 4 counts |
| | 10kHz | PRL | C. V. - 5 counts | _____ | C. V. + 5 counts |
| | | SER | C. V. - 4 counts | _____ | C. V. + 4 counts |
| 4-14 | INTERNAL DC BIAS SOURCE TEST | | | | |
| | | 1.5V | 1.425 | _____ | 1.575 |
| | | 2.2V | 2.09 | _____ | 2.31 |
| | | 6 V | 5.7 | _____ | 6.3 |

*C. V. = Calibrated Value.