Section 3
Calibration and Verification

3-1. INTRODUCTION

This section gives procedures for 5700A calibration, verification, acceptance testing, and performance testing. Information here applies to testing the performance of and calibrating a normally operating 5700A. In case of malfunction, refer to Section 5, Troubleshooting, which explains how to use self diagnostic tests to identify a faulty module. Calibration and Performance Testing is presented in the following three parts:

- Calibration, which is to be done at the beginning of every calibration cycle. This is the same procedure as in Section 7 of the 5700A Operator Manual. It uses three external standards; 1 ohm, 10 kilohm, and 10V dc. The procedure is duplicated here for convenience. Also included in this part are procedures for doing Calibration Check and Range Calibration.

- Full Performance Verification, which is the full verification procedure, recommended every two years. Part of this procedure is Wideband AC Module (Option 5700A-03) flatness calibration, also recommended only every two years.

- Optional Tests, which are recommended following repair or for use in acceptance testing. These tests include such checks as load regulation, noise, and distortion. These tests are not required on a routine basis. They are not necessary after a 5700A passes Full Performance Verification.

3-2. CALIBRATION

The following paragraphs cover the procedures for calibrating the 5700A to external standards, performing calibration check, and adjusting a range constant.

When shipped, your 5700A is calibrated at the factory, traceable to the U.S. National Bureau of Standards. All that is required to maintain traceability is calibration to external standards at the beginning of the calibration cycle and performance verification every two years. Calibration check and range calibration are optional procedures that are available for special needs.

Additional information about 5700A calibration is contained elsewhere in the manuals:

- Section 1 of the Operator Manual describes the calibration process and the theory behind its use to establish traceability to national standards. Included in the same section is a description of the calibration check feature, and how you can use it to develop a performance history for your 5700A.
- Section 2 of the Service Manual contains detailed theory of operation.
- Section 4 of the Operator Manual explains how to do the very quick, automatic DC Zeros Calibration, which removes offsets on the 2.2V dc range.
- This section of the Service Manual contains a performance verification procedure that may be done every two years to maintain traceability. Part of this is Wideband AC Module (Option 5700A-03) flatness calibration.

3-3. Calibrating the 5700A to External Standards

Calibration to external standards is required at the beginning of the calibration cycle. The cycle is selected in a setup menu as described in Section 4 of the Operator Manual (24 hours, 90 days, 180 days, or 1 year). To calibrate the 5700A, you apply three portable standards to the OUTPUT binding posts: a 10V dc voltage standard, a 1 ohm resistance standard, and a 10 kilohm resistance standard. The following standards are recommended:

- Model 732A dV Reference Standard
- Model 742A-1 1 Ohm Standard Resistor
- Model 742A-10k 10 kilohm Standard Resistor

You do not need to calibrate the 5700A in a tightly-controlled temperature environment. The recommended external standards and the 5700A have the ability to control or compensate for ambient temperature variations internally. During the procedure, the 5700A prompts you to input the ambient temperature. The 5700A retains this information for inclusion in specification readout and output shift reports.

When you finish calibration, but before you save the new constants, the 5700A presents you with the new changes as ± ppm and change as a percentage of specification for each range and function. You can print a list of changes through the serial (RS-232-C) port, or send the changes to a computer through either the serial port or the instrument control (IEEE-488) port. The 5700A displays the largest proposed change on the front panel.

Table 3-1 lists the equipment required to calibrate the 5700A to external standards.

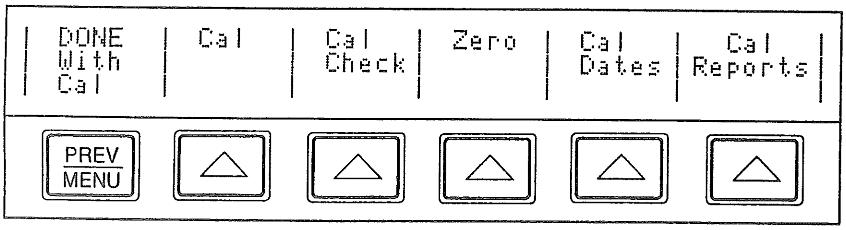
Table 3-1. Equipment Required to Calibrate the 5700A

MODEL	DESCRIPTION
Fluke 732A	DC Voltage Reference Standard
Fluke 742A-1	1 Ohm Resistance Transfer Standard
Fluke 742A-10K	10 kilohm Resistance Transfer Standard
Fluke 5440A-7002	Low Thermal EMF Test Leads, 2 ft (61 cm)

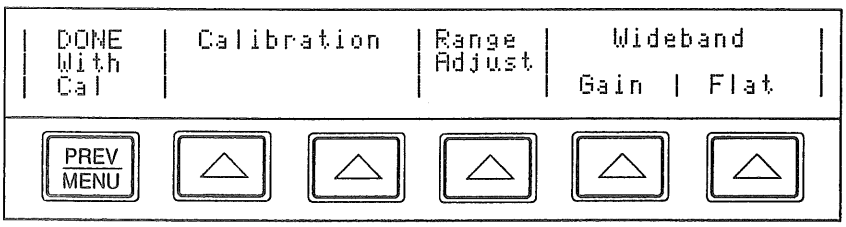
Proceed from the power-up state as follows to calibrate the main output functions:

1. Turn on the 5700A and allow it to warm up for at least 30 minutes.

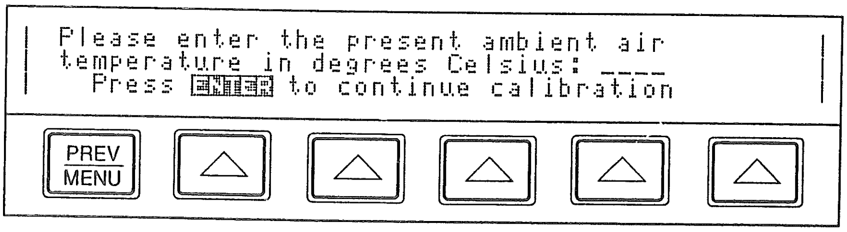
2. Press the "Setup Menus" softkey then the "Cal" softkey. The calibration menu appears:



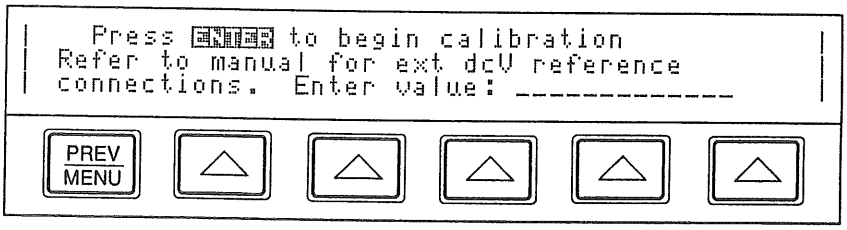
3. Press the "Cal" softkey. The display changes to:



4. To calibrate the main output functions, press one of the softkeys under the "Calibration" label. The display changes to:



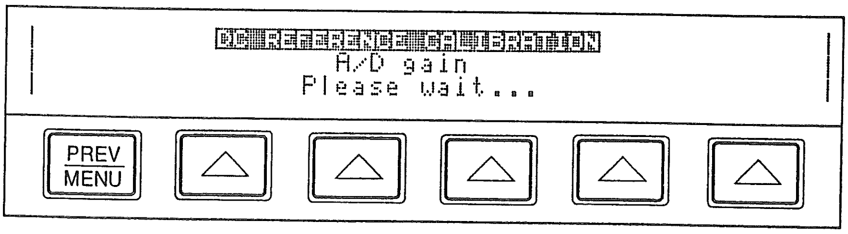
5. Enter the ambient temperature, and press the ENTER key. The display changes to:



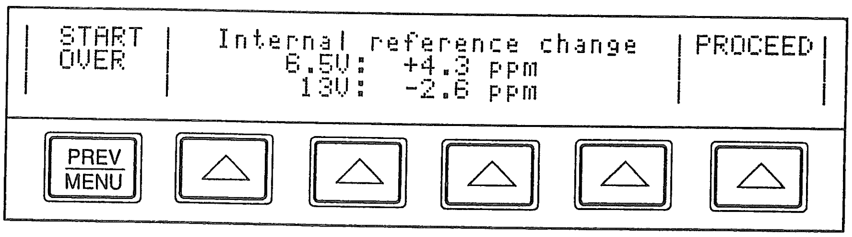
6. Connect the 732A to the 5700A as shown in Figure 3-1.

7. Enter the true value of the 732A 10V output. The true value is the value printed on the calibration sticker, plus or minus any drift since calibration. The 732A drifts in a very linear way, so you can interpolate the true value based on observed drift.

   If the entered value is not between 9 and 11V, an error message appears which allows you to start again from this point with a calibrated 732A. After you press the ENTER key, the display changes to:



   When the 5700A 6.5V and 13V references have been characterized, the following message appears, allowing you to accept or reject the changes about to be made to the calibration constants:



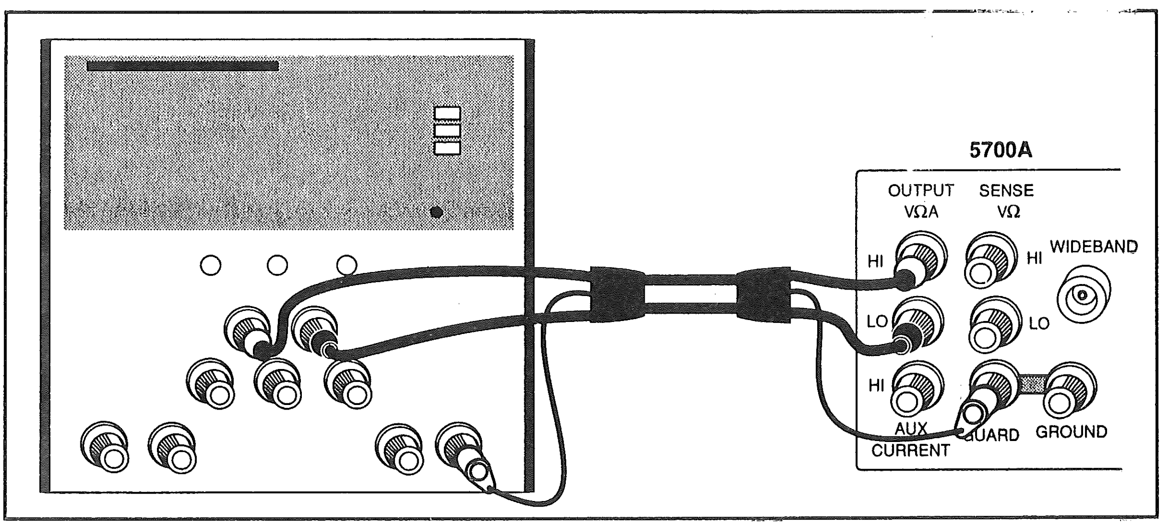
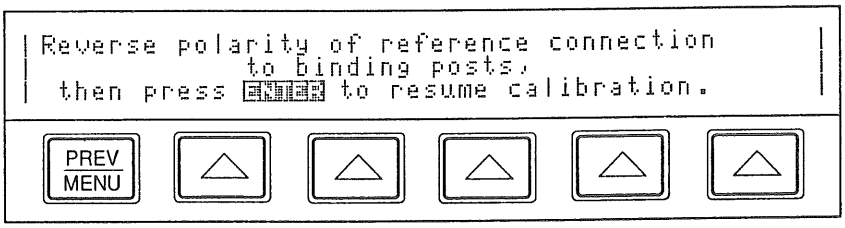
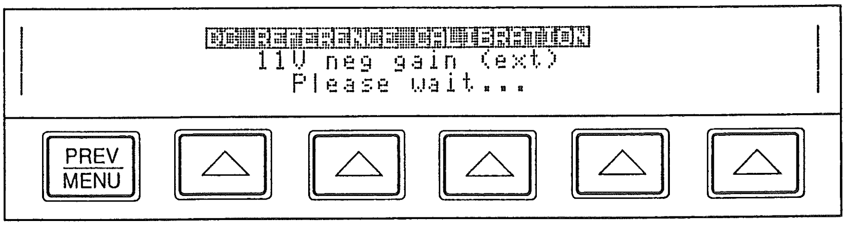


Figure 3-1. 732A External Calibration Connections

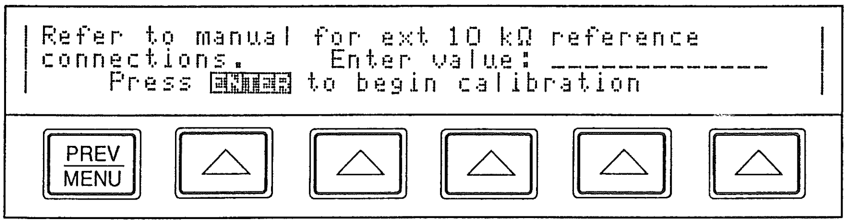
8. If you press PREV MENU, control reverts to the menu in step 3. If you press the "PROCEED" softkey, the 5700A saves the settings in temporary memory for future storage in nonvolatile memory. Calibration continues with the following message on the display:



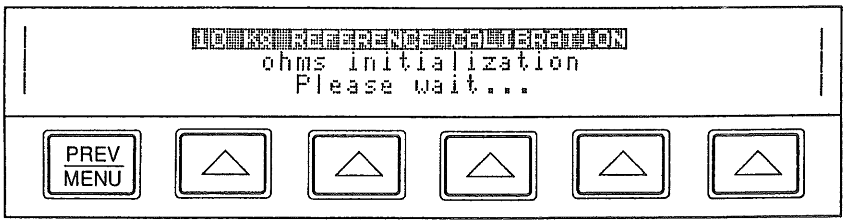
9. Reverse the HI and LO connections at the 732A terminals, and press ENTER. The display changes to:



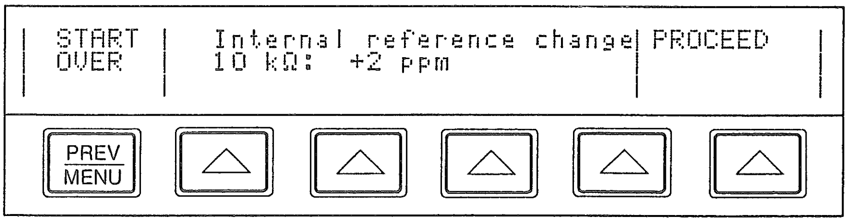
10. When the display changes to:



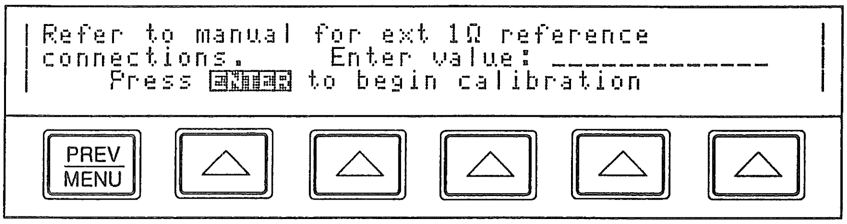
Connect the 5700A to the 10 kilohm standard as shown in Figure 3-2 and enter the true value of the standard. If the standard is not between 9 kilohm and 11 kilohm, an error message appears, which allows you to start again from this point with another standard. When you press the ENTER key, the display changes to:



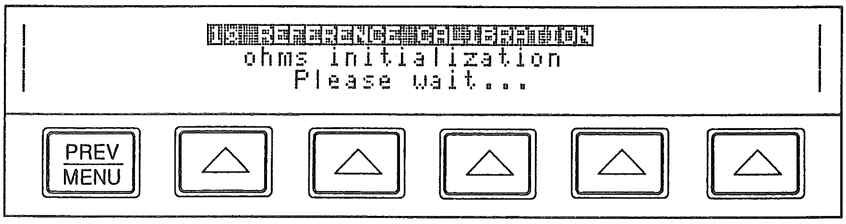
When the internal 10 kilohm reference has been characterized, the following message appears, allowing you to accept or reject the changes about to be made to the calibration constant:



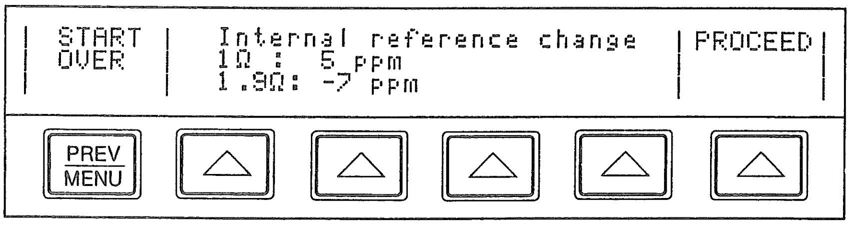
11. If you press PREV MENU, control reverts to the menu in step 3. If you press the "PROCEED" softkey, the 5700A saves the settings in temporary memory for future storage in nonvolatile memory. Calibration continues with the following message on the display:



12. Disconnect the 10 kilohm standard, and connect the 5700A to the 1 ohm standard the same way, then enter the true value of the 1 ohm standard. If the standard is not between 0.9 ohm and 1.1 ohm, an error message appears which allows you to start again from this point with another standard. When you press the ENTER key, the display changes to:



When the internal 1 ohm reference has been characterized, the following message appears allowing you to accept or reject the changes about to be made to the calibration constant:



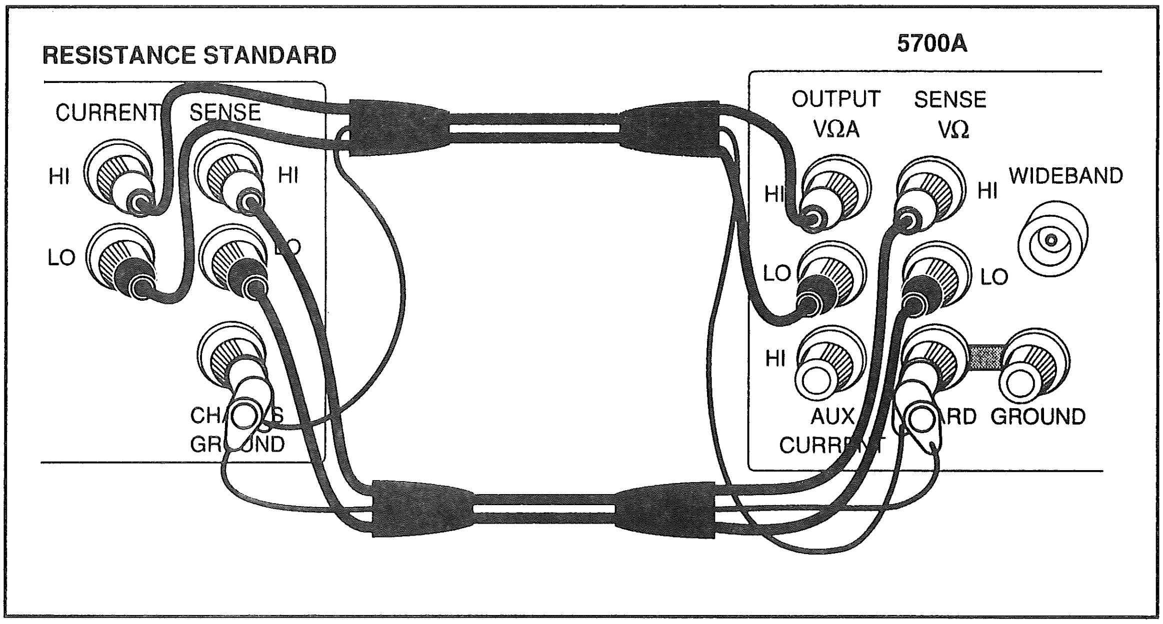


Figure 3-2. 742A-1 and 742A-10K External Calibration Connections

13. If you press PREV MENU, control reverts to the menu in step 3. If you press the "PROCEED" softkey, the 5700A saves the settings in temporary memory for future storage in nonvolatile memory. Calibration continues with internal-only calibration steps.

14. Calibration is not effective until you store the newly-calculated constants in memory. To store the constants, set the rear panel CALIBRATION switch to ENABLE, then press the "Store Values" softkey.

NOTE

You can print a listing of the proposed output shifts to review them before storing the new constants. To print the listing, press the "Print Output Shifts" softkey.

15. After you store the constants, press the "DONE with cal" softkey to exit the calibration menu and resume normal operation. If you press this softkey before storing the constants, the process is aborted without updating existing calibration constants.

16. Set the rear panel CALIBRATION switch to NORMAL.

3-4. Wideband AC Module (Option 5700A-03) Calibration

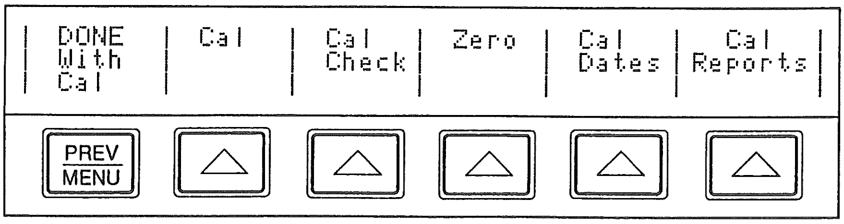
The Wideband AC Module (Option 5700A-03) requires two kinds of calibration: gain and flatness. Gain should be calibrated at the same time as routine calibration of the 5700A main output functions.

Because frequency flatness is determined by such stable parameters as circuit geometry and dielectric constants, flatness of the Wideband AC module has excellent long-term stability. This stability gives the Wideband AC Module a two-year calibration cycle for flatness calibration. Flatness calibration is required only infrequently, and can be done when the 5700A is returned to a standards laboratory for periodic verification. The wideband gain calibration procedure is presented here. The wideband flatness calibration procedure is presented later in this section under "Full Verification".

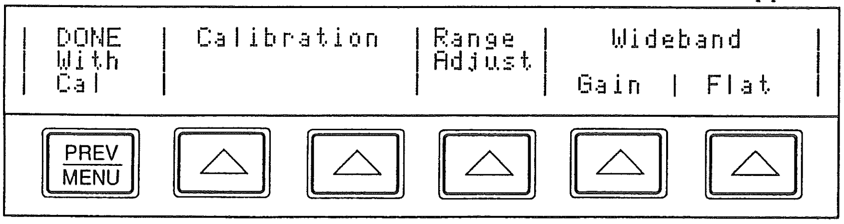
Proceed as follows to calibrate wideband gain:

1. Verify that the 5700A has warmed up for at least 30 minutes.

2. Press the "Setup Menus" softkey then the "Cal" softkey. The calibration menu appears:

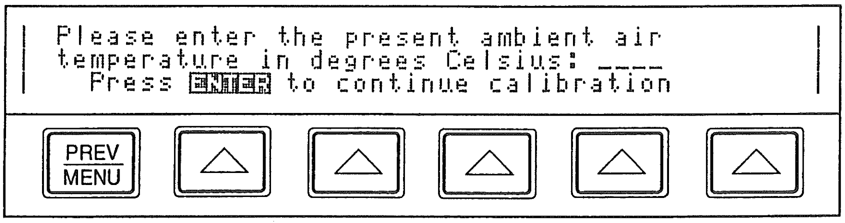


3. Press the "Cal" softkey. The calibration menu appears:

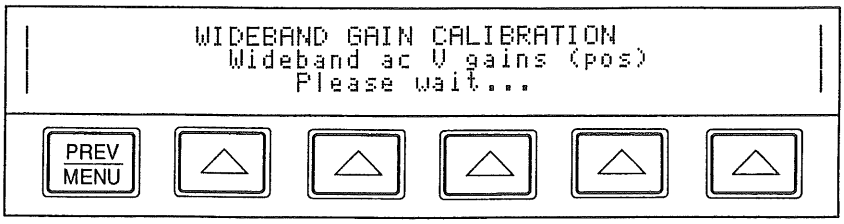


4. Connect the wideband output cable between the WIDEBAND connector and the SENSE binding posts with the center conductor of the 50 ohm feedthrough going to SENSE HI as Figure 3-3 shows. The GND tab on the adapter should be on the LO side.

5. Press the "Gain" softkey. The display changes to:



6. Enter the ambient temperature, and press ENTER. The display changes to:



As wideband gain calibration proceeds, messages appear on the display identifying all processes as they are encountered. When positive gains calibration is complete, a message appears telling you to refer to the manual for negative gains connections.

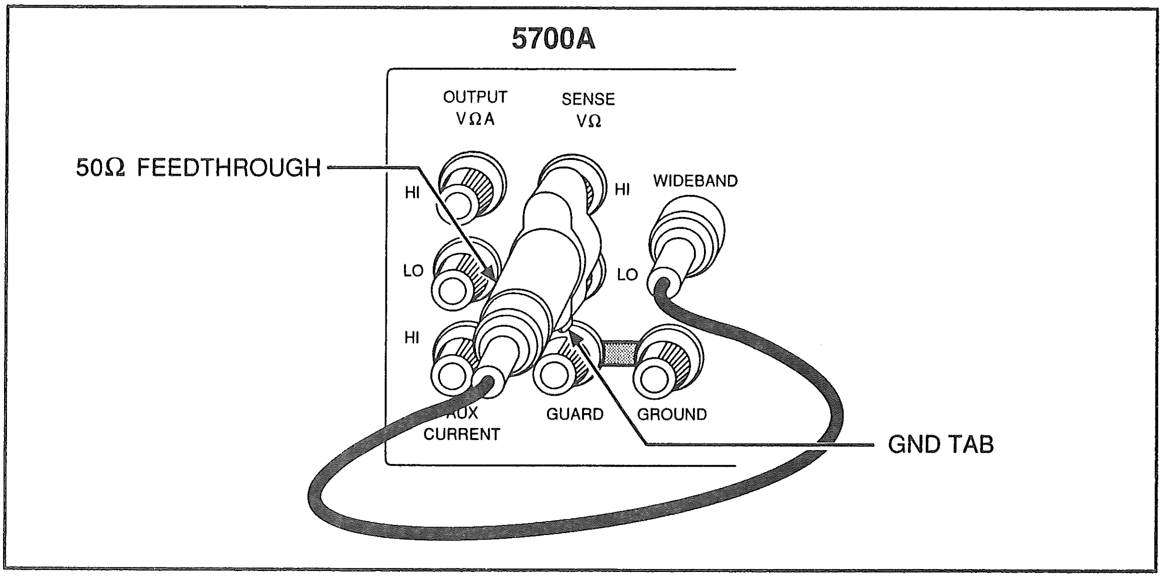
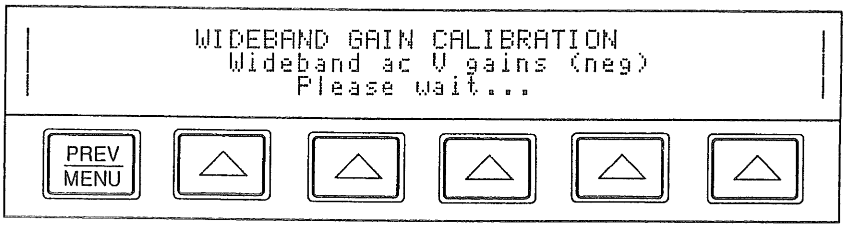


Figure 3-3. Wideband Module Calibration Connection

7. Reverse the dual-banana connector so that the center conductor is connected to LO and press ENTER. The display changes to:



A message announces that wideband gains calibration is done.

8. To store the new constants, set the CALIBRATION switch to ENABLE and press "Store values". If you do not wish to make wideband gains calibration effective, press "DONE with cal" and answer "YES" to the next display that asks for verification.

9. Calibration is finished. Set the CALIBRATION switch to NORMAL, disconnect the wideband cable, and press RESET.

3-5. Doing a Calibration Check

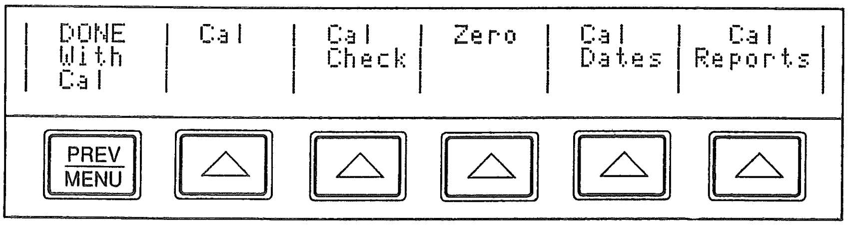
Calibration check is similar to calibration except that no changes are made to stored constants, and the internal check standards are used as the reference points. Calibration check produces a report similar to normal calibration, showing proposed changes. Because calibration check does not change stored calibration constants, there is no need to enable the rear panel CALIBRATION switch. The procedure can be done by an external computer, completely unattended by a person. (See Section 5 of the 5700A Operator Manual for a calibration check remote program example.)

You can use calibration check at any time to confirm the integrity of the 5700A's state of calibration without having to connect external standards. You can also use calibration check as a powerful performance history gathering tool.

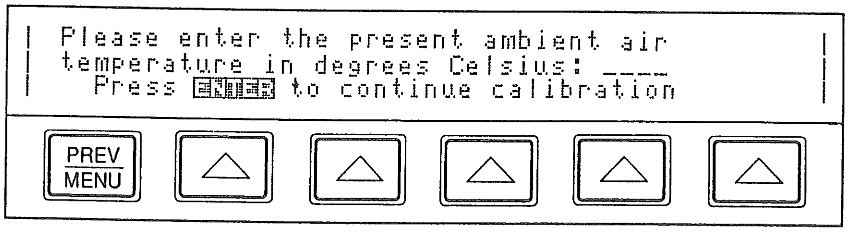
Proceed from the power-up state as follows to do a calibration check:

1. Turn on the 5700A, and allow it to warm up for at least 30 minutes.

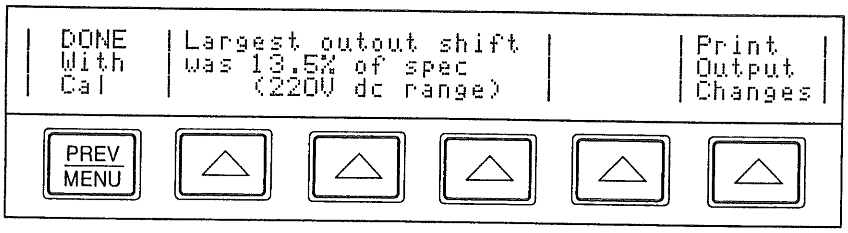
2. Press the "Setup Menus" softkey, then press the "Cal" softkey. The calibration menu appears:



3. Press the "Cal Check" softkey. The display changes to:



4. Enter the ambient temperature and press ENTER. As calibration check proceeds, messages appear on the display identifying all processes as they are encountered. When the whole process is complete, the display shows the largest shift detected:



5. At this point you can print a listing of the proposed shifts or you can quit. To return to normal operation, press the "DONE with check" softkey.

   To print a calibration check report, Press the "Print Output Changes" softkey.

6. Press PREV MENU to exit the calibration menu.

3-6. Range Calibration

After calibration, you can make further fine adjustments to each range if you wish by adjusting a range constant. This is called Range Calibration. A range constant is an additional gain multiplier for each range. Range adjustments are optional; they are not necessary to meet total uncertainty specifications. However, they do allow you to align the 5700A closer to your standards.

To adjust a range constant, you use your own laboratory standard. This procedure is designed to work for laboratory standard values that are greater than or equal to 45% of the range full-scale value and less than or equal to 95% of the range full-scale value. The new range constant is active until the next calibration event. Every time you calibrate the 5700A, all range constant multipliers are reset to 1.

The procedure to adjust a range constant is menu driven, similar to normal calibration. Many different types of standards in many different configurations can be used for the different functions and ranges. For example, you can adjust the 220V dc range using the following equipment:

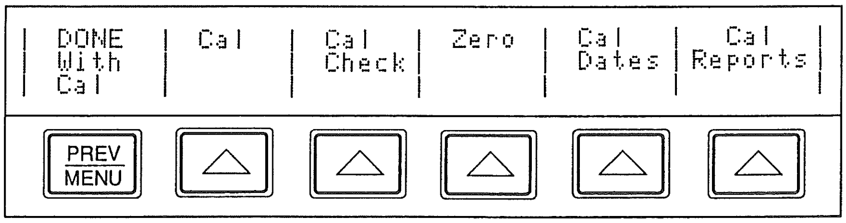
- 732A DC Reference Standard
- 752A Reference Divider
- 845AB/845AR Null Detector
- 5440B-7002 Low Thermal Test Leads (three sets)

A procedure to adjust the 220V dc range constant using the above equipment is described here. You can use your own laboratory standards to adjust other range constants similarly.

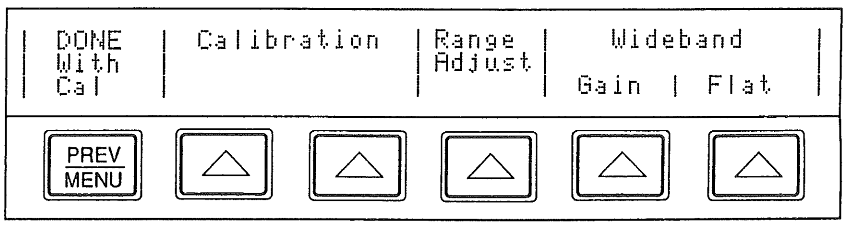
Proceed as follows to adjust the 220V dc range constant:

1. Perform calibration to external standards as described previously in this section.

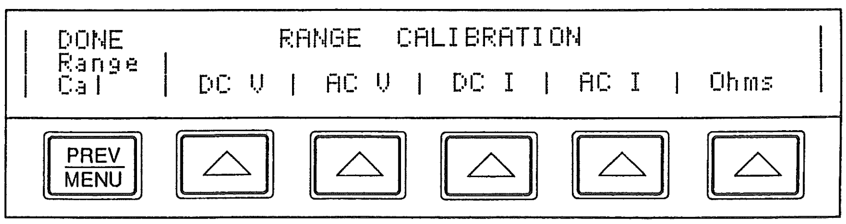
2. Press the "Setup Menus" softkey, then press the "Cal" softkey. The calibration menu appears:



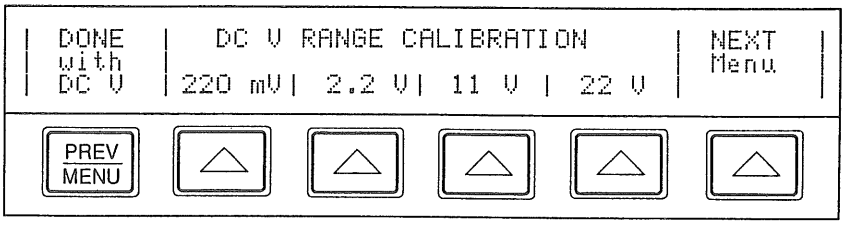
3. Press the "Cal" softkey. The display changes to:



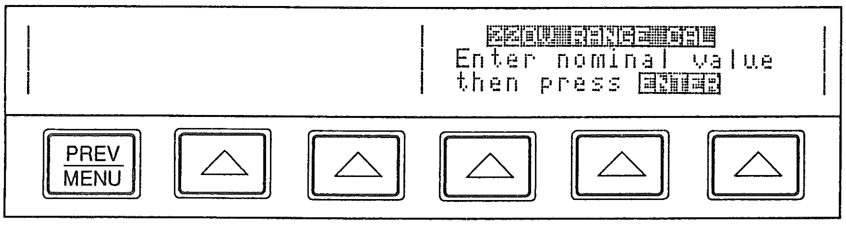
4. Press the "Range Adjust" softkey. The display changes to:



5. Press the "DC V" softkey. The display changes to:

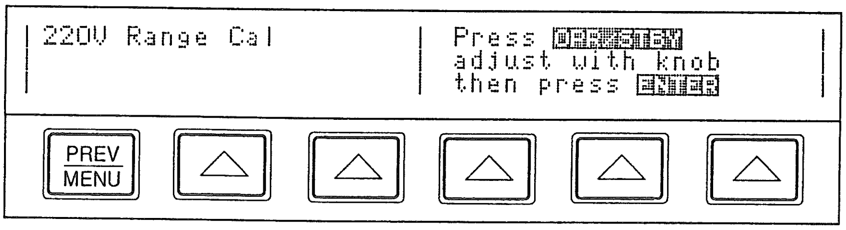


6. All the ranges for dc voltage are presented in a series of menus. Pressing the "NEXT Menu" softkey scrolls through the choices. Press "NEXT Menu" until "220 V" appears, then press its softkey.



7. Connect the 732A, 845A, and 752A in a 10:1 configuration as Figure 3-4 shows.

8. Enter the value of the 732A multiplied by 10. (This is the output of the 752A to which you will null the output of the 5700A.) When you press ENTER, the display changes to:



9. Press OPR/STBY to activate the calibrator output.

10. Rotate the 5700A output adjustment knob to achieve a null on the 845A Null Detector.

11. Set the rear panel CALIBRATION switch to ENABLE.

12. Press ENTER. This causes the 5700A to calculate a new range constant multiplier for the 220V dc range and store it in nonvolatile memory.

13. Range calibration is complete. Set the rear panel CALIBRATION switch to NORMAL, disconnect the external standards, and press RESET.

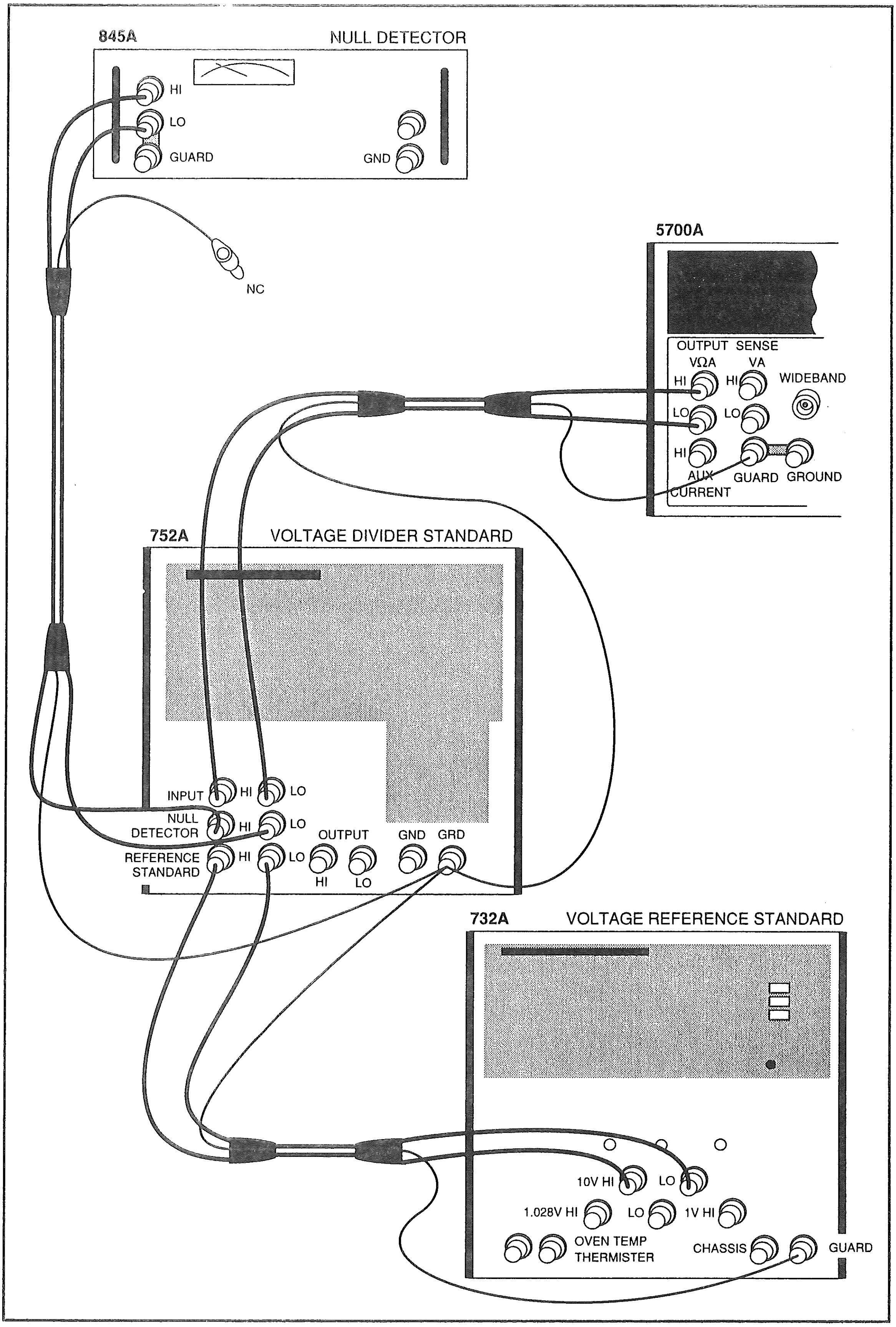


Figure 3-4. 220V DC Range Calibration Connections

3-7. FULL VERIFICATION

An independent external verification is recommended every two years, following a normal periodic calibration. Verification establishes and maintains parallel external traceability paths for the internal functions that are not adjusted or corrected during calibration. An example is the internal ac/dc transfer standard. Verification also serves as a check that internal calibration processes are in control.

NOTE

> All performance limits specified in the test records apply to 90-day specifications for the 5700A. If limits to other specifications are desired, the test records must be modified.

Before beginning verification, make copies of the Test Record (Table 3-27) (Table 3-27) located at the end of this section. Due to the state of the art performance of the 5700A, it is necessary to record test data for many of the tests for use as characterized values in subsequent tests. Many of the performance limits are shown only on the test record rather than in the body of the text. This allows an experienced technician to use the test record as an abbreviated version of the test procedure.

3-8. Required Equipment for All Tests

An abbreviated summary of required equipment for all the verification and optional tests is given in Table 3-2. Individual lists of required equipment are included at the beginning of each test. For substitution information, refer to Table 3-26, Minimum Use Requirements, located near the end of this section.

Table 3-2. List of Required Equipment for Main Output Tests

MFR.	MODEL	DESCRIPTION	APPLICATION
Fluke	742A Series	Resistance Standards	Cal, ohms, DC
Fluke	752A	Reference Divider	DC V
Fluke	845A	Null Detector	DC V
Holt	11	Thermal Voltage Conv.	AC V
Fluke	540B	Thermal Transfer Std.	AC V, AC
Fluke	5100B	Calibrator	Ohms
ESI	DT72A	Ratio Transformer	mV AC
Philips	PM6669	Frequency Counter	Frequency
Fluke	A40 Series	Shunts	AC
Fluke	Y5020	High Current Shunt	DC
L&N	0.1 Ohm	Standard Resistor	DC
Fluke	931B	RMS Differential Vm.	mV AC
Fluke	8922A	RMS Wideband Voltmeter	mV AC
Fluke	8500 Series	DMM	Ohms, DC
GenRad	874		
or, Narda	777C-20	20 dB RF Atten. (Qty. 3)	mV AC
Fluke	P/N 853429	50 Ohm Termination	mV AC
Fluke	5440-7002	Low Thermal Cables	Various

EQUIPMENT REQUIRED FOR WIDEBAND AC MODULE (OPTION 5700-03) VERIFICATION

MFR. MODEL	DESCRIPTION	APPLICATION
Fluke A55-3V	High Freq. Thermal Converter	WB
Narda 777C-20	20 dB RF Attenuator (Qty. 3)	WB
Narda 777C-10	10 dB RF Attenuator (Qty. 1)	WB
Comlinear CLC100	20 dB Amplifier (Qty. 2)	WB
Fluke 8920A	Wideband RMS Voltmeter	WB mV AC
(Any)	±12V Power Supply	WB

EQUIPMENT REQUIRED FOR OPTIONAL TESTS

MFR.	MODEL	DESCRIPTION	APPLICATION
Tektronix		Scope Mainframe	HF Noise
Tektronix	7A22	Differential Amplifier	HF Noise
HP	334A or 8903A	Distortion Analyzer	AC V, AC, Dist.
Tektronix	7L12	Spectrum Analyzer	AC V, WB, HF Dist.
Fluke	720A	Kelvin Varley	DC V Linearity

3-10. Warmup Procedure For All Verification Tests

Before performing verification, do the following things:

1. Verify that the 5700A has warmed up for at least thirty minutes.
2. If you are doing a regularly scheduled full verification as recommended by Fluke, calibrate the 5700A as previously described before continuing with verification.
3. Ensure that each piece of external test equipment has satisfied its specified warmup requirements.
4. Ensure that the 5700A is in standby (STANDBY annunciator lit).

3-11. Resistance Verification Test

The following test requires testing at the high, low and intermediate values only. This is because the 5700A creates the other values of resistance from these values. For the convenience of anyone wishing to test the intermediate values, the tolerance limits are included. Testing these values could be done using a Hammon-type ratio device and a very stable, high-resolution bridge or DMM, or a combination of the two. Table 3-3 lists equipment required for this test. See Table 3-26, Minimum Use Requirements, for substitution information.

Table 3-3. Equipment Required for Resistance Testing

EQUIPMENT	DESCRIPTION
Standard Resistors	Fluke 742A Series in the following values: 1 ohm, 10 ohm, 10 kilohm, 19 kilohm, 10 megohm, and 19 megohm
Current Source	Fluke 5100B, 5700A, or EDC CR103/J
DMM	Fluke 8500 Series

1. Connect the equipment as shown in Figure 3-5.
2. Set the 5700A output to 1 ohm with external sensing (EX SENS indicator lit) and set the dc DMM to read dc V. Record the 1 ohm standard resistor value on the test record as the "1 Ohm Standard Resistor Value."
3. Multiply the certified value of the 1 ohm standard resistor by 0.1 and record the result on the test record as the "1 Ohm Standard Voltage."
4. Connect the DMM across the sense terminals of the 1 ohm standard resistor.

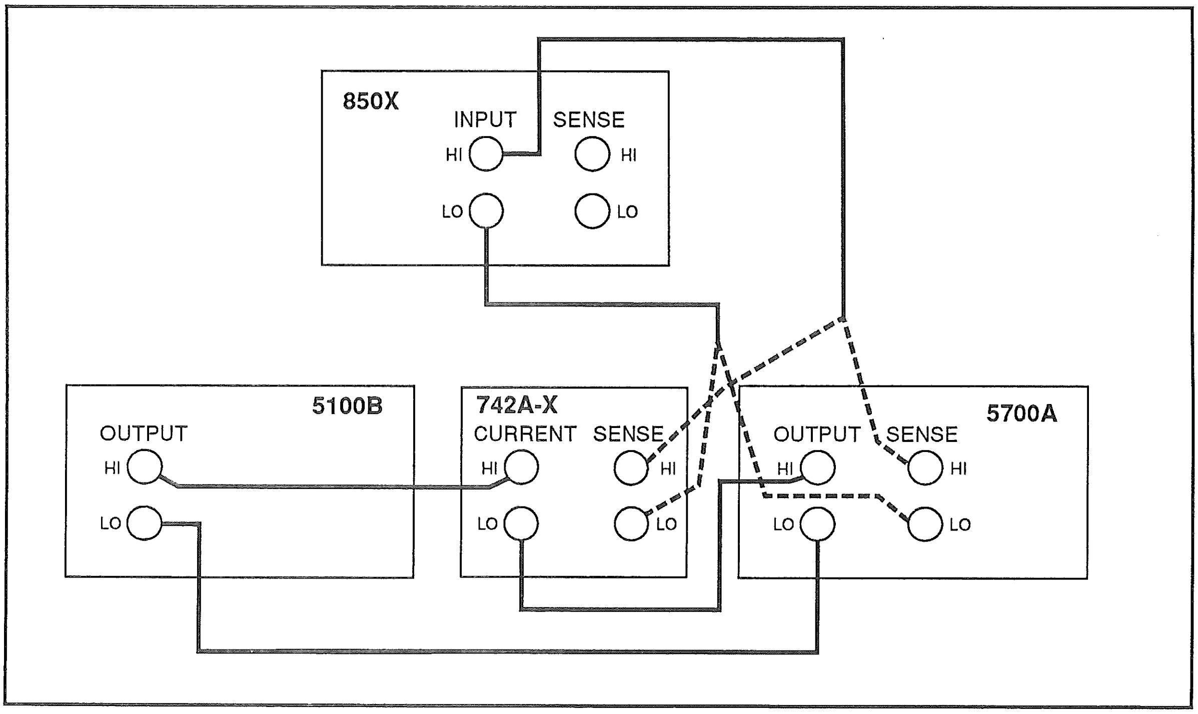


Figure 3-5. 1 Ohm and 10 Ohm Resistor Verification

5. Set the direct current source for a nominal 100 mA output. Vary the source until the DMM reading is as close as possible to the 1 ohm Standard Voltage recorded in the previous step. Record the DMM voltage reading on the test record as the "Measured 1 Ohm Standard Voltage."

6. Calculate the exact current by dividing the "Measured 1 Ohm Standard Resistance Value"; record the result on the test record as the "Calculated Current."

7. Enter the 5700A displayed 1 ohm value on the test record as the "UUT 1 ohm Displayed Value."

8. Transfer the dc DMM leads to the 5700A sense terminals.

9. Enter the DMM voltage reading on the test record as the "UUT 1 Ohm Voltage."

10. Calculate the UUT true 1 ohm resistance by dividing the "UUT 1 Ohm Voltage" by the "Cal Current."

11. Edit the 5700A "Reading = ###" on the Control Display to the true 1 ohm resistance value calculated in the previous step. The error from the displayed value is also shown on the Control Display. Enter the value of the error (with polarity reversed) on the test record as the "UUT Deviation from Displayed Value."

12. Repeat steps 3 through 11 for the 10 ohm resistance using the 10 ohm standard resistor 10 mA of current.

13. The low-value (1 ohm and 10 ohm) tests are summarized in Table 3-4.

Table 3-4. Low Value Resistance Calibration Using a Current Source

5700A RESISTANCE	APPLIED CURRENT	5700A DEVIATION FROM DISPLAYED VALUE	5700A DISPLAYED VALUE
1 ohm	100 mA	±95 ppm	0.9995 to 1.0005
10 ohm	10 mA	±28.0 ppm (90-day spec.)	9.997 to 10.003

14. For the remaining tests, no current source is required. Verify that each true 5700A value is within the limits shown in Table 3-5.

    - Connect the DMM, set for 4-wire resistance, first to the Standard Resistor equal to the 5700A nominal output and then to the 5700A. In each case, record the standard resistor DMM reading and the standard resistor certified value.

    - Calculate the DMM correction by subtracting the DMM reading from the certified value; enter this calculated value on the test record as "DMM Error."

    - Move the DMM to the 5700A (UUT) terminals; enter the DMM reading on the test record as "DMM UUT Resistance Reading."

    - Algebraically add the "DMM Error" and the "DMM UUT Resistance Reading"; enter the sum on the test record as "UUT True Resistance Value."

    - Edit the 5700A "READING - ###" on the Control Display to the true resistance value previously calculated. The error from the displayed value is also shown on the Control Display. Enter this error (with polarity reversed) on the test record as the "UUT Deviation from Displayed Value."

Table 3-5. Resistance Test Summary

1 OHM STD RES VALUE	1 OHM STD VOLTAGE	MEASURED 1 OHM STD VOLTAGE	CAL CURRENT	UUT 1 OHM DISPLAYED VALUE	UUT 1 OHM VOLTAGE	UUT TRUE RES.	UUT DEVIATION FROM DISPLAYED VALUE	LIMIT OF DEVIATION FROM DISPLAYED VALUE	MAXIMUM DIFFERENCE OF CHARACTERIZED TO NOMINAL VALUE
								+/-94 ppm	.9995 to 1.0005

10 OHM STD RES VALUE	10 OHM STD VOLTAGE	MEASURED 1 OHM STD VOLTAGE	CAL CURRENT	UUT 1 OHM DISPLAYED VALUE	UUT 1 OHM VOLTAGE	UUT TRUE RES.	UUT DEVIATION FROM DISPLAYED VALUE	LIMIT OF DEVIATION FROM DISPLAYED VALUE	MAXIMUM DIFFERENCE OF CHARACTERIZED TO NOMINAL VALUE
								+/-28.5 ppm	9.997 to 10.003

RESISTANCE ACCURACY VERIFICATION (19 OHM AND ABOVE)

	STD RES VALUE	DMM STD RES RDG	DMM ERROR	DMM UUT RES RDG	UUT TRUE RES VALUE	UUT DEVIATON FROM DISPLAYED VALUE		
19 ohm (1)							+/-26 ppm	18.9943 to 19.0057
100 ohm (1)							+/-17 ppm	99.985 to 100.015
190 ohm (1)							+/-17 ppm	189.9715 to 190.0285
1 kilohm (1)							+/-12 ppm	999.85 to 1000.15
1.9 kilohm (1)							+/-12 ppm	1.899715k to 1.900285k
10 kilohm							+/-11 ppm	9.9985k to 10.0015k
19 kilohm							+/-11 ppm	18.99715k to 19.00285k
100 kilohm (1)							+/-13 ppm	99.985k to 100.015k
190 kilohm (1)							+/-13 ppm	189.9715k to 190.0285k
1 megohm (1)							+/-18 ppm	0.9998M to 1.0002M
1.9 megohm (1)							+/-19 ppm	1.89962M to 1.90038M
10 megohm							+/-37 ppm	9.997M to 10.003M
19 megohm							+/-47 ppm	18.9943M to 19.0057M
100 megohm (2)							+/-120 ppm	99.95M to 100.05M

Note 1: Not necessary to test due to 5700A internal calibration process.

Note 2: Due to extremely slow settling time (approximately 5 minutes to 0.005% and sensitivity to any nearby movement, use of the DMM to test 100 megohms to the specified 0.01% uncertainty is not practical and therefore is not recommended. For those who wish to test it, a suitable way is to use an ESI SR 1050 10M/step Hammon-type Resistance Transfer Standard and use it in conjunction with an ESI 242-series bridge to effect the measurement to the required uncertainty.

3-12. Two-Wire Compensation Verification

Use the following steps to verify that two-wire compensation operates correctly:

1. Connect the 5700A (UUT) (output set to 100 ohm, with external sensing) to the DMM (set for 4-wire resistance measurement). Note the DMM reading.
2. Connect two shorts: DMM SOURCE HI to SENSE HI and DMM SOURCE LO to SENSE LO.
3. Activate 5700A (UUT) 2-wire compensation.
4. Check that the DMM reading returns to within 4 milliohm of the reading noted in step 1.

3-13. DC Voltage Verification Test

The following test checks every dc voltage range by testing the output accuracy at decade values of voltage from 100 mV to 1000V. Table 3-6 lists equipment required for this test as well as the Linearity Test that follows. See Table 3-26, Minimum Use Requirements, for equipment substitution information.

Table 3-6. Equipment Required for DC Voltage Testing

EQUIPMENT	MODELS
DC Reference Standard	Fluke 732A
Reference Divider	752A
Null Detector	845A(B or R)

Proceed as follows to perform the dc voltage verification test:

1. Connect the equipment as shown in Figure 3-6.
2. Set the reference divider to 0.1V. Set the 5700A to the certified value of the dc reference standard divided by 100. For example, if the the certified value of the dc reference standard is 10.000007V, set the 5700A to 100.00007 mV.
3. Press OPR/STBY. After the reading has settled, verify that the null detector reads 0V $\pm$1.45 uV (the 90-day specification). Set the 5700A to standby.
4. Repeat the above process to test each 5700A dc voltage range output listed in Table 3-7. (0.1V is in the table for completeness; you do not need to repeat it.) After the null detector reading stabilizes, ensure that any observed meter rattle over a ten-second period does not exceed the amount shown in the last column. In each case, set the 5700A to standby before changing to the next voltage settings and go back to operate before reading the null detector.

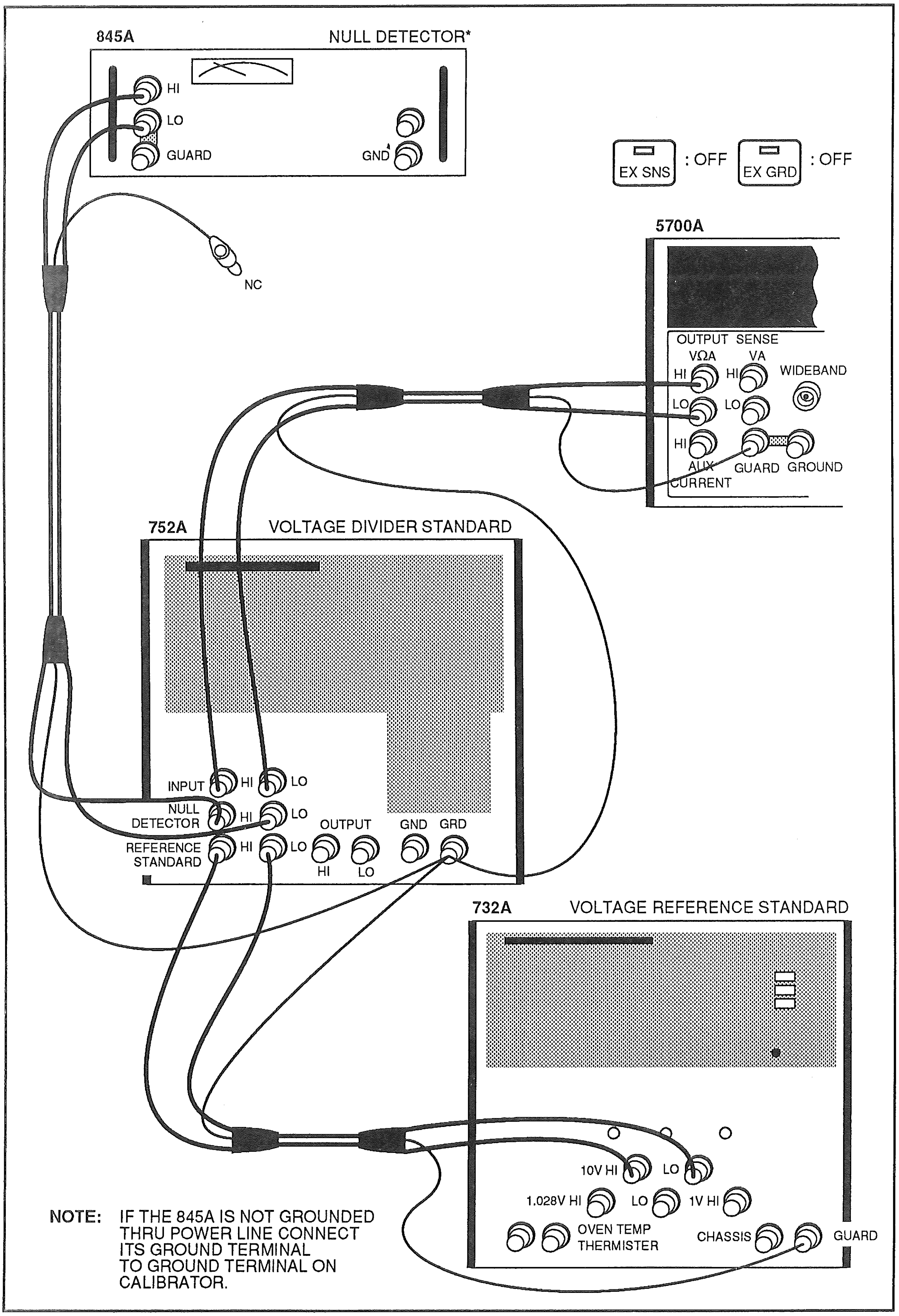


Figure 3-6. DC Voltage Verification Test

Table 3-7. Output Voltage Test Summary

DIVIDER SETTING	5700A RANGE	5700A OUTPUT (NOTE # 1)	NULL DETECTOR READING (uV)	NULL DET LIMIT (uV p-p)	METER LIMIT (uV) RATTLE
0.1V	0.22V	0.1V		±1.45 uV (# 2)	NA
1V	2.2V	1V		±7.2 uV (# 2)	0.55 uV
1V	11V	1V (# 3)		±9 uV (# 2)	2.2 uV
10V	11V	10V (# 4)		±54 uV	3.5 uV
10V	22V	10V (# 3)		±58 uV	5.5 uV
100V	220V	100V		±70 uV	7.5 uV
1000V	1100V	1000V		±86 uV	4.5 uV

TABLE NOTES

Note 1: On the 752A 0.1 and 1V ranges, the null detector polarity is reversed. A low input (5700A output) causes a positive null detector reading.

Note 2: Mathematically, the true 5700A output programmed is the certified value of the reference standard divided by the reference standard nominal value, multiplied by the required 5700A nominal output. In other words, the 5700A output is always programmed for the nominal output adjusted up or down by the same percentage as the certified value of the reference standard.

Note 3: Use Range Lock to obtain 1V on 11V and 10V on 22V range. Deactivate Range Lock before setting the next voltage output.

Note 4: Line regulation can be verified at this time by adjusting the autotransformer for a ±10% change in line voltage. The null detector reading must remain constant within ±1 uV.

5. Reverse the connections of the dc reference standard at the reference divider and repeat the previous measurement process for the -0.1V and -10V 5700A outputs only.

3-14. DC Voltage One-Tenth Scale Linearity Test

NOTE

If the result of the previous test at 1V on the 11V range was less than 2.5 uV it is not necessary to perform this test.

This test uses the same equipment as the previous test. Proceed as follows to perform the DC Voltage One-Tenth Scale Linearity Test:

1. Set the reference divider range to 10V. On the voltage reference standard, remove the lead from the 10V high terminal and connect it under the binding post of the low terminal along with the low lead to provide a 0V reference input to the reference divider. Set the 5700A output for 10V, then activate range lock for the 11V range. Now set the 5700A to 0V OPERATE.

2. Note the reading on the null detector. Press OFFSET on the 5700A. Return the lead on the voltage reference to the high output terminal.

3. Set the 5700A to 10V. Use the knob to adjust the 5700A output for the reading previously noted on the null detector. Press SCALE on the 5700A.

4. Set the reference divider to the 1V range. Set the 5700A to 1V dc and verify that the null detector indicates less than 2.5 uV from the noted reading.

5. Press RESET on the 5700A. This completes the DC Voltage Calibration Verification testing.

3-15. AC Voltage Frequency Accuracy Test

This test requires the use of a frequency counter. Philips model PM6669 is recommended. Refer to Table 3-26, Minimum Use Requirements, for substitution information.

To check the 5700A frequency accuracy, proceed as follows:

1. Connect the frequency counter to the output terminals of the 5700A.

2. Set the 5700A to 1V at the output frequencies listed in Table 3-8. Verify that the counter reads within the limits shown on the test record.

Table 3-8. AC Voltage Frequency Accuracy

FREQUENCY	TOLERANCE	ACTUAL
10 Hz	99.99 ms - 100.01 ms	
15 Hz	66.673 ms - 66.66 ms	
100 Hz	9.999 ms - 10.001 ms	
200 Hz	199.98 Hz - 200.02 Hz	
500 Hz	499.95 Hz - 500.05 Hz	
1 kHz	999.9 Hz - 1000.1 Hz	
5 kHz	4999.5 Hz - 5000.5 Hz	
10 kHz	9.999 kHz - 10.001 kHz	
140 kHz	139.986 kHz - 140.014 kHz	
200 kHz	199.98 kHz - 200.02 kHz	
500 kHz	499.95 kHz - 500.05 kHz	
1 MHz	0.9999 MHz - 1.0001 MHz	

3. Disconnect the counter from the 5700A.

3-16. Output Level Tests for AC V Ranges 2V and Above

This test requires the use of equipment listed in Table 3-9.

Table 3-9. Equipment Required for AC V Output Level Tests

Holt 11 Thermal Voltage Converter
Fluke 540B Thermal Transfer Standard
GR874 to male banana adapter
Coaxial cable from TVC output to High Freq Converter input of 540B

NOTE

Before beginning this test, refer to the Certified Report of Calibration for the transfer standard for corrections. If its corrections are 10 ppm or greater, enter them on the test record and use them to correct the results of this test to obtain a reference transfer standard indication. Enter any required corrections at this time in + or - ppm in the space provided for on the test record for each level and frequency.

1. Select a transfer standard 2V input range.

2. Connect the equipment as shown in Figure 3-7. To protect the Holt 11 from over voltage, set the limits on the 5700A to +2.002V and -2.002V.

NOTE

If a GR 874 to male banana adapter is not available, you can use a GR 874 to banana female adapter and wires of 12 gauge or heavier no more than 2 inches in length tightened securely under the terminals to attach the 5700A to the Holt 11. Support the Holt as necessary.

3. Set the 5700A for 2V dc. Press OPR/STBY.

4. Allow sufficient time (usually around 10 minutes for the first reading) for the transfer standard null meter reading to stabilize. Adjust the transfer standard null controls for a precise null indication.

5. Proceed as follows to obtain an average of the reversed dc to obtain a reference for the ac:

   a. Adjust the transfer standard null controls for a null with positive polarity voltage from the 5700A.

   b. Reverse the 5700A output voltage by pressing the 5700A ± key.

   c. Record the final deflection on the transfer standard null meter in + or - small divisions.

   d. Reverse the 5700A output voltage to obtain a positive output. Verify that the null meter returns to a precise null.

   e. Adjust the transfer standard controls to obtain one-half the deflection recorded in step c, but in the opposite direction. For example, if you recorded +4.7 divisions for step c, the correct offset for step e would be -2.4 divisions (rounded to the nearest tenth).

6. Set the 5700A output to 2V at 1 kHz.

7. Without touching the transfer standard null controls, use the knob to adjust the 5700A output as necessary to obtain a null on the Transfer Standard null meter. Record the 5700A error display reading and verify that it is within the limit shown on the test record.

8. Set the 5700A output to +2V dc.

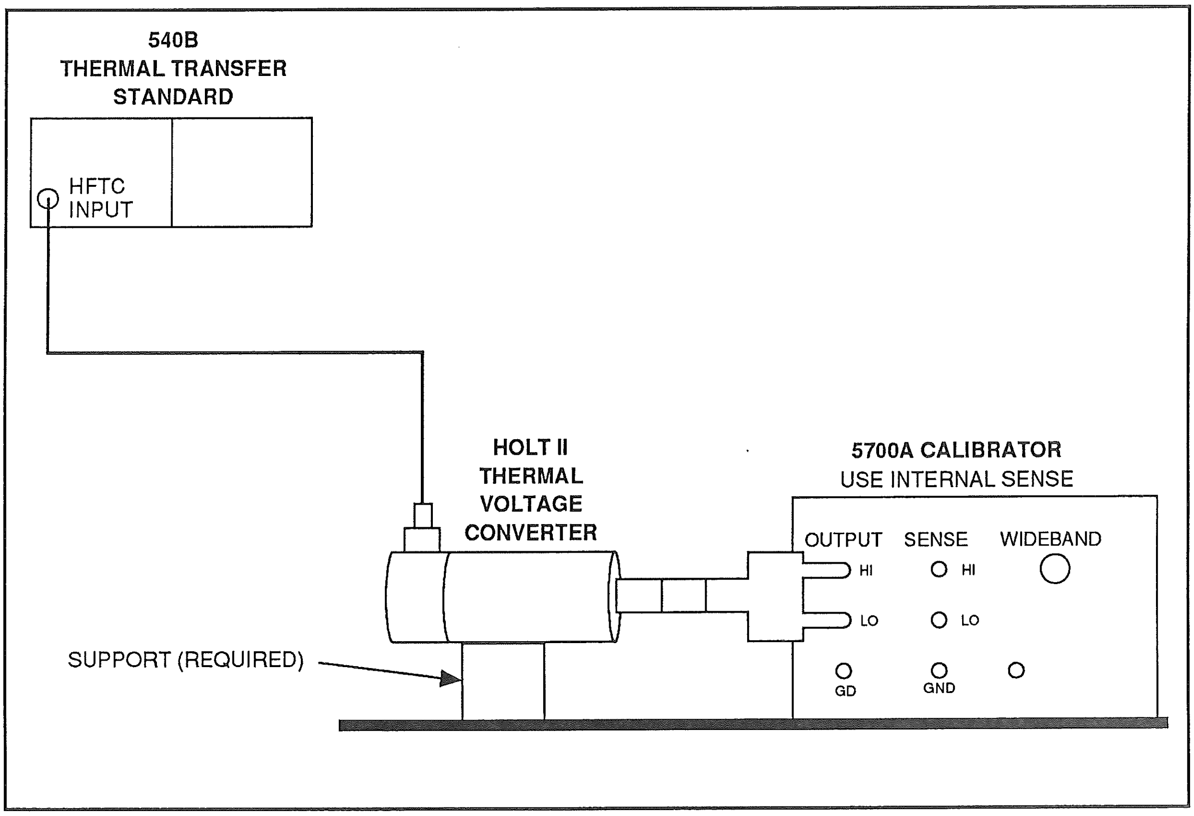


Figure 3-7. AC Voltage Verification

9. Verify that the null meter offset is within ± 1/2 small division (5 ppm) of that recorded in step 5e. Otherwise, repeat steps 5 through 10 until the required result is achieved.

NOTE

From this point on, for this range, the test uses an ac/ac transfer technique rather than ac/dc. The test references every frequency back to 1 kHz using the recorded error display reading from step 8 as the reference.

10. With the 5700A set to 2V at 1 kHz, adjust the transfer standard null controls for a null.

NOTE

Do not adjust the transfer standard controls again until instructed to do so.

11. Set the 5700A to the next frequency listed in Table 3-10 and on the test record. Adjust the 5700A using the knob for a null on the Transfer Standard null meter. Record the 5700A error display reading. Algebraically add the readings to any transfer standard corrections previously entered for 1 kHz and verify that the result is within the limits shown.

12. Repeat steps 10 and 11 for each remaining frequency for this range in Table 3-10 and on the test record.

13. Repeat the preceding process for each remaining range and frequency shown in Table 3-10 and on the test record. Select the required range of transfer standard and program the nominal dc voltage for each range to obtain the reversed dc reference as was done for the 2V range.

    For the 1000V range, remove the Holt TVC and use the 540B directly. The 50 ppm uncertainty at 1000V for the 540B is sufficient to check the 5700A/5725A 1000V range. Alternately, a more accurate check of this range can be made at 600V with the Holt 5 mA thermoelement and the 600V converter.

NOTE

At 1000V output, the transfer standard used to test the 5700A must draw less than 6 mA. Some single-range transfer standards draw 10 mA (10W dissipation) at this level. Do not use these. Table 3-21, Minimum Use Requirements, recommends alternatives.

Table 3-10. AC Voltage Output Test

FREQUENCY	OUTPUT LEVEL	TRANSFER STANDARD CORRECTION	ERROR DISPLAY READING	CAL ERROR ADDING ERROR 1 kHz	90-DAY SPEC
1 kHz	2V				78.5 ppm
40 Hz	2V				78.5 ppm
20 kHz	2V				78.5 ppm
50 kHz	2V				140 ppm
100 kHz	2V				290 ppm
300 kHz	2V				515 ppm
500 kHz	2V				0.13%
1 MHz	2V				0.27%
20 Hz	2V				185 ppm
10 Hz	2V				600 ppm
1 kHz	2.3V (Note 1)				78.5 ppm
1 kHz	20V				78.5 ppm
40 Hz	20V (Note 2)				78.5 ppm
20 kHz	20V				78.5 ppm
50 kHz	20V				140 ppm
100 kHz	20V				270 ppm
300 kHz	20V				635 ppm
500 kHz	20V				0.155%
1 MHz	20V				0.325%
20 Hz	20V				185 ppm
10 Hz	20V				600 ppm
40 Hz	200V	Stability for 10 minutes: <± 7.5 ppm			
1 kHz	200V				85 ppm
40 Hz	200V				85 ppm
20 kHz	200V				85 ppm
50 kHz	200V				240 ppm
100 kHz	200V				600 ppm
20 Hz	200V				130 ppm
10 Hz	200V				600 ppm
20 kHz	300V (Note 3)				155 ppm
50 kHz	600V (Note 3)				378 ppm
100 kHz	600V (Note 3)				0.1375%
50 Hz	1000V (Note 4)				84 ppm
200 Hz	1000V (Note 4)				84 ppm
500 Hz	1000V (Note 4)				84 ppm
1 kHz	1000V (Note 4)				84 ppm
40 Hz	1000V (Note 3)				84 ppm
20 kHz	1000V (Note 3)				131 ppm

Table 3-10. AC Voltage Output Test (cont)

TABLE NOTES

Note 1: This is a test of the bottom of the 20V range and will require re-referencing at 2.3 V dc.

Note 2: Observe the 5700A output at 20V, 40 Hz for 10 minutes and verify it remains stable within ± 7.5 ppm. Return to 1 kHz and algebraically subtract from the reading any drift caused by the element.

Note 3: Perform only for units with 5725A Amplifier attached. At 600V, use the 500V range on the 540B.

Note 4: Maximum load current is 6 mA for 1 kV range without a 5725A attached.

3-17. AC Voltage mV Ranges Output Level Test

The following test uses the just-measured 5700A 2V range and a ratio transformer to establish absolute millivoltage levels at 1 kHz on an rms differential voltmeter (200 mV and 20 mV) and an rms wideband voltmeter dc DMM combination (2 mV). These meters are used as transfer devices. The rms meters measure the absolute voltage on each 5700A millivolt range. Then 20 dB rf attenuators are connected between the 5700A output and an rms meter input. Using the corrections for the 5700A 2V range, if necessary, the 5700A output is maintained constant into the 20 dB rf attenuators. In this way, the rms meters are characterized for frequency response. Once characterized, the rms meters measure the 5700A millivolt ranges directly for frequency response from the characterized absolute 1 kHz reference. Use Table 3-11 or the test record for these tests.

3-18. ABSOLUTE LEVEL VERIFICATION AT 1 kHz (200 mV, 20 mV, AND 2 mV)

1. Connect the equipment as shown in Figure 3-8.

2. Set the 5700A for a 2V, 1 kHz output and adjust the error display for the reading recorded in step 7 of the Output Level Tests for AC Voltage Ranges 2V and Above.

3. Set the ratio transformer to 0.1, and adjust the rms differential voltmeter dials for a null. Record the dial setting as the "200 mV" reading on the test record.

4. Set the ratio transformer to 0.01 and adjust the rms differential voltmeter dials for null. Record the dial setting as the "20 mV" reading on the test record.

5. Substitute the rms wideband voltmeter (with the dc DMM connected to its output) for the rms differential voltmeter in the test setup. Switch in the 8922 filter.

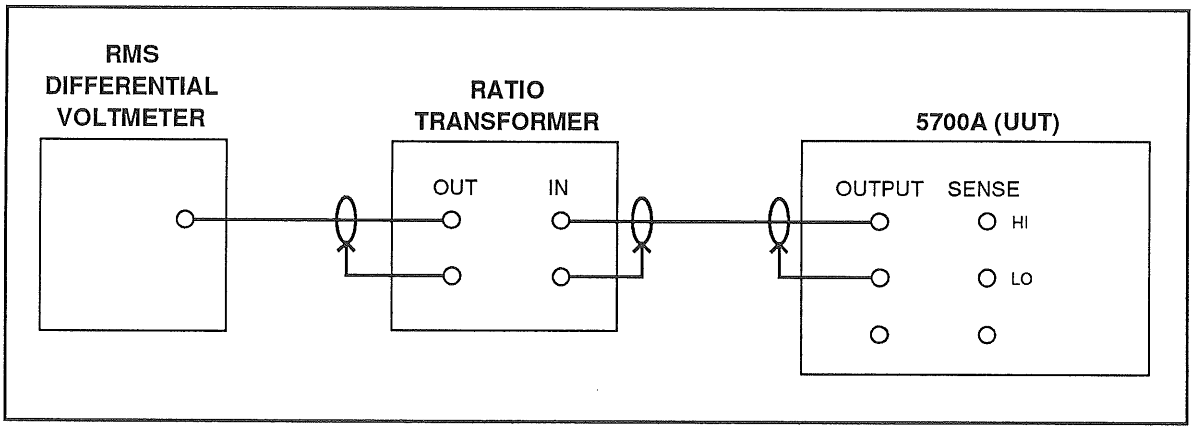


Figure 3-8. Absolute Level Verification at 1 kHz (200 mV and 20 mV)

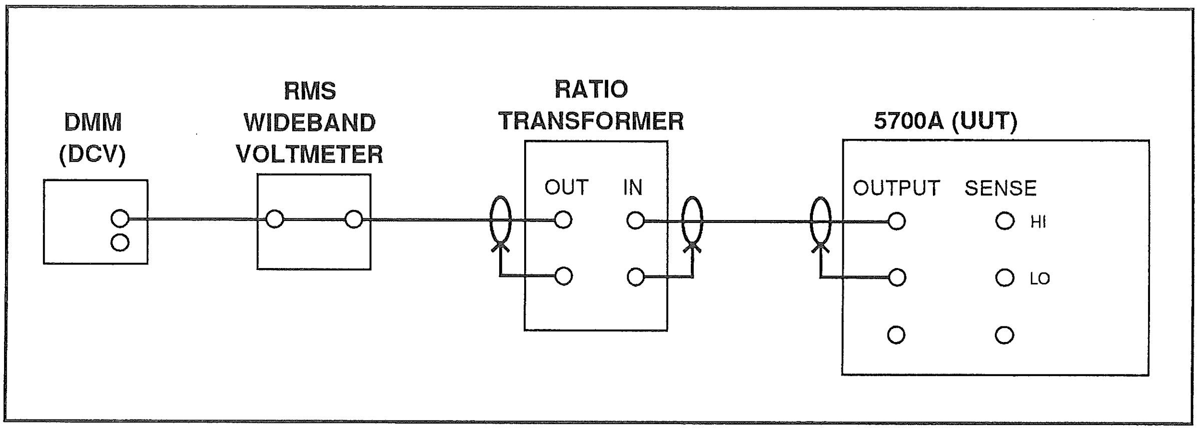


Figure 3-9. Absolute Level Verification at 1 kHz (2 mV)

6. Set the ratio transformer to 0.001 and record the dc DMM "2 mV" reading on the test record.

7. Disconnect the ratio transformer from the setup. Use the characterized rms meters to measure and record the 5700A 1 kHz outputs at each characterized 1 kHz voltage level of 2 mV, 20 mV, and 200 mV. That is, adjust the 5700A using the knob to obtain the characterized reading on the rms meter (or dc DMM). Record the 5700A error display in each case and verify it is within the limits shown.

3-18. FREQUENCY RESPONSE TESTS (200, 20, AND 2 mV RANGES)

1. Connect the equipment as shown in Figure 3-10.

2. Set the 5700A for a 2V, 1 kHz output. Set the rms differential voltmeter dials to the previously characterized 200 mV, 1 kHz setting. Adjust the 5700A using the knob until the rms differential voltmeter reads precisely null. By using the NEW REF key, simultaneously obtain a 5700A error display reading equal to that recorded for 2V, 1 kHz of the Output Level Tests for AC Voltage Ranges 2V and Above.

3. Program frequencies of 40 Hz, 20 kHz, 50 kHz, 100 kHz, 300 kHz, and 1 MHz. At each frequency, use the knob to obtain in the 5700A ppm error display the reading previously recorded for the 2V range in the Output Level Tests for AC Voltage Ranges 2V and Above.

4. Record the rms differential voltmeter percentage error as shown on its null meter at each frequency up to 100 kHz. At the higher frequencies, set the differential dials for a null and record the dial settings. Return the 5700A to 1 kHz and the dials to the original 1 kHz setting to verify the rms differential voltmeter still indicates the original null within ± 0.003% (30 ppm). If not, redo the entire process until it does repeat adequately.

5. Set the 5700A for a 200 mV, 40 Hz output.

6. Remove the 20 dB rf attenuator and 50 ohm terminator from the test setup, and connect the rms differential voltmeter directly to the 5700A output.

7. Set the rms differential voltmeter dials for the characterized 200 mV, 1 kHz setting. Adjust the 5700A using the knob for the characterized rms differential voltmeter null meter reading recorded for 40 Hz. Record the 5700A error display reading and verify that it is within the limits shown on the test record.

8. Repeat step 7 at 20 kHz, 50 kHz, 100 kHz, 300 kHz, and 1 MHz and adjust the 5700A using the knob to obtain the characterized rms differential voltmeter null meter readings recorded in step 4 for each frequency. Record the 5700A error display and verify that it is within the limits shown on the test record.

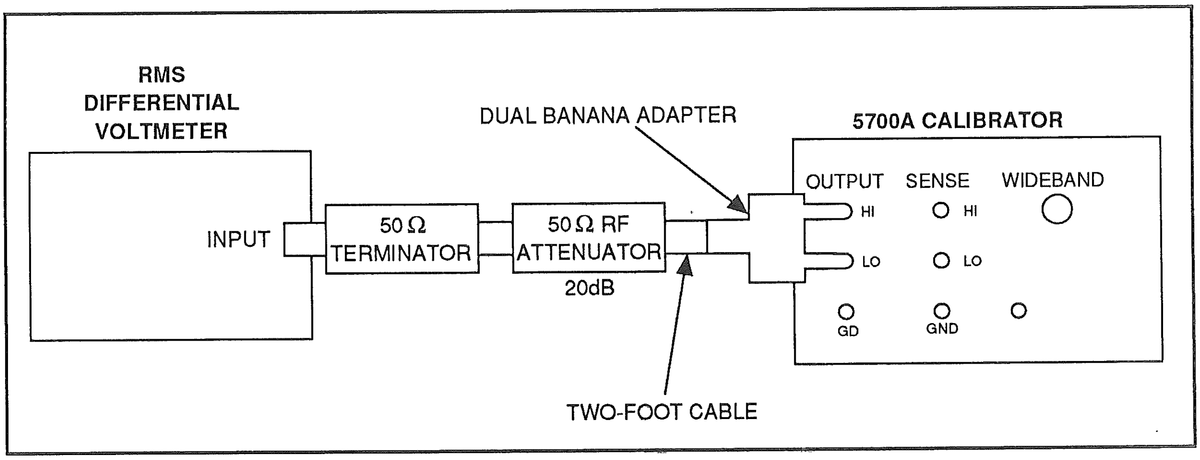


Figure 3-10. Frequency Response Characterization

9. Reconnect the equipment of Figure 3-10 except use two 20 dB RF Attenuators in series to output approximately 20 mV. Repeat the process in steps 2 through 8 for 20 mV testing, substituting 20 mV wherever 200 mV appears in the text. However, the requirement for repeatability for this level is ±0.01% whenever returning to the 1 kHz reference.

3-19. 2 mV RANGE TEST

1. Set up the equipment connections shown in Figure 3-10. Use three 20 dB rf attenuators in series.
2. Set the 5700A for a 2.0V, 1 kHz output.
3. Adjust the 5700A using the knob to obtain the characterized 2 mV reading on the dc DMM attached to the rms wideband voltmeter output.
4. Press the 5700A NEW REF key to reference the output level.
5. As was done previously for the 200 mV and 20 mV levels, set the 5700A to the following frequencies: 40 Hz, 20 kHz, 50 kHz, 100 kHz, 300 kHz, and 1 MHz. At each frequency, record the dc DMM reading. (Due to the lower accuracy, it will not be necessary to edit in any 5700A 2V range corrections for this test). Then, as before, return to the 1 kHz reference to check for repeatability within ±0.03%. The 8922 filter must be switched in at all frequencies below 100 kHz.
6. Remove the rf attenuators from the setup and connect the characterized rms wideband voltmeter/dc DMM combination directly to the 5700A output.
7. Set the 5700A for a 2.0 mV, 40 Hz output. Adjust the 5700A using the knob to obtain a dc DMM reading equal to the previously characterized reading at 40 Hz recorded in step 5. Record the 5700A error display reading and verify that it is within the limits shown on the test record.
8. Repeat step 7 at 20 kHz, 50 kHz, 100 kHz, 300 kHz, 1 MHz. At each frequency adjust the 5700A error controls to obtain the characterized reading from step 5 on the dc DMM. Record the 5700A error display and verify that it is within the limits shown on the test record.
9. This completes the AC Voltage Calibration Verification Tests.

Table 3-11. AC Voltage Millivolt Ranges Test Summary

1 KHZ LEVEL VERIFICATION (200 MV, 20 MV, AND 2 MV RANGES)

UUT OUTPUT	RATIO TRANS. SETTING	931 200 mV READING	931 20 mV READING	8922/DMM 2 mV READING
2V @ 1 kHz	0.1		N/A	N/A
2V @ 1 kHz	0.01	N/A		N/A
2V @ 1 kHz	0.001	N/A	N/A	

UUT OUTPUT	UUT ERROR DISPLAY	LIMITS
200 mV @ 1 kHz		±150 ppm
20 mV @ 1 kHz		±410 ppm
2 mV @ 1 kHz		±0.261 ppm

FREQUENCY RESPONSE TESTING (200 MV, 20 MV, AND 2 MV RANGES)

CHARACTERIZING 200 mV LEVEL OF RMS DIFF. VOLTMETER:

FREQ.	RMS DIFF. VOLTMETER READING
1 kHz	Null
40 Hz	
20 kHz	
50 kHz	
100 kHz	
300 kHz	
1 MHz	
1 kHz	Return to Null ±0.003%

200 mV OUTPUT ACCURACY:

FREQ.	UUT ERROR DISPLAY	LIMITS
40 Hz		±150 ppm
20 kHz		±150 ppm
50 kHz		±380 ppm
100 kHz		±0.115%
300 kHz		±0.19%
1 MHz		±0.38%

Table 3-11. AC Voltage Millivolt Ranges Test Summary (cont)

CHARACTERIZING 20 mV LEVEL OF RMS DIFF. VOLTMETER:

FREQ.	RMS DIFF. VOLTMETER READING
1 kHz	Null
40 Hz	
20 kHz	
50 kHz	
100 kHz	
300 kHz	
1 MHz	
1 kHz	Return to Null ±0.01%

20 mV OUTPUT ACCURACY:

FREQ.	UUT ERROR DISPLAY	LIMITS
40 Hz		±410 ppm
20 kHz		±410 ppm
50 kHz		±670 ppm
100 kHz		±0.13%
300 kHz		±0.195%
1 MHz		±0.48%

CHARACTERIZING 2 mV LEVEL OF RMS DIFF. VOLTMETER:

FREQ.	RMS DIFF. VOLTMETER READING
1 kHz	Same as reading in 1 kHz Level Verification, ratio trans: 0.001
40 Hz	
20 kHz	
50 kHz	
100 kHz	
300 kHz	
1 MHz	
1 kHz	Return to first entry reading ±0.03%

2 mV OUTPUT ACCURACY:

FREQ.	UUT ERROR DISPLAY	LIMITS
40 Hz		±0.261%
20 kHz		±0.261%
50 kHz		±0.287%
100 kHz		±0.49%
300 kHz		±0.87%
1 MHz		±1.83%

3-20. Direct Current Accuracy Verification Test

Equipment required for the Direct Current Accuracy Verification Test is listed in Table 3-12.

Table 3-12. Equipment Required for Direct Current Test

EQUIPMENT	MODEL OR DESCRIPTION
DC DMM, 6-1/2 digit	Fluke 8500 Series
High-Current Shunt	Fluke Y5020 (for 5725A)
Standard Resistor Shunts:	L&H 0.1 ohm at 2A 10 ohm at 200 mA 100 ohm at 20 mA 1 kilohm at 2 mA Fluke 742A-10k 10 kilohm at 200 uA

1. Connect the dc DMM to the 5700A output and program the 5700A for outputs of 200 mV, 2V, and -2V, and record the dc DMM reading at each voltage.

2. Refer to the standard resistor test report and enter the corrections for all the certified values in ppm in column A on the test record.

3. Connect the equipment as shown in Figure 3-11 using the L&H 0.1 ohm resistor.

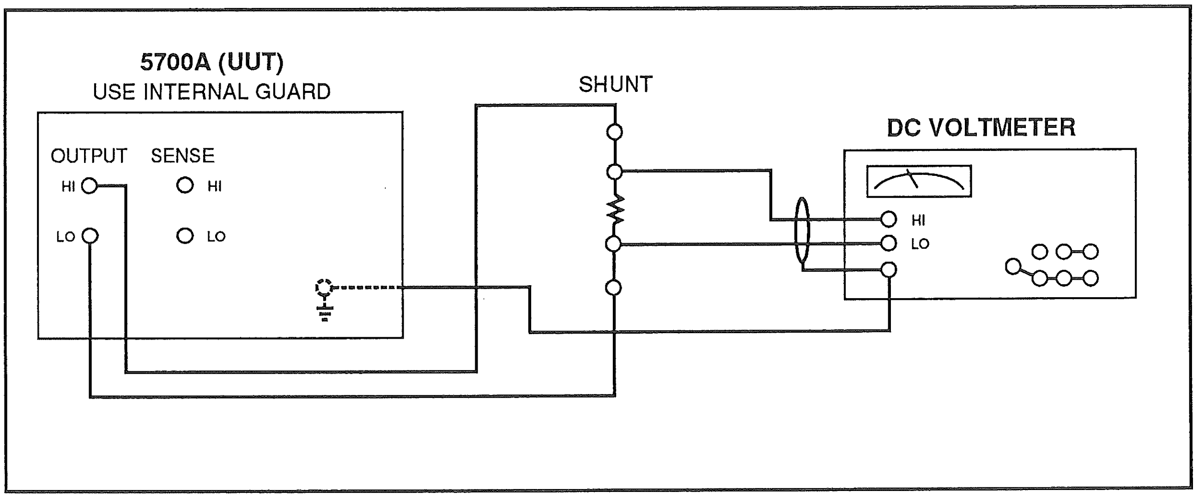


Figure 3-11. Direct Current Tests

4. Set the 5700A for a 2A dc output, and adjust the 5700A using the knob to obtain the characterized voltage reading on the dc DMM. Wait 3 seconds, and record the 5700A error display reading (Column B).

5. Subtract column B from column A. Enter the result (with polarity reversed) on the test record. Verify that it is within the limits shown on the test record.

6. Repeat steps 2 through 5 using the Fluke 742A Resistance Standards and 5700A output currents shown in Table 3-13.

Table 3-13. Direct Current Accuracy Verification

CHARACTERIZING DC DMM @ ±200 MV AND ± 2.0V

+200 mV RDG	-200 mV RDG	+2.0V RDG	-2.0V RDG

OUTPUT CURRENT	STD RES VALUE	STD RES CORRECTION	UUT ERROR READING	UUT ACTUAL ERROR (A-B) REVERSE POL	LIMIT OF ERROR
+2A	0.1 ohm				±100 ppm
-2A	0.1 ohm				±100 ppm
+200 mA	10 ohm				±65 ppm
-200 mA	10 ohm				±65 ppm
+20 mA	10 ohm				±55 ppm
+2 mA	1 kilohm				±55 ppm
-2 mA	1 kilohm				±55 ppm
+200 uA	10 kilohm				±100 ppm

5725A AMPLIFIER DC CURRENT TEST

OUTPUT CURRENT	DC DMM RDG	SHUNT CERT VALUE	CAL ACTUAL CURRENT	LIMITS
-10A				±428 ppm
5A				±428 ppm
2A				±428 ppm
-2A				±428 ppm

7. If the 5700A is attached to a 5725A Amplifier, connect the Y5020 shunt to the 5700A output terminals. Connect the dc DMM to the Y5020 sense connector.

8. Set the 5700A to 10A, 5A, 2A and -2A and record the dc DMM readings on the Test Record. Divide these readings by the certified value of the Y5020, record the resultant current and verify that it is within the tolerances shown.

9. This completes the direct current accuracy verification.

3-21. Alternating Current Tests

Equipment required for the Alternating Current Accuracy Verification Test is listed in Table 3-14.

Table 3-14. Equipment Required for Alternating Current Test

EQUIPMENT	MODEL OR DESCRIPTION
Thermal Transfer Standard	Fluke 540B
Current Shunts	Fluke A40 Series
DMM	Fluke 850X
T9 Metal Film resistors	1k ohm, 10k ohm, and 1M ohm value

1. Connect the equipment as shown in Figure 3-12. Use the 2A Current shunt.

2. Set the 5700A for a +2A dc output. Adjust the output so that the error display is equal to the UUT actual error for a +2A output, as shown on the dc current test record.

3. Allow sufficient time (usually around 10 minutes for the first reading) for the transfer standard null meter reading to stabilize. Adjust the transfer standard null controls for a precise null indication.

4. Proceed as follows to obtain an average of the reversed dc to obtain a reference for the ac:

   a. Adjust the transfer standard null controls for a null with a positive polarity current from the 5700A.

   b. Reverse the current polarity into the transfer standard by pushing the POLARITY (push to reverse) button on the transfer standard.

   c. Record the final deflection on the transfer standard null meter in + or - small divisions.

   d. Push the POLARITY button on the transfer standard again for positive polarity. Verify that the null meter returns to a precise null.

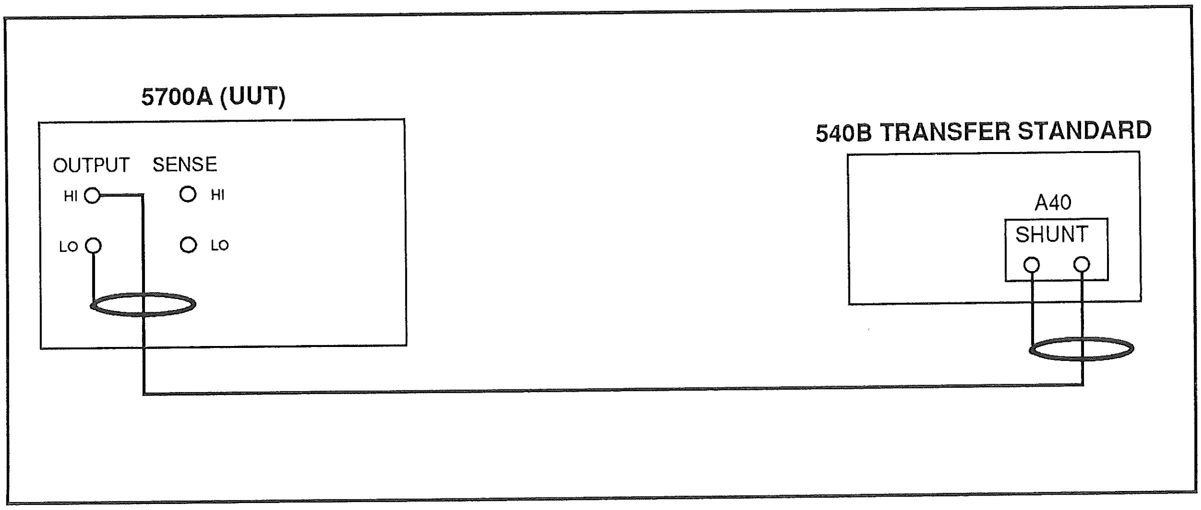


Figure 3-12. Alternating Current Accuracy Verification Test

e. Adjust the transfer standard controls to obtain one-half the deflection recorded in step c, but in the opposite direction. For example, if you recorded +4.7 divisions for step c, the correct offset for step e would be -2.4 divisions (rounded to the nearest tenth).

5. Set the 5700A to 2A at 40 Hz OPERATE.

6. Without touching the transfer standard null controls, use the 5700A edit knob to adjust the 5700A output as necessary to obtain a null on the Transfer Standard null meter. Reverse the polarity of the error display reading, and enter the result on the test record. Verify that it is within the limits shown on the test record.

7. Set the 5700A to 2A dc. Verify that the Transfer Standard null meter returns to the setting in step 4e. If necessary, repeat steps 2 through 6 until the required result is obtained.

8. Change the 5700A frequency to 1 kHz, 5 kHz, and 10 kHz. At each frequency, edit the 5700A for a null on the Transfer Standard null meter. Reverse the polarity of the error display reading, enter and verify the results as done in step 6 above.

9. Repeat steps 2 through 8 at currents of 200 mA and 20 mA using the appropriate A40 current shunt at the frequencies shown on the test record (Table 3-15).

10. For units with a 5725A Amplifier attached, repeat steps 2 through 8 at 11A using the 10A current shunt at the frequencies listed on the test record.

11. Now disconnect the 540B, and set the 5700A to 2V dc, operate. Connect the DMM to the output and record the DMM 2V dc reading on the test record.

12. Set the 5700A to 2V at frequencies of 10 Hz, 20 Hz, 40 Hz, 1 kHz, 5 kHz, and 10 kHz. At each frequency, record the DMM reading on the test record in the "DMM 2V ac READING" column.

13. Calculate the DMM ac-dc error by subtracting the 2V dc reading from each DMM 2V ac reading. Record the result on the test record in the "DMM AC-DC ERROR" column.

14. Connect the 1k ohm metal film shunt resistor across the 5700A output, and set the 5700A for a 2 mA dc operate. Adjust the output so the error display shows the same error as previously recorded at 2 mA dc. Since the DMM exhibits input impedance differences for ac and dc operation, you must connect a 1M ohm metal film resistor across the DMM input at this time to match the input impedance during an ac voltage measurement. Record the DMM reading as the "DMM 2 mA dc Reading" on the test record.

15. Algebraically add the "DMM 2 mA dc READING" to each previously calculated "DMM AC-DC ERROR", and record the results on the test record in the "EXPECTED DMM 2 mA ac READING" column.

16. Remove the 1M ohm resistor from the DMM input. Set the DMM for ac voltage operation. Set the 5700A to 2 mA ac at each frequency. Adjust the 5700A output at each frequency so that the DMM reading matches the the value in the "EXPECTED DMM 2 mA READING" column. Reverse the polarity of the error display and record this reading on the test record as the "ACTUAL 2mA ERROR". Verify that each reading is within tolerance.

17. Repeat steps 14 through 16, substituting 200 uA for 2 mA and using the 10k ohm metal film shunt resistor instead of the 1k ohm. Calculate the "EXPECTED DMM 200 uA READING" by algebraically adding the "DMM 200 uA dc READING" to each previously calculated "DMM AC-DC ERROR".

Table 3-15. Alternating Current Accuracy Verification

OUTPUT CURRENT	FREQ	ACTUAL UUT ERROR	ERROR LIMITS
2A	40 Hz		±675 ppm
2A	1 kHz		±675 ppm
2A	5 kHz		±800 ppm
2A	10 kHz		±0.91%
200 mA	10 Hz		±725 ppm
200 mA	20 Hz		±400 ppm
200 mA	40 Hz		±350 ppm
200 mA	1 kHz		±350 ppm
200 mA	5 kHz		±0.1%
200 mA	10 kHz		±0.49%
20 mA	10 Hz		±725 ppm
20 mA	20 Hz		±400 ppm
20 mA	40 Hz		±160 ppm
20 mA	1 kHz		±160 ppm
20 mA	5 kHz		±0.125%
20 mA	10 kHz		±0.54%

Table 3-15. Alternating Current Accuracy Verification (cont)

5725A AMPLIFIER TESTS

11A	40 Hz	±415 ppm
11A	1 kHz	±415 ppm
11A	5 kHz	±535 ppm
11A	10 kHz	±0.3368%

DMM 2V dc READING =

	DMM 2V ac READING	DMM AC-DC ERROR
10 Hz =		
20 Hz =		
40 Hz =		
1 kHz =		
5 kHz =		
10 kHz =		

DMM 2 mA dc READING = * Add 1 megohm to DMM Input

	EXPECTED 2 mA ac READING	ACTUAL 2 mA ERROR	ERROR LIMITS
10 Hz =			±725 ppm
20 Hz =			±400 ppm
40 Hz =			±160 ppm
1 kHz =			±160 ppm
5 kHz =			±0.175%
10 kHz =			±0.64%

DMM 200 uA dc READING = * Add 1 megohm to DMM Input

	EXPECTED 200 uA ac READING	ACTUAL 200 uA ERROR	ERROR LIMITS
10 Hz =			±850 ppm
20 Hz =			±505 ppm
40 Hz =			±240 ppm
1 kHz =			±240 ppm
5 kHz =			±0.575%
10 kHz =			±2.44%

3-22. Wideband AC Voltage Module Output Verification

The verification test for the Wideband module works as follows:

- Accuracy at 1 kHz: Output at 1 kHz is tested using a characterized rf voltmeter reading the output across a precision dc 50 ohm termination.

- Flatness relative to 1 kHz: First the 3V range is tested using the following process:

  1. Characterizing a 50 ohm detector using a 3V Thermal Voltage Converter (TVC).

  2. Using the characterized 50 ohm detector to read the 5700A 3V output flatness and recording the 5700A error display to get corrections for the next test. The absolute accuracy at frequencies between 30 Hz and 500 kHz will also be verified by inspection of the data.

- Attenuator Flatness: The attenuator flatness is tested using the following process:

  1. The 3V range corrections are used via 5700A error display to serve as a reference for characterizing the Attenuator Test Setup at a reduced number of frequencies.

  2. Each attenuator section is tested using a "put and take" method involving removal of 10 dB of external standard attenuation to correspond to each added 10 dB section of the 5700A.

3-23. WIDEBAND FLATNESS CALIBRATION PROCEDURE

Table 3-16. Test Equipment Required for the Wideband Option

MFG. AND MODEL	EQUIPMENT
Fluke A55-3V	High Freq. Thermal Converter
Narda 777C-20	20 dB RF Attenuator (Qty. 3)
Narda 777C-10	10 dB RF Attenuator (Qty. 1)
Comlinear CLC100	20 dB Amplifier (Qty. 2)
Fluke 8920A	Wideband RMS Voltmeter
(Any)	±12V Power Supply

1. Connect the equipment as shown in Figure 3-13.

2. Set the 5700A for 3V, 1 kHz operate. Select WIDEBAND Type "N" connector output by pressing the W BND key.

3. Adjust the 5700A output so the DMM connected to the RMS Wideband Voltmeter dc voltage output read exactly 1V. Press "NEW REF".

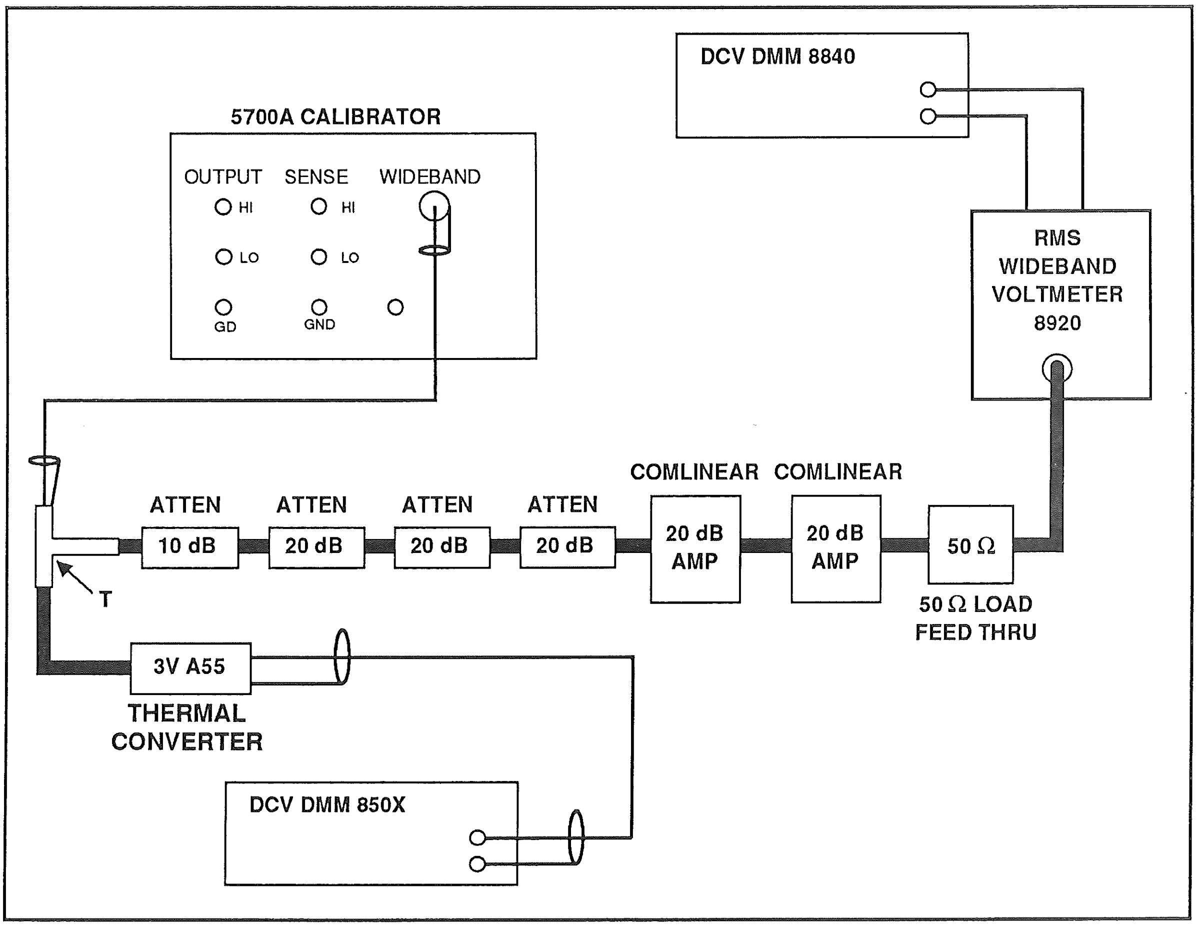


Figure 3-13. Wideband Flatness Calibration

4. Zero the 850X DMM that is connected to the A55 Thermal Sensor output.

5. At each frequency mentioned below, first adjust the 5700A output until the 850X DMM connected to the A55 Thermal Sensor reads 0 volts, then record the reading of the DMM connected to the RMS Wideband Voltmeter.

Frequency:	12 kHz,	100 kHz,	500 kHz,	1.1999 MHz,	1.2 MHz,
DMM Reading:	_______/	_______/	_________/	_________/	_________

Frequency:	2 MHz,	10 MHz,	20 MHz,	30 MHz.
DMM Reading:	_______/	______/	_______/	_______

6. Remove the A55 Thermal Sensor and the 850X DMM from the setup.

7. Call up the 5700A Wideband Flatness Calibration routine on the 5700A front panel by pressing the softkey sequence "Setup Menus", "Cal", "Calibration", "Wideband Flat".

8. Enter the present ambient air temperature as prompted, and press ENTER.

9. Wideband Flatness Calibration starts with a 3V output at 1 kHz. Using the 5700A edit knob, adjust the output until the DMM connected to the RMS Wideband Voltmeter output reads exactly 1V; then press ENTER.

10. The Wideband output frequency changes to 12 kHz. Use the 5700A output adjust knob to adjust the output until the DMM reads the voltage that was recorded for 12 kHz in step 5. Press ENTER.

    Repeat this step for each frequency through 30 MHz, adjusting the output each time to match the value recorded in step 5.

11. The 5700A Wideband output changes to 1V at 1 kHz. Remove the 10 dB attenuator from the test setup, leaving a total attenuation of 60 dB. Use the 5700A output adjust knob to adjust the output until the DMM reads the voltage that was recorded for 1 kHz in step 5. Press ENTER.

    Repeat this step for each frequency through 30 MHz, adjusting the output each time to match the value recorded in step 5.

12. The 5700A Wideband output changes to 300 mV at 1 kHz. Remove a 20 dB attenuator, and replace the 10 dB attenuator on the test set up for a total attenuation of 50 dB. Use the 5700A output adjust knob to adjust the output until the DMM reads the voltage that was recorded for 1 kHz in step 5. Press ENTER.

    Repeat this step for each frequency through 30 MHz, adjusting the output each time to match the value recorded in step 5.

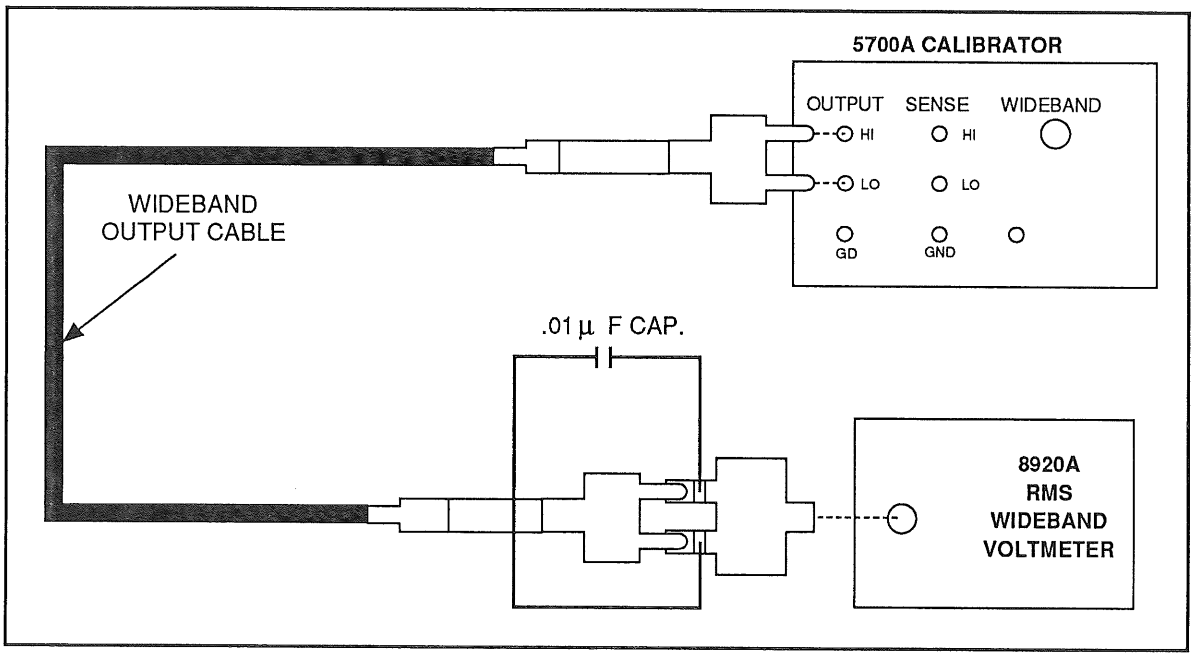


Figure 3-14. RF Voltmeter Characterization at 1 kHz

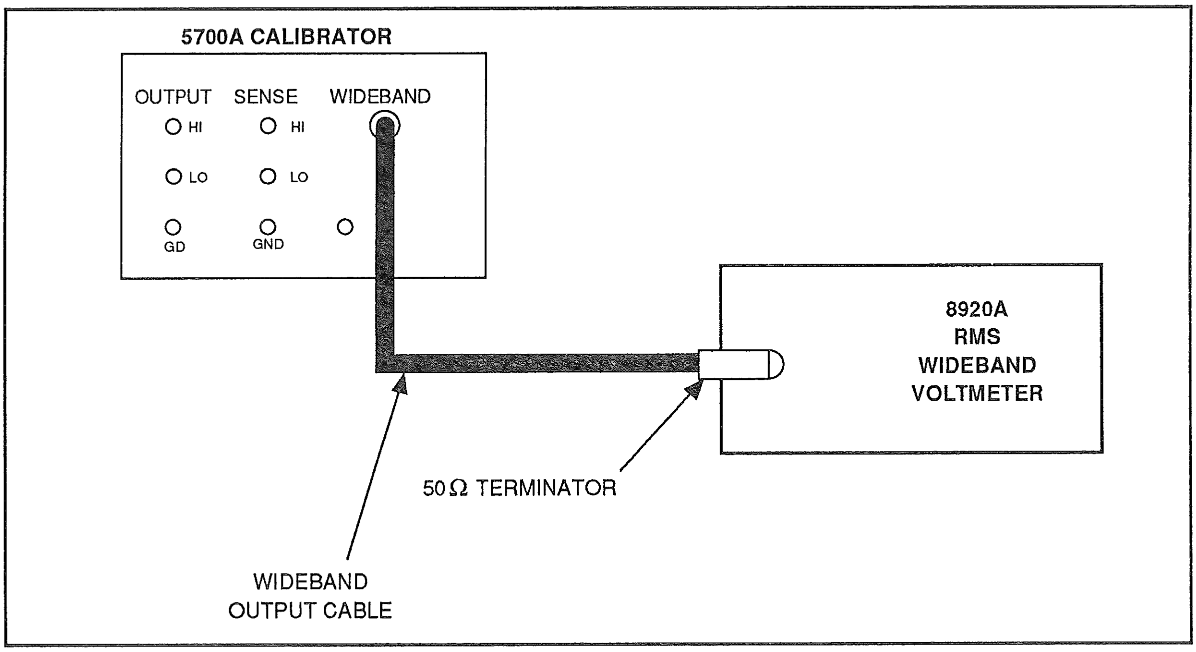


Figure 3-15. Wideband Accuracy Tests

Table 3-18. Wideband Accuracy at 1 kHz

OUTPUT LEVEL	8920A READING OF 5700A MAIN OUTPUT	WIDEBAND OUTPUT ERROR DISPLAY READING	LIMITS
3.0V			±.2167%
1.0V			±.2900%
0.3V			±.2833%
0.1V			±.3400%
30 mV			±.3333%
10 mV			±.3900%
3 mV			±.3833%
1 mV			±.4400%

3-27. WIDEBAND OUTPUT FLATNESS TEST

NOTE

The following test uses a non-50 ohm thermal voltage converter (TVC) to characterize a 50 ohm detector. For the 5700A output flatness test to be valid, the 5700A must be connected to a good rf 50 ohm device. It is not satisfactory to just parallel the input of the TVC with a good rf 50 ohm (especially at frequencies above 10 MHz). However, the TVC will indicate the actual voltage at the midpoint of a GR TEE connector when paralleled with 50 ohms. Therefore, it is valid to calibrate the 50 ohm detector with the TVC on the other end of the GR TEE.

3-28. 50 Ohm Detector Characterization

First you must perform 50 Ohm Detector Characterization. To do so, proceed as follows:

NOTE

Before beginning this test, obtain a copy of your 3V TVC test report. Apply any corrections that exceed the following:

- o 0.01% to 20 MHz
- o 0.02% to 10 MHz
- o 0.04% to 20 MHz
- o 0.1% to 30 MHz

At this time, note any corrections that exceed these levels for future reference.

1. Connect the equipment as shown in Figure 3-16.

2. Set the 5700A for a wideband output of 2.7V at 1 kHz.

3. Adjust the 5700A using the knob to obtain a convenient reference reading (such as 0.90000V) on the dc DMM connected to the RMS Wideband Voltmeter analog output. (Note: do not use log output if the meter is so equipped).

4. Allow sufficient time for the TVC to stabilize. Five to ten minutes is sufficient unless the TVC body has not reached ambient temperature before voltage is applied. Zero the 850X DMM connected to the A55 Thermal Sensor output.

5. Readjust the 5700A knob to obtain the 0.90000V reference reading of the rms wideband voltmeter dc DMM. Zero the 850X DMM again. Press the 5700A NEW REF button.

NOTE

Do not touch the 850X DMM connected to the A55 output until you are told to do so or you begin the test process at 1 kHz again.

6. Program the frequencies shown on the test record (Table 3-19). For each frequency, adjust the 5700A using the knob to obtain a zero on the 850X DMM that is connected to the A55 output. Then record the rms wideband voltmeter dc DMM reading on the test record (Table 3-19) in the "50 Ohm Detector Characterization RMS Wideband DC DMM RDG" column.

NOTE

If any TVC corrections exceed the criteria stated in the step 1 note, use them by offsetting the 850X DMM by the opposite sign of the reported value. For example, if the reported rf/dc difference is +.05%, the UUT output (the one that has been nulled on the 850X DMM connected to the A55) must be edited down 0.05% before the rms wideband dc DMM reading can be recorded.

7. The last frequency point is to return to 1 kHz. Adjust the 5700A using the knob for a rms wideband voltmeter dc DMM reading of 0.90000V and verify that the transfer standard reading returns to null within ±0.02%. If it does not, repeat the process beginning at step 2 until this tolerance is met.

8. Set the 5700A to standby.

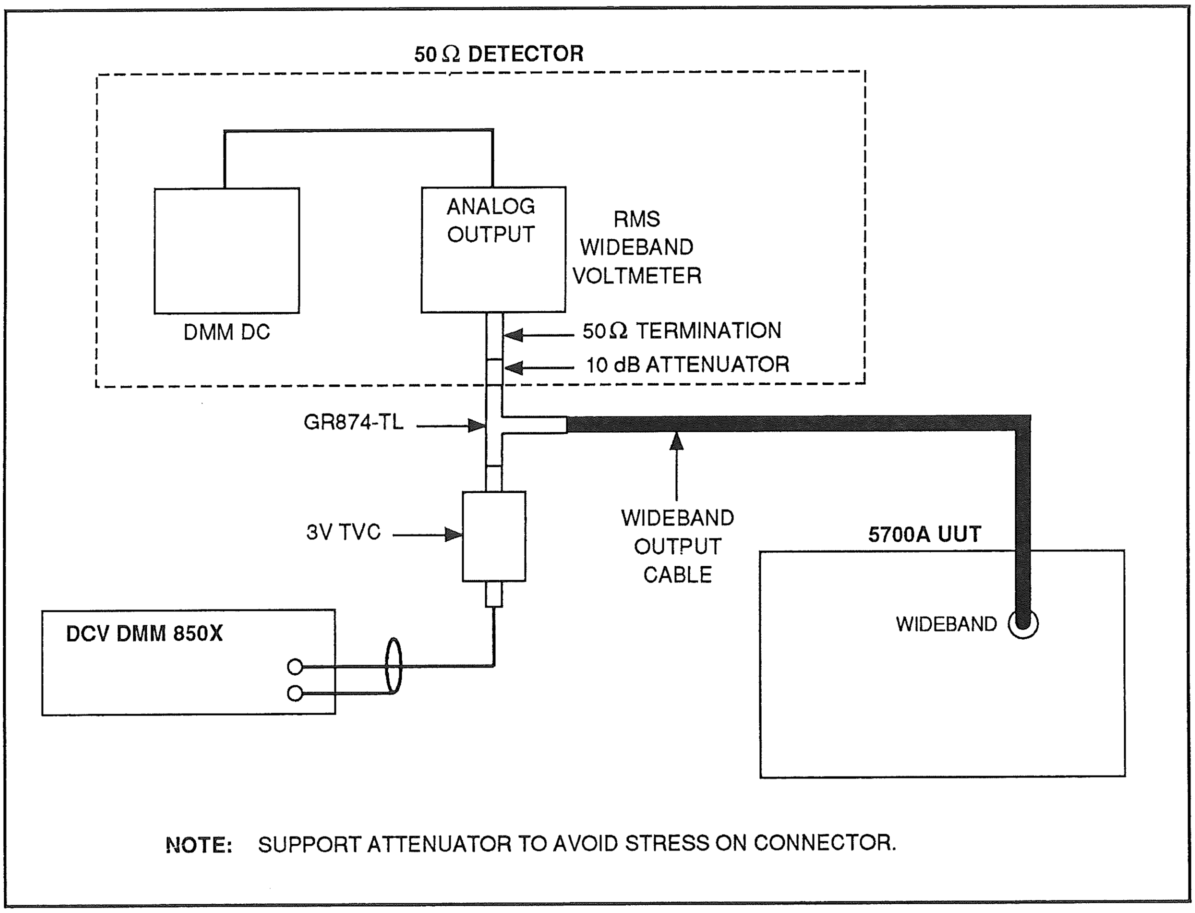


Figure 3-16. 50 Ohm Detector Characterization

3-29. 3V Range Wideband Flatness Test

1. Connect the equipment as shown in Figure 3-17.

2. Program the 5700A for a wideband output of 2.7V at 1 kHz. Adjust the 5700A using the knob until the rms wideband voltmeter dc DMM reads the same reference reading (previous example was 0.90000V) used in the characterization test. Press NEW REF to reference the 5700A error display to zero.

3. Set the 5700A to the frequencies listed on the test record. At each frequency, adjust the 5700A output level using the knob to obtain the characterized rms wideband voltmeter dc DMM reading. Record the 5700A error display for that frequency in the "3V Range Wideband Flatness Test Error Display Rdg" column. Verify that the error readings are within the limits shown on the test record. The last frequency is the 1 kHz reference. If the readings do not repeat within 0.02% it will be necessary to repeat the test process until acceptability is attained.

4. Set the 5700A to standby and disconnect the equipment from the 5700A.

3-30. Setup for Attenuator Flatness Test

1. Connect the equipment as shown in Figure 3-18.

2. Program the 5700A for a 3V wideband output at 1 kHz.

3. The rms wideband voltmeter should be reading around 100 mV if the amplifier gains are nominal. Adjust the 5700A using the knob to obtain a 0.90000V indication on the rms wideband voltmeter dc DMM and then press NEW REF to reference the output.

4. Program each output frequency shown on the test record. Record the wideband voltmeter dc DMM reading for each frequency. As before, the return reading at 1 kHz must repeat within ±0.02%.

3-40. Attenuator Flatness Test

1. In the next column enter the 3V range error display readings from the "Output Flatness Test" record (for the appropriate frequency) on the test record.

2. With the equipment still connected as in Figure 3-18, remove the 10 dB attenuator and program the 5700A for a wideband output of 1V, 1 kHz.

3. Adjust the 5700A using the knob to obtain the rms wideband voltmeter dc DMM reference level of 0.90000V. Press NEW REF to re-reference the error display to zero.

Table 3-19. Output Flatness Test and Attenuator Flatness Tests

Table 3-19. Output Flatness and Attenuator Flatness Tests

FREQUENCY	50 OHM DETECTOR CHARACTERIZATION RMS WIDEBAND DC DMM READING	3V RANGE WIDEBAND FLATNESS TEST ERROR DISPLAY READING	LIMITS
1 kHz	.90000V	---	---
10 Hz			0.3%
30 Hz			0.1%
120 kHz			0.1%
500 kHz			0.1%
2 MHz			0.1%
5 MHz			0.2%
10 MHz			0.4%
20 MHz			0.4%
30 MHz			1.0%

ATTENUATOR FLATNESS TEST RECORD

FREQ	WIDEBAND DC DMM CHAR DATA	3V RANGE WIDEBAND FLAT TEST ERR DISPL	(60 dB) 1.0V OUTPUT	(50 dB) 300 mV OUTPUT	(40 dB) 100 mV OUTPUT	(30 dB) 30 mV OUTPUT	(20 dB) 10 mV OUTPUT	>3 mV LIMIT	(10 dB) 3 mV OUTPUT	3 mV LIMIT	(0 dB) 1 mV OUTPUT	1 mV LIMIT
1 kHz	.90000V	- 0 -	.90000V	.90000V	.90000V	.90000V	.90000V		.90000V		.90000V	
2 MHz								.1%		.1%		.5%
10 MHz								.4%		.5%		.5%
20 MHz								.4%		.5%		.5%
30 MHz								1%		1.5%		3.0%
1 kHz	<.02%		<.02%	<.02%	<.02%	<.02%	<.02%		<.02%		<.02%	

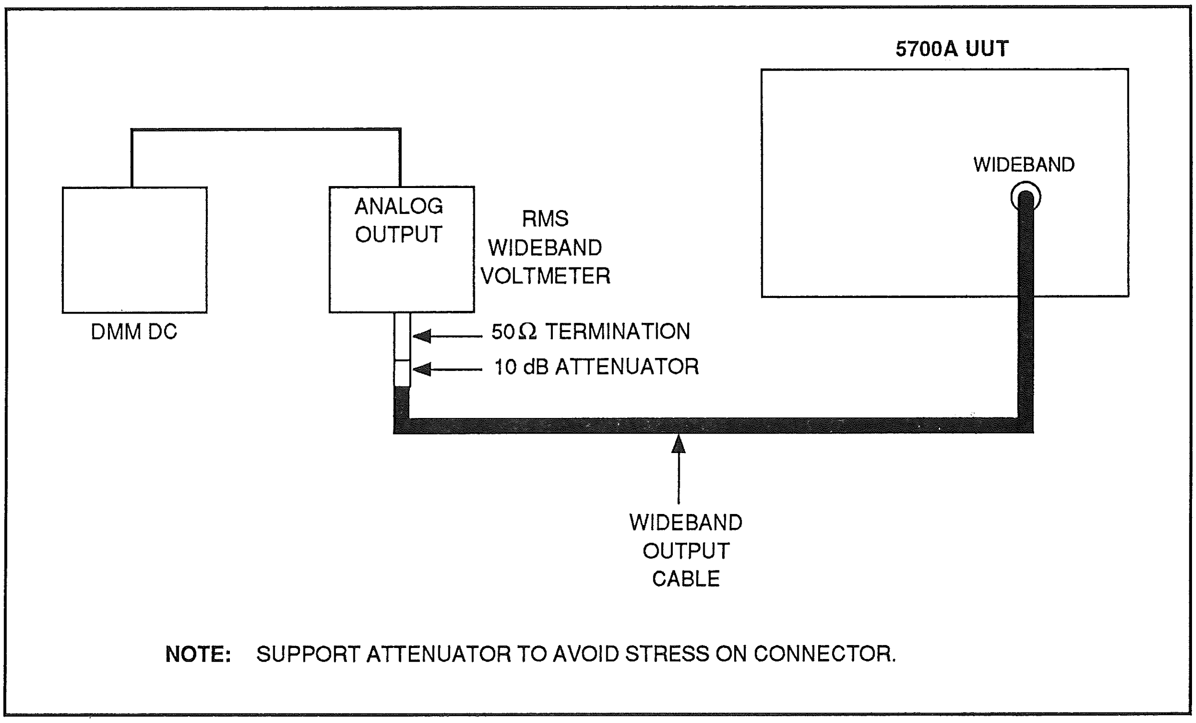


Figure 3-17. 3V Output Flatness Test

4. Set the 5700A to the frequencies listed on the test record. For each frequency, turn the 5700A knob to obtain the rms wideband voltmeter dc DMM reference reading entered on the test record. Record the error display readings and verify that, after being algebraically added to the 3V range error readings in the second column, they are within the limits shown on the test record.

5. Repeat the preceding process for the remaining ranges by decreasing the range by 10 dB and the total external attenuation by 10 dB for each range. Note that for the next range (0.3V) you will have to remove a 20 dB section and replace the 10 dB section to achieve a 10 dB shift. The total external attenuation is shown in parentheses near each range value.

6. Set the 5700A to standby and disconnect the equipment. This completes wideband verification.

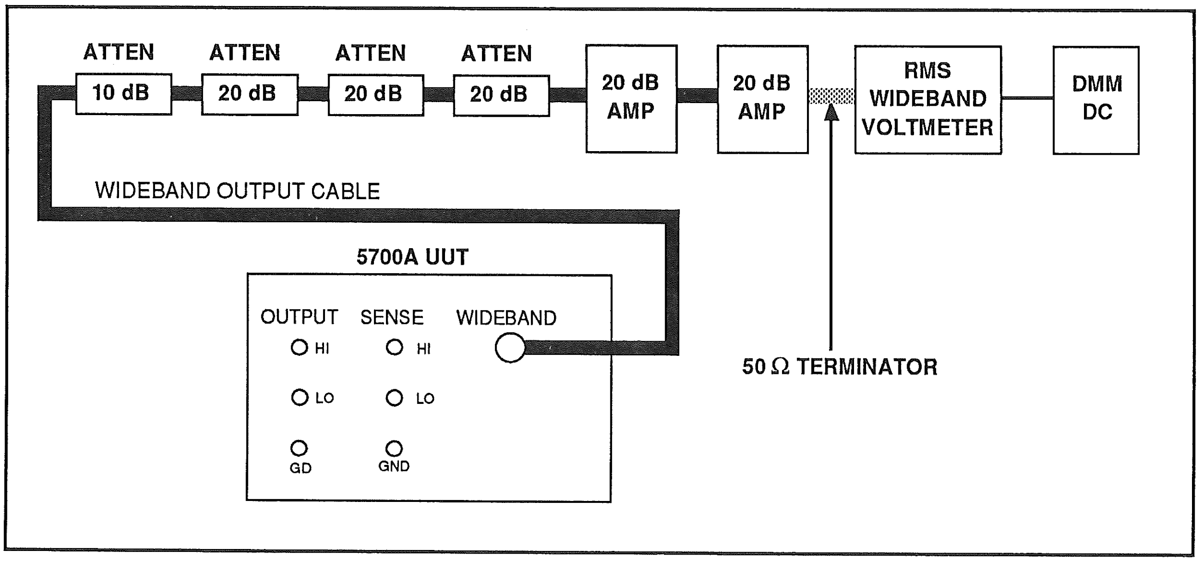


Figure 3-18. Attenuator Flatness Test Setup

3-41. OPTIONAL TESTS

These tests are recommended for use in acceptance testing or following repair likely to affect their characteristics. They are not recommended to be done routinely. If the 5700A passes Calibration Performance Verification, you do not need to perform these tests; verification either exercises these functions or is subject to their effects. The Optional Tests include such checks as load regulation, noise, and distortion.

Required equipment is listed in Table 3-20.

Table 3-20. Equipment Required For DC V Optional Tests

RMS Differential Voltmeter	Fluke 931B
Power Decade Resistor	Clarostat 240C
Differential Amplifier Plug-In	Tektronix 7A22
Oscilloscope Mainframe	Tektronix 7000-series
DC Voltage Reference Standard	Fluke 732A
Reference Divider	752A
Null Detector	845A(B or R)
Kelvin-Varley Divider	720A

3-42. DC Voltage Load Regulation Test

1. Ensure the 5700A is in standby. With the test setup of Figure 3-6, connect the power decade resistor across the 5700A OUTPUT terminals. Connect two shorting links between the 5700A SENSE and OUTPUT terminals and select external sense (EX SNS indicator lit).

2. Set the reference divider to 10V. Set the 5700A output to 10V dc. Set the power decade resistor to 199 ohms. Set the 5700A to operate. Adjust the 5700A as necessary to obtain a null on the null detector. Rotate the most significant dial on the power decade resistor to 9. Verify that the null detector indication changes less than $\pm$ 2 uV. Set 5700A to standby.

3. Repeat load regulation testing at the remaining 5700A outputs shown in Table 3-21.

Table 3-21. Load Regulation Test Summary

DIV. SETTING	5700A RANGE	5700A OUT/FULL LOAD	CHANGE IN NULL
10V	11V	10V/199 ohms	±2 uV
100V	220V	100V/1999 ohms	±2 uV
1000V	1100V	1000V/39.99 kilohms	±2 uV

4. Set the 5700A to RESET and disconnect all equipment from the 5700A.

3-43. DC Voltage Linearity Test

1. Self calibrate the Kelvin-Varley (KV) divider as called for in its service manual.

2. Connect the equipment as shown in Figure 3-19.

3. Set the KV dials to zero by using the RANGE LOCK. Set the 5700A to 0V on the 11V range operate. Note the Null Detector reading. Press OFFSET on the 5700A.

4. Set KV dials to 0.999999X and 5700A for a 10V output.

5. Adjust the 5700A output using the knob for a Null Detector reading equal to the reading noted in step 3. Press SCALE on the 5700A.

6. For each of the KV settings tabulated in Table 3-22, make the required Kelvin Varley setting, and verify that the null detector reads within the limits shown.

Table 3-22. Linearity Test Summary

KELVIN-VARLEY SETTING	5700A OUTPUT	NULL DETECTOR READING
0.1	1V	±2.3 uV
0.2	2V	±2.6 uV
0.3	3V	±2.9 uV
0.4	4V	±3.2 uV
0.5	5V	±3.5 uV
0.6	6V	±3.8 uV
0.7	7V	±4.1 uV
0.8	8V	±4.4 uV
0.9	9V	±4.7 uV

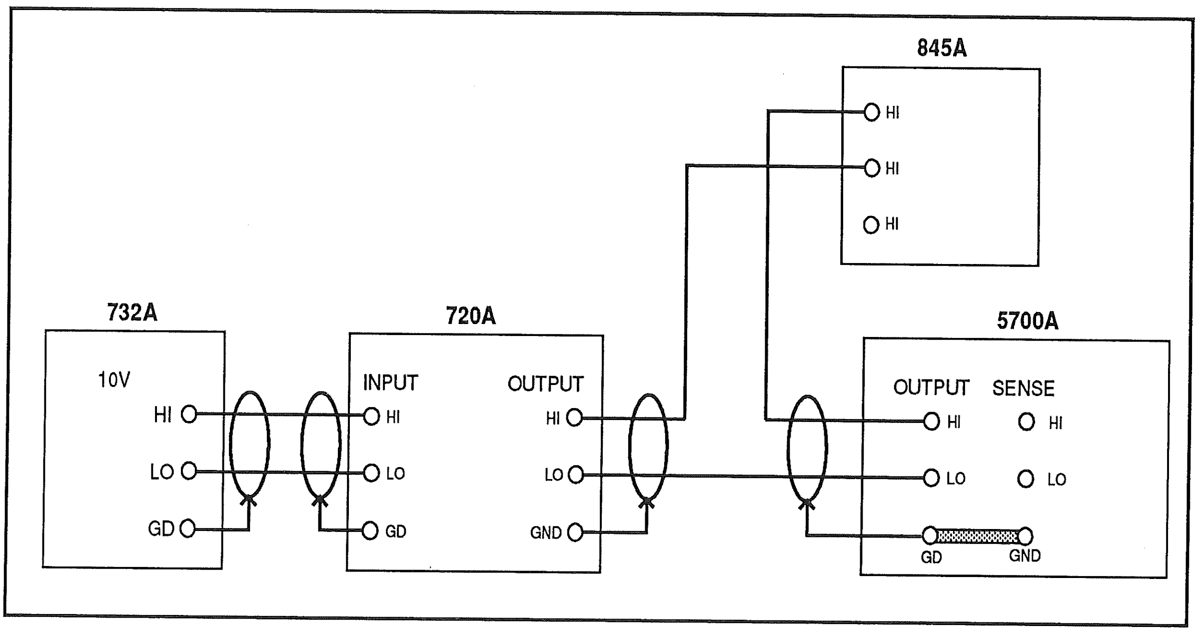


Figure 3-19. DC Voltage Linearity Test

3-44. DC Voltage Output Noise Test (10 Hz to 10 kHz)

1. Connect the equipment as shown in Figure 3-20.

2. Set the Oscilloscope Differential Amplifier controls as shown below.

Low Frequency -3 dB	10 Hz
High Frequency -3 dB	10 kHz
Input Coupling	AC (both inputs)
Volts/Div	50 uV (Var. to Cal.)

3. Set the Oscilloscope Time/Div for 2 ms.

4. Set the rms voltmeter range to 1V.

5. Set the 5700A to 2.2V dc and press OPR/STBY. Verify that the reading on the rms voltmeter is less than 150 mV.

NOTE

This test assumes that the amplifier plug-in and scope have a gain equal to 0.5V divided by the input/div. setting, which in the above case is 1 x 10^4.

6. Repeat the above process for the remaining tabulated settings shown in Table 3-23; verify that the rms meter indicates less than the amount shown for each required output level.

Table 3-23. DC Voltage Output Noise Test

DIFFERENTIAL AMPLIFIER SENSITIVITY	5700A OUTPUT	MAXIMUM RMS METER READING
50 uV/division	2.2V	150 mV
50 uV/division	10V	500 mV
50 uV/division	20V	500 mV
100 uV/division	200V	750 mV
500 uV/division	1000V	500 mV

7. Press RESET on the the 5700A and disconnect the test configuration. This completes the DC Voltage Optional tests.

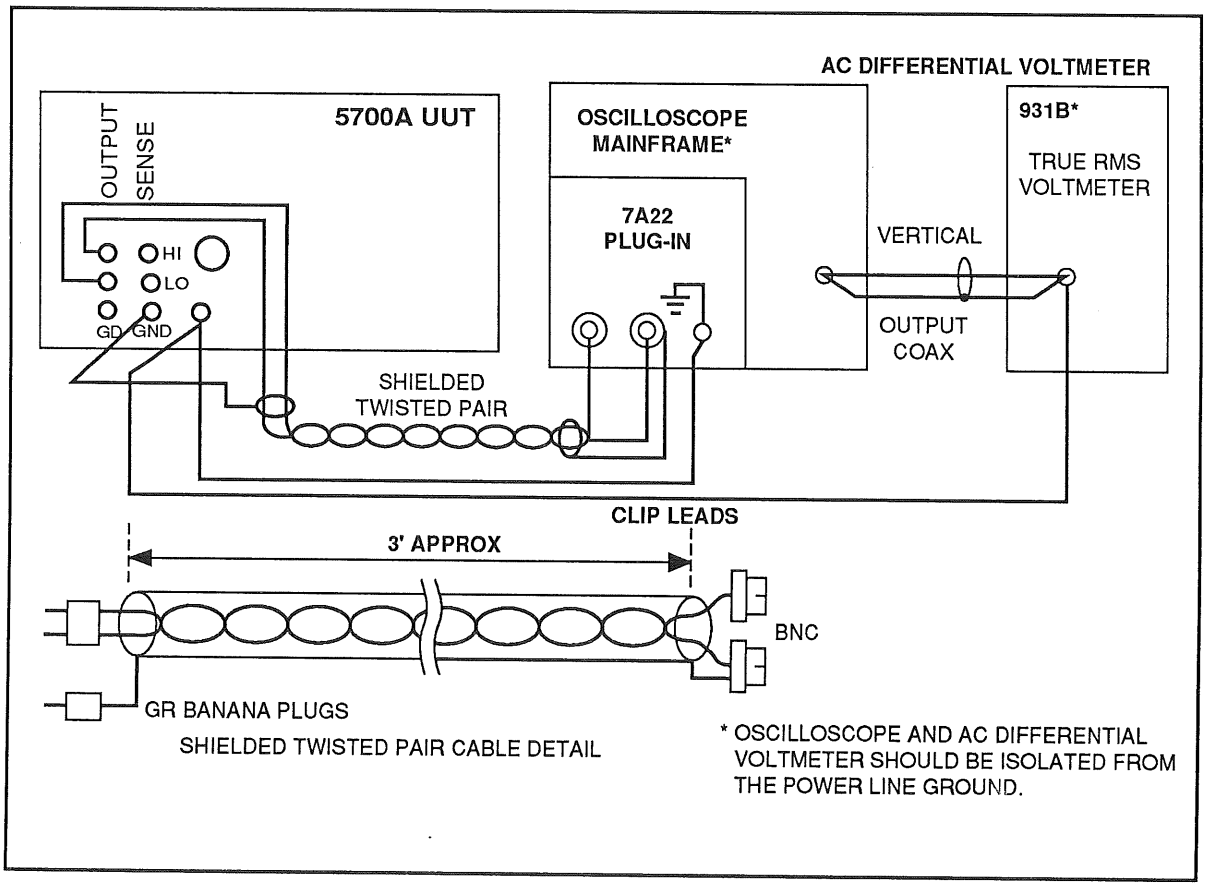


Figure 3-20. DC Voltage Output Noise Test

3-45. AC Voltage Distortion Test

Equipment required for these tests is listed in Table 3-24.

Table 3-24. Equipment Required for AC V Optional Tests

Distortion Analyzer	HP 334A or 8903A
Spectrum Analyzer	Tektronix 7L5
Non-wirewound load resistors	Stock Items (see Table 3-25 for values)

1. Connect the 5700A output terminals to the Distortion Analyzer.

2. Measure the 5700A distortion at the output voltages and frequencies tabulated in Table 3-25. Verify that the distortion measured is within the limits shown.

Table 3-25. AC Distortion Test

5700A OUTPUT	LOAD RESISTORS	FREQUENCY	MAX. DISTORTION
2V	100 ohm, 1/8W	10 Hz, 20 Hz	0.054%
		1 kHz, 20 kHz, 50 kHz,	0.044%
		100 kHz, 200 kHz, 500 kHz	0.355%
20V	1 kilohm, 1/2W	10 Hz, 20 Hz	0.0535%
		20 kHz, 100 kHz	0.0385%
		200 kHz, 500 kHz	0.304%
200V	10 kilohm, 5W	10 Hz, 20 Hz	0.055%
		50 kHz, 100 kHz	0.1065
300V	15 kilohm, 5W	10 Hz, 50 kHz, 70 kHz	0.07%

NOTE: The 5700A maximum volt-Hertz product is (2.2 x 10^7).

3-46. Wideband Distortion Testing

1. Connect the wideband output terminated in 50 ohms. If the spectrum analyzer input impedance is 50 ohms, do not use a separate termination.

2. With 0 dBm output programmed from the 5700A wideband output, select frequencies over the band of 1 MHz to 30 MHz and verify that use the spectrum analyzer to verify that any harmonics are below -40 dBm for fundamentals up to 10 MHz and below -34 dBm for fundamentals of 10 MHz and above.

3. Disconnect the equipment from the 5700A.

3-47. AC Voltage Overshoot Test

1. Connect the 5700A output to a properly compensated 10:1 probe.

2. AC couple the oscilloscope and set the sweeptime to a fairly low sweeptime (approximately 1 sec/div).

3. Set the 5700A to 7.07V at 1 kHz, and press OPR/STBY.

4. Set the scope vertical sensitivity for 0.05V/div. Offset the trace vertically until you can see the top of the waveform at the approximately center of the display (must be at least 2-3 divisions down from the top of the scope graticule).

5. Set the 5700A to standby and then back to operate. Verify that any overshoot visible on the oscilloscope display is less than 1.5 divisions (approximately 10% of the peak value).

6. Repeat the test at 100 Hz and 100 kHz. This completes the Optional Tests.

3-48. MINIMUM USE REQUIREMENTS

Table 3-26 defines specifications for test equipment needed for tests in this section of the manual. If the specific test equipment called for in these tests is not available, substitute equipment meeting these specifications can be used.

Table 3-26. Minimum Use Requirements

ITEM NO.	DESCRIPTION	MINIMUM USE SPECIFICATIONS	RECOMMENDED EQUIPMENT
		CALIBRATION EQUIPMENT	
1.	Voltage Reference	10V nominal, true value certified to within ±1.5 ppm	Fluke 732A
2.	Standard Resistors	1 ohm nominal, true value certified to within 10 ppm 10 kilohm nominal, true value certified to within 4 ppm	Fluke 742A Series, 1 ohm and 10 kilohm
		CALIBRATION VERIFICATION EQUIPMENT	
3.	Reference Voltage Divider	Range uncertainty: 100:1, 1 kV input, ±0.5 ppm 10:1, 100V input, ±0.2 ppm	Fluke 752A
4.	Null Detector	Leakage resistance to case: 10^12 ohms min. Resolution: 3 uV full scale	Fluke 854[illegible]
5.	Low Thermal EMF Cables	Plug-in or spade lug. Copper or gold-flashed copper (two cables per set, two sets required).	Fluke 5440-7002
6.	Digital Multimeter	DC Voltage Range: 0.1 to 10V Resolution and short-term stability: ±2 ppm Resistance range: 1 ohm to 10 megohms Resolution and short-term stability: ±20 microohms at 1 ohm, 1.9 ohms ±5 ppm at 10 ohms, 19 ohms ±2 ppm at 100 ohms to 1.9 megohms ±4 ppm at 10 megohms, 19 megohms	Fluke 850x
7.	Current Source	Range: 100 mA Typical short-term stability: ±15 ppm for 5 minutes	Fluke 5100B, 5700A, or EDC CR103/J

Table 3-26. Minimum Use Requirements (cont)

8.	AC/DC Transfer Standard (Thermocouple Type)	Ranges: 1 kV, 200V, 20V, and 2V Uncertainty: 1 kV; 50 Hz to 1 kHz: ±20 ppm 200V, 20V, 2V; 40 Hz to 20 kHz: ±20 ppm 200V, 20V, 2V; 10 to 20 Hz: ±125 ppm 200V, 20V, 2V; 20 to 40 Hz: ±40 ppm 200V, 20V, 2V; 20 to 50 kHz: ±40 ppm 200V, 20V, 2V; 50 to 100 kHz: ±60 ppm 200V, 20V, 2V; 100 to 300 kHz: ±125 ppm 200V, 20V, 2V; 300 to 500 kHz: ±250 ppm 200V, 20V, 2V; 500 kHz to 1 MHz: ±500 ppm	Holt 11 (Note 2)
9.	Transfer Standard	HFTC input; used as 7 mV dc output detector for item 8, and possibly as mentioned in Note 2.	Fluke 540B
10.	RMS Diff. Voltmeter	Range: 20 mV to 200mV; 10 Hz to 1 MHz Resolution: ±0.001%	Fluke 931B
11.	RMS Wideband Voltmeter	Range: 2 mV, analog dc output	Fluke 8922A
12.	Ratio Transformer	Range: 2V input at 1 kHz Uncertainty at ratio settings: 0.1 ±10 ppm; 0.01 ±15 ppm; 0.001 ±250 ppm	ESI DT72A
13.	RF Attenuators	50 ohms impedance +/1% at dc RF attenuation rated to 1 GHz minimum Flatness to 1 MHz: negligible error 20 dB (3 ea.), 10 dB (1 ea.) (Note 3)	Tektronix 017-0078-00 (20 dB)
14.	Frequency Counter	10 Hz to 30 MHz ±0.002%	Philips PM 6669
15.	Standard Resistors	0.1 ohm nominal, true value certified to within 20 ppm 1 ohm nominal, true value certified to within 20 ppm 1.9 ohms nominal, true value certified to within 20 ppm 10 ohms nominal, true value certified to within 7 ppm 100 ohms nominal, true value certified to within 4 ppm 1 kilohm nominal, true value certified to within 3 ppm 10 kilohms nominal (same as item 2) 19 kilohms nominal, true value certified to within 3 ppm 19 megohms nominal, true value certified to within 12 ppm	L&H 0.1 Fluke 742A Series or equiv.

Table 3-26. Minimum Use Requirements (cont)

16. DC Shunt (Note 4)	Range: 10A Uncertainty: ±0.008%	Fluke Y5020
17. AC/DC Shunt	Ranges: 10A and 2A, 40 Hz to 10 kHz ±100 ppm, 40 Hz to 5 kHz ±800 ppm, 5 kHz to 10 kHz	Fluke A40
18. Differential Amplifier	Sensitivity: 5 uV rms Bandwidth selectable to 10 kHz	Tektronix 7A22 w/7000-Series Mainframe
19. Distortion Analyzer	Range: 2V to to 300V Frequency: 10 Hz to 600 kHz	HP 334A or HP 8903A
20. Thermal Voltage Converter (TVC)	Range: 3V, 10 Hz to 30 MHz AC/DC difference: to 2 MHz: ±0.05% to 10 MHz: ±0.1%, to 20 MHz: ±0.15% to 30 MHz: ±0.25%	Fluke A55
21. Kelvin-Varley Voltage Divider	Ratio uncertainty: ±0.1 ppm of input	Fluke 720A
22. HV Decoupling Network	Used to decouple voltage above 2V to measure dc V output noise to 15 kHz bandwidth.	See Figure 3-21

Note 1: A Fluke 8500 Series DMM may be used for all but the 1 ohm and 1.9 ohm values. For those values using the 8500 Series, a test method using an external current source is used for low-value resistance.

Note 2: The Holt 11 draws 10 mA at 1 kV. The 5700A supplies 6 mA at voltages above 220V without a 5725A Amplifier attached. Therefore, another transfer device must be used at 1 kV unless a 5725A is attached. Substitute a Fluke 540B.

Note 3: The 10 dB attenuator is needed only for testing the Wideband AC Voltage Module (Option 5700A-03).

Note 4: Needed only for 5725A Amplifier testing.

Table 3-27. Test Record for Full Verification (cont)

Resistance Test Summary

1 OHM STD RES VALUE	1 OHM STD VOLTAGE	MEASURED 1 OHM STD VOLTAGE	CAL CURRENT	UUT 1 OHM DISPLAYED VALUE	UUT 1 OHM VOLTAGE	UUT TRUE RES.	UUT DEVIATION FROM DISPLAYED VALUE	LIMIT OF DEVIATION FROM DISPLAYED VALUE	MAXIMUM DIFFERENCE OF CHARACTERIZED TO NOMINAL VALUE
								+/-94 ppm	.9995 to 1.0005

10 OHM STD RES VALUE	10 OHM STD VOLTAGE	MEASURED 1 OHM STD VOLTAGE	CAL CURRENT	UUT 1 OHM DISPLAYED VALUE	UUT 1 OHM VOLTAGE	UUT TRUE RES.	UUT DEVIATION FROM DISPLAYED VALUE	LIMIT OF DEVIATION FROM DISPLAYED VALUE	MAXIMUM DIFFERENCE OF CHARACTERIZED TO NOMINAL VALUE
								+/-28.5 ppm	9.997 to 10.003

RESISTANCE ACCURACY VERIFICATION (19 OHM AND ABOVE)

	STD RES VALUE	DMM STD RES RDG	DMM ERROR	DMM UUT RES RDG	UUT TRUE RES VALUE	UUT DEVIATON FROM DISPLAYED VALUE		
19 ohm (1)							+/-26 ppm	18.9943 to 19.0057
100 ohm (1)							+/-17 ppm	99.985 to 100.015
190 ohm (1)							+/-17 ppm	189.9715 to 190.0285
1 kilohm (1)							+/-12 ppm	999.85 to 1000.15
1.9 kilohm (1)							+/-12 ppm	1.899715k to 1.900285k
10 kilohm							+/-11 ppm	9.9985k to 10.0015k
19 kilohm							+/-11 ppm	18.99715k to 19.00285k
100 kilohm (1)							+/-13 ppm	99.985k to 100.015k
190 kilohm (1)							+/-13 ppm	189.9715k to 190.0285k
1 megohm (1)							+/-18 ppm	0.9998M to 1.0002M
1.9 megohm (1)							+/-19 ppm	1.89962M to 1.90038M
10 megohm							+/-37 ppm	9.997M to 10.003M
19 megohm							+/-47 ppm	18.9943M to 19.0057M
100 megohm (2)							+/-120 ppm	99.95M to 100.05M

Note 1: Not necessary to test due to 5700A internal calibration process.

Note 2: Due to extremely slow settling time (approximately 5 minutes to 0.005% and sensitivity to any nearby movement, use of the DMM to test 100 megohms to the specified 0.01% uncertainty is not practical and therefore is not recommended. For those who wish to test it, a suitable way is to use an ESI SR 1050 10M/step Hammon-type Resistance Transfer Standard and use it in conjunction with an ESI 242-series bridge to effect the measurement to the required uncertainty.

Table 3-27. Test Record for Full Verification (cont)

OUTPUT VOLTAGE TEST SUMMARY

DIVIDER SETTING	5700A RANGE	5700A OUTPUT (NOTE 1)	NULL DETECTOR READING (uV)	NULL DET LIMIT (uV p-p)	METER LIMIT (uV) RATTLE
0.1V	0.22V	0.1V		±1.45 uV (Note 2)	N/A
1V	2.2V	1V		±7.2 uV (Note 2)	0.55 uV
1V	11V	1V (Note 3)		±9 uV (Note 2)	2.2 uV
10V	11V	10V (Note 4)		±54 uV	3.5 uV
10V	22V	10V (Note 3)		±58 uV	5.5 uV
100V	220V	100V		±70 uV	7.5 uV
1000V	1100V	1000V		±86 uV	4.5 uV

TABLE NOTES

Note 1: On the 752A 0.1 and 1V ranges, the null detector polarity is reversed. A low input (5700A output) causes a positive null detector reading.

Note 2: Mathematically, the true 5700A output programmed is the certified value of the reference standard divided by the reference standard nominal value, multiplied by the required 5700A nominal output. In other words, the 5700A output is always programmed for the nominal output adjusted up or down by the same percentage as the certified value of the reference standard.

Note 3: Use Range Lock to obtain 1V on 11V and 10V on 22V range. Deactivate Range Lock before setting the next voltage output.

Note 4: Line regulation can be verified at this time by adjusting the autotransformer for a ±10% change in line voltage. The null detector reading must remain constant within ±1 uV.

Table 3-27. Test Record for Full Verification (cont)

AC VOLTAGE FREQUENCY ACCURACY		
FREQUENCY	TOLERANCE	ACTUAL
10 Hz	99.99 ms - 100.01 ms	
15 Hz	66.673 ms - 66.66 ms	
100 Hz	9.999 ms - 10.001 ms	
200 Hz	199.98 Hz - 200.02 Hz	
500 Hz	499.95 Hz - 500.05 Hz	
1 kHz	999.9 Hz - 1000.1 Hz	
5 kHz	4999.5 Hz - 5000.5 Hz	
10 kHz	9.999 kHz - 10.001 kHz	
140 kHz	139.986 kHz - 140.014 kHz	
200 kHz	199.98 kHz - 200.02 kHz	
500 kHz	499.95 kHz - 500.05 kHz	
1 MHz	0.9999 MHz - 1.0001 MHz	

Table 3-27. Test Record for Full Verification (cont)

AC VOLTAGE OUTPUT TEST

FREQUENCY	OUTPUT LEVEL	TRANSFER STANDARD CORRECTION	ERROR DISPLAY READING	CAL ERROR ADDING ERROR 1 kHz	90-DAY SPEC
1 kHz	2V				78.5 ppm
40 Hz	2V				78.5 ppm
20 kHz	2V				78.5 ppm
50 kHz	2V				140 ppm
100 kHz	2V				290 ppm
300 kHz	2V				515 ppm
500 kHz	2V				0.13%
1 MHz	2V				0.27%
20 Hz	2V				185 ppm
10 Hz	2V				600 ppm
1 kHz	2.3V (Note 1)				78.5 ppm
1 kHz	20V				78.5 ppm
40 Hz	20V (Note 2)				78.5 ppm
20 kHz	20V				78.5 ppm
50 kHz	20V				140 ppm
100 kHz	20V				270 ppm
300 kHz	20V				635 ppm
500 kHz	20V				0.155%
1 MHz	20V				0.325%
20 Hz	20V				185 ppm
10 Hz	20V				600 ppm
40 Hz	200V	Stability for 10 minutes: <± 7.5 ppm			
1 kHz	200V				85 ppm
40 Hz	200V				85 ppm
20 kHz	200V				85 ppm
50 kHz	200V				240 ppm
100 kHz	200V				600 ppm
20 Hz	200V				130 ppm
10 Hz	200V				600 ppm
20 kHz	300V (Note 3)				155 ppm
50 kHz	600V (Note 3)				378 ppm
100 kHz	600V (Note 3)				0.1375%
50 Hz	1000V (Note 4)				84 ppm
200 Hz	1000V (Note 4)				84 ppm
500 Hz	1000V (Note 4)				84 ppm
1 kHz	1000V (Note 4)				84 ppm
40 Hz	1000V (Note 3)				84 ppm
20 kHz	1000V (Note 3)				131 ppm

Table 3-27. Test Record for Full Verification (cont)

AC VOLTAGE OUTPUT TEST (CONT)

TABLE NOTES

Note 1: This is a test of the bottom of the 20V range and will require re-referencing at 2.3 V dc.

Note 2: Observe the 5700A output at 20V, 40 Hz for 10 minutes and verify it remains stable within ± 7.5 ppm. Return to 1 kHz and algebraically subtract from the reading any drift caused by the element.

Note 3: Perform only for units with 5725A Amplifier attached. At 600V, use the 500V range on the 540B.

Note 4: Maximum load current is 6 mA for 1 kV range without a 5725A attached.

Table 3-27. Test Record for Full Verification (cont)

AC VOLTAGE MILLIVOLT RANGES TEST SUMMARY

1 KHZ LEVEL VERIFICATION (200 MV, 20 MV, AND 2 MV RANGES)

UUT OUTPUT	RATIO TRANS. SETTING	931 200 mV READING	931 20 mV READING	8922/DMM 2 mV READING
2V @ 1 kHz	0.1		N/A	N/A
2V @ 1 kHz	0.01	N/A		N/A
2V @ 1 kHz	0.001	N/A	N/A	

UUT OUTPUT	UUT ERROR DISPLAY	LIMITS
200 mV @ 1 kHz		±150 ppm
20 mV @ 1 kHz		±410 ppm
2 mV @ 1 kHz		±0.261 ppm

FREQUENCY RESPONSE TESTING (200 MV, 20 MV, AND 2 MV RANGES)

Characterizing 200 mV Level of RMS Diff. Voltmeter:

FREQ.	RMS DIFF. VOLTMETER READING
1 kHz	Null
40 Hz	
20 kHz	
50 kHz	
100 kHz	
300 kHz	
1 MHz	
1 kHz	Return to Null ±0.003%

200 mV Output Accuracy:

FREQ.	UUT ERROR DISPLAY	LIMITS
40 Hz		±150 ppm
20 kHz		±150 ppm
50 kHz		±380 ppm
100 kHz		±0.115%
300 kHz		±0.19%
1 MHz		±0.38%

Table 3-27. Test Record for Full Verification (cont)

AC VOLTAGE MILLIVOLT RANGES TEST SUMMARY (CONT)

FREQUENCY RESPONSE TESTING (200 MV, 20 MV, AND 2 MV RANGES) (CONT)

Characterizing 20 mV Level of RMS Diff. Voltmeter:

FREQ.	RMS DIFF. VOLTMETER READING
1 kHz	Null
40 Hz	
20 kHz	
50 kHz	
100 kHz	
300 kHz	
1 MHz	
1 kHz	Return to Null ±0.01%

20 mV Output Accuracy:

FREQ.	UUT ERROR DISPLAY	LIMITS
40 Hz		±410 ppm 20 kHz
		±410 ppm 50 kHz
		±670 ppm 100 kHz
		±0.13% 300 kHz
		±0.195% 1 MHz
		±0.48%

Characterizing 2 mV Level of RMS Diff. Voltmeter:

FREQ.	RMS DIFF. VOLTMETER READING
1 kHz	Same as reading in 1 kHz Level Verification, ratio trans: 0.001
40 Hz	
20 kHz	
50 kHz	
100 kHz	
300 kHz	
1 MHz	
1 kHz	Return to first entry reading ±0.03%

2 mV Output Accuracy:

FREQ.	UUT ERROR DISPLAY	LIMITS
40 Hz		±0.261% 20 kHz
		±0.261% 50 kHz
		±0.287% 100 kHz
		±0.49% 300 kHz
		±0.87% 1 MHz
		±1.83%

Table 3-27. Test Record for Full Verification (cont)

DIRECT CURRENT ACCURACY VERIFICATION

CHARACTERIZING DC DMM @ ±200 MV AND ± 2.0V

+200 mV RDG	-200 mV RDG	+2.0V RDG	-2.0V RDG

OUTPUT CURRENT	STD RES VALUE	STD RES CORRECTION	UUT ERROR READING	UUT ACTUAL ERROR (A-B) REVERSE POL	LIMIT OF ERROR
+2A	0.1 ohm				±100 ppm
-2A	0.1 ohm				±100 ppm
+200 mA	10 ohm				±65 ppm
-200 mA	10 ohm				±65 ppm
+20 mA	10 ohm				±55 ppm
+2 mA	1 kilohm				±55 ppm
-2 mA	1 kilohm				±55 ppm
+200 uA	10 kilohm				±100 ppm

5725A AMPLIFIER DC CURRENT TEST

OUTPUT CURRENT	DC DMM RDG	SHUNT CERT VALUE	CAL ACTUAL CURRENT	LIMITS
-10A				±428 ppm
5A				±428 ppm
2A				±428 ppm
-2A				±428 ppm

ALTERNATING CURRENT ACCURACY VERIFICATION

OUTPUT CURRENT	FREQ	ACTUAL UUT ERROR	ERROR LIMITS
2A	40 Hz		±675 ppm
2A	1 kHz		±675 ppm
2A	5 kHz		±800 ppm
2A	10 kHz		±0.91%
200 mA	10 Hz		±725 ppm
200 mA	20 Hz		±400 ppm
200 mA	40 Hz		±350 ppm
200 mA	1 kHz		±350 ppm
200 mA	5 kHz		±0.1%
200 mA	10 kHz		±0.49%
20 mA	10 Hz		±725 ppm
20 mA	20 Hz		±400 ppm
20 mA	40 Hz		±160 ppm
20 mA	1 kHz		±160 ppm
20 mA	5 kHz		±0.125%
20 mA	10 kHz		±0.54%

Table 3-27. Test Record for Full Verification (cont)

ALTERNATING CURRENT ACCURACY VERIFICATION (CONT)

5725A AMPLIFIER TESTS

11A	40 Hz	±415 ppm
11A	1 kHz	±415 ppm
11A	5 kHz	±535 ppm
11A	10 kHz	±0.3368%

DMM 2V dc READING =

	DMM 2V ac READING	DMM AC-DC ERROR
10 Hz =		
20 Hz =		
40 Hz =		
1 kHz =		
5 kHz =		
10 kHz =		

DMM 2 mA dc READING = * Add 1 megohm to DMM Input

	EXPECTED 2 mA ac READING	ACTUAL 2 mA ERROR	ERROR LIMITS
10 Hz =			±725 ppm
20 Hz =			±400 ppm
40 Hz =			±160 ppm
1 kHz =			±160 ppm
5 kHz =			±0.175%
10 kHz =			±0.64%

DMM 200 uA dc READING = * Add 1 megohm to DMM Input

	EXPECTED 200 uA ac READING	ACTUAL 200 uA ERROR	ERROR LIMITS
10 Hz =			±850 ppm
20 Hz =			±505 ppm
40 Hz =			±240 ppm
1 kHz =			±240 ppm
5 kHz =			±0.575%
10 kHz =			±2.44%

Table 3-27. Test Record for Full Verification (cont)

FREQUENCY TESTING POINTS

FREQUENCY (HZ)	TOLERANCE LIMITS
10 Hz	99.99 ms to 100.01 ms
100 Hz	9.999 ms to 10.001 ms
300 Hz	299.97 Hz to 300.03 Hz
500 Hz	499.95 Hz to 500.05 Hz
800 Hz	799.92 Hz to 800.08 Hz
900 Hz	899.91 Hz to 900.09 Hz
1 kHz	999.0 Hz to 1.0001 kHz
1.19 kHz	1.189881 kHz to 1.190119 kHz
2.2 MHz	2.19978 MHz to 2.20022 MHz
3.5 MHz	3.49965 MHz to 3.50035 MHz
3.8 MHz	3.79962 MHz to 3.80038 MHz
10 MHz	9.990 MHz to 10.001 MHz
20 MHz	19.998 MHz to 20.002 MHz
30 MHz	29.997 MHz to 30.003 MHz

WIDEBAND ACCURACY AT 1 KHZ

OUTPUT LEVEL	8920A READING OF 5700A MAIN OUTPUT	WIDEBAND OUTPUT ERROR DISPLAY READING	LIMITS
3.0V			±.2167%
1.0V			±.2900%
0.3V			±.2833%
0.1V			±.3400%
30 mV			±.3333%
10 mV			±.3900%
3 mV			±.3833%
1 mV			±.4400%

Table 3-27. Test Record for Full Verification (cont)

Output Flatness and Attenuator Flatness Tests

FREQUENCY	50 OHM DETECTOR CHARACTERIZATION RMS WIDEBAND DC DMM READING	3V RANGE WIDEBAND FLATNESS TEST ERROR DISPLAY READING	LIMITS
1 kHz	.90000V	---	---
10 Hz			0.3%
30 Hz			0.1%
120 kHz			0.1%
500 kHz			0.1%
2 MHz			0.1%
5 MHz			0.2%
10 MHz			0.4%
20 MHz			0.4%
30 MHz			1.0%

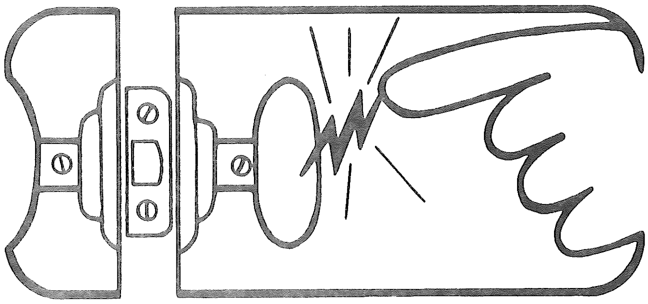
ATTENUATOR FLATNESS TEST RECORD

FREQ	WIDEBAND DC DMM CHAR DATA	3V RANGE WIDEBAND FLAT TEST ERR DISPL	(60 dB) 1.0V OUTPUT	(50 dB) 300 mV OUTPUT	(40 dB) 100 mV OUTPUT	(30 dB) 30 mV OUTPUT	(20 dB) 10 mV OUTPUT	>3 mV LIMIT	(10 dB) 3 mV OUTPUT	3 mV LIMIT	(0 dB) 1 mV OUTPUT	1 mV LIMIT
1 kHz	.90000V	- 0 -	.90000V	.90000V	.90000V	.90000V	.90000V		.90000V		.90000V	
2 MHz								.1%		.1%		.5%
10 MHz								.4%		.5%		.5%
20 MHz								.4%		.5%		.5%
30 MHz								1%		1.5%		3.0%
1 kHz	<.02%		<.02%	<.02%	<.02%	<.02%	<.02%		<.02%		<.02%	

static awareness

A Message From

John Fluke Mfg. Co., Inc.



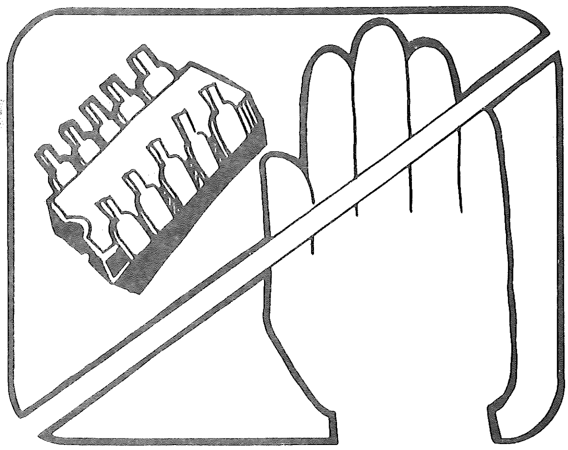
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

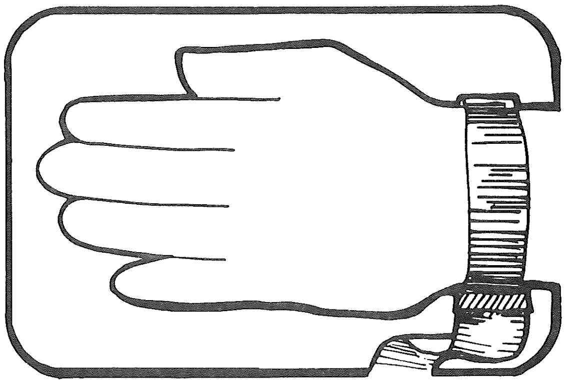
The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol

" "

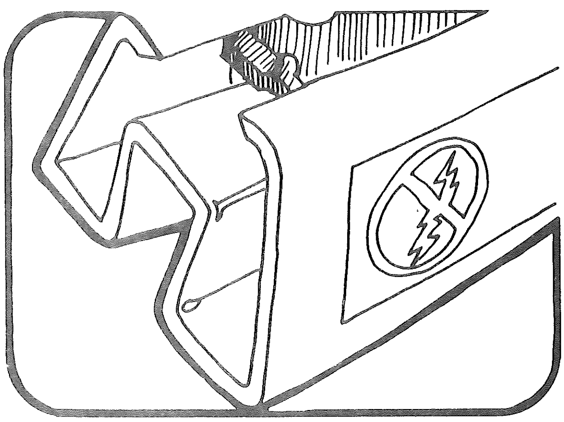
The following practices should be followed to minimize damage to S.S. devices.



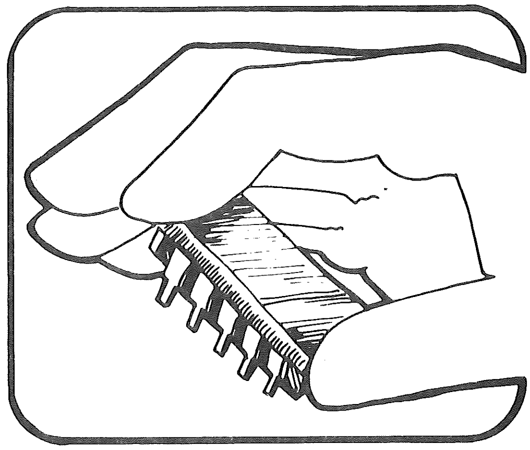
1. MINIMIZE HANDLING



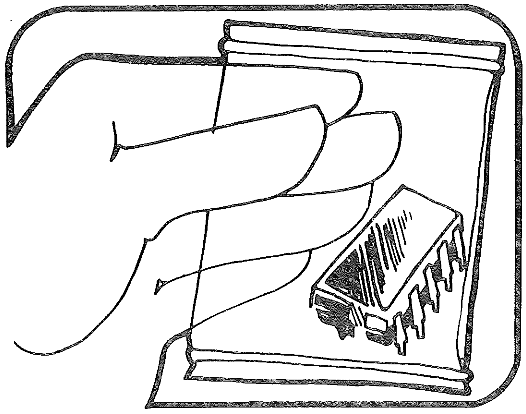
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES. USE A HIGH RESISTANCE GROUNDING WRIST STRAP.



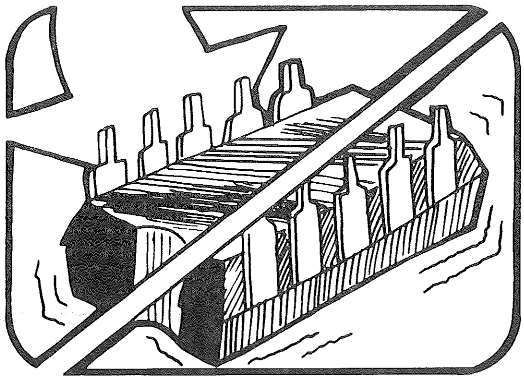
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



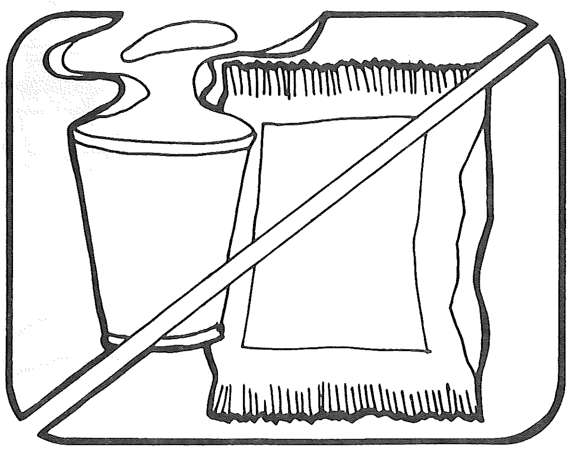
4. HANDLE S.S. DEVICES BY THE BODY



5. USE STATIC SHIELDING CONTAINERS FOR HANDLING AND TRANSPORT



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA

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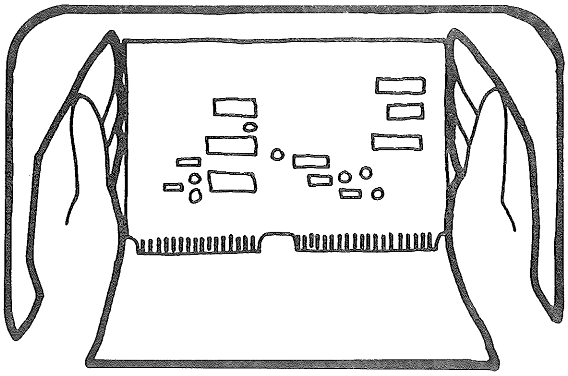
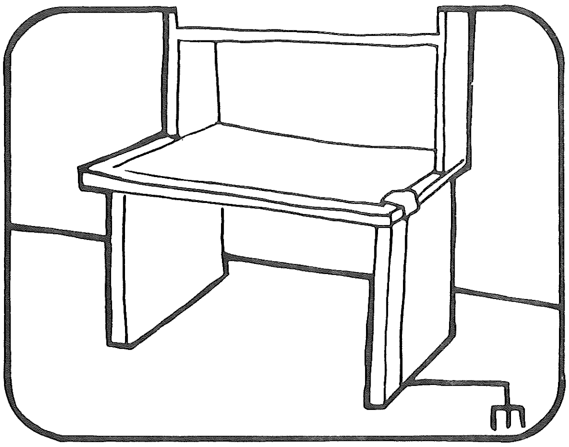


8. WHEN REMOVING PLUG-IN ASSEMBLIES, HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR HELPS TO PROTECT INSTALLED SS DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION

10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

11. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

A complete line of static shielding bags and accessories is available from Fluke Parts Department, Telephone 800-526-4731 or write to:

JOHN FLUKE MFG. CO., INC.
PARTS DEPT. M/S 86
9028 EVERGREEN WAY
EVERETT, WA 98204

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