Appendix A Specifications

Introduction

The 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 3458A accuracy specifications are relative to the calibration standards. Absolute accuracy of the 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 Agilent factory. That means that the absolute error relative to the U.S. National Institute of Standards and Technology (NIST) is 2 ppm in addition to the dcV accuracy specifications. When you recalibrate the 3458A, your actual traceability error will depend upon the errors from your calibration standards. These errors will likely be different from the Agilent error of 2 ppm.

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

Errors from temperature changes

The optimum technical specifications of the 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 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 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 3458A using auto-calibration with an operating temperature of 28°C. Results are rounded to 2 digits.

(4.1 ppm x 10 V) + (0.05 ppm x 10 V) = 42 µV

Total relative error = 42 µV

Example 3: Operating temperature is 38°C;

Without ACAL

The operating temperature of the 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 10 V) + (0.05 ppm x 10 V) = 42 µV

Temperature Coefficient (specification is per °C):

(0.5ppm x 10V + 0.01 ppm x 10V) x 14°C = 71 µV

Total error = 113 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 10 V) + (0.05 ppm x 10 V) = 42 µV

Temperature Coefficient (specification is per °C):

(0.15ppm x 10V + 0.01ppm x 10V) x 10°C = 16µV

Total error = 58 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 10 V) + (0.05 ppm x 10 V) = 42 µV

Temperature Coefficient (specification is per °C):

(0.15ppm x 10V + 0.01ppm x 10V) x 10°C = 16µV

Agilent factory traceability error of 2 ppm:

(2 ppm x 10 V) = 20 µV

Total absolute error = 78 µV

Additional errors

When the 3458A is operated at power line cycles below 100, additional errors due to noise and gain become significant. Example 6 illustrates the error correction at 0.1 PLC.

Example 6: operating temperature is 28×C; 0.1 PLC

Assuming the same conditions as Example 2, but now add additional error.

(4.1 ppm x 10 V) t (0.05 ppm x 10 V) = 42 µV

Referring to the Additional Errors chart and RMS Noise Multiplier table, additional error at 0.1 PLC is:

(2 ppm x 10 V) + (0.4 ppm x 1 x 3 x 10 V) = 32 µV

Total relative error = 74 µV

1 / DC Voltage

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 Reading for Option 002) + ppm of Range)

Range	24 Hour [4]	90 Day [5]	1 Year [5]	2 Year [5]
100 mV	2.5 + 3	5.0 (3.5)+ 3	9 (5)+ 3	14 (10)+ 3
1 V	1.5 + 0.3	4.6 (3.1)+0.3	8 (4)+ 0.3	14 (10)+0.3
10 V	0.5 + 0.05	4.1 (2.6) + 0.05	8 (4) + 0.05	14 (10)+0.05
100 V	2.5 + 0.3	6.0 (4.5) + 0.3	10 (6)+0.3	14 (10)+ 0.3
1000 V[6]	2.5 + 0.1	6.0 (4.5)+ 0.1	10 (6)+ 0.1	14 (10)+ 0.1

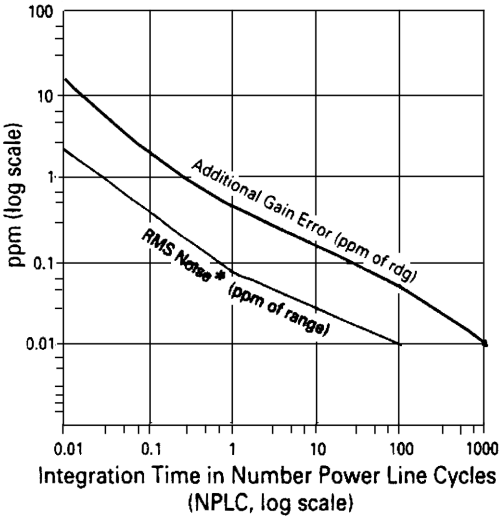
Transfer Accuracy/Linearity

Range	10 Min, Tref ± 0.5ºC (ppm of Reading + ppm of Range)	Conditions
100 mV	0.5 + 0.5	• Following 4 hour warm-up. Full scale to 10% of full scale • Measurements on the 1000 V range are within 5% of the initial meausurement value and following measurement setting. • Tref is the starting ambient temperature. • Measurements are made on a fixed range (>4 min.) using accepted metrology practices
1 V	0.3 + 0.1	
10 V	0.05 + 0.05	
100 V	0.5 + 0.1	
1000 V	1.5+0.05	

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	60	160	140
NPLC = 1000	75	170	140

*RMS Noise

Range	Multiplier
0.1V	x20
1 V	x2
10 V	x1
100 V	x2
1000 V	x1

For RMS noise error, multiply RMS noise result from graph by multiplier in chart. For peak noise error. multiply RMS noise error by 3.

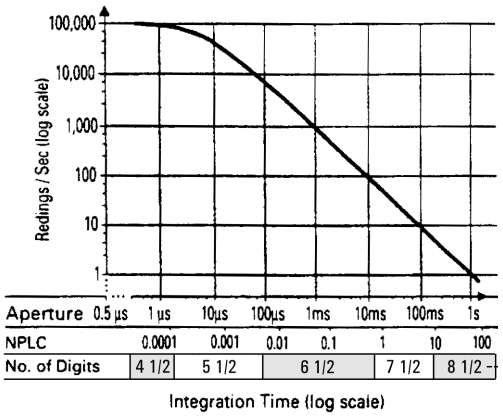
1. Additional error from Tcal or last ACAL ± 1 º C.
2. Additional error from Tcal ±5º C
3. Specifications are for PRESET, NPLC 100.
4. For fixed range (> 4 min.), MATH NULL and Tcal ±1ºC.
5. Specifications for 90 day, 1 year and 2 year are within 24 hours and ±1º C of last ACAL; Tcal ±5ºC, MATH NULL and fixed range.

   ppm of Reading specifications for High Stability (Option 002) are in parentheses.

   Without MATH NULL, add 0.15 ppm of Range to 10 V, 0.7 ppm of Range to 1 V, and 7 ppm of Range to 0.1 V. Without math null and for fixed range less than 4 minutes, add 0.25 ppm of Range to 10 V, 1.7 ppm of Range to 1 V and 17 ppm of Range to 0.1 V.

   Add 2 ppm of reading additional error for Agilent factory traceability to US NIST. Traceability error is the absolute error relative to National Standards associated with the source of last external calibration.
6. Add 12 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 55 dB for NPLC ≥ 100. For line frequency ± 5%, ACNMR is 30 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	Digits	Bits	Readings / Sec A-Zero Off	Readings / Sec A-Zero On
0.0001	1.4 µs	4.5	16	100,000 [3]	4,130
0.0006	10 µs	5.5	18	50,000	3,150
0.01	167 µs[2]	6.5	21	5,300	930
0.1	1.67 ms[2]	6.5	21	592	245
1	16.6 ms[2]	7.5	25	60	29.4
10	0.166 s[2]	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; ARANGE OFF.
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[4]	±200 V pk	±350 V pk
Guard to Earth[5]	±500 V pk	±1000 V pk

4. $> 10^{10}$ Ω LO to Guard with guard open.
5. $> 10^{12}$ Ω Guard to Earth.

Input Terminals

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

2 / Resistance

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

Range	Full Scale	Maximum Resolution	Current Source[6]	Test Voltage	Open Circuit	Maximum Lead Resistance (OHMF)	Maximum Series Offset (OCOMP ON)	Temperature Coefficient (ppm of Reading + ppm of Range) / °C	
								Without ACAL[7]	With ACAL[8]
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[9]	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

6. Current source is ± 3% absolute accuracy.
7. Additional error from Tcal or last ACAL ± 1° C.
8. Additional error from Tcal ± 5° C.
9. Measurement is computed from 10 M Ω in parallel with input

2 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

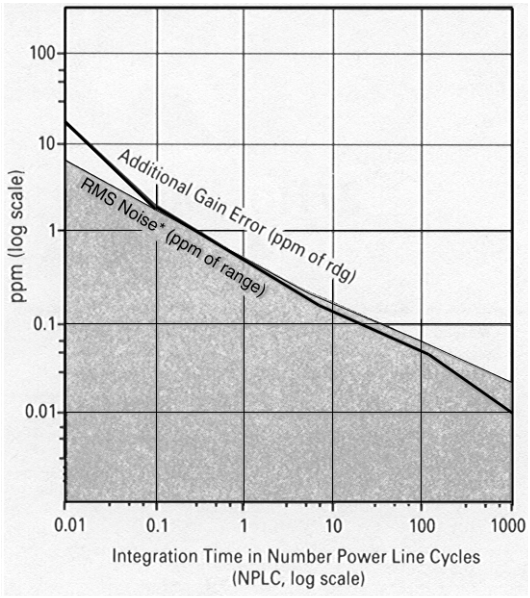
1. Specifications are for PRESET; NPLC 100; OCOMP ON; OHMF.
2. Tcal ± 1°C.
3. Specifications for 90 day, 1 year, and 2 year are within 24 hours and ± 1°C of last ACAL; Tcal ±5°C.

   Add 3 ppm of reading additional error for Agilent factory traceability of 10 KΩ to US NIST. Traceability is the absolute error relative to National Standards associated wifh 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



*RMS Noise	
Range	**Multiplier**
10 Ω & 100 Ω	×10
1k Ω to 100 kΩ	×1
1 MΩ	×1.5
10 MΩ	×2
100 MΩ	×120
1 GΩ	×1200

For RMS noise error, multiply RMS noise result from graph by multiplier in chart. For peak noise error, multiply RMS noise error by 3.

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]

			Readings/Sec	
NPLC [5]	**Aperture**	**Digits**	**Auto-Zero Off**	**Auto-Zero On**
0.0001	1.4 µs	4.5	100,000 [7]	4,130
0.0006	10 µs	5.5	50,000	3,150
0.01	167 µs[6]	6.5	5,300	930
0.1	1.66 ms[6]	6.5	592	245
1	16.6 ms[6]	7.5	60	29.4
10	0.166 s[6]	7.5	6	3
100		7.5	36 /min	18/min

4. For PRESET; DELAY 0; DISP OFF; OFORMAT DINT; ARANGE OFF.

   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 deNemours and Co.

Measurement Consideration

Agilent 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 Coefficient (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		

3 / DC Current

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

1. Additional error from Tcal or last ACAL±1°C.
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 Agilent factory traceability to US NIST. Traceability error is the sum of the 10 V and 10 kΩ traceability values.
6. Typical accuracy.

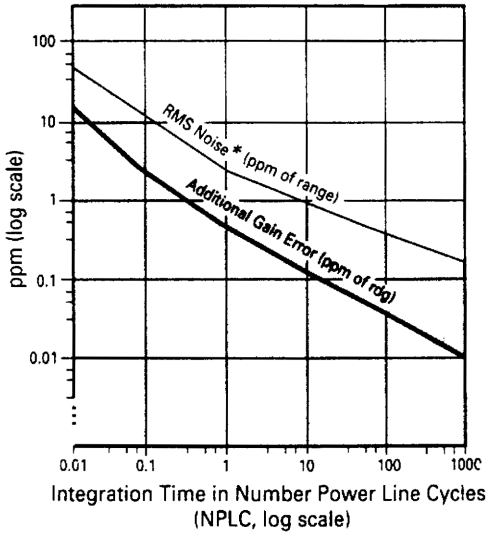
Accuracy [3] (ppm Reading + ppm Range)

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+7	15+10	20+10	25+10
100 µA	10+6	15+8	20+8	25+8
1 mA	10+4	15+5	20+5	25+5
10 mA	10+4	15+5	20+5	25+5
100 mA	25+4	30+5	35+5	40+5
1 A	100+10	100+10	110+10	115+10

Settling Characteristics

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

Additional Errors



*RMS Noise	
Range	**Multiplier**
100 nA	×100
1 µA	×10
10 µA to 1A	×1

For RMS noise error, multiply RMS noise result from graph by multiplier in chart. For peak noise error, multiply RMS noise error by 3.

Measurement Considerations

Agilent 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	Digits	Readings / Sec
0.0001	1.4 µs	4.5	2,300
0.0006	10 µs	5.5	1,350
0.01	167 µs[8]	6.5	157
0.1	1.67 ms[8]	6.5	108
1	16.6 ms [8]	7.5	26
10	0.166 s[8]	7.5	3
100		7.5	18/min

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

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

4 / AC Voltage

General Information

The 3458A 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 technique at power-up or following an instrument reset. This mode works well with any signal within its 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

Synchronous 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<140pF	0.003 + 0.02
100 mV	120.00000	10 nV	1 MΩ±15% with<140pF	0.0025 + 0.0001[2]
1 V	1.2000000	100 nV	1 MΩ±15% with <140pF	0.0025 + 0.0001
10 V	12.000000	1 µV	1 MΩ±2% with <140pF	0.0025 + 0.0001
100 V	120.00000	10 µV	1 MΩ±2% with <140pF	0.0025 + 0.0001
1000 V	700.0000	100 µV	1 MΩ±2% with <140pF	0.0025 + 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. Lo to Guard Switch on.

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

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

3. LFILTER ON recommended.

AC Accuracy[2]

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

Range	ACBAND ≤ 2 MHz							
	1 Hz to[3] 40 Hz	40 Hz to[3] 1 kHz	1 kHz to[3] 20 kHz	20 kHz to[3] 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): 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	7 + 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

1. Resolution in % is the value of RES command or parameter (reading resolution as percentage of measurement range).

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

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. Lo to Guard switch on.

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 ΩTerminated	0.003	0	0	0
75 ΩTerminated	0.004	2	5	5
50 Ω	0.005	3	7	10

Crest Factor	Resolution Multiplier [1]
1–2	(Resolution in%) × 1
2–3	(Resolution in%) × 2
3–4	(Resolution in%) × 3
4–5	(Resolution in%) × 5

3. Flatness error including instrument loading.

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

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.

Settling Characteristics

There is no instrument settling required.

Common Mode Rejection

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

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	$1x10^8$	

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<140pF	0.003 + 0.006
100 mV	120.0000	100 nV	1 MΩ±15% with<140pF	0.002 + 0
1 V	1.200000	1 µV	1 MΩ±15% with<140pF	0.002 + 0
10 V	12.00000	10 µV	1 MΩ±2% with<140pF	0.002 + 0
100 V	120.0000	100 µV	1 MΩ±2% with<140pF	0.002 + 0
1000 V	700.000	1 mV	1 MΩ±2% with<140pF	0.002 + 0

1. Additional error beyond ±1°C, but within ±5°C of last A CAL.
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, Lo to Guard switch on to.

   Maximum DC is limited to 400 V in ACV function.

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

ACAccuracy [2]

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

Range	10Hz 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	0.6 + 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 additionat 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**
10–200 Hz	0		
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 Characteristics

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

	Related 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 Coefficients[2] % of Reading+% of Range)/°C
10 mV	12.000	1 µV	1 MΩ ±15% with<140 pF	0.002 + 0.02
100 mV	120.00	10 µV	1 MΩ ±15% with<140 pF	0.001 + 0.0001
1 V	1.2000	100 µV	1 MΩ ±15% with<140 pF	0.001 + 0.0001
10 V	12.000	1 mV	1 MΩ ±2% with<140 pF	0.001 + 0.0001
100 V	120.00	10 mV	1 MΩ ±2% with<140 pF	0.0015 + 0.0001
1000 V	700.0	100 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 ≤ 2 MHz				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	7 + 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. LO to Guard switch on.

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

   Maximum DC is limited to 400V 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 Terminated	0.003	0	0	0
75 Ω Terminated	0.004	2	5	5
50 Ω	0.005	3	7	10

Crest Factor	Resolution MultIplier
1–2	(Resolution in %) × 1
2–3	(Resolution in %) × 3
3–4	(Resolution in %) × 5
4–5	(Resolution in %) × 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 – 1 V	0.02	0.08
10 V – 1000 V	0.08	0.08

Settling Characteristics

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	

5 / AC Current

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

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

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+0.03	0.15+0.03	0.06+0.03	0.06+0.03			
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	

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 additonal error for Agilent factory traceabiltiy to US NIST. Traceability is the sum of the 10V and 10 kΩ traceability values.

3. Typical performance

4. 1 kHz maximum on the 100 µA range.

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+.001	0.15+0.25	0.0+0.007

5. 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)

Signal Frequency	ACBAND Low: 10 Hz-1 kHz NPLC >10	1 to 10 kHz NPLC >1	>10 kHz NPLC >0.1
10–200 Hz	0		
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

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 lnput	Non-Destructive
I to LO	± 1.5 A pk	< 1.25A 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	1sec – 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 – 730 Ω[2]

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.

Accuracy

Range	24 Hour- 2 Year 0°C-55°C
1 Hz–40 Hz	
1 s–25 ms	0.05% ofReading
40 Hz – 10 MHz	
25 ms–100 ns	.01% ofReading

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

7 / Digitizing Specifications

General Information

The 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 100k 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 GPIB. 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. <125 ns variability between multiple 3458As

Dynamic Performance

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

Test	Input (2 x full scale pk-pk)	Result
DFT-harmonics	1 kHz	< –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 x10^8 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

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 3458As

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

8 / System Specifications

Function-Range-Measurement

The time required to program via GPIB 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; NPLC 0.

TO - FROM Configuration Description	GPIB Rate [1]	Subprogram Rate
DCV ≤ 10 V to DCV ≤10 V	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

1. Using HP 9000 Series 350.
2. SINT data is valid for APER ≤10.8µs.

Selected Operating Rates [2]

Conditions	Rate
DCV Autorange Rate (100 mV to 10 V)	110 / sec
Execute simple command changes (CALL, OCOMP, etc.)	330 / sec
Readings to GPIB, ASCII	630 / sec
Readings to GPIB, DREAL	1000 / sec
Readings to GPIB, DINT	50,000 / sec
Readings to internal memory, DINT	50,000 / sec
Readings from internal memory to GPIB, DINT	50,000 / sec
Readings to GPIB, SINT	100,000 / sec
Readings to internal memory, SINT	100,000 / sec
Readings from internal memory to GPIB, 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

9 / Ratio

Type of Ratio [1]

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

1. All SETACV measurement types are selectable. LO Sense to LO limited to ± 0.25 V.

Accuracy

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

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 x 10^{37}. Out of range values indicate OVLD in the display and 1 × 10^{38} to GPIB. The minimum execution time is the time required to complete one math operation after each reading has completed.

NULL:
X–OFFSET
Minimum Execution Time = 180 µs

PERC:
100 × (X–PERC) / PERC
Minimum Execution Time = 600 µs

dB:
20 × 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 (Agilent 40653A).
Minimum Execution time = 160 µs

CRTD85 (FRTD85):
°C (°F) temperature conversion for RTD of 100 Ω, Alpha = 0.00385
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 × 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) temperature conversion for 5 kΩ thermistor (Agilent 40653B).
Minimum Execution Time = 160 µs

CTHRM10K (FTHRM10K):
°C (°F) temperature conversion for 10 kΩ thermistor (Agilent 40653C).
Minimum Execution Time = 160 µs

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

11 / General Specifications

Operating Environment
Temperature Range: 0°C to 55°C
Operating Location: Indoor Use Only
Operating Altitude: Up to 2,000 Meters
Pollution Rating: IEC 664 Degree 2

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

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

Storage Temperature
–40°C to + 75°C

Warm-Up Time
4 Hours to published specifications

Power Requirements
100/120 V, 220/240 V ±10%
48–66Hz, 360–420Hz (auto sensed)
<30 W, <80 VA (peak)
Fused: 1.5 @ 115 V or 0.5 A @230 V

Cleaning Guidelines
To clean the instrument, use a clean cloth slightly dampened with water.

Warranty Period
One year

Input Terminals
Gold-plated Tellurium Copper

Input Limits
Input HI to LO: 300 Vac Max (CAT II)

IEEE-488 Interface
Complies with the following:
IEEE-488.1 Interface Standard
IEEE-728 Codes/Formats Standard
CIIL (Option 700)

Included with Agilent 3458A:
Test Lead Set (Agilent 34118A)
Power Cord
User's Guide
Calibration Manual
Assembly Level Repair Manual
Quick Reference Guide

Field Installation Kits		Agilent Part Number
Option 001	Extended Reading Memory	03458-87901
Option 002	High Stability Reference	03458-80002
Extra Keyboard Overlays (5 each)		03458-84303

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