HEWLETT PACKARD

Calibration Manual

HP 3245A Universal Source

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(tel) (852) 3197 7777
(fax) (852) 2506 9284

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Printing History

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Many product updates and revisions do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.

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Hewlett-Packard Company
3000 Hanover Street, Palo Alto, California 94304

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SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements. This is a Safety Class 1 instrument.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DO NOT OPERATE A DAMAGED INSTRUMENT

Whenever it is possible that the safety protection features built into this instrument have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the instrument until safe operation can be verified by service-trained personnel. If necessary, return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

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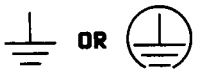
Operating and Safety Symbols

Symbols Used On Products And In Manuals

~ LINE — AC line voltage input receptacle.

Instruction manual symbol affixed to product. Warns and cautions the user to refer to respective instruction manual procedures to avoid personal injury or possible damage to the product.

Indicates dangerous voltage – terminals connected to interior voltage exceeding 1000 volts.



Protective conductor terminal. Indicates the field wiring terminal that must be connected to earth ground before operating equipment – protects against electrical shock in case of fault.

Clean ground (low-noise). Indicates terminal that must be connected to earth ground before operating equipment – for single common connections and protection against electrical shock in case of fault.

Frame or chassis ground. Indicates equipment chassis ground terminal – normally connects to equipment frame and all metal parts.

Affixed to product containing static sensitive devices – use anti-static handling procedures to prevent electrostatic discharge damage to components.

NOTE

NOTE — *Calls attention to a procedure, practice, or condition that requires special attention by the reader.*

CAUTION

CAUTION — *Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.*

WARNING

WARNING — *Calls attention to a procedure, practice, or condition that could possibly cause bodily injury or death.*

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Manual Contents

This manual describes procedures for operational verification, performance testing, and adjustments for the HP 3245A Universal Source. Chapter 2 through 4 contents are:

Chapter 2 - Operational Verification describes operational verification tests for the HP 3245A, including DCV tests, DCI tests, and AC tests.

Chapter 3 - Performance Tests describes performance tests for the HP 3245A, including DCV tests, DCI tests, and AC tests.

Chapter 4 - Adjustments describes adjustment procedures for the HP 3245A, including securing adjustments, manual adjustments, and automated adjustments.

Calibration Guidelines

Guidelines for performing operational verification, performance testing, and adjustments for the HP 3245A follow.

Operational Verification

Operational verification provides a 90% confidence that the HP 3245A is operational and meets its 90-day specifications. Operational verification offers a faster way to check operation and accuracy than does performance testing. Use operational verification during incoming inspection and after repair.

Performance Tests

Performance testing provides an approximately 95% confidence that the HP 3245A is operational and meets its 90-day specifications. Use performance tests (as required) during incoming inspection, at 90-day intervals, at one-year intervals, and after repair.

Adjustments

Most HP 3245A adjustments require that you read a series of voltage and current outputs from the instrument and enter the values back into the HP 3245A. The 10x Voltage Amplifier (Option 002) offset must be manually adjusted using a screwdriver. Perform the necessary adjustments during incoming inspection and as required.

Warnings and Cautions

WARNINGS and CAUTIONS which apply to operation and programming of the HP 3245A follow. Please review the WARNINGS and CAUTIONS before applying power to the instrument.

WARNING

SHOCK/FIRE HAZARD. Only qualified, service-trained personnel who are aware of the hazards involved should install or configure the HP 3245A. Turn off all power to the instrument before attempting repairs or connecting cables. For protection from electrical shock, the power cord ground must not be defeated. For continued fire protection, replace fuse only with one of the same type and rating.

CAUTION

POSSIBLE INSTRUMENT DAMAGE. Before connecting the HP 3245A to an AC power source, verify that the line voltage selector switch is set to match the AC line voltage and the proper line fuse is installed.

CAUTION

VOLTAGE/CURRENT LIMITS. Voltage/current limits for all BNC connectors on the HP 3245A are TTL-compatible 5.0 Vdc @-5.2 mA (HIGH) and 0 Vdc @ 48 mA (LOW).

The 3245A's output BNCs are specified to source up to 100 mA and are current limited at approximately 120 mA. Application of voltages higher than ±15 Vpeak external to the output terminals may open the output relays. Each channel contains two output relays: one each for the front and rear panel BNC connectors. The relays are fused for additional protection.

CAUTION

The 10x V Output BNCs are specified to source up to ±40 mA and are current limited at approximately ±100 mA. Application of voltages greater than ±102.5 volts peak external to the output terminals may open the output relays. Each 10x V Output contains output protection relays. The 10x V Outputs are also fused for additional protection (a spare fuse is also included on the printed circuit board).

Chapter 2
Operational Verification

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Introduction

The Operational Verification Tests are designed to provide a 90% confidence that the HP 3245A is operational and meets specification. The tests, which provide a faster method of checking HP 3245A operation and accuracy than the performance tests, are recommended during incoming inspection and following repair.

NOTE

Ninety day specifications are used in the following procedures. These tests can be performed without access to the interior of the HP 3245A.

Equipment Required

In order to perform the operational verification, the following equipment is required:

Instrument	Critical Specifications	Model
Digital Multimeter	DCV, DCI, ACV measurements Accuracy: 10 ppm, DCV 25 ppm, DCI 500 ppm, ACV Frequency Range to 1 MHz	HP 3458A
Electronic Counter	Frequency measurement Frequency range to 1.5 MHz Resolution: 7 digits Accuracy: 10ppm	HP 5316A

Test Record

An Operational Verification Test record can be found at the end of this chapter. The test record contains 90 day specifications. Copies of the test record can be made.

Preliminary Steps

Before the test procedures are performed, complete the following steps:

1. Select the test environment. For greatest accuracy, the temperature of the test area should be between 18°C and 28°C and should be stable within ±1°C.

2. Power on the HP 3245A and other test equipment. Allow 1 hour for warm-up.

3. The channel being tested must be designated as the *USE channel*. To select channel A, toggle the Chan A/Chan B key or execute **USE 0**. To select channel B, toggle Chan A/Chan B or execute **USE 100**.

4. Connect the HP 3245A Channel A Output connector to the channel's Trigger (I/O) connector. Execute the **FTEST 0** command. To test Channel B, connect the Channel B connectors and execute **FTEST 100**. If you are testing a rear panel output, connect the Output connector to the appropriate Trigger (I/O) connector on the front panel. Execute either **FTEST 1** or **FTEST 101** to test the rear panel Output connector of Channel A or Channel B respectively. If any test fails, note and correct the cause of the failure before proceeding.

5. Execute **RESET, NPLC 100,** and **ACAL** on the HP 3458A.

NOTE

The HP 3458A autocalibration (ACAL) takes approximately 15 minutes to complete.

DC Tests

This section describes DC voltage and current tests. It includes:

- DCV Amplitude Accurary
- DCV Zero Ohm Output Resistance
- DCI Amplitude Accuracy

DCV Amplitude Accuracy

This procedure tests the accuracy of the HP 3245A DCV output signals.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

High Resolution Mode

1. Execute the following commands: **RESET 0; USE 0; RANGE 1; APPLY DCV 1.25**. (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Set the DMM to DCV, connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be 1.25V ±84µV (1.2499160 to 1.2500840).

3. For the following output values, execute the command **APPLY DCV** *volts* and record the DMM reading.

Volts	Specification
0.0	0.000V ± 31µV (-0.0000310 to 0.0000310)
-1.25	-1.250V ±84µV (-1.2500840 to -1.2499160)

4. Execute the following commands: **RANGE 10; APPLY DCV 10.25.**

5. Record the DMM reading. The reading must be 10.25V ±570µV (10.249430 to 10.250570).

6. For the following values, execute the command **APPLY DCV** *volts* and record the DMM reading.

Volts	Specification
0.0	0.000V ±180µV (-0.0001800 to 0.0001800)
-10.25	-10.250V ±570µV (-10.250570 to -10.249430)

Low Resolution Mode

1. Execute the following commands on the HP 3245A: **RESET 0; USE 0; DCRES LOW; RANGE .15625; APPLY DCV .15625.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be .15625V ±1.0mV (0.155250 to 0.157250).

3. For the following values, execute the command **APPLY DCV** *volts* and record the DMM reading.

Volts	Specification
0.0	0.00000V ±0.73mV (-0.0007300 to 0.0007300)
-0.15625	-0.15625V ±1.00mV (-0.1572500 to -0.1552500)

4. Execute the following commands on the HP 3245A: **RANGE 10; APPLY DCV 10.**

5. Record the DMM voltage reading. The reading must be 10V ±54mV (9.9460000 to 10.0540000).

6. For the following values, execute the command **APPLY DCV** *volts* and record the DMM reading.

Volts	Specification
0.0	0.000V ±37mV (-0.0370000 to 0.0370000)
-10	-10.000V ±54mV (-10.0540000 to -9.9460000)

DCV Zero Ohm Output Resistance

This test determines if the output resistance is within the range of 0Ω - 0.5Ω.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. On the HP 3245A, execute the command **RESET 0** (or **RESET 100**).

2. Configure the DMM to measure 2-wire ohms (use a low resistance cable) and measure the resistance at the front Output connector of the HP 3245A.

3. The resistance should be between 0.0Ω and 0.5Ω. If the reading is slightly out of the specification, try a 4-wire ohm measurement or subtract the cable resistance from the 2-wire reading.

DCI Amplitude Accuracy

This procedure tests the accuracy of the HP 3245A DCI output signals.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

High Resolution Mode

1. Execute the following commands on the HP 3245A: **RESET 0; USE 0; RANGE .0001; APPLY DCI .0001**. (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Set the DMM to DCI, connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be .0001A ±8.5nA (0.0999915 mA to 0.1000085 mA).

3. For the following values, execute the command **APPLY DCI** *value* and record the DMM reading.

Value	Specification
0.0	0.00000A ± 3.3 nA (-0.0000033 mA to 0.0000033 mA)
-0.0001	-0.0001A ±8.5 nA (-0.1000085 mA to -0.0999915 mA)

4. Execute the following commands: **RANGE .1; APPLY DCI .1**.

5. Record the DMM reading. The reading must be 0.1A ±23.3 uA (0.0999767 to 0.1000233).

6. For the following output values, execute the command **APPLY DCI** *value* and record the DMM reading.

Value	Specification
0.0	0.0000A ± 3.3 uA (-0.0000033 to 0.0000033)
-0.1	-0.100A ±23.3 uA (-0.1000233 to -0.0999767)

Low Resolution Mode

1. Execute the following HP 3245A commands: **RESET 0; USE 0; DCRES LOW; RANGE .0001; APPLY DCI .0001**. (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be 0.0001 ±630 nA (0.000099370 to 0.000100630).

3. For the following values, execute the command **APPLY DCI** *value* and record the DMM reading.

Value	Specification
0.0	0.00000A ±380 nA (-0.000000380 to 0.000000380)
-0.0001	-0.0001A ±630 nA (-0.000100630 to -0.000099370)

4. Execute the following commands: **RANGE .1; APPLY DCI .1**.

5. Record the DMM reading. The reading must be .1A ±720 uA (0.0992800 to 0.1007200).

6. For the following values, execute the command **APPLY DCI** *value* and record the DMM reading.

Value	Specification
0.0	0.0000A ±400 uA (-0.000400 to 0.000400)
-0.1	-0.100A ±720 uA (-0.100720 to -0.099280)

AC Tests

This section describes AC tests. It includes:

- ACV Amplitude Accuracy
- Offset Accuracy
- Flatness
- Frequency Accuracy
- Reference Frequency Output Accuracy

ACV Amplitude Accuracy

This procedure tests the amplitude accuracy of HP 3245A ACV output signals.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

Sine Wave

1. Execute the following commands on the source: **RESET 0; USE 0; IMP 50; APPLY ACV .15625; RANGE .15625.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. If using the HP 3458A DMM, execute the commands **RESET, ACV** and **ACBAND 1000** on the HP 3458A.

3. Connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be 0.11047V RMS ±720 uV (0.109750 to 0.111190).

4. For the following values, execute the command **APPLY ACV** *volts* and record the DMM reading.

Volts	Specification
0.11719	0.08285V RMS ±640µV (0.08221 to 0.08349)
0.07813	0.05523V RMS ±560µV (0.05467 to 0.05579)

5. Execute the following HP 3245A commands: **ARANGE ON; APPLY ACV 10; RANGE 10.**

6. Record the DMM voltage reading. The reading must be 7.070V RMS ±46mV (7.024 to 7.116).

7. For the following values, execute the command **APPLY ACV** *volts* and record the DMM reading.

Volts	Specification
7.5	5.303V RMS ±41mV (5.262 to 5.344)
5.0	3.535V RMS ±36mV (3.499 to 3.571)

Square Wave

1. Execute the following HP 3245A commands: **RESET 0; USE 0; IMP 50; APPLY SQV .15625; RANGE .15625.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. If using the HP 3458A DMM, execute the commands **RESET, ACV** and **ACBAND 1000** on the HP 3458A.

3. Connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be 0.15625V RMS ±1.27mV (0.15498 to 0.15752).

4. For the following values, execute the command **APPLY SQV** *volts* and record the DMM reading.

Volts	Specification
0.11719	0.11719V RMS ±1.15mV (0.11604 to 0.11834)
0.07813	0.07813V RMS ±1.04mV (0.07709 to 0.07917)

5. Execute the following commands on the source: **ARANGE ON; APPLY SQV 10; RANGE 10.**

6. Record the DMM voltage reading. The reading must be 10V RMS ±81mV (9.919 to 10.081).

7. For the following values, execute the command **APPLY SQV** *volts* and record the DMM reading.

Volts	Specification
7.5	7.5V RMS ±74mV (7.426 to 7.574)
5.0	5.0V RMS ±67mV (4.933 to 5.067)

Offset Accuracy

This procedure tests the amplitude accuracy of the DC Offset Voltage (**DCOFF**). A DC offset voltage = 0.5*RANGE/2 and a peak to peak ACV = RANGE/2 are generated with the HP 3245A and the DC offset voltage is measured. The measured voltage will equal twice the expected value because the HP 3245A output resistance will be set to 50 ohms, but an external 50 ohm load will not be used (a very high R load, the DMM input, will be used instead).

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. Execute the following HP 3245A commands: **RESET 0; USE 0; IMP 50.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. If using the HP 3458A DMM, execute the command **PRESET**, then connect the DMM to the HP 3245A Output connector.

3. On the HP 3245A, execute the commands **APPLY ACV 5; FREQ 600; DCOFF -2.5** then record the negative DC offset reading from the DMM.

4. Execute the command **DCOFF 2.5** and record the positive DC offset reading. The readings obtained in steps 3 and 4 must be ±5 Volts ±86.5mV (4.91350 to 5.08650, -5.08650 to -4.91350).

5. Execute the command **DCOFF 0.**

6. Record the DMM reading for the following **APPLY ACV** and **DCOFF** values.

ACV	DCOFF	Specification
0.078125	±0.0390625	±0.078125V ±1.352mV (0.076773 to 0.079477) (-0.079477 to -0.076773)

Flatness

This procedure tests the amplitude accuracy of an ACV sine wave signals over the frequency range.

Frequency	Flatness *
to 10 kHz	0.07 dB
to 1 MHz	2.00 dB

* 1kHz Reference

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. Execute the following HP 3245A commands: **RESET 0; USE 0; IMP 50; APPLY ACV 10; FREQ 1000.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. If using the HP 3458A DMM, execute the commands **RESET** and **ACDCV.**

3. Connect the DMM to the HP 3245A Output connector using a cable < 2 meters long and record the DMM reading. The reading must be 7.070V RMS ±54mV (7.016 to 7.124).

4. On the HP 3458A DMM, execute the commands **SMATH 9** and **MATH**

DB. Succeeding readings will be referenced to the reading in step 3 and returned in dB.

5. Change the frequency to 10 kHz by executing the command **FREQ 10000**.

6. Record the DMM reading and verify the reading is $\leq \pm .07$ dB.

7. Change the frequency to 1 MHz and verify the reading is $\leq \pm 2.0$ dB.

Frequency Accuracy

This test determines if sine, square, and ramp frequencies are accurate within ±50 ppm. The frequencies tested are 1 MHz for the sine and square wave, and 100 kHz for the ramp.

Equipment Required: Electronic Counter (HP 5316 or equivalent).

Procedure:

1. Connect the HP 3245A Output connector to the electronic counter input.

2. On the HP 3245A, execute the commands **RESET 0; USE 0; IMP 50; APPLY ACV 1; FREQ 1E6** to measure sine wave accuracy. (For channel B, use **RESET 100; USE 100;**.)

3. Measure the frequency of the output signal and ensure it is within the specified limits of 1 MHz ±50 Hz (999,950 to 1,000,050).

4. On the HP 3245A, execute the command **APPLY SQV 1** to measure square wave accuracy. The frequency limits are the same as those listed in step 3.

5. Execute the commands **APPLY RPV 1; FREQ 1E5** to measure ramp wave accuracy. Ensure the frequency is within the specified limits of 100 kHz ±5 Hz (99,995 to 100,005).

Reference Frequency Output Accuracy

This test compares the accuracy of the FREQ REF output signal to the specification of 1,073,741.824 Hz ±50 ppm (1,073,688 - 1,073,796).

Equipment Required: Electronic Counter (HP 5316A or equivalent).

Procedure:

1. Connect the HP 3245A FREQ REF connector to the electronic counter input.

2. Execute the HP 3245A commands **USE 0** and **REFOUT EXT** (or **USE 100**).

3. Measure the frequency of the FREQ REF output signal and ensure it is within the specified limits shown above.

10x Voltage Output Tests

This section describes 10x voltage output tests (Option 002). It includes:

- Output Resistance
- DCV Amplitude Accuracy
- ACV Amplitude Accuracy

Output Resistance

This test determines if the output resistance is within the range of 0Ω to 0.5Ω.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. On the HP 3245A, execute the command **RESET 0.**

2. Configure the DMM to measure 2-wire ohms with **OCOMP ON** (use a low resistance cable) and measure the resistance at the front 10x V Output connector of the HP 3245A.

3. The resistance should be between 0.0Ω and 0.5Ω. If the reading is slightly out of specification, try a 4-wire ohms measurement or subtract the cable resistance from the 2-wire reading.

DCV Amplitude Accuracy

This procedure tests the accuracy of the 10x V Output DCV signals.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. Set the DMM to DCV, connect the DMM to the HP 3245A 10x V Output connector.

2. On the HP 3245A, execute the following commands: **RESET 0; RANGE 10; APPLY DCV 10.25.**

3. Record the DMM reading. The reading must be 102.5 volts ± 34.05 mV (102.46595 to 102.53405).

4. For the following 10x V Output values, execute the command **APPLY DCV** *volts* and record the DMM reading.

Volts	Test Limit
0	0 volts ± 3.3 mV (-0.0033000 to 0.0033000)
-10.25	-102.5 volts ± 34.05 mV (-102.53405 to -102.46595)

ACV Amplitude Accuracy

This procedure tests the accuracy of the 10x V Output ACV signals.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. On the HP 3245A, execute the commands: **RESET 0.**

2. On the DMM, execute **RESET** and then set it to ACV. Connect the DMM to the HP 3245A 10x V Output connector.

3. On the HP 3245A, execute the following commands: **FREQ 1000; RANGE 10; APPLY ACV 20.**

4. Record the DMM reading. The reading must be 70.7107 volts ± 0.5863 volts (70.1424 to 71.2790).

5. On the HP 3245A, execute the command **APPLY ACV 2.**

6. Record the DMM reading. The reading must be 7.0711 volts ± 0.1126 volts (6.9585 to 7.1837).

HP 3245A OPERATION VERIFICATION TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

DC VOLTAGE TEST

Step#	HP 3245A Output	Range		High Limit	Reading		Low Limit	Test Pass	Test Fail
	High Resolution Accuracy								
1	1.25	1 V	+	1.250084V	_____	+	1.249916V	_____	_____
2	0.00	1 V	+	31.0 µV	_____	-	31.0 µV	_____	_____
3	-1.25	1 V	-	1.249916V	_____	-	1.250084V	_____	_____
4	10.25	10 V	+	10.250570V	_____	+	10.249430V	_____	_____
5	0.00	10 V	+	180.0 µV	_____	-	180.0 µV	_____	_____
6	-10.25	10 V	-	10.249430V	_____	-	10.250570V	_____	_____
	Low Resolution Accuracy								
7	.15625	.15625	+	.15725 V	_____	+	.15525 V	_____	_____
8	0.00	.15625	+	730.0 µV	_____	-	730.0 µV	_____	_____
9	-.15625	.15625	-	.15525 V	_____	-	.15725 V	_____	_____
10	10.0	10.0	+	10.054 V	_____	+	9.946 V	_____	_____
11	0.00	10.0	+	37 mV	_____	-	37 mV	_____	_____
12	-10.0	10.0	-	9.946 V	_____	-	10.054 V	_____	_____
	DCV Zero Ohm Output Resistance								
13	RESET			0.5 Ω	_____		0 Ω	_____	_____

HP 3245A OPERATION VERIFICATION TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

DC CURRENT TEST

Step#	HP 3245A Output	Range	High Limit	Reading	Low Limit	Test Pass	Test Fail
	High Resolution Accuracy						
1	.0001	.0001	+ 100.0085 uA	_____	+ 99.9915 uA	_____	_____
2	0.0	.0001	+ 3.3 nA	_____	- 3.3 nA	_____	_____
3	-.0001	.0001	- 99.9915 uA	_____	- 100.0085 uA	_____	_____
4	.1	.1	+ 100.0233 mA	_____	+ 99.9767 mA	_____	_____
5	0.0	.1	+ 3.3 uA	_____	- 3.3 uA	_____	_____
6	-.1	.1	- 99.9767 mA	_____	- 100.0233 mA	_____	_____
	Low Resolution Accuracy						
7	.0001	.0001	+ 100.630 uA	_____	+ 99.370 uA	_____	_____
8	0.0	.0001	+ 380 nA	_____	- 380 nA	_____	_____
9	-.0001	.0001	- 99.370 uA	_____	- 100.630 uA	_____	_____
10	.1	.1	+ 100.72 mA	_____	+ 99.28 mA	_____	_____
11	0.0	.1	+ 400 uA	_____	- 400 uA	_____	_____
12	-.1	.1	- 99.28 mA	_____	- 100.72 mA	_____	_____

HP 3245A OPERATION VERIFICATION TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

AC VOLTAGE TEST

Step#	HP 3245A Output	Range	High Limit	Reading RMS	Low Limit	Test Pass	Test Fail
	Sine Wave						
1	.15625	.15625	.11119 V	_____	.10975 V	_____	_____
2	.11719	.15625	.08349 V	_____	.08221 V	_____	_____
3	.07813	.15625	.05579 V	_____	.05467 V	_____	_____
4	10.	10.	7.116 V	_____	7.024 V	_____	_____
5	7.5	10.	5.344 V	_____	5.262 V	_____	_____
6	5.0	10.	3.571 V	_____	3.499 V	_____	_____
	Square Wave						
7	.15625	.15625	.15752 V	_____	.15498 V	_____	_____
8	.11719	.15625	.11834 V	_____	.11604 V	_____	_____
9	.07813	.15625	.07917 V	_____	.07709 V	_____	_____
10	10.	10.	10.081 V	_____	9.919 V	_____	_____
11	7.5	10.	7.574 V	_____	7.426 V	_____	_____
12	5.0	10.	5.067 V	_____	4.933 V	_____	_____
	Offset Accuracy ACV	DCV					
13	5.0	-2.5	- 4.91350 V	_____	- 5.08650 V	_____	_____
14	5.0	2.5	+ 5.08650 V	_____	+ 4.91350 V	_____	_____
15	0.078125	-0.0390625	- 0.076773V	_____	- 0.079477V	_____	_____
16	0.078125	0.0390625	+ 0.079477V	_____	+ 0.076773V	_____	_____

Step#	HP 3245A Output	Freq.	High Limit	Reading	Test Pass	Test Fail
	Flatness					
15	10	10 KHz	.07dB	_____	_____	_____
16	10	1 MHz	2.0 dB	_____	_____	_____

HP 3245A OPERATION VERIFICATION TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number _____

Test Performed by _____
Date _____
Reference Temperature _____

FREQUENCY TEST

Step #	HP 3245A Output	Range	High Limit	Reading	Low Limit	Test Pass	Test Fail
	Output Frequency Accuracy						
1	1 V, 1 MHz	1 V Sine	1000050 Hz	_____	999950 Hz	_____	_____
2	1 V, 1 MHz	1 V Square	1000050 Hz	_____	999950 Hz	_____	_____
3	1 V, 100 kHz	1 V Ramp	100005 Hz	_____	99995 Hz	_____	_____
	Reference Frequency Accuracy						
4	1073741 Hz	REFOUT	1073796 Hz	_____	1073688 Hz	_____	_____

10X VOLTAGE AMPLIFIER TEST

Step #	HP 3245A 10x Output	Range	High Limit	Reading	Low Limit	Test Pass	Test Fail
	10x V Output Resistance						
1	RESET 0		0.5Ω	_____	0Ω	_____	_____
	10x V Output DCV Amplitude Accuracy						
1	+ 102.5 V	10	102.53405 V	_____	102.46595 V	_____	_____
2	0 V	10	0.0033000 V	_____	-0.0033000 V	_____	_____
3	- 102.5 V	10	-102.46595 V	_____	-102.53405 V	_____	_____
	10x V Output ACV Amplitude Accuracy						
1	200.0 V p-p	10	70.1424 V	_____	71.2790 V	_____	_____
2	20.00 V p-p	10	7.1837 V	_____	6.9585 V	_____	_____

Chapter 3
Performance Tests

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Chapter 3
Performance Tests

Introduction

The HP 3245A performance tests check the operation and accuracy of the instrument against its 90 day specifications. These tests can be performed without access to the interior of the HP 3245A.

Equipment Required

Execution of the performance tests requires the following equipment:

Instrument	Critical Specs	Model
DMM	DCV, DCI, ACV measurement Accuracy: 10 ppm, DCV 25 ppm, DCI 500 ppm, ACV Freq. range to 1MHz	HP 3458
Electronic Counter	Frequency measurement Frequency range to 1.5 MHz Resolution: 7 digits Accuracy: 10ppm	HP 5316
Oscilloscope	Risetime <25 ns Bandwidth 50MHz	HP 54200
Power Supply	8 to 10 volt output	General Purpose
Spectrum Analyzer	Frequency Range to 5 MHz Amplitude Accuracy ±1dB	HP 3585A
50 Ohm Termination		HP 11048C

Calibration Cycle

The HP 3245A performance tests should be performed periodically depending on instrument usage and the operating environment. To maintain 90 day specifications, the performance tests should be performed at 90 day intervals. To maintain 1 year specifications, the tests should be performed annually.

Test Record

Results of the performance tests can be tabulated on the Test Record located at the end of the chapter. The test record lists all tested specifications and their acceptable limits (90 day). It is recommended the Performance Tests be performed, and the results tabulated, when the instrument is received. Copies of the test record can be made if necessary.

Preliminary Steps

Before the test procedures are performed, complete the following steps:

1. Select the test environment. For greatest accuracy, the temperature of the test area should be between 18°C and 28°C and should be stable within ±1°C.

2. Power on the HP 3245A and other test equipment. Allow 1 hour for

warm-up.

3. The channel being tested must be designated as the *USE channel*. To select channel A, toggle the Chan A/Chan B key or execute **USE 0**. To select channel B, toggle Chan A/Chan B or execute **USE 100**.

4. Connect the HP 3245A Channel A Output connector to the channel's Trigger (I/O) connector. Execute the **FTEST 0** command. To test Channel B, connect the Channel B connectors and execute **FTEST 100**. If you are testing a rear panel output, connect the Output connector to the appropriate Trigger (I/O) connector on the front panel. Execute either **FTEST 1** or **FTEST 101** to test the rear panel Output connector of Channel A or Channel B respectively. If any test fails, note and correct the cause of the failure before proceding.

5. Execute **RESET, NPLC 100, and ACAL** on the HP 3458A.

NOTE

The HP 3458A autocalibration (ACAL) takes approximately 15 minutes to complete.

DCV Tests

This section describes DCV tests. It includes:

- Amplitude Accuracy
- High Resolution Settling Time
- Zero Ohm Output Impedance

Amplitude Accuracy

This procedure tests the accuracy of the HP 3245A DCV output signals.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

High Resolution Mode

1. Execute the following commands: **RESET 0; USE 0; RANGE 1; APPLY DCV 1.25**. (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Set the DMM to DCV, connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be 1.25V ±84μV.

3. For the following values, execute the command **APPLY DCV** *volts* and record the DMM reading.

Volts	Specification
0.625	0.625V ± 57μV
0.0	0.000V ± 31μV
-0.625	-0.625V ± 57μV
-1.25	-1.250V ±84μV

4. Execute the following commands: **RANGE 10; APPLY DCV 10.25.**

5. Record the DMM reading. The reading must be 10.25V ±570µV.

6. For the following values, execute the command **APPLY DCV** *volts* and record the DMM reading.

Volts	Specification
5.125	5.125V ±375µV
0.0	0.000V ±180µV
-5.125	-5.125V ±375µV
-10.25	-10.250V ±570µV

Low Resolution Mode

1. Execute the following commands on the HP 3245A: **RESET 0; USE 0; DCRES LOW; RANGE .15625; APPLY DCV .15625.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be .15625V ±1.0mV.

3. For the following values, execute the command **APPLY DCV** *volts* and record the DMM reading.

Volts	Specification
0.07813	0.07813V ±0.86mV
0.0	0.00000V ±0.73mV
-0.07813	-0.07813V ±0.86mV
-0.15625	-0.15625V ±1.00mV

4. Execute the following commands on the HP 3245A: **RANGE .3125; APPLY DCV .3125.**

5. Record the DMM voltage reading. The reading must be .3125V ±1.83mV.

6. For the following values, execute the command **APPLY DCV** *volts* and record the DMM reading.

Volts	Specification
0.15625	0.15625V ±1.57mV
0.0	0.00000V ±1.30mV
-0.15625	-0.15625V ±1.57mV
-0.3125	-0.31250V ±1.83mV

7. Record the DMM voltage readings for the following **RANGE** and **APPLY DCV** values.

Range	Volts	Specification
0.625	0.625	0.625V ±3.56mV
	0.3125	0.3125V ±3.03mV
	0.0	0.000V ±2.50mV
	-0.3125	-0.3125V ±3.03mV
	-0.625	-0.625V ±3.56mV

Range	Volts	Specification
1.25	1.25	1.250V ±6.73mV
	0.625	0.625V ±5.66mV
	0.0	0.000V ±4.60mV
	-0.625	-0.625V ±5.66mV
	-1.25	-1.250V ±6.73mV

Range	Volts	Specification
2.5	2.5	2.500V ±13.5mV
	1.25	1.250V ±11.3mV
	0.0	0.000V ±9.2mV
	-1.25	-1.250V ±11.3mV
	-2.5	-2.500V ±13.5mV

Range	Volts	Specification
5	5.0	5.000V ±28mV
	2.5	2.500V ±24mV
	0.0	0.000V ±19mV
	-2.5	-2.500V ±24mV
	-5.0	-5.000V ±28mV

Range	Volts	Specification
10	10	10.00V ±54mV
	5	5.00V ±46mV
	0	0.00V ±37mV
	-5	-5.00V ±46mV
	-10	-10.00V ±54mV

High Resolution Settling Time

This test ensures the output voltage has settled to 0.1% of the programmed voltage within 20 mS and 0.001% in 40 mS.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. From the HP 3245A menu, enter and execute: **RESET 0; USE 0; RANGE 10; DELAY 0; TRIGOUT EXT; APPLY DCV 10.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Set the DMM to DCV, connect the DMM INPUT terminals to the HP 3245A Output connector and record the reading. This will be the reference reading for the following.

3. Set the HP 3245A output to 0 volts by executing **APPLY DCV 0.**

4. To measure the voltage at 20 ms, execute the following commands on the DMM: **RESET; RANGE 10; DELAY .02; NPLC .1; TRIG EXT.** Leave the DMM connected to the HP 3245A and connect the DMM EXT TRIG connector to the HP 3245A Trigger connector.

5. On the HP 3245A, execute **APPLY DCV 10; TRIGIN SGL.** Record the DMM reading. The reading must be within 0.1% of the reading recorded in step 2 (≃10V ±10mV).

6. Set the HP 3245A output to 0 volts by executing **APPLY DCV 0; TRIGIN SGL.**

7. To measure the voltage at 40 ms, execute the DMM commands **DELAY .04; NPLC 1.**

8. On the HP 3245A, execute **APPLY DCV 10; TRIGIN SGL.** Record the DMM reading.

9. Set the HP 3245A output to 0 volts by executing the commands **APPLY DCV 0; TRIGIN SGL.**

NOTE

Since the 3458A accuracy/HP 3245A accuracy ratio is 2/1, it is recommended that Steps 8 and 9 be repeated until five readings have been recorded. Calculate the average of the readings. The average must be within 0.001% of the reading recorded in Step 2 (≃10V ±100 uV).

Zero Ohm Output Resistance

This test determines if the output resistance is within the range of 0Ω - 0.5Ω.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. Reset the HP 3245A by executing **RESET 0** (or **RESET 100**).

2. Reset the DMM and configure it to measure 2-wire ohms (use low resistance cable) and measure the resistance at the front Output connector of the HP 3245A.

3. Ensure the resistance meets the specification listed above. If the reading is slightly out of the specification, try a 4-wire ohm measurement or subtract the cable resistance from the 2-wire reading.

DCI Tests

This section describes DCI tests. It includes:

- Amplitude Accuracy
- Output Resistance
- Voltage Compliance

Amplitude Accuracy

This procedure tests the accuracy of the HP 3245A DCI output signals.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

High Resolution Mode

1. Execute the following HP 3245A commands: **RESET 0; USE 0; RANGE .0001; APPLY DCI .0001.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Set the DMM to DCI, connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be .0001A ±8.5nA.

3. For the following values, execute **APPLY DCI** *value* and record the DMM reading.

Value	Specification
0.00005	0.00005A ±5.9 nA
0.0	0.00000A ±3.3 nA
-0.00005	-0.00005A ±5.9 nA
-0.0001	-0.0001A ±8.5 nA

4. Execute the following commands: **RANGE .001; APPLY DCI .001.**

5. Record the DMM reading. The reading must be 0.001A ±72 nA.

6. For the following values, execute **APPLY DCI** *value* and record the DMM reading.

Value	Specification
0.0005	0.0005A ±46 nA
0.0	0.0000A ±20 nA
-0.0005	-0.0005A ±46 nA
-0.001	-0.001A ±72 nA

7. Record the DMM current readings for the following HP 3245A **RANGE** and **APPLY DCI** values.

Range	Value	Specification
0.01	0.01	0.01A ±0.96µA
	0.005	0.005A ±0.59µA
	0.0	0.000A ±0.22µA
	-0.005	-0.005A ±0.59µA
	-0.01	-0.01A ±0.96µA

Range	Value	Specification
0.1	0.1	0.1A ±23.5µA
	0.05	0.05A ±13.4µA
	0.0	0.00A ± 3.3µA
	-0.05	-0.05A ±13.4µA
	-0.1	-0.1A ±23.5µA

Low Resolution Mode

1. Execute the following HP 3245A commands: **RESET 0; USE 0; DCRES LOW; RANGE .0001; APPLY DCI .0001**. (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be 0.0001 ±630 nA.

3. For the following values, execute the command **APPLY DCI** *value* and record the DMM reading.

Value	Specification
0.00005	0.00005A ±505 nA
0.0	0.00000A ±380 nA
-0.00005	-0.00005A ±505 nA
-0.0001	-0.0001A ±630 nA

4. Execute the following commands: **RANGE .001; APPLY DCI .001**.

5. Record the DMM reading. The reading must be .001A ±6.3µA.

6. For the following values, execute **APPLY DCI** *value* and record the DMM reading.

Value	Specification
0.0005	0.0005A ±5.1µA
0.0	0.0000A ±3.8µA
-0.0005	-0.0005A ±5.1µA
-0.001	-0.001A ±6.3µA

7. Record the DMM current readings for the following HP 3245A ranges and currents (**RANGE, APPLY DCI**).

Range	Value	Specification
0.01	0.01	0.01A ±82.0µA
	0.005	0.005A ±67.0µA
	0.0	0.000A ±52.0µA
	-0.005	-0.005A ±67.0µA
	-0.01	-0.01A ±82.0µA

Range	Value	Specification
0.1	0.1	0.1A ±720µA
	0.05	0.05A ±560µA
	0.0	0.00A ±400µA
	-0.05	-0.05A ±560µA
	-0.1	-0.1A ±720µA

Output Resistance

This test determines if the high resolution mode output resistance meets the specified limits shown below.

Range	Output Resistance
100mA	>3.1 Mohm
10mA	>210 Mohm
1mA	>2500 Mohm
0.1mA	>10000 Mohm

Equipment Required: Digital Multimeter (HP 3458A); Power Supply (10 volt output)

Procedure:

1. Execute the following HP 3245A commands: **RESET 0; USE 0; APPLY DCI 0; RANGE .1.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Using the DMM, measure and record the current at the HP 3245A Output connector. With the **RANGE** command, change the range to 0.01, 0.001, and 0.0001 (for example **RANGE 0.01**). Measure and record the current on each range.

3. Adjust the power supply voltage to 8 volts ±.05V. Connect the power supply (+) terminal to the DMM 'LO' terminal. Connect the DMM 'I' terminal to the HP 3245A high terminal (center of BNC). Connect the HP 3245A low terminal (outside of BNC) to the power supply (-) terminal. See Figure 3-1.

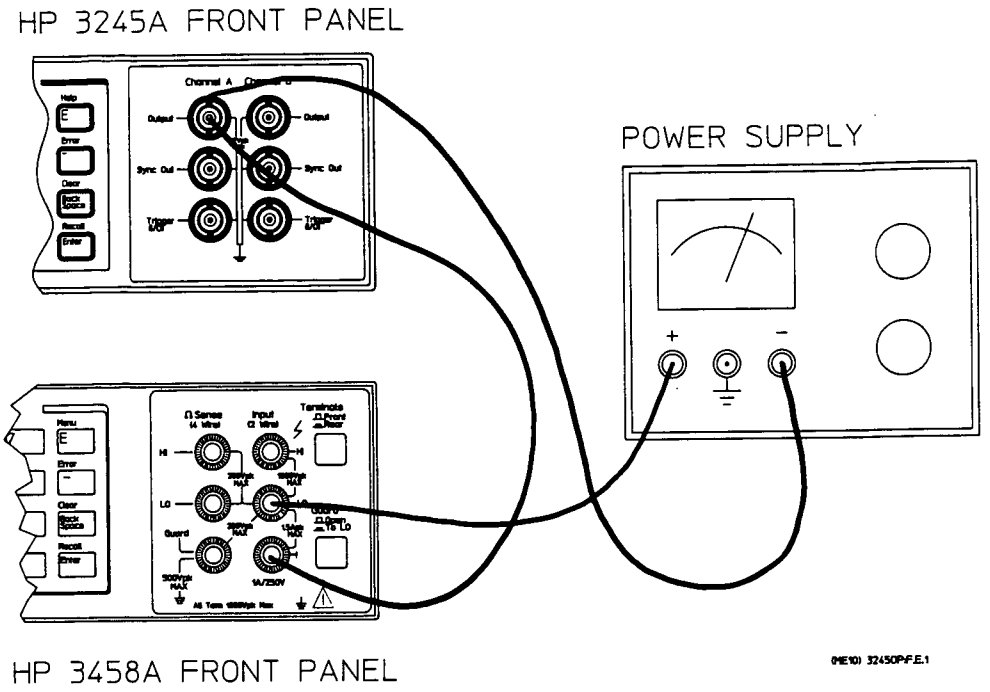

Figure 3-1. DCI Output Resistance and Voltage Compliance Test Set Up

4. Change the HP 3245A range to 0.1 then measure and record (under `Step 6 Rdg` on the Performance Test Record) the current at the Output connector.

5. To determine the output resistance for the 0.1 range, the formula $R=\Delta E/\Delta I$ is used. $\Delta E = 8$ and ΔI = the reading taken in Step 2, minus the reading taken in Step 4.

6. Change the supply to 10V and record the current for the ranges: 0.01, 0.001, and 0.0001A. For each range, subtract the reading in Step 2 from the reading in Step 6. Divide 10 by the result to determine the resistance. Verify all readings are within specification.

Voltage Compliance

This test checks the voltage compliance limits. The procedure identifies the maximum load resistance for full-scale output current and voltage where the maximum voltage is the compliance voltage.

Equipment Required: Digital Multimeter (HP 3458A); Power Supply (8 to 10 volt output)

Procedure:

1. Execute the following HP 3245A commands: **RESET 0; USE 0 (RESET 100; USE 100;** for channel B).

2. Connect the power supply, DMM, and HP 3245A as shown in Figure E-1.

3. To check for compliance on the 100mA range, set the DMM to DCI and the power supply output to 8 volts ±0.1V.

4. On the HP 3245A, execute **APPLY DCI .1**.

5. Record the DMM reading and ensure it is 100mA ±26uA.

6. To check for compliance while applying negative current, reverse the positions of the power supply leads (move power supply + to HP 3245A low and - to current meter 'LO').

7. Execute **APPLY DCI -.1**, record the DMM reading, and ensure it is -100mA ±26uA.

8. Set the HP 3245A to 0A by executing the command **APPLY DCI 0**.

9. To check for compliance on the -10mA range, adjust the power supply output to 10 volts ±0.1V.

10. Execute **APPLY DCI -.01**, record the DMM reading, and ensure it is -10mA ±2uA.

11. To check the +10mA compliance, reverse the position of the power supply leads (move power supply - to HP 3245A low and + to current meter 'LO').

12. Execute **APPLY DCI .01**, record the DMM reading, and ensure it is +10mA ±2uA.

ACV Tests

This section describes ACV Tests. It includes:

- Amplitude Accuracy
- Offset Accuracy
- Flatness
- Harmonic and Spurious Levels

- Square Wave Rise Time
- Square Wave Symmetry
- Frequency Accuracy
- Reference Frequency Output Accuracy

Amplitude Accuracy

This procedure tests the amplitude accuracy of the HP 3245A ACV output signals.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

Sine Wave

1. Execute the following HP 3245A commands: **RESET 0; USE 0; IMP 50; RANGE .15625; APPLY ACV .15625.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. If using the 3458A DMM, execute **RESET, ACV**, and **ACBAND 1000**.

3. Connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be 0.11047V RMS ±720µV.

4. For the following values, execute **APPLY ACV** *volts* and record the DMM reading.

Volts	Specification
0.11719	0.08285V RMS ±640µV
0.07813	0.05523V RMS ±560µV

5. Execute the following HP 3245A commands: **RANGE .3125; APPLY ACV .3125.**

6. Record the DMM voltage reading. The reading must be .22094V RMS ±1.44mV.

7. For the following values, execute **APPLY ACV** *volts* and record the DMM reading.

Volts	Specification
0.23438	0.16570V RMS ±1.28mV
0.15625	0.11047V RMS ±1.12mV

8. Record the DMM reading for the following HP 3245A ranges and amplitudes (**RANGE** and **APPLY ACV**).

Range	Volts	Specification
0.625	0.625	0.44188V RMS ±2.87mV
	0.46875	0.33141V RMS ±2.55mV
	0.3125	0.22094V RMS ±2.23mV
1.25	1.25	0.88375V RMS ±5.75mV
	0.9375	0.66281V RMS ±5.11mV
	0.625	0.44188V RMS ±4.46mV
2.5	2.5	1.76750V RMS ±11.49mV
	1.875	1.32562V RMS ±10.21mV
	1.25	0.88375V RMS ± 8.93mV
5	5.0	3.535V RMS ±23.0mV
	3.75	2.65125V RMS ±20.4mV
	2.5	1.76750V RMS ±17.9mV
10	10	7.070V RMS ±46mV
	7.5	5.303V RMS ±41mV
	5	3.535V RMS ±36mV

Square Wave

1. Execute the following HP 3245A commands: **RESET 0; USE 0; IMP 50;**

RANGE .15625; APPLY SQV .15625. (To test channel B, substitute **RESET 100; USE 100;** into the command string.)

2. On the 3458A DMM, execute **RESET, ACV,** and **ACBAND 1000.**

3. Connect the DMM to the HP 3245A Output connector and record the DMM reading. The reading must be 0.15625V RMS ±1.27mV.

4. For the following values, execute **APPLY SQV** *volts* and record the DMM reading.

Volts	Specification
0.11719	0.11719V RMS ±1.15mV
0.07813	0.07813V RMS ±1.04mV

5. Execute the following HP 3245A commands: **RANGE .3125; APPLY SQV .3125.**

6. Record the DMM voltage reading. The reading must be 0.3125V RMS ±2.53mV.

7. For the following values, execute **APPLY SQV** *volts* and record the DMM reading.

Volts	Specification
0.23438	0.23438V RMS ±2.31mV
0.15625	0.15625V RMS ±2.08mV

8. Record the DMM reading for the following HP 3245A ranges and amplitudes (**RANGE** and **APPLY SQV**).

Range	Volts	Specification
0.625	0.625	0.625V RMS ±5.06mV
	0.46875	0.46875V RMS ±4.61mV
	0.3125	0.3125V RMS ±4.16mV
1.25	1.25	1.25V RMS ±10.13mV
	0.9375	0.9375V RMS ± 9.22mV
	0.625	0.625V RMS ± 8.31mV
2.5	2.5	2.5V RMS ±20.25mV
	1.875	1.875V RMS ±18.44mV
	1.25	1.25V RMS ±16.63mV
5	5.0	5.0V RMS ±40.5mV
	3.75	3.75V RMS ±36.9mV
	2.5	2.5V RMS ±33.3mV
10	10	10.0V RMS ±81mV
	7.5	7.5V RMS ±74mV
	5	5.0V RMS ±67mV

Offset Accuracy

This procedure tests the amplitude accuracy of the DC Offset Voltage (**DCOFF**). A DC offset voltage = 0.5*RANGE/2 and a peak to peak ACV = RANGE/2 are generated with the HP 3245A and the DC offset voltage is measured. The measured voltage will equal twice the expected value because the HP 3245A output resistance is set to 50 ohms, but an external 50 ohm load is not used (a very high R load, the DMM input, will be used instead).

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. Execute the following HP 3245A commands: **RESET 0; USE 0; IMP 50** (**RESET 100; USE 100;** if using channel B).

2. On the 3458A, execute **PRESET** then connect the DMM to the HP 3245A Output connector.

3. On the HP 3245A, execute **APPLY ACV 5; FREQ 600; DCOFF -2.5** then record the negative DC offset reading from the DMM.

4. Execute **DCOFF 2.5** and record the positive DC offset reading. The readings obtained in Steps 3 and 4 must be ±5 Volts ±86.5mV.

5. Record the DMM reading for the following HP 3245A AC amplitude and DC offset values (**APPLY ACV** and **DCOFF**).

ACV	DCOFF	Specification
2.5	±1.25	±2.50V ±43.25mV
1.25	±0.625	±1.25V ±21.625mV
0.625	±0.3125	±0.625V ±10.813mV
0.3125	±0.15625	±0.3125V ±5.406mV
0.15625	±0.078125	±0.15625V ±2.703mV
0.078125	±0.0390625	±0.078125V ±1.352mV

Flatness

This procedure tests the amplitude accuracy of ACV sine wave signals over the frequency range.

Frequency	Flatness *
to 3 kHz	0.07 dB
to 10 kHz	0.07 dB
to 30 kHz	0.07 dB
to 100 kHz	0.20 dB
to 300 kHz	0.60 dB
to 1 MHz	2.00 dB

* 1 kHz Reference

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. Execute the following HP 3245A commands: **RESET 0; USE 0; IMP 50; APPLY ACV 10; FREQ 1000.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. On the 3458A, execute **RESET** and **ACDCV**.

3. Connect the DMM to the HP 3245A Output connector using a cable < 2 meters long and record the DMM reading. The reading must be 7.070V RMS ±54mV.

4. On the 3458A, execute the commands **SMATH 9** and **MATH DB**. Succeeding readings will be referenced to the reading in Step 3 and returned in dB.

5. Change the frequency of the HP 3245A by executing **FREQ 3000**.

6. Record the DMM reading and verify the reading is $\leq$ ±.07 dB.

7. Check the frequencies listed below against their specifications.

10 kHz	0.07 dB	300 kHz	0.60 dB
30 kHz	0.07 dB	1 MHz	2.00 dB
100 kHz	0.20 dB		

Harmonic and Spurious Levels

This procedure tests the harmonic and spurious signal levels of the sine wave output.

Frequency	Harmonic & Spurious Signal Levels*
to 3 kHz	< -62 dB
to 10 kHz	< -62 dB
to 30 kHz	< -55 dB
to 100 kHz	< -46 dB
to 300 kHz	< -40 dB
to 1 MHz	< -40 dB

* Relative to fundamental, and with amplitude $\geq$ 50% of range.

Equipment Required: Spectrum Analyzer (HP 3585A)

Procedure:

1. Execute the following HP 3245A commands: **RESET 0; USE 0; IMP 50; APPLY ACV 10; FREQ 3000.** (To test channel B, substitute **RESET 100; USE 100;** in the command string.)

2. Connect the HP 3585A Spectrum Analyzer 50Ω terminal to the HP 3245A Output connector.

3. Configure the spectrum analyzer to measure the level of the harmonics and spurious signals. The following settings are recommended: Start Freq = frequency being measured; Stop Freq = 10 X frequency being measured; Res BW and Video BW = 100Hz.

4. Verify that all harmonics are below the specified level of -62 dB, relative to the fundamental.

5. On the HP 3245A, set the following frequencies by using the **FREQ** command and verify that all harmonics are below the specified levels, relative to the fundamental. Recommended spectrum analyzer settings are those given in Step 3, except Res BW and Video BW should be adjusted as needed.

10 kHz	-62 dB	100 kHz	-46 dB	1 MHz	-40 dB
30 kHz	-55 dB	300 kHz	-40 dB		

Square Wave Rise Time

This procedure compares the square wave output to its rise/fall time specification which is given below.

Rise and Fall Time: <250 ns, 10% - 90%

Equipment Required: Oscilloscope (HP 54200 or equivalent) and 50 Ohm Termination (HP 11048C or equivalent)

Procedure:

1. Connect the oscilloscope and 50 ohm termination to the HP 3245A Output connector.

2. On the HP 3245A, execute **RESET 0; USE 0; IMP 50; APPLY SQV 10** (**RESET 100; USE 100;** if channel B).

3. Adjust the oscilloscope's vertical and horizontal controls so the square wave rise time between the 10% and 90% points can be measured. Rise time should be less than 250 ns.

Square Wave Symmetry

This test checks the symmetry of the square wave signal to determine if the symmetry is accurate within ±(0.8% of period + 120 ns).

Equipment Required: Electronic Counter (HP 5316A or equivalent).

Procedure:

1. Connect the HP 3245A Output connector to the electronic counter input, channel A. Set the counter SEP/COM A switch to COM A; AC/DC coupling to DC; Filter to NORM; ATTN to X1 and Trigger Levels to 0 volts.

2. On the HP 3245A, execute the commands **RESET 0; USE 0; APPLY SQV 1; FREQ 1E6** (**RESET 100; USE 100;** if channel B).

3. Adjust the counter to measure time interval average A to B, set channel A Slope to + and channel B Slope to -. Record the reading.

4. Change Slope A to - and Slope B to + and record the reading. The difference between the Step 3 and Step 4 reading must be ≤ ±256 ns.

Frequency Accuracy

This test determines if sine, square, and ramp frequencies are accurate within ±50 ppm. The frequencies tested are 1 MHz for the sine and square wave, and 100 kHz for the ramp.

Equipment Required: Electronic Counter (HP 5316A or equivalent).

Procedure:

1. Configure the electronic counter to measure frequency and connect it to the HP 3245A output.

2. On the HP 3245A, execute **RESET 0; USE 0; IMP 50; APPLY ACV 1; FREQ 1E6** (**RESET 100; USE 100;** for channel B) to measure sine wave accuracy.

3. Measure the frequency of the output signal and ensure it is within the specified limits of 1 MHz ±50 Hz.

4. On the HP 3245A, execute **APPLY SQV 1** to measure square wave accuracy. The frequency limits are the same as those listed in Step 3.

5. Execute the commands **APPLY RPV 1; FREQ 1E5** to measure ramp wave accuracy. Ensure the frequency is within the specified limits of 100 kHz ±5 Hz.

Reference Frequency Output Accuracy

This test compares the accuracy of the FREQ REF output signal to the specification of 1,073,741.824 Hz ±50 ppm (1,073,688 - 1,073,796).

Equipment Required: Electronic Counter (HP 5316A or equivalent).

Procedure:

1. Connect the HP 3245A FREQ REF connector to the electronic counter input.

2. On the HP 3245A, execute **USE 0** (**USE 100**) and **REFOUT EXT**.

3. Measure the frequency of the FREQ REF output signal and ensure it is within the specified limits shown above.

10x Voltage Output Tests

This section describes 10x voltage output tests (Option 002). It includes:

- Output Resistance
- DCV Amplitude Accuracy
- ACV Amplitude Accuracy
- Harmonic and Spurious Levels
- Amplifier Flatness
- Square Wave Rise Time

Output Resistance

This test determines if the output resistance is within the range of 0Ω to 0.5Ω.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. On the HP 3245A, execute the command **RESET 0.**

2. Configure the DMM to measure 2-wire ohms with **OCOMP ON** (use a low resistance cable) and measure the resistance at the front 10x V Output connector of the HP 3245A.

3. The resistance should be between 0.0Ω and 0.5Ω. If the reading is slightly out of specification, try a 4-wire ohms measurement or subtract the cable resistance from the 2-wire reading.

DCV Amplitude Accuracy

This procedure tests the accuracy of the 10x V Output DCV signals.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. Set the DMM to DCV, connect the DMM to the HP 3245A 10x V Output connector.

2. On the HP 3245A, execute the following commands: **RESET 0; RANGE 10; APPLY DCV 10.25.**

3. Record the DMM reading. The reading must be 102.5 volts ± 34.05 mV (102.46595 to 102.53405).

4. For the following 10x V Output values, execute the command **APPLY DCV** *volts* and record the DMM reading.

Volts	Test Limit
0	0 volts ± 3.3 mV (-0.0033000 to 0.0033000)
-10.25	-102.5 volts ± 34.05 mV (-102.53405 to -102.46595)

5. On the HP 3245A, execute the command **APPLY 1.**

6. Record the DMM reading. The reading must be 10 volts ± 4.8 mV (9.995200 to 10.004800).

7. On the HP 3245A, execute the command **APPLY -1.**

8. Record the DMM reading. The reading must be -10 volts ± 4.8 mV (-10.004800 to -9.995200).

ACV Amplitude Accuracy

This procedure tests the accuracy of the 10x V Output ACV signals.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. On the HP 3245A, execute the commands: **RESET 0.**

2. On the DMM, execute **RESET** and then set it to ACV. Connect the DMM to the HP 3245A 10x V Output connector.

3. On the HP 3245A, execute the following commands: **FREQ 1000; RANGE 10; APPLY ACV 20.**

4. Record the DMM reading. The reading must be 70.7107 volts ± 0.5863 volts (70.1424 to 71.2790).

5. On the HP 3245, execute the command **APPLY ACV 2.**

6. Record the DMM reading. The reading must be 7.0711 volts ± 0.1126 volts (6.9585 to 7.1837).

Harmonic and Spurious Levels

This procedure tests the harmonic and spurious levels of the sine wave output of the 10x V Output.

Equipment Required: Spectrum Analyzer (HP 3585A).

Procedure:

1. Execute the HP 3245A commands: **RESET 0.**

2. Connect the Spectrum Analyzer's 1 MΩ input using a 10:1 oscilloscope probe to the HP 3245A 10x V Output connector.

3. Execute the HP 3245A commands: **APPLY ACV 20; FREQ 1000.** Use caution, the output signal is 70.7 volts RMS.

4. Configure the spectrum analyzer to measure the level of the harmonics and spurious signals. These settings are recommended: Start Frequency = frequency being measured, Stop Frequency = 10 X frequency being measured, Resolution BW and Video BW = 100 Hz.

5. Verify that all harmonics and spurious signals are below the specified level of -54 dB relative to the fundamental.

6. On the HP 3245A, set the following frequencies using the **FREQ** command and verify that all harmonics and spurious signals are below the specified levels related to the fundamental. The recommended spectrum analyzer settings are those in step 4, except the Resolution BW and Video BW which should be adjusted as needed.

Frequency	Specified Level
10 kHz	- 54 dB
100 kHz	- 40 dB

Amplifier Flatness

This procedure test the amplitude accuracy of ACV sine wave signals over the frequency range.

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. Execute the following HP 3245A commands: **RESET 0.**

2. On the HP 3458A, execute **RESET** and **ACDCV.**

3. Connect the DMM to the HP 3245A 10x V Output connector using a cable less than 2 meters long.

4. On the HP 3245A, execute these commands: **RANGE 10; APPLY ACV 20; FREQ 1000.**

5. Record the DMM reading. The reading must be 70.7107 volts ± 0.5863 volts (70.1424 to 71.2790).

6. On the HP 3458A, execute the commands **SMATH 9** and **MATH DB.** Successive readings will be referenced to the reading in step 5 and returned in dB.

7. Change the frequency of the HP 3245A by executing **FREQ 10000.**

8. Record the DMM reading and verify that the reading is ≤ ± 0.2 dB.

9. Change the frequency of the HP 3245A by executing **FREQ 100000.**

10. Record the DMM reading and verify that the reading is ≤ ± 0.6 dB.

Square Wave Rise Time

This procedure compares the square wave output of the 10x V Output to its rise/fall time specification.

Equipment Required: Oscilloscope (HP 54200 or equivalent)

Procedure:

1. On the HP 3245A, execute **RESET 0.**

2. Connect the oscilloscope using a 10:1 oscilloscope probe to the HP 3245A 10x V Output connector.

3. On the HP 3245A, execute **APPLY SQV 20; FREQ 10000.** Use caution, there is now high voltage on the 10x V Output connector.

4. Adjust the oscilloscope's vertical and horizontal controls so the square wave rise times and fall times between the 10% and 90% points can be measured. These times should be less than 3 μsec.

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

DC VOLTAGE TEST

Step#	HP 3245A Output	Range		High Limit	Reading		Low Limit	Test Pass	Test Fail
	High Resolution Accuracy								
1	1.25	1 V	+	1.250084V	_____	+	1.249916V	_____	_____
2	0.625	1 V	+	0.625057V	_____	+	0.624943V	_____	_____
3	0.00	1 V	+	31.0 µV	_____	-	31.0 µV	_____	_____
4	-0.625	1 V	-	0.624943V	_____	-	0.625057V	_____	_____
5	-1.25	1 V	-	1.249916V	_____	-	1.250084V	_____	_____
6	10.25	10 V	+	10.250570V	_____	+	10.249430V	_____	_____
7	5.125	10 V	+	5.125375V	_____	+	5.124625V	_____	_____
8	0.00	10 V	+	180.0 µV	_____	-	180.0 µV	_____	_____
9	-5.125	10 V	-	5.124625V	_____	-	5.125375V	_____	_____
10	-10.25	10 V	-	10.249430V	_____	-	10.250570V	_____	_____
	Low Resolution Accuracy								
11	.15625	.15625	+	.15725 V	_____	+	.15525 V	_____	_____
12	.07813	.15625	+	.07899 V	_____	+	.07727 V	_____	_____
13	0.00	.15625	+	730.0 µV	_____	-	730.0 µV	_____	_____
14	-.07813	.15625	-	.07727 V	_____	-	.07899 V	_____	_____
15	-.15625	.15625	-	.15525 V	_____	-	.15725 V	_____	_____
16	.3125	.3125	+	.31433 V	_____	+	.31067 V	_____	_____
17	.15625	.3125	+	.15782 V	_____	+	.15468 V	_____	_____
18	0.00	.3125	+	1.3 mV	_____	-	1.3 mV	_____	_____
19	-.15625	.3125	-	.15468 V	_____	-	.15782 V	_____	_____
20	-.3125	.3125	-	.31067 V	_____	-	.31433 V	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

DC VOLTAGE TEST (Cont'd)

Step#	HP 3245A Output	Range	High Limit	Reading	Low Limit	Test Pass	Test Fail
21	.625	.625	+ .62856 V	_____	+ .62144 V	_____	_____
22	.3125	.625	+ .31553 V	_____	+ .30947 V	_____	_____
23	0.00	.625	+ 2.5 mV	_____	- 2.5 mV	_____	_____
24	-.3125	.625	- .30947 V	_____	- .31553 V	_____	_____
25	-.625	.625	- .62144 V	_____	- .62856 V	_____	_____
26	1.25	1.25	+ 1.2567 V	_____	+ 1.2433 V	_____	_____
27	0.625	1.25	+ .63066 V	_____	+ .61934 V	_____	_____
28	0.00	1.25	+ 4.6 mV	_____	- 4.6 mV	_____	_____
29	-0.625	1.25	- .61934 V	_____	- .63066 V	_____	_____
30	-1.25	1.25	- 1.2433 V	_____	- 1.2567 V	_____	_____
31	2.5	2.5	+ 2.5135 V	_____	+ 2.4865 V	_____	_____
32	1.25	2.5	+ 1.2613 V	_____	+ 1.2387 V	_____	_____
33	0.00	2.5	+ 9.2 mV	_____	- 9.2 mV	_____	_____
34	-1.25	2.5	- 1.2387 V	_____	- 1.2613 V	_____	_____
35	-2.5	2.5	- 2.4865 V	_____	- 2.5135 V	_____	_____
36	5.0	5.0	+ 5.028 V	_____	+ 4.972 V	_____	_____
37	2.5	5.0	+ 2.524 V	_____	+ 2.476 V	_____	_____
38	0.00	5.0	+ 19 mV	_____	- 19 mV	_____	_____
39	-2.5	5.0	- 2.476 V	_____	- 2.524 V	_____	_____
40	-5.0	5.0	- 4.972 V	_____	- 5.028 V	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

DC VOLTAGE TEST (Cont'd)

Step#	HP 3245A Output	Range	High Limit	Reading	Low Limit	Test Pass	Test Fail
41	10.0	10.0	+ 10.054 V	_____	+ 9.946 V	_____	_____
42	5.0	10.0	+ 5.046 V	_____	+ 4.954 V	_____	_____
43	0.00	10.0	+ 37 mV	_____	- 37 mV	_____	_____
44	-5.0	10.0	- 4.954 V	_____	- 5.046 V	_____	_____
45	-10.0	10.0	- 9.946 V	_____	- 10.054 V	_____	_____
	High Resolution Settling Time						
46	10.0	10.0	N/A	_____	N/A	N/A	N/A
47	10.0	10.0	Within .1% of Step 46	_____		_____	_____
48	10.0	10.0	Within .001% of Step 46	_____		_____	_____
	DCV Zero Ohm Output Resistance						
49	RESET		0.5 Ω	_____	0 Ω	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

DC CURRENT TEST

Step#	HP 3245A Output	Range	High Limit	Reading	Low Limit	Test Pass	Test Fail
	High Resolution Accuracy						
1	.0001	.0001	+ 100.0085 uA	_____	+ 99.9915 uA	_____	_____
2	.00005	.0001	+ 50.0059 uA	_____	+ 49.9941 uA	_____	_____
3	0.0	.0001	+ 3.3 nA	_____	- 3.3 nA	_____	_____
4	-.00005	.0001	- 49.9941 uA	_____	- 50.0059 uA	_____	_____
5	-.0001	.0001	- 99.9915 uA	_____	- 100.0085 uA	_____	_____
6	.001	.001	+ 1000.072 uA	_____	+ 999.928 uA	_____	_____
7	.0005	.001	+ 500.046 uA	_____	+ 499.954 uA	_____	_____
8	0.0	.001	+ 20 nA	_____	- 20 nA	_____	_____
9	-.0005	.001	- 499.954 uA	_____	- 500.046 uA	_____	_____
10	-.001	.001	- 999.928 uA	_____	- 1000.072 uA	_____	_____
11	.01	.01	+ 10.00096 mA	_____	+ 9.99904 mA	_____	_____
12	.005	.01	+ 5.00059 mA	_____	+ 4.99941 mA	_____	_____
13	0.0	.01	+ .22 uA	_____	- .22 uA	_____	_____
14	-.005	.01	- 4.99941 mA	_____	- 5.00059 mA	_____	_____
15	-.01	.01	- 9.99904 mA	_____	- 10.00096 mA	_____	_____
16	.1	.1	+ 100.0235 mA	_____	+ 99.9765 mA	_____	_____
17	.05	.1	+ 50.0134 mA	_____	+ 49.9866 mA	_____	_____
18	0.0	.1	+ 3.3 uA	_____	- 3.3 uA	_____	_____
19	-.05	.1	- 49.9866 mA	_____	- 50.0134 mA	_____	_____
20	-.1	.1	- 99.9765 mA	_____	- 100.0235 mA	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

DC CURRENT TEST (Cont'd)

Step#	HP 3245A Output	Range	High Limit	Reading	Low Limit	Test Pass	Test Fail
	Low Resolution Accuracy						
21	.0001	.0001	+ 100.630 uA	_____	+ 99.470 uA	_____	_____
22	.00005	.0001	+ 50.505 uA	_____	+ 49.495 uA	_____	_____
23	0.0	.0001	+ 380 nA	_____	- 380 nA	_____	_____
24	-.00005	.0001	- 49.495 uA	_____	- 50.505 uA	_____	_____
25	-.0001	.0001	- 99.470 uA	_____	- 100.630 uA	_____	_____
26	.001	.001	+ 1006.3 uA	_____	+ 993.7 uA	_____	_____
27	.0005	.001	+ 505.1 uA	_____	+ 494.9 uA	_____	_____
28	0.0	.001	+ 3.8 uA	_____	- 3.8 uA	_____	_____
29	-.0005	.001	- 494.9 uA	_____	- 505.1 uA	_____	_____
30	-.001	.001	- 993.7 uA	_____	- 1006.3 uA	_____	_____
31	.01	.01	+ 10.082 mA	_____	+ 9.918 mA	_____	_____
32	.005	.01	+ 5.067 mA	_____	+ 4.933 mA	_____	_____
33	0.0	.01	+ 52 uA	_____	- 52 uA	_____	_____
34	-.005	.01	- 4.933 mA	_____	- 5.067 mA	_____	_____
35	-.01	.01	- 9.918 mA	_____	- 10.082 mA	_____	_____
36	.1	.1	+ 100.72 mA	_____	+ 99.28 mA	_____	_____
37	.05	.1	+ 50.560 mA	_____	+ 49.440 mA	_____	_____
38	0.0	.1	+ 400 uA	_____	- 400 uA	_____	_____
39	-.05	.1	- 49.440 mA	_____	- 50.560 mA	_____	_____
40	-.1	.1	- 99.28 mA	_____	- 100.72 mA	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

DC CURRENT TEST (Cont'd)

Step#	Range	Step 6 Rdg		Step 2 Rdg		Delta I (DI)	Resistance R=10/DI	Low Limit	Test Pass	Test Fail
	DCI Output Resistance. High Resolution									
44	100mA	_____	-	_____	=	_____	_____	3.1Mohm	_____	_____
45	10mA	_____	-	_____	=	_____	_____	210 Mohm	_____	_____
46	1mA	_____	-	_____	=	_____	_____	2500 Mohm	_____	_____
47	.1mA	_____	-	_____	=	_____	_____	10000 Mohm	_____	_____

Step#	HP 3245A Output	Pwr Sup Output		High Limit		Reading		Low Limit		Test Pass	Test Fail
	DCI Voltage Compliance										
48	.1	8V	+	100.026	mA	_____	+	99.974	mA	_____	_____
49	-.1	8V	-	99.974	mA	_____	-	100.026	mA	_____	_____
50	-.01	10V	-	9.998	mA	_____	-	10.002	mA	_____	_____
51	.01	10V	+	10.002	mA	_____	+	9.998	mA	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

AC VOLTAGE TEST

Step#	HP 3245A Output	Range	High Limit	Reading RMS	Low Limit	Test Pass	Test Fail
	Sine Wave						
1	.15625	.15625	.11119 V	_____	.10975 V	_____	_____
2	.11719	.15625	.08349 V	_____	.08221 V	_____	_____
3	.07813	.15625	.05579 V	_____	.05467 V	_____	_____
4	.3125	.3125	.22238 V	_____	.21950 V	_____	_____
5	.23438	.3125	.16698 V	_____	.16442 V	_____	_____
6	.15625	.3125	.11159 V	_____	.10935 V	_____	_____
7	.625	.625	.44475 V	_____	.43901 V	_____	_____
8	.4688	.625	.33396 V	_____	.32886 V	_____	_____
9	.3125	.625	.22317 V	_____	.21871 V	_____	_____
10	1.25	1.25	.88950 V	_____	.87800 V	_____	_____
11	.9375	1.25	.66792 V	_____	.65770 V	_____	_____
12	.625	1.25	.44634 V	_____	.43742 V	_____	_____
13	2.5	2.5	1.77899 V	_____	1.75601 V	_____	_____
14	1.875	2.5	1.33583 V	_____	1.31541 V	_____	_____
15	1.25	2.5	.89268 V	_____	.87482 V	_____	_____
16	5.0	5.0	3.5580 V	_____	3.5120 V	_____	_____
17	3.75	5.0	2.67165 V	_____	2.63085 V	_____	_____
18	2.5	5.0	1.78565 V	_____	1.74985 V	_____	_____
19	10.	10.	7.116 V	_____	7.024 V	_____	_____
20	7.5	10.	5.344 V	_____	5.262 V	_____	_____
21	5.0	10.	3.571 V	_____	3.499 V	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

AC VOLTAGE TEST (Cont'd)

Step#	HP 3245A Output	Range	High Limit	Reading	Low Limit	Test Pass	Test Fail
	Square Wave						
22	.15625	.15625	.15752 V	_____	.15498 V	_____	_____
23	.11719	.15625	.11834 V	_____	.11604 V	_____	_____
24	.07813	.15625	.07917 V	_____	.07709 V	_____	_____
25	.3125	.3125	.31503 V	_____	.30997 V	_____	_____
26	.23438	.3125	.23669 V	_____	.23207 V	_____	_____
27	.15625	.3125	.15833 V	_____	.15417 V	_____	_____
28	.625	.625	.63006 V	_____	.61994 V	_____	_____
29	.46875	.625	.47336 V	_____	.46414 V	_____	_____
30	.3125	.625	.31666 V	_____	.30834 V	_____	_____
31	1.25	1.25	1.26013 V	_____	1.23987 V	_____	_____
32	.9375	1.25	.94672 V	_____	.92828 V	_____	_____
33	.625	1.25	.63331 V	_____	.61669 V	_____	_____
34	2.5	2.5	2.52025 V	_____	2.47975 V	_____	_____
35	1.875	2.5	1.89344 V	_____	1.85656 V	_____	_____
36	1.25	2.5	1.26663 V	_____	1.23337 V	_____	_____
37	5.0	5.0	5.0405 V	_____	4.9595 V	_____	_____
38	3.75	5.0	3.7869 V	_____	3.7131 V	_____	_____
39	2.5	5.0	2.5333 V	_____	2.4667 V	_____	_____
40	10.	10.	10.081 V	_____	9.919 V	_____	_____
41	7.5	10.	7.574 V	_____	7.426 V	_____	_____
42	5.0	10.	5.067 V	_____	4.933 V	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

AC VOLTAGE TEST (Cont'd)

Step#	HP 3245A Output			High Limit	Reading		Low Limit	Test Pass	Test Fail
	Offset Accuracy ACV	DCOFF							
43	5.0	-2.5	-	4.91350 V	_____	-	5.08650 V	_____	_____
44	5.0	2.5	+	5.08650 V	_____	+	4.91350 V	_____	_____
45	2.5	-1.25	-	2.45675 V	_____	-	2.54325 V	_____	_____
46	2.5	1.25	+	2.54325 V	_____	+	2.45675 V	_____	_____
47	1.25	-0.625	-	1.228375V	_____	-	1.271625V	_____	_____
48	1.25	0.625	+	1.271625V	_____	+	1.228375V	_____	_____
49	0.625	-0.3125	-	0.614187V	_____	-	0.635813V	_____	_____
50	0.625	0.3125	+	0.635813V	_____	+	0.614187V	_____	_____
51	0.3125	-0.15625	-	0.307094V	_____	-	0.317906V	_____	_____
52	0.3125	0.15625	+	0.317906V	_____	+	0.307094V	_____	_____
53	0.15625	-0.078125	-	0.153547V	_____	-	0.158953V	_____	_____
54	0.15625	0.078125	+	0.158953V	_____	+	0.153547V	_____	_____
55	0.078125	-0.0390625	-	0.076773V	_____	-	0.079477V	_____	_____
56	0.078125	0.0390625	+	0.079477V	_____	+	0.076773V	_____	_____

Step#	HP 3245A Output	Freq.	High Limit	Reading	Test Pass	Test Fail
	Flatness					
57	10	3 KHz	.07dB	_____	_____	_____
58	10	10 KHz	.07dB	_____	_____	_____
59	10	30 KHz	.07dB	_____	_____	_____
60	10	100 KHz	.2 dB	_____	_____	_____
61	10	300 KHz	.6 dB	_____	_____	_____
62	10	1 MHz	2.0 dB	_____	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number_____

Test Performed by _____
Date _____
Reference Temperature_____

AC VOLTAGE TEST (Cont'd)

Step#	HP 3245A Output	Imp./Freq.	High Limit	Reading		Test Pass	Test Fail
	Harmonics and Spurious Levels						
63	10	50/ 3 KHz	62 dB	_____		_____	_____
64	10	50/10 KHz	62 dB	_____		_____	_____
65	10	30 KHz	55 dB	_____		_____	_____
66	10	50/100 KHz	46 dB	_____		_____	_____
67	10	50/300 KHz	40 dB	_____		_____	_____
68	10	50/1 MHz	40 dB	_____		_____	_____
	Rise Time						
69	10 SQV	50/1 KHz	250 nS	_____		_____	_____

Step#	HP 3245A Output	Freq.	High Limit	Reading		Test Pass	Test Fail
	Squarewave Symmetry						
72	1	1E6	+ 128 nS	_____	- 128 nS	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number _____

Test Performed by _____
Date _____
Reference Temperature _____

FREQUENCY TEST

Step #	HP 3245A Output	Range	High Limit	Reading	Low Limit	Test Pass	Test Fail
	Output Frequency Accuracy						
1	1 V, 1 MHz	1 V Sine	1000050 Hz	_____	999950 Hz	_____	_____
2	1 V, 1 MHz	1 V Square	1000050 Hz	_____	999950 Hz	_____	_____
3	1 V, 100 kHz	1 V Ramp	100005 Hz	_____	99995 Hz	_____	_____
	Reference Frequency Accuracy						
4	1073741 Hz	REFOUT	1073796 Hz	_____	1073688 Hz	_____	_____

10X VOLTAGE AMPLIFIER TEST

Step #	HP 3245A 10x Output	Range	High Limit	Reading	Low Limit	Test Pass	Test Fail
	10x V Output Resistance						
1	RESET 0		0.5Ω	_____	0Ω	_____	_____
	10x V Output DCV Amplitude Accuracy						
1	+ 102.5 V	10	102.53405 V	_____	102.46595 V	_____	_____
2	0 V	10	0.0033000 V	_____	-0.0033000 V	_____	_____
3	- 102.5 V	10	-102.46595 V	_____	-102.53405 V	_____	_____
4	10 V	10	9.995900 V	_____	10.004100 V	_____	_____
5	- 10 V	10	-10.004100 V	_____	-9.995900 V	_____	_____
	10x V Output ACV Amplitude Accuracy						
1	200.0 V p-p	10	70.1424 V	_____	71.2790 V	_____	_____
2	20.00 V p-p	10	7.1837 V	_____	6.9585 V	_____	_____

PERFORMANCE TEST RECORD
90 DAY LIMITS

Hewlett-Packard Model 3245A
Universal Source
Serial Number _____

Test Performed by _____
Date _____
Reference Temperature _____

10X VOLTAGE AMPLIFIER TEST (cont'd)

Step #	HP 3245A 10x Output	Frequency	High Limit	Reading	Test Pass	Test Fail
	Harmonics and Spurious Levels					
1	200.0 V p-p	1 kHz	-54 dB	_____	_____	_____
2	200.0 V p-p	10 kHz	-54 dB	_____	_____	_____
3	200.0 V p-p	100 kHz	-40 dB	_____	_____	_____
	Flatness					
1	200.0 V p-p	10 kHz	± 0.2 dB	_____	_____	_____
2	200.0 V p-p	100 kHz	± 0.6 dB	_____	_____	_____
	Rise/Fall Times					
1	200.0 V p-p	10 kHz	3 μsec	_____	_____	_____

Chapter 4
Adjustments

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Chapter 4
Adjustments

Introduction

All but one of the HP 3245A adjustments require that you read a series of voltage and current outputs from the instrument and enter the values back into the HP 3245A. The 10x Voltage Amplifier (Option 002) offset must be manually adjusted using a screwdriver. Perform the necessary adjustments during incoming inspection and as required.

There are two adjustment options: a full adjustment which consists of 71 readings; 47 which are voltage, and 24 which are current. The second option is a voltage adjustment only. Here, only the 47 voltage readings are entered back into the HP 3245A. In addition, the 10x V Output requires the manual adjustment of its offset.

Equipment Required

Equipment required to perform the adjustment depends on whether a manual or automated procedure is used. The manual procedure requires an HP 3458A Digital Multimeter. The automated procedure requires the HP 3458A, an HP 9000 Series 200/300 controller, and the adjustment software (3.5 inch or 5.25 inch disc).

Adjustment Software

An automated adjustment procedure, which includes software and instructions, is included with this product. This software is for use with the HP 9000 Series 200 and Series 300 controllers. The software automatically adjusts the HP 3245A to its rated specifications. Instructions on loading and running the adjustment program are at the end of this chapter.

Adjustment Commands

Six commands are associated with HP 3245A adjustments. Refer to the HP 3245A Command Reference Manual for details on these commands. A brief explanation of each command follows.

- **SECURE** sets a security code to prevent accidental or unauthorized adjustment of the HP 3245A.

- **CAL** initializes an algorithm to perform a full adjustment of voltage and current ranges. **CAL VOLTS** performs only voltage range adjustment.

- **CALEN?** is a calibration enable query. Returns "1" if the CAL Jumper is in the left (ENABLE) position, or "0" if the jumper is in the right (DISABLE) position.

- **CALSTR** sends information to the CALibration RAM. Up to 75 characters of information can be stored in RAM in the form of calibration dates, calibration temperature, etc.

- **CALSTR?** is calibration string query. Returns the information stored in the CAL RAM by **CALSTR**.

- **CAL VALUE** reading is used during adjustment to enter voltage and current values into memory.

Preliminary Steps

Complete the following steps before adjusting (manual or automatic) the HP 3245A.

1. Select the adjustment environment. For greatest accuracy, the temperature of the environment should be between 18° C and 28° C and should be stable within ± 1° C.

2. Power on the HP 3245A and other adjustment equipment. Allow one hour for warm-up.

3. The channel being adjusted must be designated as the **USE** channel. To select channel A, execute **USE 0** . To select channel B, execute **USE 100**.

4. Connect the HP 3245A Channel A OUTPUT connector to the channel's Trigger (I/O) connector. Execute the **FTEST 0** command. To test Channel B, connect the Channel B connectors and execute **FTEST 100**.

5. If you are using a rear panel output, connect the Output connector to the appropriate Trigger (I/O) connector on the front panel. Execute either **FTEST 1** or **FTEST 101** to test the rear panel Output connector of Channel A or Channel B respectively.

6. If any test fails, note and correct the cause of the failure before proceeding.

Securing Adjustments

A security feature of the HP 3245A allows the person responsible for calibration/adjustments to enter a security code which prevents accidental or unauthorized calibrations/adjustments. The security code is set with the **SECURE** command.

WARNING

SHOCK/FIRE HAZARD. Only qualified, service-trained personnel who are aware of the hazards involved should install or configure the HP 3245A. Turn off all power to the instrument before attempting repairs or connecting cables. For protection from electrical shock, the power cord ground must not be defeated. For continued fire protection, replace fuse only with one of the same type and rating.

Using Security Code

The security code is set with **SECURE** *old_code, new_code*. The security code must be an integer from -2.1E-9 to 2.1E9. If the number specified is not an integer, the HP 3245A rounds it to an integer value. The HP 3245A is shipped from the factory with the security code set to 3245.

NOTE

Using **SECURE** *0 disables the security feature so it is no longer necessary to enter the security code to perform a calibration or adjustment.*

Changing the Security Code

Use **SECURE** *old_code, new_code* to change the security code. The procedure to change the security code is:

1. Access the **SECURE** command from the MENU or send the command over HP-IB.

2. Enter the old security code, the "," delimiter, and the new security code. The instrument is shipped from the factory with security code set to 3245. To change the security code from 3245 to 12345 (for example), enter 3245, 12345.

3. Press the **Enter** key. The instrument will now respond to the new security code. Note that "ERR 61:OUT OF RANGE - - Secure code" will occur if the wrong security code (*old_code*) is entered.

Disabling the Security Feature

If the security code is unknown, the security feature can be disabled with the following procedure, thus allowing a new code to be entered.

1. Turn the HP 3245A OFF and remove the line cord from the instrument.

2. Remove the top cover:

   (a) Remove both rear handle brackets with a #2 Pozidrive.
   (b) Remove the rear bezel by loosening the four #15 TORX screws.
   (c) With the back of the instrument facing you, remove the #10 TORX screw securing the top cover to the right side.
   (d) Remove the top cover.

3. With the front of the instrument facing you, change the position of jumper JM600 on the 03245-66505 assembly from the left position to the right position. The jumper is located underneath the ribbon cable.

4. Reconnect the power and turn the instrument on.

5. Access the **SECURE** command from the MENU.

6. Enter the number 0 followed by the "," delimiter and the security code you want to use.

7. Press the **ENTER** key.

8. Turn the HP 3245A OFF, disconnect power, and return jumper JM600 to the left position.

9. Replace the top cover and reconnect power. The HP 3245A will now respond to the new security code.

NOTE

When jumper JM600 is in the right position, the security feature is disabled (i.e., old_code = 0) and the HP 3245A can be adjusted without entering a security number. If a new security number (new_code of **SECURE** *command) is not entered while the jumper is in the right position, the original number will again be in effect when jumper JM600 is returned to the left position.*

Hardware Lock-Out

You can set jumper JM1 (labeled S1) on the 03245-66501 assembly so that removing the instrument cover and repositioning the jumper are required whenever an adjustment is performed. The following procedure sets this "hardware lock-out" for both channels.

1. Remove the top cover of the HP 3245A as described in Steps 1 and 2 of "Disabling the Security Feature".

2. With the front of the HP 3245A facing you, set jumper JM1 to the right position. The **CAL** command cannot be executed when the jumper is in the right position even when the correct security code is entered.

3. Replace the top cover.

NOTE

To perform an adjustment with the **CAL** *command, you must remove the top cover and set jumper JM1 to the left position (HP 3245A front facing you).*

Adjustments Procedures

This section describes manual and automatic adjustment procedures for the HP 3245A.

Manual Adjustments Procedure

The manual adjustment procedure requires an HP 3245A and an HP 3458A multimeter. To begin the procedure, connect the HP 3245A output to the 'HI' and 'LO' inputs of the HP 3458A.

NOTE

The HP 3457 can be used; however, it has less accuracy. The HP 3456 will calibrate voltage only.

---

1. Execute **RESET, ACAL,** and **NPLC 100** on the HP 3458A multimeter.

NOTE

The HP 3458A autocalibration (ACAL) takes approximately 15 minutes.

---

2. On the HP 3245A, execute: **RESET; USE 0; CAL** [*code*] to perform a full calibration. If only the voltage is to be calibrated, execute **CAL VOLTS** [*code*] in place of the **CAL** command. (If Channel B is adjusted, substitute **USE 100** in the command string.) [*code*] is not necessary if the 3245A has been unsecured.

3. A reading near +9.5 volts should be displayed on the HP 3458A. Enter this reading into the HP 3245A using the command **CAL VALUE** *reading*. Be sure to use the proper sign before the value. For best accuracy, the value entered should have resolution to better than 1 ppm.

NOTE

Be careful when entering values or one of the following may occur:

(a) The first few values entered are not checked against an internal limit by the processor. Therefore, if the value entered is incorrect, later values may not be accepted by the processor. When this occurs, restart the adjustment procedure.

(b) Some values are checked against limits and if too large or small, the error string will exhibit **ERR 116: CAL INPUT OUT OF RANGE.** *When this occurs, check the value just entered and correct if necessary.*

---

4. Once the value in Step 3 is entered, another reading (reading #2) is generated by the HP 3245A and is measured by the HP 3458A. Enter the value displayed (on the HP 3458A) again using **CAL VALUE** *reading*.

5. Repeat Step 4 for each of the following values. Note that the values are approximately equal to those generated by the HP 3245A each time a new

reading is entered with **CAL VALUE**. They are intended to help you keep track of the readings you have entered. Remember to enter the readings as measured on the HP 3458A, not the values shown below.

NOTE

Reading number 45 should be taken on the HP 3458A 100V DC range. Autorange should be used for all other readings.

Typical Voltage Values

Rdg #	Value	Rdg #	Value	Rdg #	Value	Rdg #	Value
2	-9.55612	13	8.69571	25	.260405	37	.972845
3	-9.07270	14	-8.98757	26	-.277966	38	-.975624
4	9.11090	15	8.87979	27	.128434	39	.482371
5	.003857	16	1.527120	28	-.141705	40	-.488240
6	.006429	17	4.34966	29	7.87700	41	.235490
7	.009027	18	-4.50022	30	8.33560	42	-.242910
8	.003856	19	2.16810	31	-7.83650	43	.115940
9	9.11371	20	-2.24777	32	-8.12451	44	-.124109
10	-9.06988	21	1.074346	33	3.93995	45	.100220
11	1.130233	22	-1.118369	34	-3.9241	46	9.98835
12	-1.124515	23	.532930	35	1.96365	47	-10.03865
		24	-.559357	36	-1.9603		

NOTE

If calibrating voltage only, omit Step 6.

---

6. Connect the HP 3245A output to the 'I' and 'LO' inputs of the HP 3458A. Change the multimeter function to DCI and continue the adjustments. The following values are approximately equal to those that will be measured by the 3458A. Again, enter the measured values.

Typical Current Values

Rdg #	Value	Rdg #	Value	Rdg #	Value	Rdg #	Value
48	.028483	54	8.46492E-5	60	.000594	66	.008824
49	-.028022	55	-8.42163E-5	61	-.000621	67	-.008763
50	.009772	56	.0590461	62	5.94123E-5	68	.000786
51	-.009725	57	-.0626234	63	-6.21755E-5	69	-.000780
52	.000846	58	.0068411	64	.078508	70	7.88477E-5
53	-.000842	59	-.0071487	65	-.078732	71	-7.82605E-5

7. After all calibration values have been entered, the CAL RAM is updated. At this time, adjustment string information such as adjustment dates, temperature, etc. can be stored in memory using the **CALSTR** command.

Automated Adjustments Procedure

To run the automated adjustments procedure, first ensure that the BASIC language is loaded into the HP 9000 Series 200/300 computer. The adjustment program is stored on the disc labeled "Adjustments." Insert the disc and load the program by entering **LOAD "CAL"**. Then press **RUN** to start the program. Follow the instructions as prompted.

10x Voltage Output Offset Adjustment

This section describes the manual adjustment procedure for the 10x V Output of the HP 3245A.

Manual Adjustment Procedure

Equipment Required: Digital Multimeter (HP 3458A)

Procedure:

1. Connect the HP 3245A 10x V Output to the "HI" and "LO" inputs of the HP 3458A.

2. On the HP 3458A, execute: **RE SET** and **NPLC 100.**

3. On the HP 3245A, execute: **RESET 0; RANGE 1; APPLY DCV 0.**

4. With a small screwdriver, adjust the potentiometer through the ventilation slot shown in Figure 4-1. An LED is positioned behind the potentiometer to make it easy to locate through the ventilation slot. The reading on the DMM should be less than $\pm$ 100 μV.

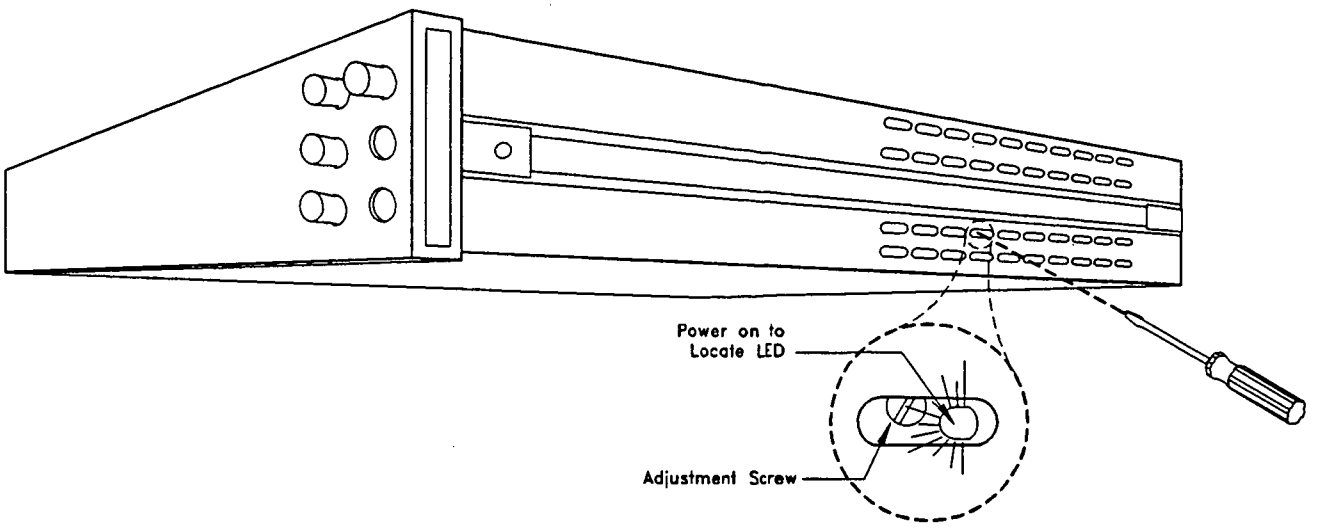

Figure 4-1. 10x Voltage Output Adjustment Location

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