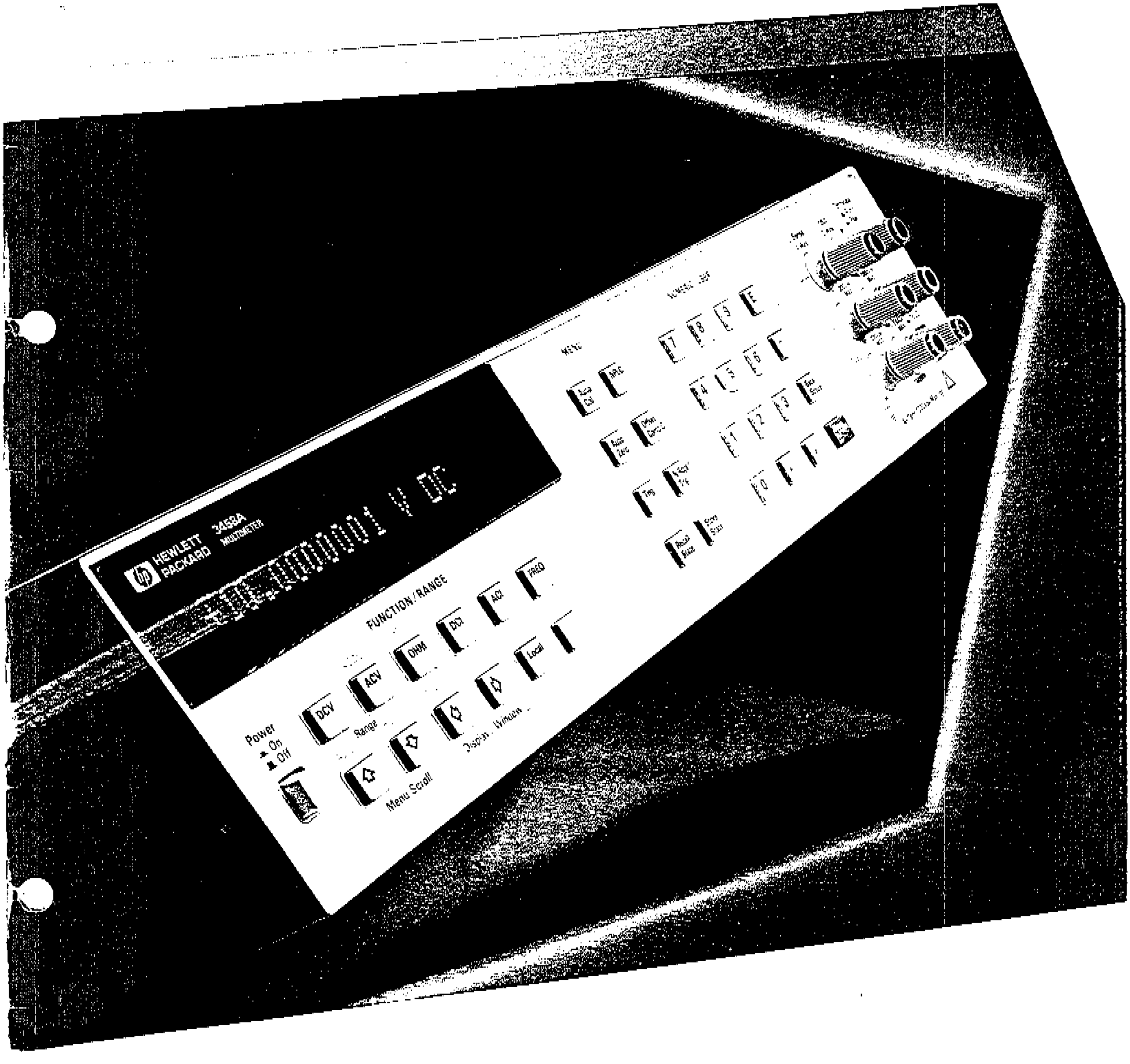
HP 3458A Multimeter

Shatters performance barriers
of speed and accuracy!

Technical Data: May 1988



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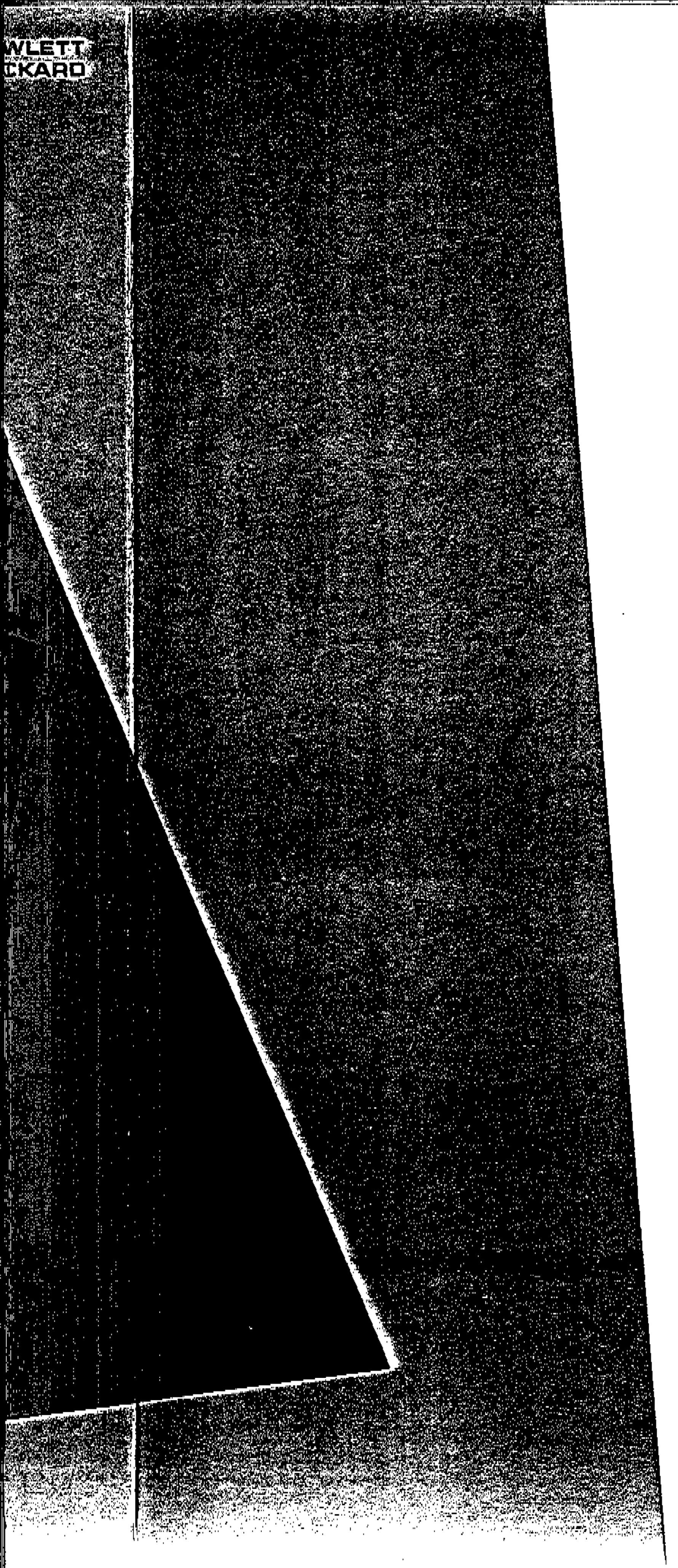
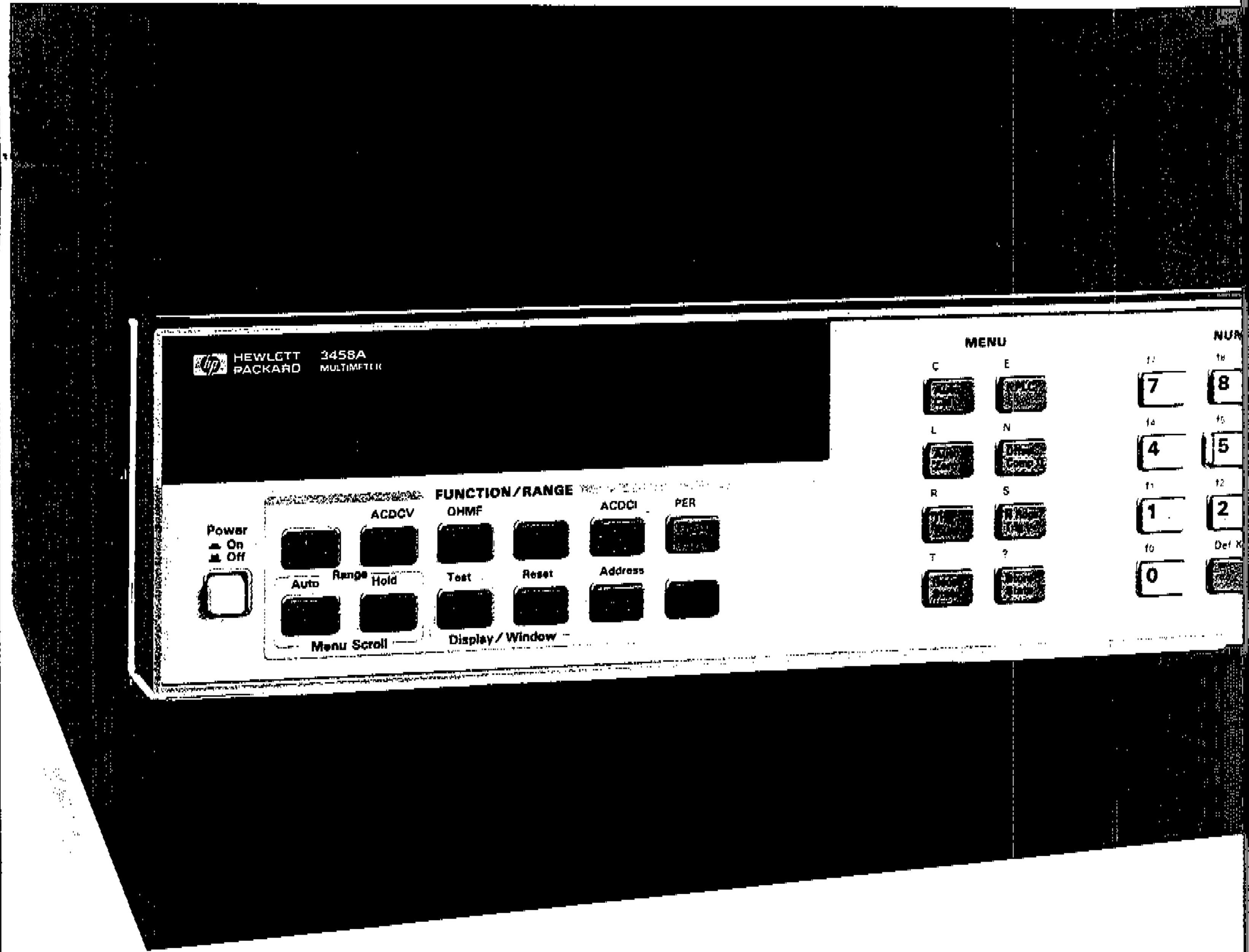


Finally!
A system multimeter with both high speed and high accuracy!

The HP 3458A Multimeter shatters long-standing performance barriers of speed and accuracy on the production test floor, in R&D, and in the calibration lab. The HP 3458A is simply the fastest, most flexible, and most accurate multimeter ever offered by Hewlett-Packard. In your system or on the bench, the HP 3458A saves you time and money with unprecedented test system throughput and accuracy, seven function measurement flexibility, and low cost of ownership.

Select a reading rate of 100,000 readings per second for maximal test throughput. Or achieve highest levels of precision with up to 8 1/2 digits of measurement resolution and 0.1 part per million transfer accuracy. Add to this, programming compatibility through the Hewlett-Packard Multimeter Language [HPML] and the HP 3458A's simplicity of operation and you have the ideal multimeter for your most demanding applications.



HP 3458A Multimeter performance features

dc Volts
- 5 ranges: 0.1 V to 1000 V
- 8½ to 4½ digit resolution
- Up to 100,000 readings/sec (4½ digits)
- Maximum sensitivity: 10 nV
- 0.6 ppm 24 hour accuracy
- 8 ppm (4 ppm optional) / year voltage reference stability

Ohms
- 9 ranges: 10 Ω to 1 GΩ
- Two-wire and four-wire Ohms with offset compensation
- Up to 10,000 readings/sec (5½ digits)
- Maximum Sensitivity: 10 μΩ
- *2.2 ppm* 24 hour accuracy

ac Volts
- 6 ranges: 10 mV to 1000 V
- 1 Hz to 10 MHz bandwidth
- Up to 50 readings/sec with all readings to specified accuracy
- Choice of sampling or analog true rms techniques
- 100 ppm best accuracy

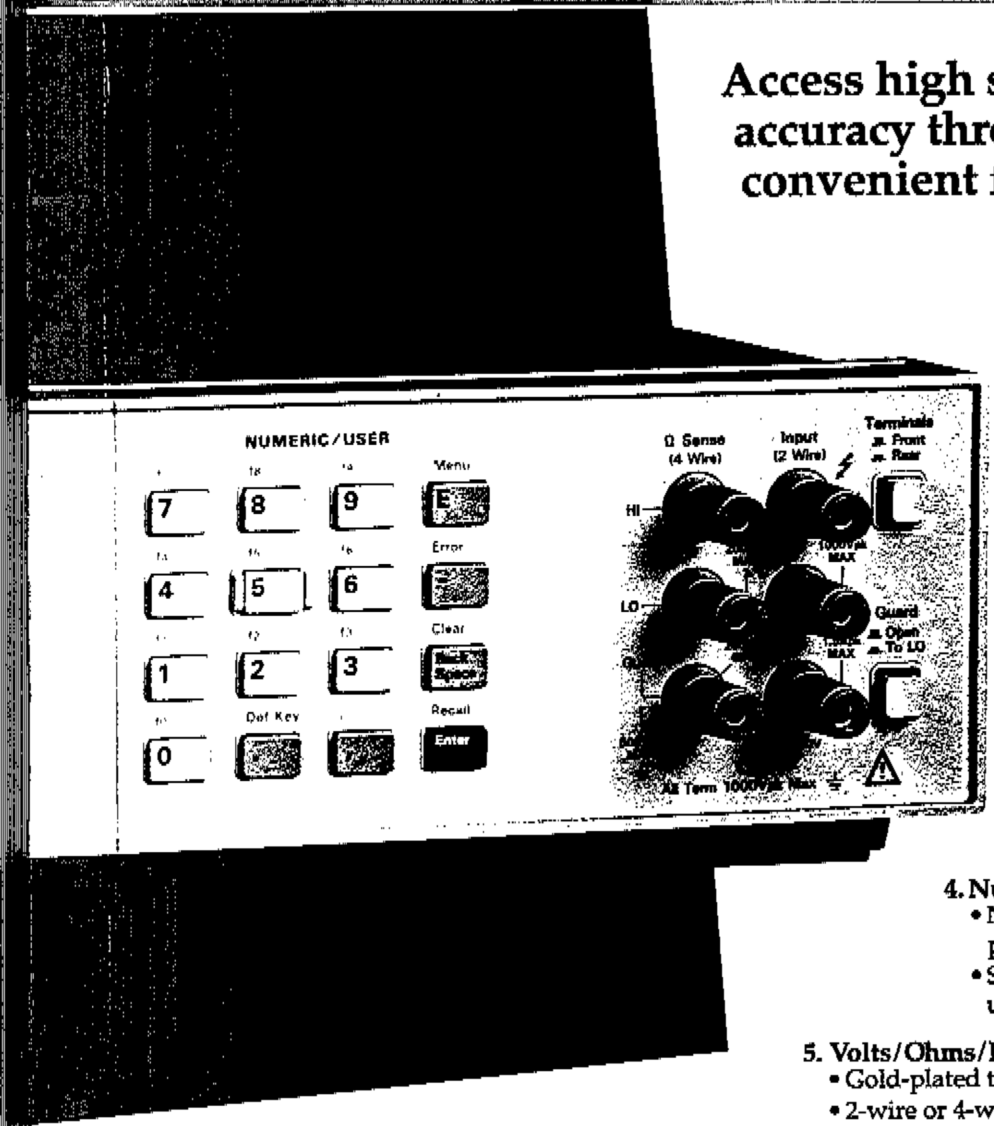
dc Current
- 8 ranges: 100 nA to 1 A
- Up to 3,000 readings/sec (5½ digits)
- Maximum sensitivity: 1 pA
- 13 ppm 24 hour accuracy

ac Current
- 5 ranges: 100 μA to 1 A
- 10 Hz to 100 kHz bandwidth
- Up to 50 readings/sec
- 500 ppm 24 hour accuracy

Frequency and Period
- Voltage or current ranges
- Frequency: 1 Hz to 10 MHz
- Period: 100 ns to 1 sec
- 0.01% accuracy
- ac or dc coupled

Maximum
- 100,000 re
  at 4½ d
- 50,000 rea
  at 5½ d
- 6,000 read
  at 6½ d
- 60 readin
  at 7½ d
- 6 reading
  at 8½ d

Measuren
- 100,000 re
  or with in
- 110 autor
- 200 functi
- Post-proc
  internal m



Access high speed and accuracy through a powerful, convenient front panel

1. **Display**
   - Bright, easy-to-read, vacuum flourescent display
   - 16 character alpha-numeric display to easily read data, messages, and commands
2. **Standard Function/Range Keys**
   - Simple to use, for bench measurements of dcV, acV, Ohms, current, frequency and period
   - Select autorange or manual ranging
3. **Menu Command Keys**
   - Immediate access to eight common commands
   - Shifted keys allow simple access to complete command menu
4. **Numeric/User Keys**
   - Numeric entry for constants and measurement parameters
   - Shifted keys (f0 through f9) access up to ten user-defined setups
5. **Volts/Ohms/Ratio Terminals**
   - Gold-plated tellurium copper for minimum thermal emf
   - 2-wire or 4-wire Ohms measurements
   - dc/dc or ac/dc ratio inputs
6. **Current Measurement Terminals**
   - Easy fuse replacement with fuseholder built into terminal
7. **Guard Terminal and Switch**
   - For maximum common mode noise rejection
8. **Front-Rear Terminal Switch**
   - Position selects front or rear measurement terminals

Maximum Speeds

- **100,000 readings/sec** at 4½ digits (16 bits)
- **50,000 readings/sec** at 5½ digits
- **6,000 readings/sec** at 6½ digits
- **60 readings/sec** at 7½ digits
- **6 readings/sec** at 8½ digits

Measurement Set-Up Speed

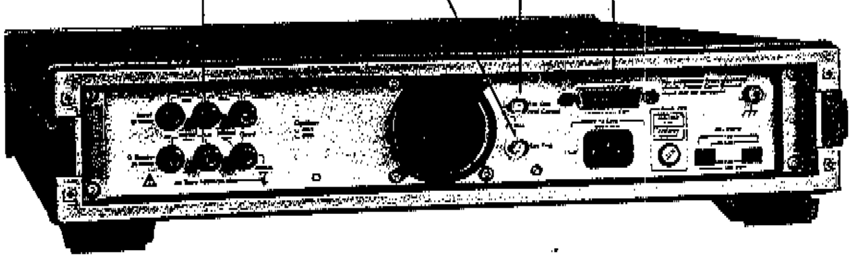
- 100,000 readings/sec over HP-IB or with internal memory
- 110 autoranges/sec
- 200 function or range changes/sec
- Post-processed math from internal memory

External Output
- Programmable TTL output pulse with 5 modes for flexible system interface
- Defaults to a voltmeter complete pulse

Rear Input Terminals
- For convenient system use

External Trigger Input

HP-IB Interface Connector



Special Supplement

Standards Laboratory Applications

Built-in standards deliver extraordinary transfer accuracy.

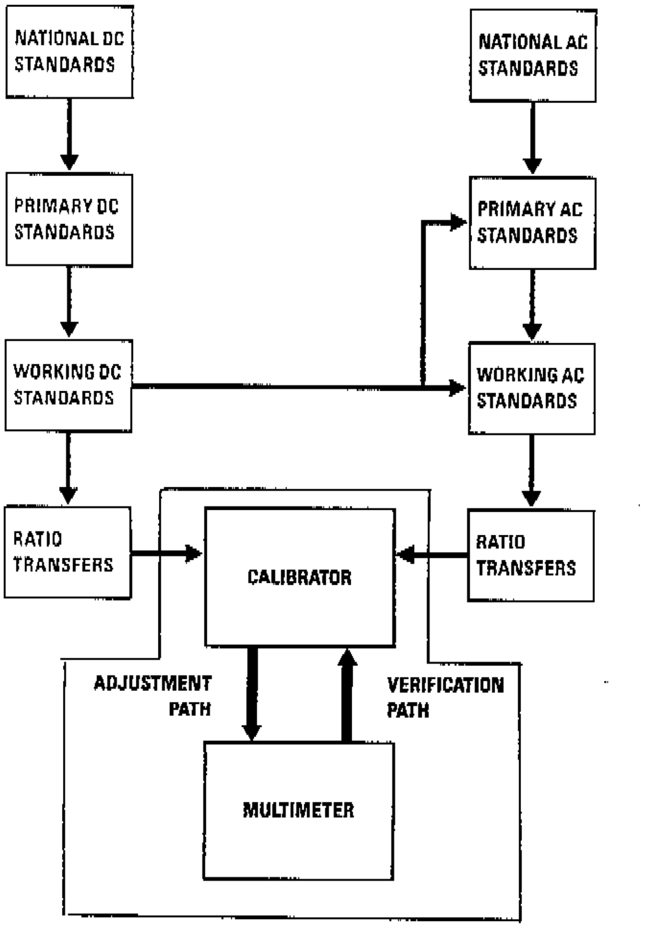
The HP 3458A Multimeter's built-in dc voltage and resistance standards reduce the number of links in the traditional calibration chain—thereby reducing the potential opportunities for compounding of human, environmental or systematic errors.

Further, the short-term stability and 8½ digit resolution of the HP 3458A make it exceptionally accurate compared with other instrumentation.

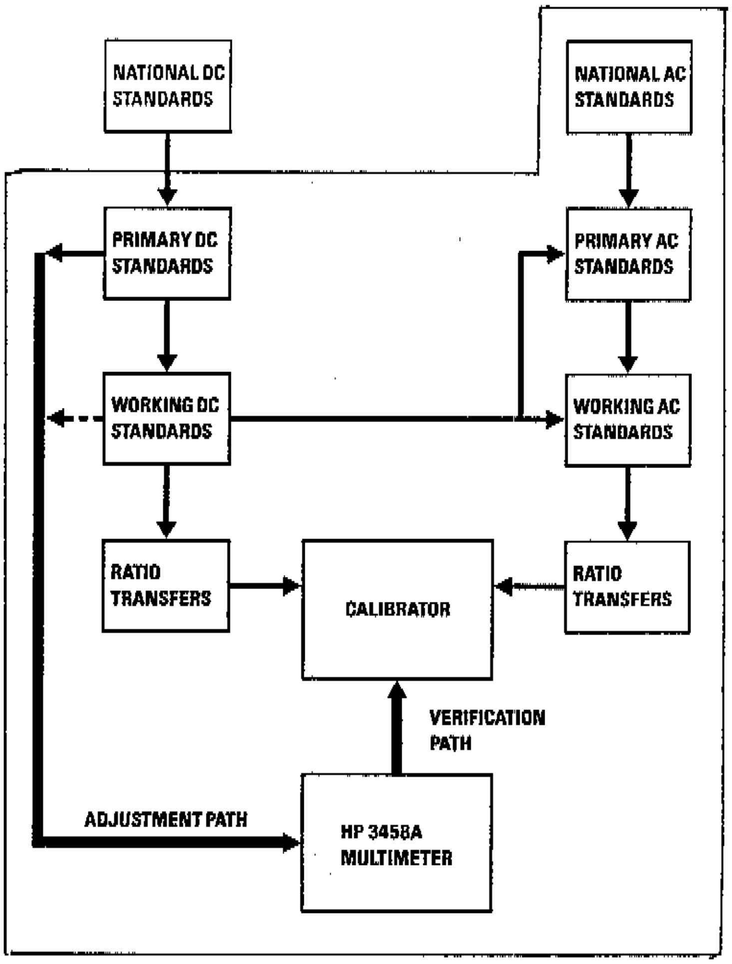
Reading-to-reading measurements vary no more than 0.01 ppm rms of the 10 V range, and transfer accuracy for 10 V dc over 10 minutes is 0.1 ppm.

Gold-plated tellurium copper input terminals minimize thermal emf errors. Resistance measurement accuracy is increased using the HP 3458A's four-wire and offset-compensated ohms capabilities. Four-wire ohms cuts out lead resistance errors, while offset-compensated ohms measures and removes thermally-induced voltage offset errors in series with the measurement path.

Transfer accuracy: traditional calibration method vs. the new HP 3458A Multimeter procedure*



Traditional calibration chain for dc and ac voltage.



HP 3458A calibration chain with reference standards built in for increased verification confidence.

*Shaded areas indicate where potential error sources can be detected.

Automatic internal adjustments provide higher confidence levels.

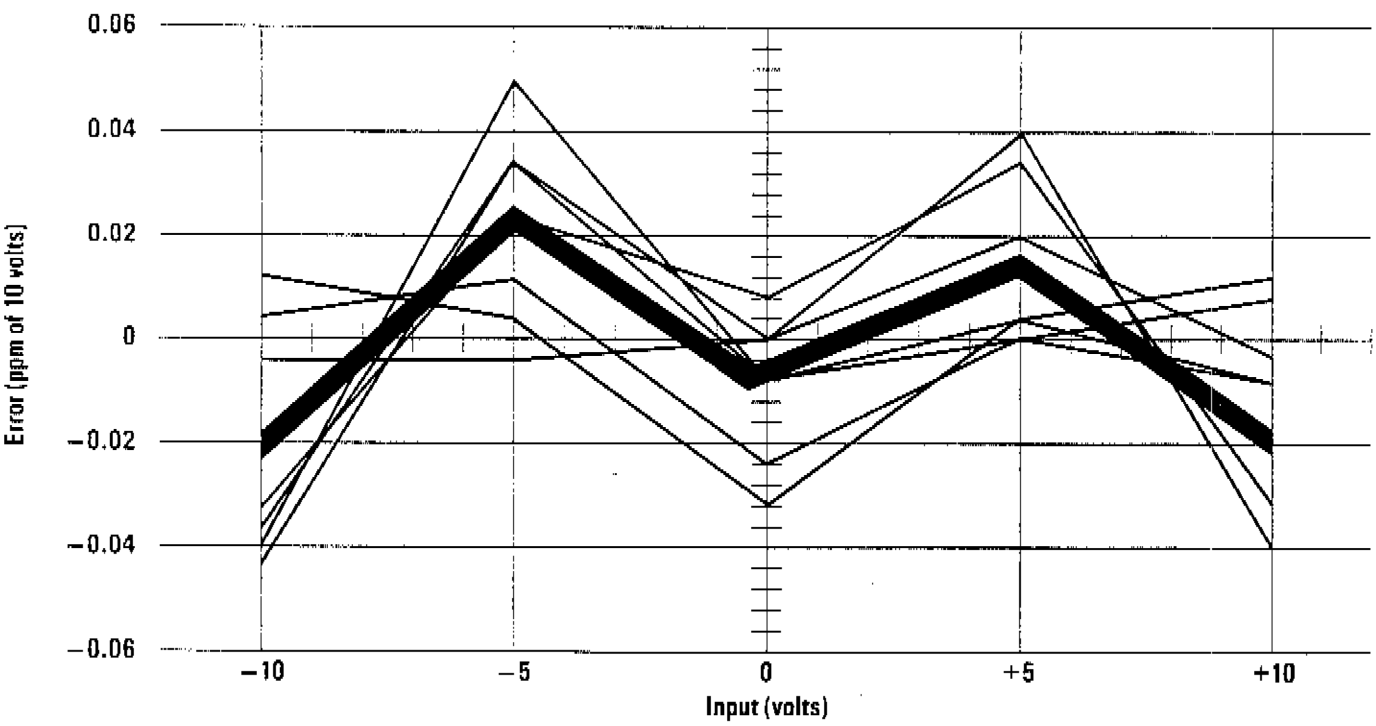
The built-in reference standards of the HP 3458A and its automatic internal measurement systems can adjust all ranges of all functions—reducing errors to levels comparable with some of the best metrology practices.

For instances, auto-calibration can adjust for operating temperatures between 0 to 60 degrees Celsius, removing measurement circuit errors caused by the environment. The HP 3458A also automatically records the temperature in non-volatile memory as part of each calibration process. So by comparing that reading with an external source, you can easily determine whether re-calibration of the HP 3458A is due.

The accuracy of the internal references is assured by the exacting design of all components. The voltage reference is a temperature-stabilized solid state zener reference. A proportional temperature control loop senses the chip temperature of the reference device and reduces the temperature drift to less than 0.15 ppm per Celsius degree. And the internal reference resistor has a temperature coefficient of 1 ppm per Celsius degree.

Recently, 1 and 10 V Josephson Junction Arrays were acquired from the National Institute of Standards and Technology for use in verifying our voltage standards. To date, measurements have been repeatable to a few parts in 10^8. In addition to traditional procedures, the 10 V array is also in use in verifying the exceptional accuracy of the HP 3458A.

HP 3458A analog-to-digital converter linearity measurements using Josephson Junction Array standards



The HP 3458A's internal auto-calibration algorithm transfers external source accuracy with lower error than most commercially available dividers. Measurements using a Josephson Junction Array confirmed linearity of the HP 3458A's analog-to-digital converter design to within ± 0.05 ppm on some units. The bold line shows the mean of all measurements.

Unique verification procedures identify errors throughout the traceability chain.

As the diagram on the first page indicates, typical multimeters are both adjusted *and* verified using the same calibrator, and the same ratio transfers between the standards in the traceability chain. Thus, if a transfer within the chain contained a systematic error, or inadvertant human error, that error would be propagated throughout the calibration process and verification might be compromised.

The HP 3458A Multimeter, however, makes ratio transfers that are independent of the verification loop. So if errors have been introduced—whether in technique, cabling or the instruments used to generate calibration values—these errors will be caught.

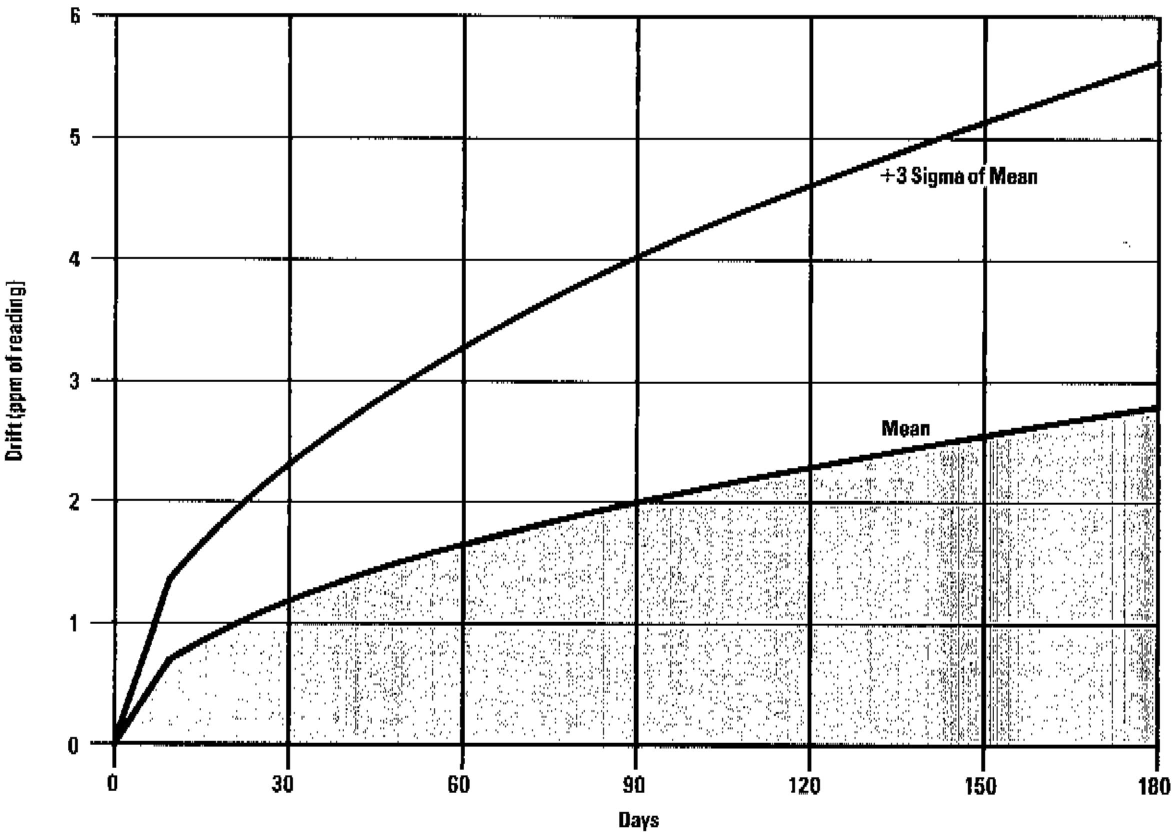
This calibration technique—unique to the HP 3458A—enables you to identify errors anywhere in the traceability chain, from primary standards to final values.

Long-term dc and ac accuracy are exceptional.

With the HP 3458A's high-stability option, basic dc accuracy is only 4 ppm one year after calibration to an external source.

For ac voltages, auto-calibration provides the same accuracy 2 years after calibration that you would get within 24 hours using ordinary multimeters. For example, accuracy over 40 Hz to 1 kHz is 100 ppm.

HP 3458A voltage reference drift



This stability plot shows the distribution of voltage references used in the HP 3458A Multimeter. For optional increased long-term stability, Hewlett-Packard hand picks the units that exhibit characteristics within the shaded area.

New analog-to-digital converter design increases speed dramatically—without sacrificing accuracy.

The HP 3458A gives you 8½ digit dc voltage measurements at 6 readings per second—and measurements are still quiet with integration over 10 power line cycles. For example, on the 10 V range, the peak noise between measurements is just 0.1 ppm (0.03 ppm rms). At 1000 power line cycle integration, you can get 2 readings per minute with noise reduced to 0.03 ppm peak (0.01 ppm rms).

The HP 3458A's unique digitizing ac voltage measurements are also fast. For example, a 1 Hz ac voltage measurement only takes 6 seconds without the usual settling error—which reads at 120 ppm of 10 V rms.

The key to this accuracy and speed performance is Hewlett-Packard's analog-to-digital converter design, which is a major advancement of the multi-slope integrating algorithms we pioneered.

With this converter, the aperture of integration is set anywhere from 500 nanoseconds to 1 second, in 100 nanosecond increments. The converter is capable of resolving to more than 30 bits of accuracy (28 bits = 8½ digits). Or, you can get 100,000 readings per second with 4½ digits of resolution. With this programmability, the HP 3458A Multimeter provides incredible speed as well as extraordinary accuracy.

Non-volatile state storage means faster, simpler, more accurate test procedures.

Non-volatile state storage of a program configuration simplifies procedures considerably—and reduces the possibility of error. With only a few keystrokes, the execution of the same configuration can be repeated exactly.

Similarly, an entire test sequence can be stored and executed with a function key on the front panel of the multimeter, or even from a controlling computer.

Built-in math functions also save time by simplifying data retrieval. Math capabilities include null, percent change, dB, dBm, statistics, thermistor conversions, RTD conversions, scaling, digital filtering and limits testing. Ratio test setups are simplified by the built-in ratio function that measures dc/dc or ac/dc ratios.

The language of the HP 3458A Multimeter is "plain English" and is extremely easy to use. Because it is plug-compatible with other HP multimeters, there is no need to relearn programming or reprogram if the others are in use.

Extensive built-in security measures provide calibration confidence and efficiency.

The non-volatile security system of the HP 3458A locks in calibration constants—and is only accessible via passwords you assign to authorized users. Thus, no unauthorized adjustments can be made. The use of passwords provides far greater security than systems which employ a single key for all instruments with the same model number.

Further, a built-in calibration counter automatically advances each time the HP 3458A is unlocked. By tracking the number of calibrations and comparing against the count expected, any unrecorded calibrations can be detected.

Secured messages can be stored and recalled, to ensure that calibration notes always stay with the multimeter. This simplifies tracking and saves you from having to duplicate your efforts in future tests.

As a final security measure, an internal switch is also provided which would force would-be tamperers to physically remove the multimeter's covers.

The most convincing test of the HP 3458A's incredible speed and accuracy will be one you devise yourself, under your own test conditions and specifications. To arrange to put the HP 3458A to the test soon, please contact your local HP sales office.

HEWLETT PACKARD

Data subject to change.
Printed in U.S.A. 1/89
5953-7090

The HP 3458A Multimeter for:

High test system throughput

Faster testing
- Up to 100,000 readings/sec
- Internal test setups > 200/sec
- Programmable integration times from 500 ns to 1 sec

Greater test yield
- More accuracy for tighter test margins
- Up to 8½ digits resolution

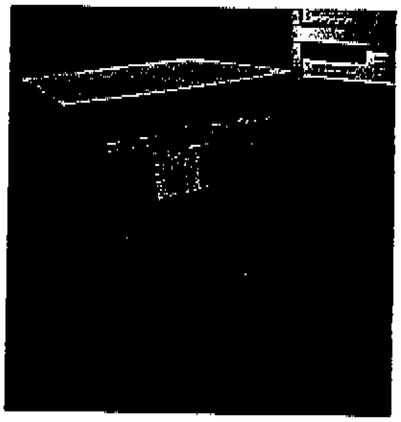
Longer up-time
- Two-source (10V, 10kΩ) calibration, including ac
- Self-adjusting, self-verifying auto-calibration for all functions and ranges, including ac

[redacted]

High resolution digitizing

Greater waveform resolution and accuracy
- 16 bits at 100,000 samples/sec
- 18 bits at 50,000 samples/sec
- 12 MHz bandwidth
- Timing resolution to 10 ns
- Less than 100 ps time jitter
- Over 75,000 reading internal memory

Flexible digitizing software
- Powerful, easy-to-use analysis software for HP 9000 Series 200/300 Computers
- Subprograms for waveform acquisition, data transfer, FFT, IFT, and data presentation



[redacted]

Calibration lab precision

Superb transfer measurements
- 8½ digits resolution
- 0.1 ppm dc Volts linearity
- 0.1 ppm dc Volts transfer capability
- 0.01 ppm rms internal noise

Extraordinary accuracy
- 0.6 ppm for 24 hours in dc Volts
- 2.2 ppm for 24 hours in Ohms
- 100 ppm mid-band ac Volts
- 8 ppm (4 ppm optional) per year voltage reference stability

[redacted]

For High Test System Throughput

- **Faster system start-up**
  - **HP Multimeter Language (HPML) compatible**
- **Faster measurements and setups**
  - **100,000 readings/sec in 4 1/2 digits**
  - **50,000 readings/sec in 5 1/2 digits**
  - **200 function or range changes/sec**
- **Longer system up-time**

The HP 3458A System Multimeter heightens test performance in three phases of your production test: faster test system start-up, faster test throughput, and lower cost of ownership through longer system uptime, designed-in reliability, and fast and easy calibration.

Faster system start-up

The value of a fast system multimeter in production test is clear. But it is also important that the dmm programs easily to reduce the learning time for new system applications. The Hewlett-Packard Multimeter Language (HPML) offers a standard set of commands for the multimeter user that consist of easily understood, readable commands. Easier programming and clearer documentation reduce system development time.

Faster measurements and setups

Now you can have a system dmm with both fast and accurate measurements. The HP 3458A optimizes your measurements for the right combination of accuracy, resolution, and speed. The HP 3458A Multimeter fits your needs from 4 1/2 digit dc Volts measurements at 100,000 per second, to 8 1/2 digit dc Volts measurements at 6 per second, or anywhere in between in 100 ns steps.

Even the traditionally slower measurement functions, such as ac Volts, are quicker with the HP 3458A. For example, you can measure true rms acV at up to 50 readings per second with full accuracy for input frequencies greater than 10 kHz.

Besides high reading rates, the HP 3458A's design was tuned for the many function and level changes required in testing your device. The HP 3458A can change function and range, take a measurement, and output the result at 200 per second. This is at least 3 times faster than other dmms. In addition, the HP 3458A transfers high speed measurement data over HP-IB or into and out of its 75,000 reading memory at 100,000 readings per second.

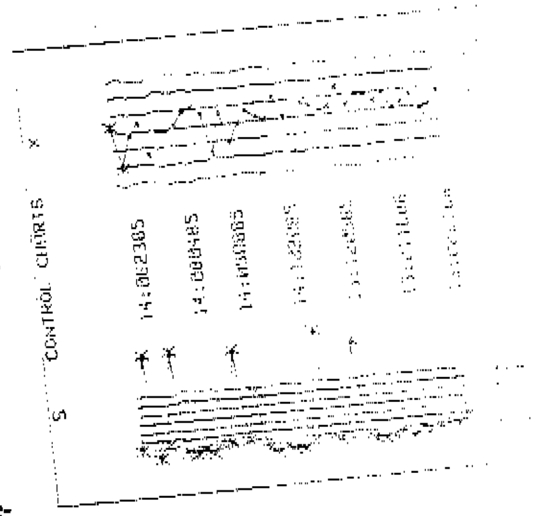
You can reduce your data transfer overhead by using the unique non-volatile Program Memory of the HP 3458A to store complete measurement sequences. These test sequences can be programmed and initiated from the front panel for stand-alone operation without a controller.

Finally, the HP 3458A Multimeter makes fast and accurate measurements. Consider the HP 3458A's 0.6 ppm 24 hour dc Volts accuracy, 100 ppm ac Volts accuracy and its standard functions of dcV, acV, dcI, acI, Ohms, frequency and period. Greater measurement accuracy from your dmm means higher confidence and higher test yields. More functions mean greater versatility and lower-cost test systems.

Longer system up-time

The HP 3458A Multimeter performs a complete self-calibration of all functions, including ac, using high stability internal standards. This self- or auto-calibration eliminates measurement errors due to time drift and temperature changes in your rack or on your bench for superior accuracy. When it's time for periodic calibration to external standards, simply connect a precision 10 V dc source and a precision 10 kΩ resistor. All ranges and functions, including ac, are automatically calibrated using precision internal ratio transfer measurements relative to the external standards.

The HP 3458A's reliability is a product of Hewlett-Packard's "10 X" program of defect reduction. Through extensive environmental, abuse, and stress testing during the design stages of product development, HP has reduced the number of defects and early failures in its instruments by a factor of ten over the past ten years. Our confidence in the HP 3458A's reliability is reflected in the low cost of the option for two additional years of return-to-HP repair. This option (W30), when combined with the standard one-year warranty, will give you three years of worry-free operation.

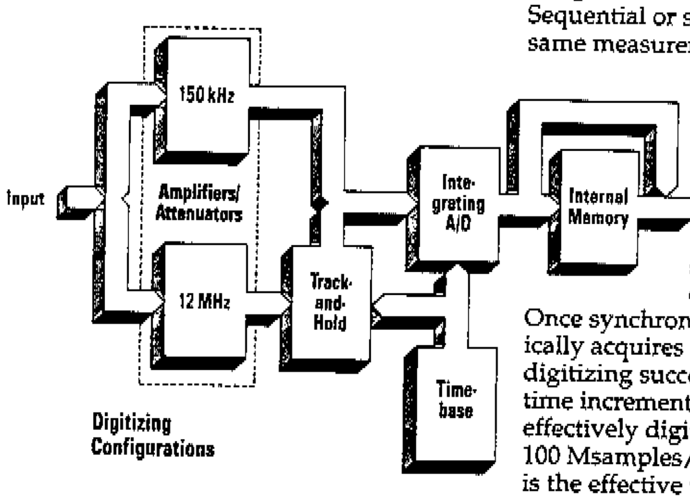


For High Resolution Digitizing

- 16 bits at 100,000 samples/sec
- Effective rates to 100 Msamples/sec
- Signal bandwidth of 12 MHz
- 10 ns timing with < 100 ps jitter
- Waveform analysis software

Easily acquire waveforms
Simple, application-oriented commands in the Hewlett-Packard Multimeter Language (HPML) make the task of waveform digitizing as easy as measuring dcV. Simply specify the sweep rate and number of samples.

Integration or track-and-hold paths
The HP 3458A gives you the choice of two configurations for high speed measurements: a 150 kHz bandwidth integrating path with a variable aperture from 500 ns to 1 second or a 12 MHz bandwidth path with a fixed 2 ns aperture and 16 bit track-and-hold. Use the integration path for lower noise, but use the track-and-hold path to precisely capture the voltage at a single point on a waveform.



Digitizing Configurations

Direct sampling function
The HP 3458A has two sampling functions for digitizing wave-forms: direct sampling and sequential or sub-sampling. With direct sampling, the HP 3458A samples through the 12 MHz path followed by the 2 ns track-and-hold providing 16 bits of resolution. The maximum sample rate is 50,000 samples/second or 20 µs between samples. Samples can be internally paced by a 0.01% accurate timebase with time increments in 100 ns steps. Data transfers directly to your computer at full speed or into the dmm's internal reading memory. Waveform reconstruction consists of simply plotting the digitized voltage readings versus the sampling interval of the timebase.

Sequential sampling function
Sequential or sub-sampling uses the same measurement path as direct sampling; however sequential sampling requires a periodic input signal. The HP 3458A will synchronize to a trigger point on the waveform set by a level threshold or external trigger. Once synchronized, the dmm automatically acquires the waveform through digitizing successive periods with time increment steps as small as 10 ns, effectively digitizing at rates up to 100 Msamples/second. All you specify is the effective timebase and the number of samples desired, the HP 3458A automatically optimizes its sampling to acquire the waveform in the least amount of time. Then, for your ease of use, the HP 3458A automatically re-orders the data in internal memory to reconstruct the waveform.

Waveform analysis software
The HP 9000 Series 200/300 Computer waveform analysis software option turns your HP 3458A and your computer into an easy-to-use, high-resolution single channel digitizer. The Option 005 Waveform Analysis Software Library of subroutines will help you extract parametric data from your test signal, compare it with limits, and perform FFT analysis. Scaled, annotated results are displayed either as frequency spectra or time records on your computer display.

For Calibration Lab Precision

- 8 1/2 Digits resolution
- 0.1 ppm dcV linearity
- 100 ppm acV absolute accuracy
- 4 ppm/year optional stability

In the calibration lab, you'll find the HP 3458A's 8 1/2 digits to have extraordinary linearity, low internal noise, and excellent short term stability. The linearity of the HP 3458A's Multislope A to D converter has been characterized with state-of-the-art precision. Using Josephsen Junction Array intrinsic standards, linearity has been measured within ±0.05 ppm of 10 Volts. The HP 3458A's transfer accuracy for 10 Volts dc is 0.1 ppm over 1 hour ± 0.5°C. Internal noise has been reduced to less than 0.01 ppm rms yielding 8 1/2 digits of usable resolution. So, the right choice for your calibration standard dmm is the HP 3458A.

dcV stability

The long term accuracy of the HP 3458A is a remarkable 8 ppm per year – more accurate than many system dmms are after only a day. Option 002 gives you a higher stability voltage reference specified to 4 ppm/year for the ultimate performance.

Reduced-error resistance

The HP 3458A doesn't stop with accurate dcV. Similar measurement accuracy is achieved for resistance, acV, and current. You can measure resistance from 10 µΩ to 1 GΩ with midrange accuracy of 2.2 ppm.

Finally, the HP 3458A, like its HP dmm predecessors, offers offset-compensated Ohms on the 10 Ω to 100 kΩ ranges to eliminate the errors introduced by small series voltage offsets. Usable for both two- and four-wire ohms, the HP 3458A supplies a current through the unknown resistance, measures the voltage drop, sets the current to zero, and measures the voltage drop again. The result is reduced error for resistance measurements.

Precision acV

The HP 3458A introduces new heights of true rms ac volts performance with a choice of traditional analog or a new sampling technique for higher accuracy. For calibration sources and periodic waveforms from 1 Hz to 10 MHz, the HP 3458A's precision sampling technique offers extraordinary accuracy. With 100 ppm absolute accuracy for 45 Hz to 1 kHz or 170 ppm absolute accuracy to 20 kHz, the HP 3458A will enhance your measurement capabilities. Accuracy is maintained for up to 2 years with only a single 10 Volt dc precision standard. No ac standards are necessary. For higher speed and less accuracy, the analog true rms ac technique has a midband absolute measurement accuracy of 400 ppm using the same simple calibration procedure. With a bandwidth of 10 Hz to 2 MHz and reading rates to 50/second, the analog technique is an excellent choice for high throughput computer-aided testing.

Easy calibration

The HP 3458A gives you low cost of ownership with a simple, two-source electronic calibration. With its superior linearity, the HP 3458A is fully calibrated, including ac, from a precision 10 V dc source and a precision 10 kΩ resistor. All ranges and functions are automatically calibrated using precise internal ratio transfer measurements relative to these external standards. In addition, the HP 3458A's internal voltage standard and resistance standard are calibrated. Now you can perform a self-verifying, self- or auto-calibration relative to the HP 3458A's low drift internal standards at any time with the ACAL command. So, if your dmm's environment changes, auto-calibration optimizes your measurement accuracy.

Calibration security

Unlike other dmms, the HP 3458A goes to great lengths to assure calibration security. First, a password security code "locks" calibration values and the self-calibration function. Next, you can easily store and recall a secured message for noting items, such as calibration date and due date. Plus, the HP 3458A automatically increments a calibration counter each time you "unlock" the dmm – another safeguard against calibration tampering. If you have a unique situation or desire ultimate security, use the internal dmm hardwired switch to force removal of the instrument covers to perform calibration.

HP 3458A Technical Specifications

Contents

Introduction

The HP 3458A accuracy is specified as a part per million (ppm) of the reading plus a ppm of range for dcV, Ohms, and dcl. In acV and acl, the specification is percent of reading plus percent of range. Range means the name of the scale, e.g. 1 V, 10 V, etc.; range does not mean the full scale reading, e.g. 1.2 V, 12 V, etc. These accuracies are valid for a specific time from the last calibration.

Absolute versus Relative Accuracy

All HP 3458A accuracy specifications are relative to the calibration standards. Absolute accuracy of the HP 3458A is determined by adding these relative accuracies to the traceability of your calibration standard. For dcV, 2 ppm is the traceability error from the HP factory. That means that the absolute error relative to the U.S. National Bureau of Standards (NBS) is 2 ppm in addition to the dcV accuracy specifications. When you recalibrate the HP 3458A, your actual traceability error will depend upon the errors from your calibration standards. These errors will likely be different from the HP error of 2ppm.

Example 1: Relative Accuracy; 24 Hour
Operating temperature is Tcal ±1°C

Assume that the ambient temperature for the measurement is within ±1°C of the temperature of calibration (Tcal). The 24 hour accuracy specification for a 10 V dc measurement on the 10 V range is 0.5 ppm + 0.05 ppm. That accuracy specification means:

0.5 ppm of Reading + 0.05 ppm of Range

For relative accuracy, the error associated with the measurement is:

(0.5 / 1,000,000 x 10V) + (0.05 / 1,000,000 x 10V) =
± 5.5 μV or 0.55 ppm of 10V

Errors from temperature changes

The optimum technical specifications of the HP 3458A are based on auto-calibration (ACAL) of the instrument within the previous 24 hours and following ambient temperature changes of less than ±1°C. The HP 3458A's ACAL capability corrects for measurement errors resulting from the drift of critical components from time and temperature.

The following examples illustrate the error correction of auto-calibration by computing the relative measurement error of the HP 3458A for various temperature conditions. Constant conditions for each example are:

10 V DC Input
10 V DC range
Tcal = 23°C
90 day accuracy specifications

Example 2: Operating temperature is 28°C;
With ACAL

This example shows basic accuracy of the HP 3458A using auto-calibration with an operating temperature of 28°C.

(4.1 ppm x 10V) + (0.2 ppm x 10V) = 43 μV
Total relative error = 43 μV

Example 3: Operating temperature is 38°C;
Without ACAL

The operating temperature of the HP 3458A is 38°C, 14°C beyond the range of Tcal ±1°C. Additional measurement errors result because of the added temperature coefficient without using ACAL.

(4.1 ppm x 10V) + (0.2 ppm x 10V) = 43 μV

Temperature Coefficient (specification is per °C):
(0.5 ppm x 10V + 0.01 ppm x 10V) x 14°C = 71 μV

Total error = 114 μV

Example 4: Operating temperature is 38°C;
With ACAL

Assuming the same conditions as Example 3, but using ACAL significantly reduces the error due to temperature difference from calibration temperature.Operating temperature is 10°C beyond the standard range of Tcal ±5°C.

(4.1 ppm x 10V) + (0.2 ppm x 10V) = 43 μV

Temperature Coefficient (specification is per °C):
(0.15 ppm x 10V + 0.01 ppm x 10V) x 10°C = 16 μV

Total error = 59 μV

Example 5: Absolute Accuracy; 90 Day

Assuming the same conditions as Example 4, but now add the traceability error to establish absolute accuracy.

(4.1 ppm x 10V) + (0.2 ppm x 10V) = 43 μV

Temperature Coefficient (specification is per °C):
(0.15 ppm x 10V + 0.01 ppm x 10V) x 10°C = 16 μV

HP factory traceability error of 2 ppm:
(2 ppm x 10V) = 20 μV

Total absolute error = 79 μV

DC Voltage

Range	Full Scale	Maximum Resolution	Input Impedance	Temperature Coefficient (ppm of Reading + ppm of Range) / °C	
				Without ACAL [1]	With ACAL [2]
100 mV	120.00000	10 nV	> 10 GΩ	1.2 + 1	0.15 + 1
1 V	1.20000000	10 nV	> 10 GΩ	1.2 + 0.1	0.15 + 0.1
10 V	12.0000000	100 nV	> 10 GΩ	0.5 + 0.01	0.15 + 0.01
100 V	120.000000	1 μV	10 MΩ ± 1%	2 + 0.4	0.15 + 0.1
1000 V	1050.00000	10 μV	10 MΩ ± 1%	2 + 0.04	0.15 + 0.01

Accuracy [3] (ppm of Reading + ppm of Range)

Range	24 Hour [4]	90 Day [5]	1 Year [5]	2 Year [5]
100 mV	2.5 + 5	5.0 + 10	9 + 10	14 + 20
1 V	1.5 + 0.5	4.6 + 1	8 + 1	14 + 2
10 V	0.5 + 0.05	4.1 + 0.2	8 + 0.2	14 + 0.5
100 V	2.5 + 0.3	6.0 + 0.3	10 + 0.3	14 + 0.5
1000 V [6]	2.5 + 0.1	6.0 + 0.1	10 + 0.1	14 + 0.5

Transfer Accuracy

Range	10 Min, Tref ± 0.5°C (ppm of Reading + ppm of Range)
100 mV	0.5 + 0.5
1 V	0.3 + 0.1
10 V	0.05 + 0.05
100 V	0.5 + 0.1
1000 V	1.5 + 0.05

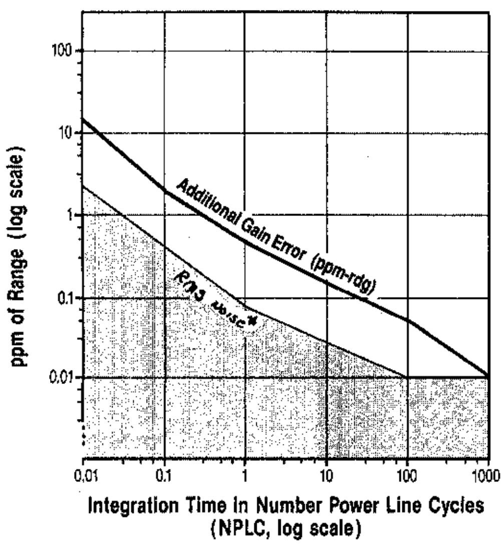
Conditions

- Following 4 hour warm-up. Full scale to 10% of full scale.
- Measurements on the 1000 V range are within 5% of the initial measurement value and following measurement settling.
- Tref is the starting ambient temperature.
- Measurements are made on a fixed range using accepted metrology practices.

Settling Characteristics

For first reading or range change error, add 0.0001% of input voltage step additional error.
Reading settling times are affected by source impedance and cable dielectric absorption characteristics.

Additional Errors



Noise Rejection (dB) [7]

	AC NMR [8]	AC ECMR	DC ECMR
NPLC < 1	0	90	140
NPLC ≥ 1	60	150	140
NPLC ≥ 10	60	150	140
NPLC ≥ 100	70	160	140
NPLC = 1000	80	170	140

*

Range	Multiplier
0.1 V	x 20
1 V	x 2
10 V	x 1
100 V	x 2
1000 V	x 1

1 Additional error from Tcal ±1°C without ACAL.

2 Additional error from Tcal ± 5°C.

3 Specifications are for PRESET; NPLC 100.

4 For fixed range and Tcal ±1°C. Valid over full range. For 24 hour accuracy without fixed range, add 0.05 ppm of Range to 10 V, 0.5 ppm of Range to 1 V, and 5 ppm of Range to 0.1 V specifications.

5 Specifications for 90 day, 1 year, and 2 year are within 24 hours and ± 1° C of last ACAL; Tcal ± 5°C.

For High stability (Option 002) subtract 1.5 ppm of Reading from 90 day, and 4 ppm of Reading from 1 or 2 year accuracy.

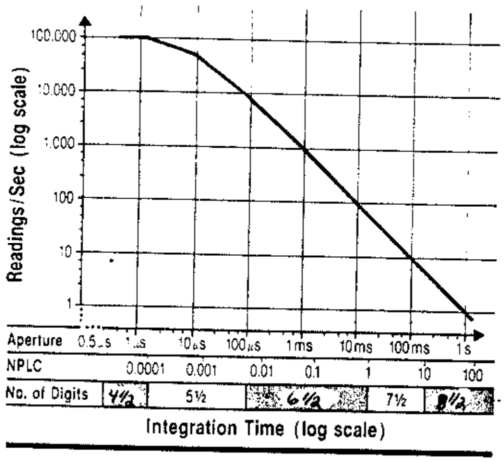
Add 2 ppm of reading additional error for HP factory traceability of 10 V dc to US NBS. Traceability error is the absolute error relative to National Standards associated with the source of last external calibration.

6 Add 10 ppm X $(Vin / 1000)^2$ additional error for inputs > 100 V.

7 Applies for 1 kΩ unbalance in the LO lead and ± 0.1% of the line frequency currently set for LFREQ.

8 For line frequency ±1%, ACNMR is 40 dB for NPLC ≥ 1, or 80 dB for NPLC ≥ 100. For line frequency ± 5%, ACNMR is 65 dB for NPLC ≥100.

Reading Rate (Auto-Zero Off)



Temperature Coefficient (Auto-Zero Off)

For a stable environment ± 1°C add the following additional error for AZERO OFF

Range	Error
100 mV - 10 V	5 µV/°C
100 V - 1000 V	500 µV/°C

Selected Reading Rates[1]

NPLC	Aperture [2]	Digits	Bits	Readings / Sec A-Zero Off	Readings / Sec A-Zero On
0.0001	1.4 µs	4.5	16	100,000 [3]	4,900
0.0006	10 µs	5.5	18	50,000	3,500
0.01	167 µs	6.5	21	5,300	960
0.1	1.67 ms	6.5	21	592	245
1	16.6 ms	7.5	25	60	29.4
10	0.166 s	8.5	28	6	3
100		8.5	28	36 / min	18 / min
1000		8.5	28	3.6 / min	1.8 / min

[1] *For PRESET; DELAY 0; DISP OFF; OFORMAT DINT.*

[2] *Aperture is selected independent of line frequency (LFREQ). These apertures are for 60 Hz NPLC values where 1 NPLC = 1 / LFREQ. For 50 Hz and NPLC indicated, aperture will increase by 1.2 and reading rates will decrease by 0.833.*

[3] *For OFORMAT SINT.*

Maximum Input

	Rated Input	Non-Destructive
HI to LO	± 1000 V pk	± 1200 V pk
LO to Guard	± 200 V pk	± 350 V pk
Guard to Earth	± 500 V pk	± 1000 V pk

Input Terminals

Terminal Material: Gold-plated Tellurium Copper
Input Leakage Current: < 20 pA at 25°C

2 / Resistance

Two-wire and Four-wire Ohms (OHM and OHMF Functions)

Range	Full Scale	Maximum Resolution	Current [4] Source	Test Voltage	Open Circuit	Maximum Lead R (OHMF)	Maximum Series Offset (OCOMP ON)	Temperature Coefficient (ppm of Reading + ppm of Range) / °C Without ACAL[5]	With ACAL[6]
10 Ω	12.00000	10 µΩ	10 mA	0.1 V	12 V	20 Ω	0.01 V	3 + 1	1 + 1
100 Ω	120.00000	10 µΩ	1 mA	0.1 V	12 V	200 Ω	0.01 V	3 + 1	1 + 1
1 kΩ	1.2000000	100 µΩ	1 mA	1.0 V	12 V	150 Ω	0.1 V	3 + 0.1	1 + 0.1
10 kΩ	12.000000	1 mΩ	100 µA	1.0 V	12 V	1.5 kΩ	0.1 V	3 + 0.1	1 + 0.1
100 kΩ	120.00000	10 mΩ	50 µA	5.0 V	12 V	1.5 kΩ	0.5 V	3 + 0.1	1 + 0.1
1 MΩ	1.2000000	100 mΩ	5 µA	5.0 V	12 V	1.5 kΩ		3 + 1	1 + 1
10 MΩ	12.000000	1 Ω	500 nA	5.0 V	12 V	1.5 kΩ		20 + 20	5 + 2
100 MΩ [7]	120.00000	10 Ω	500 nA	5.0 V	5 V	1.5 kΩ		100 + 20	25 + 2
1 GΩ [7]	1.2000000	100 Ω	500 nA	5.0 V	5 V	1.5 kΩ		1000 + 20	250 + 2

[4] *Current source is ± 3% absolute accuracy.*

[5] *Additional error from Tcal ±1° C without ACAL.*

[6] *Additional error from Tcal ± 5°C.*

[7] *Measurement is computed from 10 M Ω parallel with input.*

Accuracy[1] (ppm of Reading + ppm of Range)

Range	24 Hour [2]	90 Day [3]	1 Year [3]	2 Year [3]
10 Ω	5 + 3	15 + 5	15 + 5	20 + 10
100 Ω	3 + 3	10 + 5	12 + 5	20 + 10
1 kΩ	2 + 0.2	8 + 0.5	10 + 0.5	15 + 1
10 kΩ	2 + 0.2	8 + 0.5	10 + 0.5	15 + 1
100 kΩ	2 + 0.2	8 + 0.5	10 + 0.5	15 + 1
1 MΩ	10 + 1	12 + 2	15 + 2	20 + 4
10 MΩ	50 + 5	50 + 10	50 + 10	75 + 10
100 MΩ	500 + 10	500 + 10	500 + 10	0.1% + 10
1 GΩ	0.5% + 10	0.5% + 10	0.5% + 10	1% + 10

1 Specifications are for PRESET; NPLC 100; OCOMP ON.

2 Tcal ±1°C.

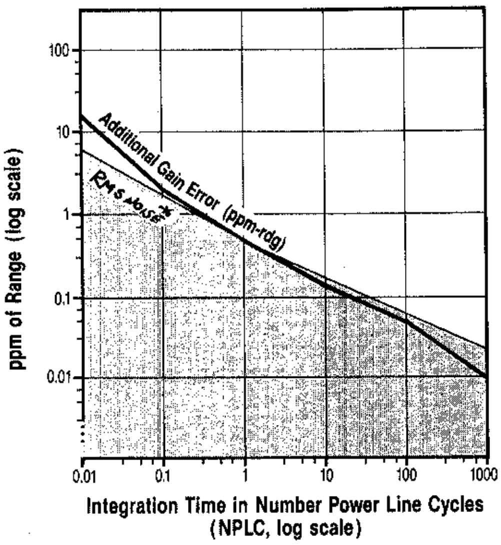
3 Specifications for 90 day, 1 year, and 2 year are within 24 hours and ±1°C of last ACAL; Tcal ± 5°C.

Add 3 ppm of reading additional error for HP factory traceability of 10 KΩ to US NBS. Traceability is the absolute error relative to National Standards associated with the source of last external calibration.

Two-Wire Ohms Accuracy

For Two-Wire Ohms (OHM) accuracy, add the following offset errors to the Four-Wire Ohms (OHMF) accuracy. 24 Hour: 50 mΩ. 90 Day: 150 mΩ. 1 Year: 250 mΩ. 2 Year: 500 mΩ

Additional Errors



*

Range	Multiplier
10 Ω & 100 Ω	x 10
1 kΩ to 100 kΩ	x 1
1 MΩ	x 1.5
10 MΩ	x 2
100 MΩ	x 120
1 GΩ	x 1200

Settling Characteristics

For first reading error following range change, add the total 90 day measurement error for the current range. Preprogrammed settling delay times are for < 200 pF external circuit capacitance.

Selected Reading Rates[4]

NPLC [5]	Aperture [6]	Digits	Readings / Sec Auto-Zero Off	Readings / Sec Auto-Zero On
0.0001	1.4 μs	4.5	100,000 [7]	4,900
0.0006	10 μs	5.5	50,000	3,500
0.01	167 μs	6.5	5,300	960
0.1	1.66 ms	6.5	592	245
1	16.6 ms	7.5	60	29.4
10	0.166 s	7.5	6	3
100		7.5	36 / min	18 / min

Measurement Consideration

HP recommends the use of Teflon* cable or other high impedance, low dielectric absorption cable for these measurements.

Maximum Input

	Rated Input	Non-Destructive
HI to LO	± 1000 V pk	± 1000 V pk
HI & LO Sense to LO	± 200 V pk	± 350 V pk
LO to Guard	± 200 V pk	± 350 V pk
Guard to Earth	± 500 V pk	± 1000 V pk

Temperature Coefficients (Auto-Zero Off)

For a stable environment ± 1°C add the following error for AZERO OFF. (ppm of Range) / °C

Range	Error	Range	Error
10 Ω	50	1 MΩ	1
100 Ω	50	10 MΩ	1
1 kΩ	5	100 MΩ	10
10 kΩ	5	1 GΩ	100
100 kΩ	1		

4 FOR PRESET; DELAY 0; DISP OFF; OFORMAT DINT.

For OHMF or OCOMP ON, the maximum reading rates will be slower.

5 Ohms measurements at rates < NPLC 1 are subject to potential noise pickup. Care must be taken to provide adequate shielding and guarding to maintain measurement accuracies.

6 Aperture is selected independent of line frequency (LFREQ). These apertures are for 60 Hz NPLC values where 1 NPLC = 1 / LFREQ. For 50 Hz and NPLC indicated, aperture will increase by 1.2 and reading rates will decrease by 0.833.

7 For OFORMAT SINT.

* Teflon is a registered trademark of E.I. duPont de Nemours and Co.

DC Current (DCI Function)

Range	Full Scale	Maximum Resolution	Shunt Resistance	Burden Voltage	Temperature Coefficient (ppm of Reading + ppm of Range / °C) Without ACAL[1]	With ACAL[2]
100 nA	120.000	1 pA	545.2 kΩ	0.055 V	10 + 200	2 + 50
1 µA	1.200000	1 pA	45.2 kΩ	0.045 V	2 + 20	2 + 5
10 µA	12.000000	1 pA	5.2 kΩ	0.055 V	10 + 4	2 + 1
100 µA	120.00000	10 pA	730 Ω	0.075 V	10 + 3	2 + 1
1 mA	1.2000000	100 pA	100 Ω	0.100 V	10 + 2	2 + 1
10 mA	12.000000	1 nA	10 Ω	0.100 V	10 + 2	2 + 1
100 mA	120.00000	10 nA	1 Ω	0.250 V	25 + 2	2 + 1
1 A	1.0500000	100 nA	0.1 Ω	<1.5 V	25 + 3	2 + 2

Accuracy[3] (ppm Reading + ppm Range)

Range	24 Hour[4]	90 Day[5]	1 Year[5]	2 Year[5]
100 nA[6]	10 + 400	30 + 400	30 + 400	35 + 400
1 µA[6]	10 + 40	15 + 40	20 + 40	25 + 40
10 µA[6]	10 + 5	15 + 10	20 + 10	25 + 10
100 µA	10 + 5	15 + 8	20 + 8	25 + 8
1 mA	10 + 3	15 + 5	20 + 5	25 + 5
10 mA	10 + 3	15 + 5	20 + 5	25 + 5
100 mA	25 + 3	30 + 5	35 + 5	40 + 5
1 A	100 + 10	100 + 10	110 + 10	115 + 10

1 Additional error from Tcal ±1°C without ACAL.

2 Additional error from Tcal ± 5 °C.

3 Specifications are for PRESET; NPLC 100.

4 Tcal ±1°C.

5 Specifications for 90 day, 1 year, and 2 year are within 24 hours and ±1°C of last ACAL; Tcal ± 5 °C.

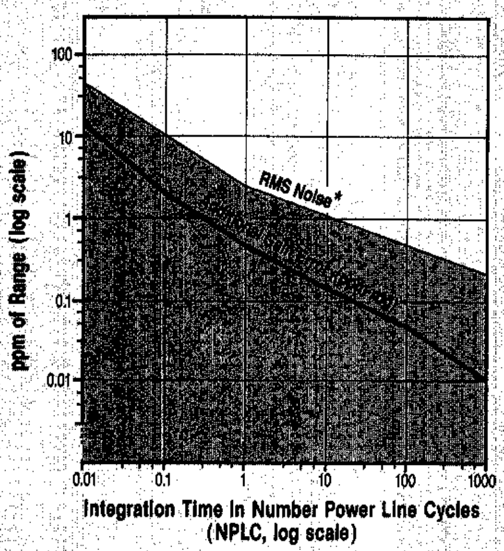
Add 5 ppm of reading additional error for HP factory traceability to US NBS. Traceability error is the sum of the 10 V and 10 kΩ traceability values.

6 Typical accuracy.

Settling Characteristics

For first reading or range change error, add .001% of input current step additional error. Reading settling times can be effected by source impedance and cable dielectric absorption characteristics.

Additional Errors



* Range	Multiplier
100 nA	x 100
1 µA	x 10
10 µA to 1 A	x 1

Measurement Considerations

HP recommends the use of Teflon cable or other high impedance, low dielectric absorption cable for low current measurements. Current measurements at rates < NPLC 1 are subject to potential noise pickup. Care must be taken to provide adequate shielding and guarding to maintain measurement accuracies.

Selected Reading Rates[7]

NPLC	Aperture[8]	Digits	Readings / Sec
0.0001	1.4 µs	4.5	4,900
0.0006	10 µs	5.5	3,500
0.01	167 µs	6.5	960
0.1	1.67 ms	6.5	245
1	16.6 ms	7.5	29.4
10	0.166 s	7.5	3
100		7.5	18 / min

7 For PRESET; DELAY 0; DISP OFF; OFORMAT DINT.

8 Aperture is selected independent of line frequency (LFREQ). These apertures are for 60 Hz NPLC values where 1 NPLC = 1 / LFREQ. For 50 Hz and NPLC indicated, aperture will increase by 1.2 and reading rates will decrease by 0.833.

Maximum Input

	Rated Input	Non-Destructive
I to LO	± 1.5 A pk	< 1.25 A rms
LO to Guard	± 200 V pk	± 350 V pk
Guard to Earth	± 500 V pk	± 1000 V pk

General Information

The HP3458A supports three techniques for measuring true rms AC voltage, each offering unique capabilities. The desired measurement technique is selected through the SETACV command. The ACV functions will then apply the chosen method for subsequent measurements.

The following section provides a brief description of the three operation modes along with a summary table helpful in choosing the technique best suited to your specific measurement need.

SETACV SYNC **Synchronously Sub-sampled Computed true rms technique.**

This technique provides excellent linearity and the most accurate measurement results. It does require that the input signal be repetitive (not random noise for example). The bandwidth in this mode is from 1 Hz to 10 MHz.

SETACV ANA **Analog Computing true rms conversion technique.**

This is the measurement type at power-up or following an instrument reset. This mode works well with any signal within it's 10 Hz to 2 MHz bandwidth and provides the fastest measurement speeds.

SETACV RNDM **Random Sampled Computed true rms technique.**

This technique again provides excellent linearity, however the overall accuracy is the lowest of the three modes. It does not require a repetitive input signal and is therefore well suited to wideband noise measurements. The bandwidth in this mode is from 20 Hz to 10 MHz.

Selection Table

Technique	Frequency Range	Best Accuracy	Repetitive Signal Required	Readings / Sec Minimum	Readings / Sec Maximum
Synchronous Sub-sampled	1 Hz - 10 MHz	0.010%	Yes	0.025	10
Analog	10 Hz - 2 MHz	0.03%	No	0.8	50
Random Sampled	20 Hz - 10 MHz	0.1%	No	0.025	45

Synchronously Sub-sampled Mode (ACV Function, SETACV SYNC)

Range	Full Scale	Maximum Resolution	Input Impedance	Temperature Coefficient[1] (% of Reading + % of Range) / °C
10 mV	12.00000	10 nV	1 MΩ ± 15% with < 140 pF	0.002 + 0.02
100 mV	120.0000	100 nV	1 MΩ ± 15% with < 140 pF	0.001 + 0.0001
1 V	1.200000	1 µV	1 MΩ ± 15% with < 140 pF	0.001 + 0.0001
10 V	12.00000	10 µV	1 MΩ ± 2% with < 140 pF	0.001 + 0.0001
100 V	120.0000	100 µV	1 MΩ ± 2% with < 140 pF	0.001 + 0.0001
1000 V	1050.000	1 mV	1 MΩ ± 2% with < 140 pF	0.001 + 0.0001

1 Additional error beyond ±1°C, but within ± 5°C of last ACAL.

For ACBAND >2 MHz, use 10 mV range temperature coefficient for all ranges.

2 Specifications apply full scale to 10% of full scale, DC < 10% of AC, sine wave input, crest factor = 1.4, and PRESET. Within 24 hours and ±1°C of last ACAL.

Peak (AC + DC) input limited to 5 x full scale for all ranges in ACV function.

Add 2 ppm of reading additional error for HP factory traceability of 10 V DC to US NBS.

AC Accuracy [2]

24 Hour to 2 Year (% of Reading + % of Range)

	ACBAND ≤ 2 MHz							
Range	1 Hz to 40 Hz	40 Hz to 1 kHz	1 kHz to 20 kHz	20 kHz to 50 kHz	50 kHz to 100 kHz	100 kHz to 300 kHz	300 kHz to 1 MHz	1 MHz to 2 MHz
10 mV	0.03 + 0.03	0.02 + 0.011	0.03 + 0.011	0.1 + 0.011	0.5 + 0.011	4.0 + 0.02		
100 mV - 10 V	0.007 + 0.004	0.007 + 0.002	0.014 + 0.002	0.03 + 0.002	0.08 + 0.002	0.3 + 0.01	1 + 0.01	1.5 + 0.01
100 V	0.02 + 0.004	0.02 + 0.002	0.02 + 0.002	0.035 + 0.002	0.12 + 0.002	0.4 + 0.01	1.5 + 0.01	
1000 V	0.04 + 0.004	0.04 + 0.002	0.06 + 0.002	0.12 + 0.002	0.3 + 0.002			

AC Accuracy continued on following page.

AC Accuracy continued: 24 Hour to 2 Year (% of Reading + % of Range)

	ACBAND > 2 MHz				
Range	45 Hz to 100 kHz	100 kHz to 1 MHz	1 MHz to 4 MHz	4 MHz to 8 MHz	8 MHz to 10 MHz
10 mV	0.09 + 0.06	1.2 + 0.05	3 + 0.07	20 + 0.08	
100 mV - 10 V	0.09 + 0.06	2.0 + 0.05	4 + 0.07	4 + 0.08	15 + 0.1
100 V	0.12 + 0.002				
1000 V	0.3 + 0.01				

Transfer Accuracy

Range	% of Reading
100 mV - 100 V	(0.002 + Resolution in %) [1]

Conditions
- Following 4 Hour warm-up
- Within 10 Min and ± 0.5°C of the reference measurement
- 45 Hz to 20 kHz, sine wave input
- Within ± 10% of the reference voltage and frequency

AC + DC Accuracy (ACDCV Function)

For ACDCV Accuracy apply the following additional error to the ACV accuracy. (% of Range)

DC < 10% of AC Voltage

Range	ACBAND ≤ 2 MHz	ACBAND > 2 MHz	Temperature Coefficient [2]
10 mV	0.09	0.09	0.03
100 mV - 1000 V	0.008	0.09	0.0025

DC > 10% of AC Voltage

Range	ACBAND ≤ 2 MHz	ACBAND > 2 MHz	Temperature Coefficient [2]
10 mV	0.7	0.7	0.18
100 mV - 1000 V	0.07	0.7	0.025

Additional Errors

Apply the following additional errors as appropriate to your particular measurement setup. (% of Reading)

	Input Frequency [3]			
Source R	0 - 1 MHz	1 - 4 MHz	4 - 8 MHz	8 - 10 MHz
0 Ω	0	2	5	5
50 Ω Termination	0.003	0	0	0
75 Ω Termination	0.004	2	5	5
50 Ω	0.005	3	7	10

Crest Factor	Resolution Multiplier [1]
1 - 2	(Resolution in %) x 1
2 - 3	(Resolution in %) x 2
3 - 4	(Resolution in %) x 3
4 - 5	(Resolution in %) x 5

Reading Rates [4]

ACBAND Low	Maximum Sec / Reading
1 - 5 Hz	6.5
5 - 20 Hz	2.0
20 - 100 Hz	1.2
100 - 500 Hz	0.32
> 500 Hz	0.02

% Resolution	Maximum Sec / Reading
0.001 - 0.005	32
0.005 - 0.01	6.5
0.01 - 0.05	3.2
0.05 - 0.1	0.64
0.1 - 1	0.32
> 1	0.1

Settling Characteristic

There is no instrument settling required.

Common Mode Rejection

For 1 kΩ imbalance in LO lead, > 90 dB, DC to 60 Hz.

1 Resolution is the value of RES command or parameter.

2 Additional error beyond ±1°C, but within ± 5°C of last ACAL. (% of Range) / °C. For ACBAND > 2 MHz, use 10 mV range temperature coefficient.

3 Flatness error including instrument loading.

4 Reading time is the sum of the Sec / Reading shown for your configuration. The tables will yield the slowest reading rate for your configuration. Actual reading rates may be faster. For DELAY-1; ARANGE OFF.

High Frequency Temperature Coefficient

For outside Tcal ± 5°C add the following error.
(% of Reading) / °C

	Frequency	
Range	2 - 4 MHz	4 - 10 MHz
10 mV - 1 V	0.02	0.08
10 V - 1000 V	0.08	0.08

Maximum Input

	Rated Input	Non-Destructive
HI to LO	± 1000 V pk	± 1200 V pk
LO to Guard	± 200 V pk	± 350 V pk
Guard to Earth	± 500 V pk	± 1000 V pk
Volt - Hz Product	1 x 10^8	

Analog Mode (ACV Function, SETACV ANA)

Range	Full Scale	Maximum Resolution	Input Impedance	Temperature Coefficient [1] (% of Reading+ % of Range) / °C
10 mV	12.00000	10 nV	1 MΩ ± 15% with < 140 pF	0.003 + 0.006
100 mV	120.0000	100 nV	1 MΩ ± 15% with < 140 pF	0.002 + 0.0
1 V	1.200000	1 µV	1 MΩ ± 15% with < 140 pF	0.002 + 0.0
10 V	12.00000	10 µV	1 MΩ ± 2% with < 140 pF	0.002 + 0.0
100 V	120.0000	100 µV	1 MΩ ± 2% with < 140 pF	0.002 + 0.0
1000 V	1050.000	1 mV	1 MΩ ± 2% with < 140 pF	0.002 + 0.0

1 Additional error beyond ±1°C, but within ± 5°C of last ACAL.

2 Specifications apply full scale to 1/20 full scale, sinewave input, crest factor = 1.4, and PRESET. Within 24 hours and ±1°C of last ACAL.

Maximum DC is limited to 400 V in ACV function.

Add 2 ppm of reading additional error for HP factory traceability of 10 V DC to US NBS.

AC Accuracy [2]

24 Hour to 2 Year (% Reading + % Range)

Range	10 Hz to 20 Hz	20 Hz to 40 Hz	40 Hz to 100 Hz	100 Hz to 20 kHz	20 kHz to 50 kHz	50 kHz to 100 kHz	100 kHz to 250 kHz	250 kHz to 500 kHz	500 kHz to 1 MHz	1 MHz to 2 MHz
10 mV	0.4 + 0.32	0.15 + 0.25	0.06 + 0.25	0.02 + 0.25	0.15 + 0.25	0.7 + 0.35	4 + 0.7			
100 mV - 10 V	0.4 + 0.02	0.15 + 0.02	0.06 + 0.01	0.02 + 0.01	0.15 + 0.04	0.6 + 0.08	2 + 0.5	3 + 0.6	5 + 2	10 + 5
100 V	0.4 + 0.02	0.15 + 0.02	0.06 + 0.01	0.03 + 0.01	0.15 + 0.04	0.5 + 0.08	2 + 0.5	3 + 0.6	5 + 2	
1000 V	0.42 + 0.03	0.17 + 0.03	0.08 + 0.02	0.06 + 0.02	0.15 + 0.04	0.6 + 0.2				

AC + DC Accuracy (ACDCV Function)

For ACDCV Accuracy apply the following additional error to the ACV accuracy. (% of Reading + % of Range)

	DC < 10% of AC Voltage		DC > 10% of AC Voltage	
Range	Accuracy	Temperature Coefficient [3]	Accuracy	Temperature Coefficient [3]
10 mV	0.0 + 0.2	0 + 0.015	0.15 + 3	0 + 0.06
100 mV - 1000 V	0.0 + 0.02	0 + 0.001	0.15 + 0.25	0 + 0.007

3 Additional error beyond ±1°C, but within ± 5°C of last ACAL. (% of Reading + % of Range) / °C.

Additional Errors

Apply the following additional errors as appropriate to your particular measurement setup.

Low Frequency Error (% of Reading)

	ACBAND Low		
Signal Frequency	10 Hz - 1 kHz NPLC > 10	1 - 10 kHz NPLC > 1	> 10 kHz NPLC > 0.1
200 - 500 Hz	0	0.15	
500 - 1 kHz	0	0.015	0.9
1 - 2 kHz	0	0	0.2
2 - 5 kHz	0	0	0.05
5 - 10 kHz	0	0	0.01

Crest Factor Error (% of Reading)

Crest Factor	Additional Error
1 - 2	0
2 - 3	0.15
3 - 4	0.25
4 - 5	0.40

Reading Rates[1]

	Sec / Reading		
ACBAND Low	NPLC	ACV	ACDCV
≥ 10 Hz	10	1.2	1
≥ 1 kHz	1	1	0.1
≥ 10 kHz	0.1	1	0.02

[1] For DELAY-1; ARANGE OFF.

For DELAY 0; NPLC .1, unspecified reading rates of greater than 500 / Sec are possible.

Settling Characteristic

For first reading or range change error using default delays, add .01% of input step additional error.
The following data applies for DELAY 0.

Function	ACBAND Low	DC Component	Settling Time
ACV	≥ 10 Hz	DC < 10% AC	0.5 sec to 0.01%
		DC > 10% AC	0.9 sec to 0.01%
ACDCV	10 Hz - 1 kHz		0.5 sec to 0.01%
	1 kHz - 10 kHz		0.08 sec to 0.01%
	≥ 10 kHz		0.015 sec to 0.01%

Maximum Input

	Rated Input	Non-Destructive
HI to LO	± 1000 V pk	± 1200 V pk
LO to Guard	± 200 V pk	± 350 V pk
Guard to Earth	± 500 V pk	± 1000 V pk
Volt - Hz Product	1×10^8	

Common Mode Rejection

For 1 kΩ imbalance in LO lead, >90 dB, DC - 60 Hz.

Random Sampled Mode (ACV Function, SETACV RNDM)

Range	Full Scale	Maximum Resolution	Input Impedance	Temperature Coefficient[2] (% of Reading + % of Range) / °C
10 mV	120.0000	10 nV	1 MΩ ± 15% with < 140 pF	0.002 + 0.02
100 mV	120.0000	100 nV	1 MΩ ± 15% with < 140 pF	0.001 + 0.0001
1 V	1.200000	1 μV	1 MΩ ± 15% with < 140 pF	0.001 + 0.0001
10 V	12.00000	10 μV	1 MΩ ± 2% with < 140 pF	0.001 + 0.0001
100 V	120.0000	100 μV	1 MΩ ± 2% with < 140 pF	0.001 + 0.0001
1000 V	1050.000	1 mV	1 MΩ ± 2% with < 140 pF	0.001 + 0.0001

[2] Additional error beyond ±1°C, but within ± 5 °C of last ACAL.

For ACBAND > 2 MHz, use 10 mV range temperature coefficient for all ranges.

AC Accuracy[3]

24 Hour to 2 Year (% of Reading + % of Range)

	ACBAND ≤ 2MHz				ACBAND > 2 MHz				
Range	20 Hz to 100 kHz	100 kHz to 300 kHz	300 kHz to 1 MHz	1 MHz to 2 MHz	20 Hz to 100 kHz	100 kHz to 1 MHz	1 MHz to 4 MHz	4 MHz to 8 MHz	8 MHz to 10 MHz
10 mV	0.5+0.02	4+0.02			0.1+0.05	1.2+0.05	3+0.07	20+0.08	
100 mV - 10 V	0.08+0.002	0.3+0.01	1+0.01	1.5+0.01	0.1+0.05	2+0.05	4+0.07	4+0.08	15+0.1
100 V	0.12+0.002	0.4+0.01	1.5+0.01		0.12+0.002				
1000 V	0.3+0.01				0.3+0.01				

[3] Specifications apply from full scale to 5% of full scale, DC < 10% of AC, sine wave input, crest factor = 1.4, and PRESET. Within 24 hours and ±1°C of last ACAL.

Add 2 ppm of reading additional error for HP factory traceability of 10 V DC to US NBS.

Maximum DC is limited to 400 V in ACV function.

AC + DCV Accuracy (ACDCV Function)

For ACDCV Accuracy apply the following additional error to the ACV accuracy. (% of Range).

	DC ≤ 10% of AC Voltage			DC >10% of AC Voltage		
Range	ACBAND ≤ 2 MHz	ACBAND > 2 MHz	Temperature Coefficient [1]	ACBAND ≤ 2 MHz	ACBAND > 2 MHz	Temperature Coefficient [1]
10 mV	0.09	0.09	0.03	0.7	0.7	0.18
100 mV - 1 kV	0.008	0.09	0.0025	0.07	0.7	0.025

[1] *Additional error beyond ±1°C, but within ± 5 °C of last ACAL. (% of Reading) / °C.*

For ACBAND >2 MHz, use 10 mV range temperature coefficient for all ranges.

Additional Errors

Apply the following additional errors as appropriate to your particular measurement setup. (% of Reading)

	Input Frequency [2]			
Source R	0 - 1 MHz	1 - 4 MHz	4 - 8 MHz	8 - 10 MHz
0 Ω	0	2	5	5
50 Ω Termination	0.003	0	0	0
75 Ω Termination	0.004	2	5	5
50 Ω	0.005	3	7	10

Crest Factor	Resolution Multiplier
1 - 2	(Resolution in %) x 1
2 - 3	(Resolution in %) x 3
3 - 4	(Resolution in %) x 5
4 - 5	(Resolution in %) x 8

[2] *Flatness error including instrument loading.*

Reading Rates [3]

	Sec / Reading	
% Resolution	ACV	ACDCV
0.1 - 0.2	40	39
0.2 - 0.4	11	9.6
0.4 - 0.6	2.7	2.4
0.6 - 1	1.4	1.1
1 - 2	0.8	0.5
2 - 5	0.4	0.1
>5	0.32	0.022

[3] *For DELAY -1; ARANGE OFF. For DELAY 0 in ACV, the reading rates are identical to ACDCV.*

High Frequency Temperature Coefficient

For outside Tcal ± 5°C add the following error.
(% of Reading) / °C

Range	2 - 4 MHz	4 - 10 MHz
10 mV - 1V	0.02	0.08
10 V - 1000 V	0.08	0.08

Settling Characteristic

For first reading or range change error using default delays, add 0.01% of input step additional error. The following data applies for DELAY 0.

Function	DC Component	Settling Time
ACV	DC <10% of AC	0.5 sec to 0.01%
	DC >10% of AC	0.9 sec to 0.01%
ACDCV	No instrument settling required.	

Common Mode Rejection

For 1 kΩ imbalance in LO lead, >90 dB, DC to 60 Hz.

Maximum Input

	Rated Input	Non-Destructive
HI to LO	± 1000 V pk	± 1200 V pk
LO to Guard	± 200 V pk	± 350 V pk
Guard to Earth	± 500 V pk	± 1000 V pk
Volt - Hz Product	1×10^8	

AC Current (ACI and ACDCI Functions)

Range	Full Scale	Maximum Resolution	Shunt Resistance	Burden Voltage	Temperature Coefficient [1] (% of Reading + % of Range) / °C
100 µA	120.0000	100 pA	730 Ω	0.1 V	0.002 + 0
1 mA	1.200000	1 nA	100 Ω	0.1 V	0.002 + 0
10 mA	12.00000	10 nA	10 Ω	0.1 V	0.002 + 0
100 mA	120.0000	100 nA	1 Ω	0.25 V	0.002 + 0
1 A	1.050000	1 µA	0.1 Ω	<1.5 V	0.002 + 0

AC Accuracy [2]

24 Hour to 2 Year (% Reading + % Range)

Range	10 Hz to 20 Hz	20 Hz to 45 Hz	45 Hz to 100 Hz	100 Hz to 5 kHz	5 kHz to 20 kHz [3]	20 kHz to 50 kHz [3]	50 kHz to 100 kHz [3]
100 µA [4]	0.4+0.02	0.15+0.02	0.06+0.02	0.06+0.02			
1 mA - 100 mA	0.4+0.02	0.15+0.02	0.06+0.02	0.03+0.02	0.06+0.02	0.4+0.04	0.55+0.15
1 A	0.4+0.02	0.16+0.02	0.08+0.02	0.1+0.02	0.3+0.02	1+0.04	

AC + DC Accuracy (ACDCI Function)

For ACDCI Accuracy apply the following additional error to the ACI accuracy.
(% of Reading + % of Range).

DC ≤ 10% of AC Accuracy	Temperature Coefficient [5]	DC > 10% of AC Accuracy	Temperature Coefficient [5]
0.005 + 0.02	0.0 + 0.001	0.15 + 0.25	0.0 + 0.007

Additional Errors

Apply the following additional errors as appropriate to your particular measurement setup.

Low Frequency Error (% of Reading)

Signal Frequency	ACBAND Low 10 Hz - 1 kHz NPLC >10	1 - 10 kHz NPLC >1	> 10 kHz NPLC >0.1
200 - 500 Hz	0	0.15	
500 - 1 kHz	0	0.015	0.9
1 - 2 kHz	0	0	0.2
2 - 5 kHz	0	0	0.05
5 - 10 kHz	0	0	0.01

Crest Factor Error (% of Reading)

Crest Factor	Additional Error
1 - 2	0
2 - 3	0.15
3 - 4	0.25
4 - 5	0.40

Reading Rates [6]

ACBAND Low	NPLC	Maximum Sec / Reading ACI	ACDCI
≥ 10 Hz	10	1.2	1
≥ 1 kHz	1	1	0.1
≥ 10 kHz	0.1	1	0.02

1 *Additional error beyond ±1°C, but within ± 5 °C of last ACAL.*

2 *Specifications apply full scale to 1 / 20 full scale, for sine wave inputs, crest factor = 1.4, and following PRESET within 24 hours and ±1°C of last ACAL.*

Add 5 ppm of reading additional error for HP factory traceability to US NBS. Traceability is the sum of the 10 V and 10 kΩ traceability values.

3 *Typical performance.*

4 *1 kHz maximum on the 100 µA range.*

5 *Additional error beyond ±1°C, but within ± 5 °C of last ACAL. (% of Reading + % of Range) / °C.*

6 *For DELAY-1; ARANGE OFF. For DELAY 0; NPLC .1, unspecified reading rates of greater than 500 / sec are possible.*

Settling Characteristics

For first reading or range change error using default delays, add .01% of input step additional error for the 100 μA to 100 mA ranges. For the 1 A range add .05% of input step additional error.
The following data applies for DELAY 0.

Function	ACBAND Low	DC Component	Settling Time
ACI	≥10 Hz	DC < 10% AC	0.5 sec to 0.01%
		DC > 10% AC	0.9 sec to 0.01%
ACDCI	10 Hz-1 kHz		0.5 sec to 0.01%
	1 kHz - 10 kHz		0.08 sec to 0.01%
	≥ 10 kHz		0.015 sec to 0.01%

Maximum Input

	Rated Input	Non-Destructive
I to LO	± 1.5 A pk	< 1.25 A rms
LO to Guard	± 200 V pk	± 350 V pk
Guard to Earth	± 500 V pk	± 1000 V pk

6 / Frequency / Period

Frequency / Period Characteristics

	Voltage (AC or DC Coupled) ACV or ACDCV Functions [1]	Current (AC or DC Coupled) ACI or ACDCI Functions [1]
Frequency Range	1 Hz – 10 MHz	1 Hz – 100 kHz
Period Range	1 sec – 100 ns	1 sec – 10 μs
Input Signal Range	700 V rms – 1 mV rms	1 A rms – 10 μA rms
Input Impedance	1 MΩ ± 15% with < 140 pF	0.1 – 1000 Ω [2]

Accuracy

Range	24 Hour – 2 Year 0°C – 55°C
1 Hz – 40 Hz **1 s – 25 ms**	0.05 % of Reading
40 Hz – 10 MHz **25 ms – 100 ns**	0.01 % of Reading

Reading Rates

Resolution	Gate Time [3]	Readings / Sec [4]
0.00001%	1 s	0.95
0.0001%	100 ms	9.6
0.001%	10 ms	73
0.01%	1 ms	215
0.1%	100 μs	270

Measurement Technique:
Reciprocal Counting

Time Base:
10 MHz ± 0.01%, 0°C to 55°C

Level Trigger:
± 500% of Range in 5% steps

Trigger Filter:
Selectable 75 kHz Low Pass Trigger Filter

Slope Trigger:
Positive or Negative

1 The source of frequency measurements and the measurement input coupling are determined by the FSOURCE command.

2 Range dependent, see ACI for specific range impedance values.

3 Gate Time is determined by the specified measurement resolution.

4 For Maximum Input specified to fixed range operation. For auto range, the maximum speed is 30 readings / sec for ACBAND ≥ 1 kHz.

Actual Reading Speed is the longer of 1 period of the input, the chosen gate time, or the default reading time-out of 1.2 sec.

General Information

The HP 3458A supports three independent methods for signal digitizing. Each method is discussed below to aid in selecting the appropriate setup best suited to your specific application.

DCV — **Standard DCV function.**
This mode of digitizing allows signal acquisition at rates from 0.2 readings / sec at 28 bits resolution to 100 k readings / sec at 16 bits. Arbitrary sample apertures from 500 ns to 1 sec are selectable with 100 ns resolution. Input voltage ranges cover 100 mV to 1000 V full scale. Input bandwidth varies from 30 kHz to 150 kHz depending on the measurement range.

DSDC — **Direct Sampling DC Coupled measurement technique.**

DSAC — **Direct Sampling AC Coupled measurement technique.**
In these modes the input is sampled through a track / hold with a fixed 2 ns aperture which yields a 16 bit resolution result. The sample rate is selectable from 6000 sec / sample to 20 µs / sample with 100 ns resolution. Input voltage ranges cover 10 mV peak to 1000 V peak full scale. The input bandwidth is limited to 12 MHz.

SSDC — **Sub-Sampling (Effective time sampling) DC Coupled.**

SSAC — **Sub-Sampling (Effective time sampling) AC Coupled.**
These techniques implement synchronous sub-sampling of a repetitive input signal through a track / hold with a 2 ns sample aperture which yields a 16 bit resolution result. The effective sample rate is settable from 6000 sec / sample to 10 ns / sample with 10 ns resolution. Sampled data can be time ordered by the instrument and output to the HP-IB. Input voltage ranges cover 10 mV peak to 1000 V peak full scale. The input bandwidth is limited to 12 MHz.

Summary of Digitizing Capabilities

Technique	Function	Input Bandwidth	Best Accuracy	Sample Rate
Standard	DCV	DC - 150 kHz	0.00005 - 0.01%	100 k / sec
Direct-sampled	DSDC / DSAC	DC - 12 MHz	0.02%	50 k / sec
Sub-sampled	SSDC / SSAC	DC - 12 MHz	0.02%	100 M / sec (effective)

Standard DC Volts Digitizing (DCV Function)

Range	Input Impedance	Offset Voltage [1]	Typical Bandwidth	Settling Time to 0.01% of Step
100 mV	$>10^{10}\,\Omega$	< 5 µV	80 kHz	50 µs
1 V	$>10^{10}\,\Omega$	< 5 µV	150 kHz	20 µs
10 V	$>10^{10}\,\Omega$	< 5 µV	150 kHz	20 µs
100 V	10 MΩ	< 500 µV	30 kHz	200 µs
1000 V	10 MΩ	< 500 µV	30 kHz	200 µs

1 ±1°C of an AZERO or within 24 hours and ±1°C of last ACAL.

DC Performance

0.005 % of Reading + Offset [1]

Maximum Sample Rate (See DCV for more data.)

Readings / sec	Resolution	Aperture
100 k	15 bits	0.8 µs
100 k	16 bits	1.4 µs
50 k	18 bits	6.0 µs

Sample Timebase

Accuracy: 0.01 %
Jitter: < 100 ps rms

External Trigger

Latency: < 175 ns [2]
Jitter: < 50 ns rms

Level Trigger

Latency: < 700 ns
Jitter: < 50 ns rms

2 < 75 ns variability between multiple HP 3458As.

Dynamic Performance

100 mV, 1 V, 10 V Ranges; Aperture = 6 µs

Test	Input (2 x full scale pk-pk)	Result
DFT-harmonics	1kHz	< -96 dB
DFT-spurious	1 kHz	< -100 dB
Differential non-linearity	dc	< 0.003% of Range
Signal to Noise Ratio	1 kHz	> 96 dB

Direct and Sub-sampled Digitizing (DSDC, DSAC, SSDC and SSAC Functions)

Range [1]	Input Impedance	Offset Voltage [2]	Typical Bandwidth
10 mV	1 MΩ with 140 pF	< 50 µV	2 MHz
100 mV	1 MΩ with 140 pF	< 90 µV	12 MHz
1 V	1 MΩ with 140 pF	< 800 µV	12 MHz
10 V	1 MΩ with 140 pF	< 8 mV	12 MHz
100 V	1 MΩ with 140 pF	< 80 mV	12 MHz [3]
1000 V	1 MΩ with 140 pF	< 800 mV	2 MHz [3]

1 Maximum DC voltage limited to 400 V DC in DSAC or SSAC functions.

2 ±1°C and within 24 hours of last ACAL ACV.

3 Limited to 1 x 10^8 V-Hz product.

DC to 20 kHz Performance

0.02 % of Reading + Offset [2]

Maximum Sample Rate

Function	Readings / sec	Resolution
SSDC, SSAC:	100 M (effective) [4]	16 bits
DSDC, DSAC	50 k	16 bits

Dynamic Performance

100 mV, 1 V, 10 V Ranges; 50,000 Samples / sec

Test	Input (2 x full scale pk-pk)	Result
DFT-harmonics	20 kHz	< - 90 dB
DFT-harmonics	1.005 MHz	< - 60 dB
DFT-spurious	20 kHz	< - 90 dB
Differential non-linearity	20 kHz	< 0.005 % of Range
Signal to Noise Ratio	20 kHz	> 66 dB

Sample Timebase

Accuracy: 0.01 %

Jitter: < 100 ps rms

External Trigger

Latency: < 125 ns [5]

Jitter: < 2 ns rms

Level Trigger

Latency: < 700 ns

Jitter: < 100 ps, for 1 MHz full scale input

4 Effective sample rate is determined by the smallest time increment used during synchronous sub-sampling of the repetitive input signal, which is 10 ns.

5 < 25 ns variability between multiple HP 3458As.

Function-Range-Measurement

The time required to program via HP-IB a new measurement configuration, trigger a reading, and return the result to a controller with the following instrument setup: PRESET FAST; DELAY 0; AZERO ON; OFORMAT SINT; INBUF ON.

TO - FROM Configuration Description	HP-IB Rate [1]	Subprogram Rate
DCV ≤ 10V to DCV ≤ 10V	180 / sec	340 / sec
any DCV / OHMS to any DCV / OHMS	85 / sec	110 / sec
any DCV / OHMS to any DCV / OHMS with DEFEAT ON	150 / sec	270 / sec
TO or FROM any DCI	70 / sec	90 / sec
TO or FROM any ACV or ACI	75 / sec	90 / sec

Selected Operating Rates [2]

	Rate
DCV Autorange Rate (100 mV to 10 V)	110 / sec
Execute simple command changes (CALL, OCOMP, etc.)	330 / sec
Readings to HP-IB, ASCII	650 / sec
Readings to HP-IB, DREAL	1200 / sec
Readings to HP-IB, DINT	50,000 / sec
Readings to internal memory, DINT	50,000 / sec
Readings from internal memory to HP-IB, DINT	50,000 / sec
Readings to HP-IB, SINT	100,000 / sec
Readings to internal memory, SINT	100,000 / sec
Readings from internal memory to HP-IB, SINT	100,000 / sec
Maximum internal trigger reading rate	100,000 / sec
Maximum external trigger reading rate	100,000 / sec

Memory

	Standard		Option 001	
	Readings	Bytes	Readings	Bytes
Reading Storage (16 bit)	10,240	20 k	+65,536	+128 k
Non-volatile, for subprograms and / or state storage		14 k		

Delay Time

Accuracy	± 0.01% ± 5 ns
Maximum	6000 s
Resolution	10 ns
Jitter	50 ns pk-pk

Timer

Accuracy	± 0.01% ± 5 ns
Maximum	6000 s
Resolution	100 ns
Jitter	< 100 ps rms

1 Using HP 9000 Series 350.

2 SINT data is valid for APER ≤ 10.8 µs.

Type of Ratio [1]

DCV / DCV	Ratio = (Input) / (Reference)
ACV / DCV	Reference: (HI Sense to LO) - (LO Sense to LO) [2]
ACDCV / DCV	Reference Signal Range: ± 12 V DC (autorange only)

Accuracy

± (Input error + Reference Error)
Input error = 1 x Total Error for input signal measurement function (DCV, ACV, ACDCV)
Reference error = 1.5 x Total error for the range of the reference DC input

1 All SETACV measurement types are selectable.

2 LO Sense to LO limited to ± 0.25 V.

10 / Math Functions

General Math Function Specifications

Math is executable as either a real-time or post processed operation.

Math function specifications do not include the error in X (the instrument reading) or errors in user entered values. The range of values input-or output is + 1.0×10^{-37} to + 1.0×10^{37}. Out of range values indicate OVLD in the display and 1×10^{38} to HP-IB. The minimum execution time is the time required to complete one math operation <u>after</u> each reading has completed.

NULL:
X-OFFSET
Minimum Execution Time = 180 µs

PERC:
100 x (X-PERC) / PERC
Minimum Execution Time = 600 µs

dB:
20 x Log (X/REF)
Minimum Execution Time = 3.9 ms

RMS:
1-pole digital filter
Computed rms of inputs.
Minimum Execution Time = 2.7 ms

STAT:
MEAN, SDEV computed for sample population (N-1).
NSAMP, UPPER, LOWER accumulated.
Minimum Execution Time = 900 µs

CTHRM2K (FTHRM2K):
°C (°F) temperature conversion for 2.2 kΩ thermistor (HP40653A).
Minimum Execution Time = 160 µs

CRTD85 (FRTD85):
°C (°F) temperature conversion for RTD of 100 Ω, Alpha = 0.00385 (HP40654A or HP40654B).
Minimum Execution Time = 160 µs

SCALE:
(X-OFFSET) / SCALE
Minimum Execution Time = 500 µs

PFAIL:
Based on MIN, MAX registers
Minimum Execution Time = 160 µs

dBm:
10 x Log [(X^2 / RES) / 1 mW]
Minimum Execution Time = 3.9 ms

FILTER:
1-pole digital filter
Weighted Average of inputs
Minimum Execution Time = 750 µs

CTHRM (FTHRM):
°C (°F) temp conversion for 5 kΩ thermistor (HP40653B).
Minimum Execution Time = 160 µs

CTHRM10K (FTHRM10K):
°C (°F) temperature conversion for 10 kΩ thermistor (HP40653C).
Minimum Execution Time = 160 µs

CRTD92 (FRTD92):
°C (°F) temperature conversion for RTD of 100 Ω, Alpha = 0.003916
Minimum Execution Time = 160 µs

Operating Environment
0°C to 55°C

Operating Humidity Range
up to 95% RH at 40°C

Physical Characteristics
88.9mm H x 425.5mm W x 502.9mm D
Net Weight: 12kg (26.5 lbs)
Shipping Weight 14.8kg (32.5 lbs)

IEEE-488 Interface
Complies with the following:
IEEE-488.1 Interface Standard
IEEE-728 Codes/Formats Standard
HPML (HP Multimeter Language)

Storage Temperature
-40°C to +75°C

Warm-Up Time
4 Hours to published specifications

Power Requirements
100/120 V, 220/240 V ± 10%
48 Hz to 420 Hz automatically sensed
< 30 W, < 80 VA (peak)
Fused: 1.5 A @ 115 V or 0.5 A @ 230 V

Designed in Accordance with
Safety: IEC 348, UL1244, CSA
EMI: FTZ 1046, FCC part 15-J

Input Terminals
Gold-plated Tellurium Copper

Field Installation Kits		HP Part Number
Option 001	Extended Reading Memory	03458-87401
Option 002	High Stability Reference	03458-80002
Option 005	Waveform Analysis Library	03458-80005
Extra Keyboard Overlays (5 each)		03458-84303

Available Documentation		HP Part Number
Product Note 3458A-1:	Optimizing Throughput and Reading Rate	5953-7058
Product Note 3458A-2:	High Resolution Digitizing with the HP 3458A	5953-7059
Product Note 3458A-3:	Electronic Calibration of the HP 3458A	5953-7060
Extra Operating Manual		03458-90000

Waveform Analysis Library Description

Provides a library of subprograms and functions that can initialize the computer and the HP 3458A, acquire waveform data, perform parametric measurements on the data, compare the waveform data to previously captured limits, and format and output the measurement results in a real-time scope-like fashion on the display.

Software routines are also provided for time domain analysis (frequency, rise time, pulse width) and frequency domain analysis (Fast Fourier transforms, FFT). Routines also provide interpolation between data points (linear or sin x / x).