Agilent 4294A
Precision Impedance Analyzer

Data Sheet

Specifications

Specifications describe the instrument's warranted performance over the temperature range of 0 °C to 40 °C (except as noted). Supplemental performance characteristics are intended to provide information that is useful in applying the instrument by given non-warranted performance parameters. These are denoted as SPC (supplemental performance characteristics), typical, or nominal. Warm-up time must be greater than or equal to 30 minutes after power on for all specifications.

Basic Characteristics

Measurement Parameter

Impedance Parameters	|Z|-θ, R-X, Ls-Rs, Ls-Q, Cs-Rs, Cs-Q, Cs-D, |Y|-θ, G-B, Lp-G, Lp-Q, Cp-G, Cp-Q, Cp-D, Complex Z-Y, |Z|-Ls, |Z|-Cs, |Z|-Lp, |Z|-Cp, |Z|-Rs, |Z|-Q, |Z|-D, Lp-Rp, Cp-Rp

Measurement Terminal

Configuration	Four-terminal pair configuration
Connector type	Four BNC (female) connectors. Can be converted to one port terminal using the Agilent 42942A Terminal Adapter (7-mm port) or 42941A Impedance Probe (3.5-mm port).

Source Characteristics

Frequency

Range 40 Hz to 110 MHz	
Resolution	1 mHz

Agilent Technologies

Accuracy	
without Option 4294A-1D5	±20 ppm (at 23 ±5 °C) ±40 ppm (at 0 to 55 °C)
with Option 4294A-1D5	±0.13 ppm (at 0 to 55 °C)

Voltage Signal Level

Range	5 mVrms to 1 Vrms
Resolution	1 mV
Accuracy	
at four-terminal pair port of the 4294A or 7-mm port of the 42942A	±[(10 + 0.05 × f)% + 1 mV] (at 23 ±5 °C)
at measurement port of the 42941A, 16048G/H	±[(15 + 0.1 × f)% + 1 mV] (at 23 ±5 °C)

NOTE
f: frequency [MHz].
These characteristics apply when OPEN is connected to each port.
Test signal level should be ≤0.5 Vrms when the measured impedance is ≤50 Ω.
Beyond 23 ±5 °C of temperature, test signal level setting accuracy is twice as bad as described.

Current Signal Level

Range	200 µArms to 20 mArms
Resolution	20 µA
Accuracy	
at four-terminal pair port of the 4294A	
at ≤15 MHz	+[10% + 50 µA], –[(10 + 0.2 × f^2)% + 50 µA] (at 23 ±5 °C, typical)
at >15 MHz	±[(10 + 0.3 × f)% + 50 µA] (at 23 ±5 °C, typical)
at 7-mm port of the 42942A	
at ≤5 MHz	+[10% + 50 µA], –[(10 + 1 × f^2)% + 50 µA] (at 23 ± 5 °C, typical)
at >5 MHz	±[(10 + 0.3 × f)% + 50 µA] (at 23 ±5 °C, typical)

at measurement port of the 42941A, 16048G/H	
at ≤5 MHz	+[10% + 50 μA], –[(15 + 1.5 × f^2)% + 50 μA] (at 23 ±5 °C, typical)
at >5 MHz	±[(20 + 0.3 × f)% + 50 μA] (at 23 ±5 °C, typical)

NOTE
f: frequency [MHz].
These characteristics apply when SHORT is connected to each port.
Test signal level should be ≤20 mArms when the measured impedance is ≤50 Ω.

Signal Level Monitor

Voltage range	(Same as the voltage signal level setting range)
Voltage monitor accuracy	
at four-terminal pair port of the 4294A or 7-mm port of the 42942A	±(10 + 0.05 × f + 100/Z_X)[%] (at 23 ±5 °C, typical)
at measurement port of the 42941A, 16048G/H	±(10 + 0.15 × f + 100/Z_X)[%] (at 23 ±5 °C, typical)
Current range	(Same as the current signal level setting range)
Current monitor accuracy	
at four-terminal pair port of the 4294A or 7-mm port of the 42942A	±(10 + 0.3 × f + Z_X/100)[%] (at 23 ±5 °C, typical)
at measurement port of the 42941A, 16048G/H	±(10 + 0.4 × f + Z_X/100)[%] (at 23 ±5 °C, typical)

NOTE
f: frequency [MHz], Z_X impedance measurement value [Ω].
Beyond 23 ±5 °C, the test signal level monitor accuracy is twice as bad as described.

Output Impedance

Output impedance	25 Ω (nominal)

DC Bias Function

DC voltage bias	
Range	0 to ±40 V (see Figure 1)
Resolution	1 mV
Accuracy	±[0.1% + (5 + 30 × $\lvert I_{mon} \rvert$) mV](at 23 ±5 °C) ±[0.2% + (10 + 30 × $\lvert I_{mon} \rvert$) mV](beyond 23 ±5 °C)
DC current bias	
Range	0 to ±100 mA (see Figure 1)
Resolution	40 μA
Accuracy	±[2% + (0.2 + $\lvert V_{mon} \rvert$/20) mA] (at 23 ±5 °C) ±[4% + (0.4 + $\lvert V_{mon} \rvert$/20) mA] (beyond 23 ±5 °C)
DC voltage bias at constant voltage mode	
Range	0 to ±40 V (see Figure 1)
Resolution	1 mV
Accuracy	±[0.5% + (5 + Z_d × $\lvert I_{mon} \rvert$) mV] (at 23 ±5 °C, typical) ±[1.0% + (10 + Z_d × $\lvert I_{mon} \rvert$) mV] (beyond 23 ±5 °C, typical)
DC current bias at constant current mode	
Range	0 to ±100 mA (see Figure 1)
Resolution	40 μA
Accuracy	±[1% + (0.5 + $\lvert V_{mon} \rvert$/10000) mA] (at 23 ±5 °C, typical) ±[2% + (1.0 + $\lvert V_{mon} \rvert$/5000) mA] (beyond 23 ±5 °C, typical)
DC bias monitor	
DC voltage range	(Same as the dc voltage bias setting range)
DC voltage accuracy	±[0.2% + (5 + Z_d × $\lvert I_{mon} \rvert$) mV] (at 23 ±5 °C) ±[0.4% + (10 + Z_d × $\lvert I_{mon} \rvert$) mV] (beyond 23 ±5 °C)
DC current range	(Same as the dc current bias setting range)

DC current monitor accuracy	±[1% + (0.5 + | V_{mon} | /10000)mA] (at 23 ±5 °C) ±[2% + (1.0 + | V_{mon} | /5000)mA] (beyond 23 ±5 °C)
Output impedance	25 Ω (nominal)

NOTE
V_{mon} : dc voltage bias monitor reading value [mV]
I_{mon} : dc current bias monitor reading value [mA]
Z_d = 0.3 (at four-terminal pair port of the 4294A, adapter setup: NONE)
Z_d = 2.0 (at 3.5 mm port of the 42941A, adapter setup: 42941A Impedance Probe)
Z_d = 0.5 (at 7-mm port of the 42942A, adapter setup: 42942A Terminal Adapter)
Z_d = 1.0 (at measurement port of the 16048G, adapter setup: four-terminal pair 1 m)
Z_d = 1.5 (at measurement port of the 16048H, adapter setup: four-terminal pair 2 m)

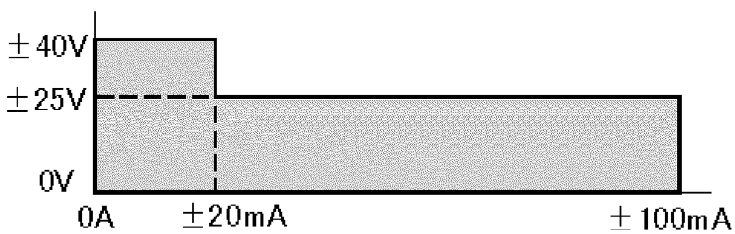


Figure 1. DC Bias Range (SPC)

Sweep Characteristics

Available sweep parameters	Frequency, Signal voltage, Signal current, DC bias voltage, DC bias current
Sweep type	Linear, Log[1], List[1], Zero-span, Manual
Manual sweep	Available for all sweep types
Sweep direction	Up sweep, Down sweep
Number of measurement points	2 to 801 points
List Sweep	
Available setup parameters for each segment	Sweep frequency range, Number of measurement points, Signal level (voltage or current), DC bias (voltage or current), Measurement bandwidth, Point averaging factor

1. Frequency sweep only.

Number of segments	1 to 18
Sweep span type	Segment span or single span
Delay time	
Type	Point delay or sweep delay
Range	0 sec to 30 sec
Resolution	1 msec

Measurement Time

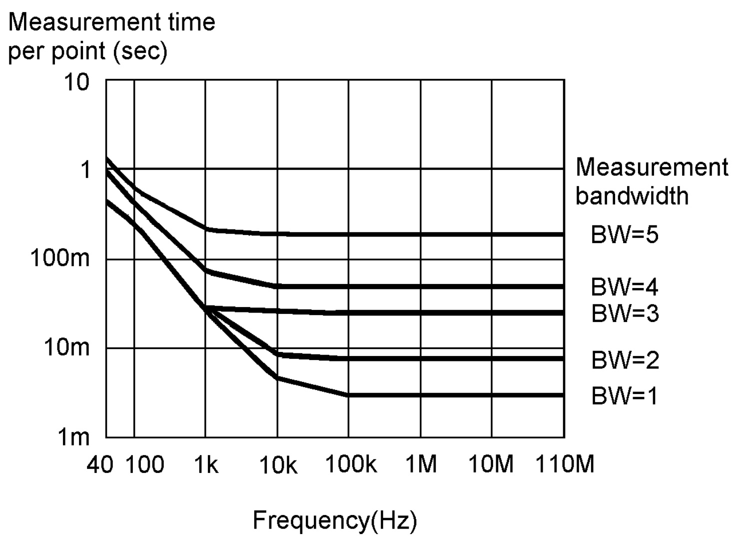


Figure 2. Measurement Time (SPC)

NOTE
When the Agilent 42941A Impedance Probe or 42942A Terminal Adapter is used, measurement time is 1.5 times longer than the value in Figure 2.

Trigger Function

Trigger type	Continuous, Single, Number of groups
Trigger source	Internal (Free run), External (BNC connector input), GPIB or LAN, Manual (Front key)
Trigger event type	Point trigger, Sweep trigger

Measurement Bandwidth/Averaging

Measurement bandwidth	
Range	1 (Fast) to 5 (Precise), 5 steps
Averaging	
Type	Sweep-to-sweep averaging, Point averaging
Averaging factor	1 to 256 (integer)

Adapter Setup

Adapter Selection	
NONE	No adapter (the 16047E, etc. direct connection type test fixture is connected)
4TP 1M	Four-terminal pair 1 m (16048G)
4TP 2M	Four-terminal pair 2 m (16048H)
7-mm 42942A	Terminal Adapter (42942A)
PROBE 42941A	Impedance Probe (42941A)

Calibration

Calibration	
User calibration	Calibration performed with user-defined calibration kit (OPEN, SHORT, LOAD)
Port extension	Compensation performed when the measurement terminal is expanded from the 7-mm connector of the 42942A Terminal Adapter or the 3.5-mm connector of the 42941A Impedance Probe. Enter electrical length or delay time for the extension.
Fixture compensation	Compensation performed at the device contacts of the test fixture using OPEN, SHORT, LOAD.
Calibration points	Fixed points, or User points determined by sweep setups

Measurement Accuracy

Conditions of Accuracy Specifications

Temperature	
Four-terminal pair port of the 4294A's front panel	23 ±5 °C Beyond 23 ±5 °C, the measurement accuracy is twice as bad as described.
7-mm port of the 42942A Terminal Adapter	Within ±5 °C from the adapter setup temperature. Measurement accuracy applies when the adapter setup is performed at 23 ±5 °C. When the adapter setup is performed beyond 23 ±5 °C, the measurement accuracy is twice as bad as described.
3.5-mm port of the 42941A Impedance Probe	Within ±5 °C from the adapter setup temperature. Measurement accuracy applies when the adapter setup is performed at 23 ±5 °C. When the adapter setup is performed beyond 23 ±5 °C, the measurement accuracy is twice as bad as described.
Measurement terminal of the 16048G or 16048H	Within ±5 °C from the adapter setup temperature. Measurement accuracy applies when the adapter setup is performed at 23 ±5 °C. When the adapter setup is performed beyond 23 ±5 °C, the measurement accuracy is twice as bad as described.
Measurement bandwidth	5

Measurement Accuracy

|Z|, |Y| accuracy	$\pm E$ [%] (see Equation 1 on page 10, Equation 2 on page 12, Equation 3 on page 14)
θ accuracy	$\pm E/100$ [rad]
L, C, X, B accuracy	
at $D_x \le 0.1$	$\pm E$ [%]
at $D_x > 0.1$	$\pm E \times \sqrt{1 + D_x^2}$ [%]
R accuracy	

at $D_x \leq 0.1$ ($Q_x \geq 10$)	Rp: $\pm \frac{E}{D_x \mp E/100}$ [%] Rs: $\pm E/D_x$ [%]
at $0.1 < D_x < 10$ ($0.1 < Q_x < 10$)	Rp: $\pm E \times \frac{\sqrt{1 + D_x^2}}{D_x \mp \frac{E}{100} \times \sqrt{1 + D_x^2}}$ [%] Rs: $\pm E \times \frac{\sqrt{1 + D_x^2}}{D_x}$ [%]
at $D_x \geq 10$ ($Q_x \leq 0.1$)	$\pm E$ [%]
D accuracy	
at $D_x \leq 0.1$	$\pm E/100$
at $0.1 < D_x \leq 1$	$\pm E \times (1 + D_x)/100$
Q accuracy (at $Q_x \times D_a < 1$)	
at $Q_x \leq 10$ ($D_x \geq 0.1$)	$\pm \frac{Q_x^2 \times E(1 + D_x)/100}{1 \mp Q_x \times E(1 + D_x)/100}$
at $Q_x > 10$ ($D_x < 0.1$)	$\pm \frac{Q_x^2 \times E/100}{1 \mp Q_x \times E/100}$
G accuracy	
at $D_x > 0.1$	$\pm E \times \frac{\sqrt{1 + D_x^2}}{D_x}$ [%]
at $D_x \leq 0.1$	$\pm E/D_x$ [%]

NOTE
D_x : measurement value of D.
Q_x : measurement value of Q.
D_a : measurement accuracy of D.

Impedance Measurement Accuracy at Four-Terminal Pair Port

Equation 1 shows the impedance measurement accuracy [%] at four-terminal pair port of the Agilent 4294A, or measurement port of the 16048G/16048H.

Equation 1. Impedance Measurement Accuracy [%] at Four-Terminal Pair Port

$$E = E_p' + \left(\frac{Z_s'}{|Z_x|} + Y_o' \cdot |Z_x| \right) \times 100$$

Where,

$E_P' = E_{PL} + E_{PBW} + E_{POSC} + E_P$ [%]
$Y_O' = Y_{OL} + K_{BW} \times Ky_{OSC} \times (Y_{ODC} + Y_O)$ [S]
$Z_S' = Z_{SL} + K_{BW} \times Kz_{OSC} \times Z_S$ [Ω]

Y_o, E_p, Z_s: See Figure 3 on page 17.

E_{posc} [%] =	
at oscillator level >500 mV	$0.03 \times \left(\frac{1000}{V_{mV}} - 1 \right) + \frac{f}{100}$
at oscillator level >250 mV, ≤500 mV	$0.03 \times \left(\frac{500}{V_{mV}} - 1 \right)$
at oscillator level >125 mV, ≤250 mV	$0.03 \times \left(\frac{250}{V_{mV}} - 1 \right)$
at oscillator level >64 mV, ≤125 mV	$0.03 \times \left(\frac{125}{V_{mV}} - 1 \right)$
at oscillator level ≤64 mV	$\left(\frac{64}{V_{mV}} - 1 \right) \times (0.03 + E_{PBW})$
Ky_{osc} =	
at oscillator level >500 mV	$\frac{1000}{V_{mV}}$
at oscillator level ≤500 mV	$\frac{500}{V_{mV}}$
Kz_{osc} =	
at oscillator level >500 mV	2
at oscillator level >250 mV, ≤500 mV	$\frac{500}{V_{mV}}$
at oscillator level >125 mV, ≤250 mV	$\frac{250}{V_{mV}}$
at oscillator level >64 mV, ≤125 mV	$\frac{125}{V_{mV}}$
at oscillator level ≤64 mV	$\frac{64}{V_{mV}}$

E_{PBW} [%] =	
at measurement BW = 5	0
at measurement BW = 4	
frequency ≥50 kHz	0.03
frequency <50 kHz	0.06
at measurement BW = 3	
frequency ≥50 kHz	0.1
frequency <50 kHz	0.2
at measurement BW = 2	
frequency ≥50 kHz	0.2
frequency <50 kHz	0.4
at measurement BW = 1	
frequency ≥50 kHz	0.4
frequency <50 kHz	0.8
K_{BW} =	
at measurement BW = 5	1
at measurement BW = 4	1
at measurement BW = 3	
frequency ≤1 MHz	3
frequency >1 MHz	4
at measurement BW = 2	
frequency ≤1 MHz	4
frequency >1 MHz	5
at measurement BW = 1	
frequency ≤1 MHz	6
frequency >1 MHz	10
Y_{ODC} =	
at dc bias range = 1 mA	0 [S]
at dc bias range = 10 mA	1 [μS]
at dc bias range = 100 mA	10 [μS]

E_{PL} [%] =

when 16048G is used	$0.02 + 2 \times \frac{f}{100}$
when 16048H is used	$0.02 + 3 \times \frac{f}{100}$

Y_{OL} =

when 16048G is used	$500 \times \frac{f}{100}$ [nS]
when 16048H is used	$1 \times \frac{f}{100}$ [µS]

Z_{SL} =

when 16048G or 16048H is used	
frequency ≥500 Hz	2 [mΩ]
frequency <500 Hz	5 [mΩ]

NOTE
SPC at frequency >10 MHz.
f : frequency in MHz.
V_{mV} *:* oscillator level in mV

Impedance Measurement Accuracy at 7-mm Port of the Agilent 42942A

Equation 2 shows the impedance measurement accuracy [%] at 7-mm port of the 42942A Terminal Adapter.

Equation 2. Impedance Measurement Accuracy [%] at 7-mm Port of the Agilent 42942A

$$E = E_p' + \left(\frac{Z_s'}{|Z_x|} + Y_o' \cdot |Z_x| \right) \times 100$$

Where,

$E_P' = E_{PBW} + E_{POSC} + E_P$ [%]
$Y_O' = K_{BW} \times Ky_{OSC} \times (Y_{ODC} + Y_O)$ [S]
$Z_S' = K_{BW} \times Kz_{OSC} \times Z_S$ [Ω]

Y_o, E_p, Z_s: See Figure 3 on page 17.

E_{posc} [%] =

at oscillator level >500 mV	$\frac{f}{100} \times \left(\frac{V_{mV}}{500} - 1 \right)$
at oscillator level >125 mV, ≤500 mV	0

at oscillator level ≤125 mV	$\left(\frac{125}{V_{mV}} - 1\right) \times (0.05 + E_{PBW})$
Ky_{osc} =	
at oscillator level ≥500 mV	1
at oscillator level <500 mV	$\frac{500}{V_{mV}}$
Kz_{osc} =	
at oscillator level >500 mV	$2 + \frac{f}{100}$
at oscillator level >250 mV, ≤500 mV	$\frac{500}{V_{mV}}$
at oscillator level ≤250 mV, >125 mV	$\frac{250}{V_{mV}}$
at oscillator level ≤125 mV	$\frac{125}{V_{mV}}$
E_{PBW} [%] =	
at measurement BW = 5	0
at measurement BW = 4	
frequency ≥50 kHz	0.03
frequency <50 kHz	0.06
at measurement BW = 3	
frequency ≥50 kHz	0.1
frequency <50 kHz	0.2
at measurement BW = 2	
frequency ≥50 kHz	0.2
frequency <50 kHz	0.4
at measurement BW = 1	
frequency ≥50 kHz	0.4
frequency <50 kHz	0.8
K_{BW} =	
at measurement BW = 5	1
at measurement BW = 4	1

at measurement BW = 3	3
at measurement BW = 2	4
at measurement BW = 1	6
Y_{ODC} =	
at dc bias range = 1 mA	0 [S]
at dc bias range = 10 mA	1 [μS]
at dc bias range = 100 mA	10 [μS]

NOTE
f : frequency in MHz.
V_{mV} : oscillator level in mV.

Impedance Measurement Accuracy at 3.5-mm Port of the Agilent 42941A
Equation 3 shows the impedance measurement accuracy [%] at 3.5-mm port of the 42941A Impedance Probe.

Equation 3. Impedance Measurement Accuracy [%] at 3.5-mm Port of the Agilent 42941A

$$E = E_p' + \left(\frac{Z_s'}{|Z_x|} + Y_o' \cdot |Z_x| \right) \times 100$$

Where,

$E_P' = E_{PBW} + E_{POSC} + E_P$ [%]
$Y_O' = K_{BW} \times Ky_{OSC} \times (Y_{ODC} + Y_O)$ [S]
$Z_S' = K_{BW} \times Kz_{OSC} \times Z_S$ [Ω]

Y_o, E_p, Z_s: See Figure 3 on page 17.

E_{posc} [%] =

at oscillator level >500 mV	$\frac{f}{100} \times \left(\frac{V_{mV}}{500} - 1 \right)$
at oscillator level >125 mV, ≤500 mV	0
at oscillator level ≤125 mV	$\left(\frac{125}{V_{mV}} - 1 \right) \times (0.05 + E_{PBW})$
Ky_{osc} =	
at oscillator level ≥500 mV	1
at oscillator level <500 mV	$\frac{500}{V_{mV}}$

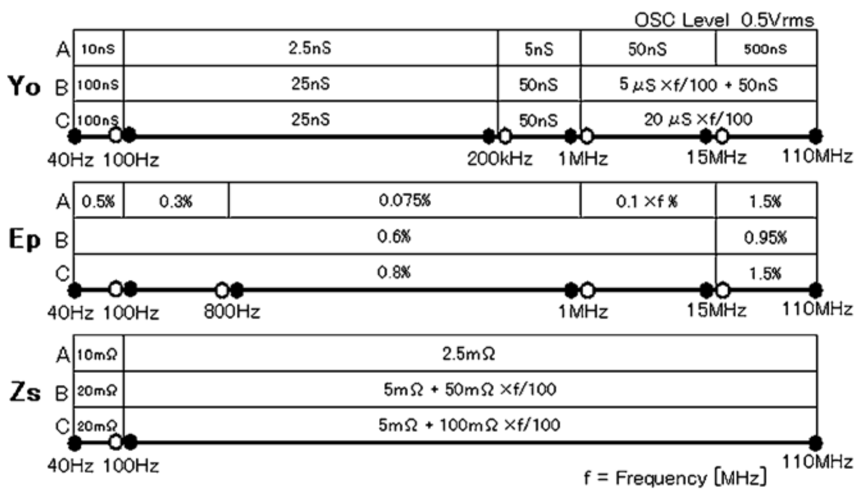
Kz_{osc} =	
at oscillator level >500 mV	$2 + \frac{f}{100}$
at oscillator level >250 mV, ≤500 mV	$\frac{500}{V_{mV}}$
at oscillator level ≤250 mV, >125 mV	$\frac{250}{V_{mV}}$
at oscillator level ≤125 mV	$\frac{125}{V_{mV}}$
E_{PBW} [%] =	
at measurement BW = 5	0
at measurement BW = 4	
frequency ≥50 kHz	0.03
frequency <50 kHz	0.06
at measurement BW = 3	
frequency ≥50 kHz	0.1
frequency <50 kHz	0.2
at measurement BW = 2	
frequency ≥50 kHz	0.2
frequency <50 kHz	0.4
at measurement BW = 1	
frequency ≥50 kHz	0.4
frequency <50 kHz	0.8
K_{BW} =	
at measurement BW = 5	1
at measurement BW = 4	1
at measurement BW = 3	3
at measurement BW = 2	4
at measurement BW = 1	6
Y_{ODC} =	
at dc bias range = 1 mA	0 [S]
at dc bias range = 10 mA	1 [μS]
at dc bias range = 100 mA	10 [μS]

NOTE
f : frequency in MHz.
V_{mV} : oscillator level in mV.

Temperature Coefficient of the Agilent 42941A Impedance Probe (SPC)

Proportional part (at 50 Ω measurement)	
|Z| deviation [ppm/°C]	
at frequency ≤1 MHz	<5
at frequency >1 MHz	$20 + 500 \times \frac{f}{100}$
θ deviation [μrad/°C]	
at frequency ≤1 MHz	<5
at frequency >1 MHz, ≤5 MHz	$30 \times \frac{f}{5}$
at frequency >5 MHz, ≤30 MHz	$50 + 150 \times \frac{f}{30}$
at frequency >30 MHz	200
Residual part	
Residual impedance	$5 \times \frac{f}{100}$ [mΩ/°C]
Residual admittance	$\frac{f}{100}$ [μS/°C]

NOTE
f : frequency in MHz.
These characteristics apply when the temperature of the probe (tip to 30 cm) is changed.



A = 4294A front panel 4 terminal pair port (no extension),
B = 7-mm one port (with 42942A).
C = Probe 3.5-mm port (with 42941A).
For accuracy at probe tip, add the following error factors (typical):
Yo: + $2\pi f \times 0.1\ \mu S$
Zs: + 20mΩ

Figure 3. Parameters Y_o, E_p, and Z_S

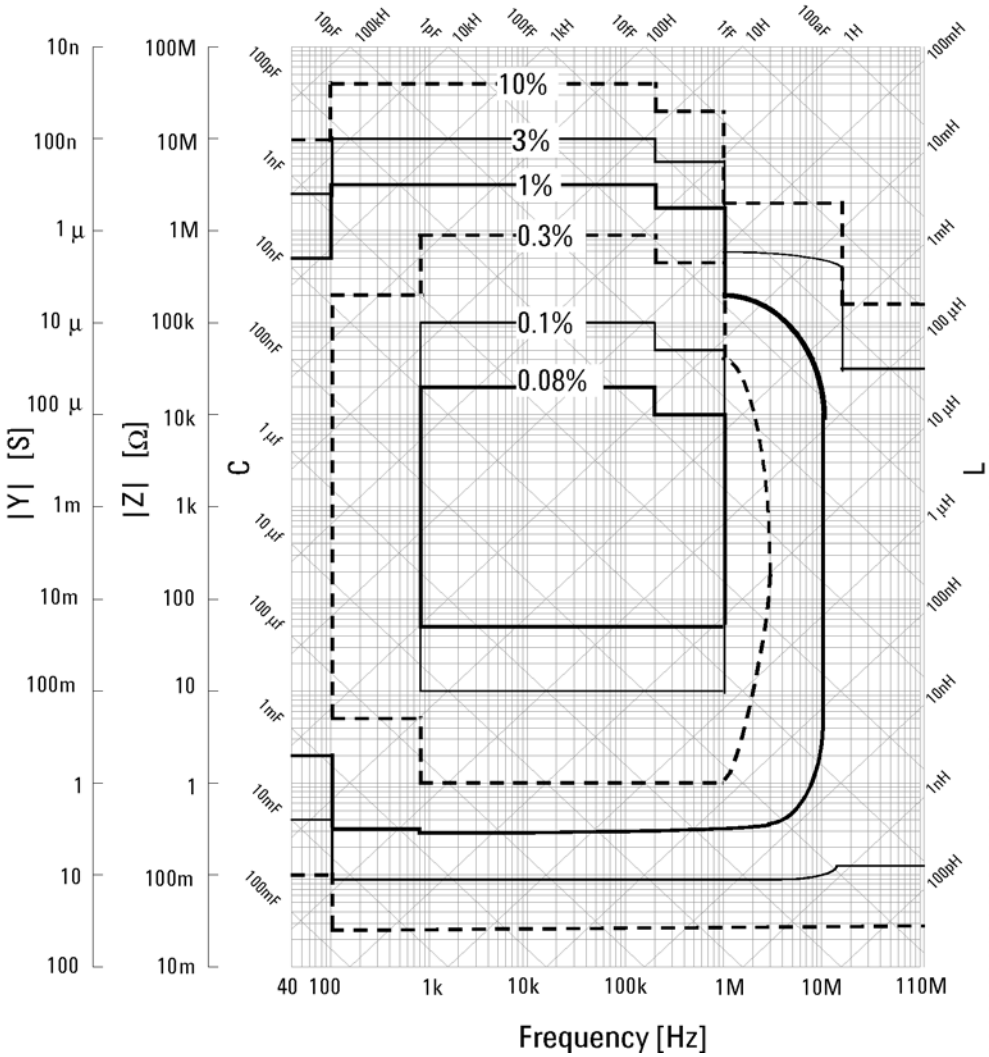


Figure 4. Examples of Calculated Impedance Measurement Accuracy at Four-Terminal Pair Port of the Agilent 4294A's Front Panel (Oscillator Level = 0.5 Vrms)

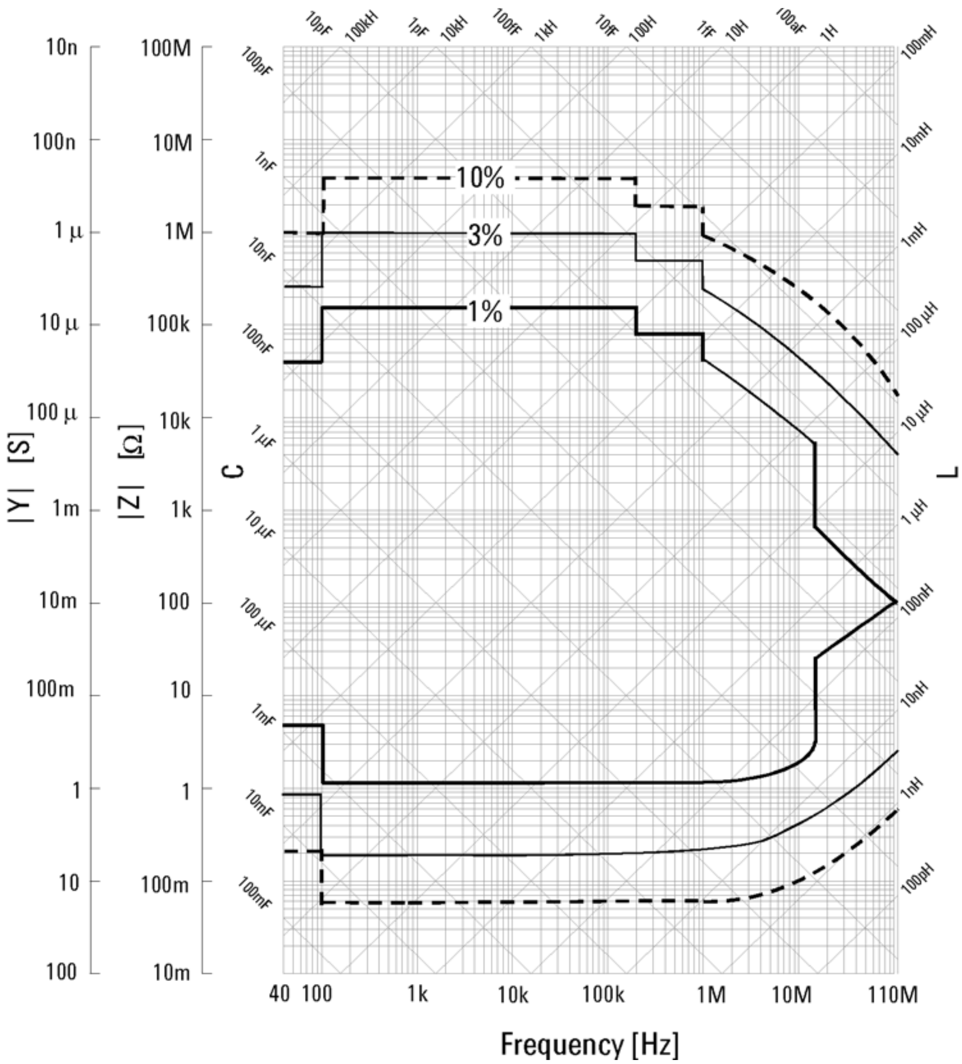


Figure 5. Impedance Measurement Accuracy at 7-mm Port of the Agilent 42942A Terminal Adapter Connected to the Agilent 4294A (Oscillator Level = 0.5 Vrms)

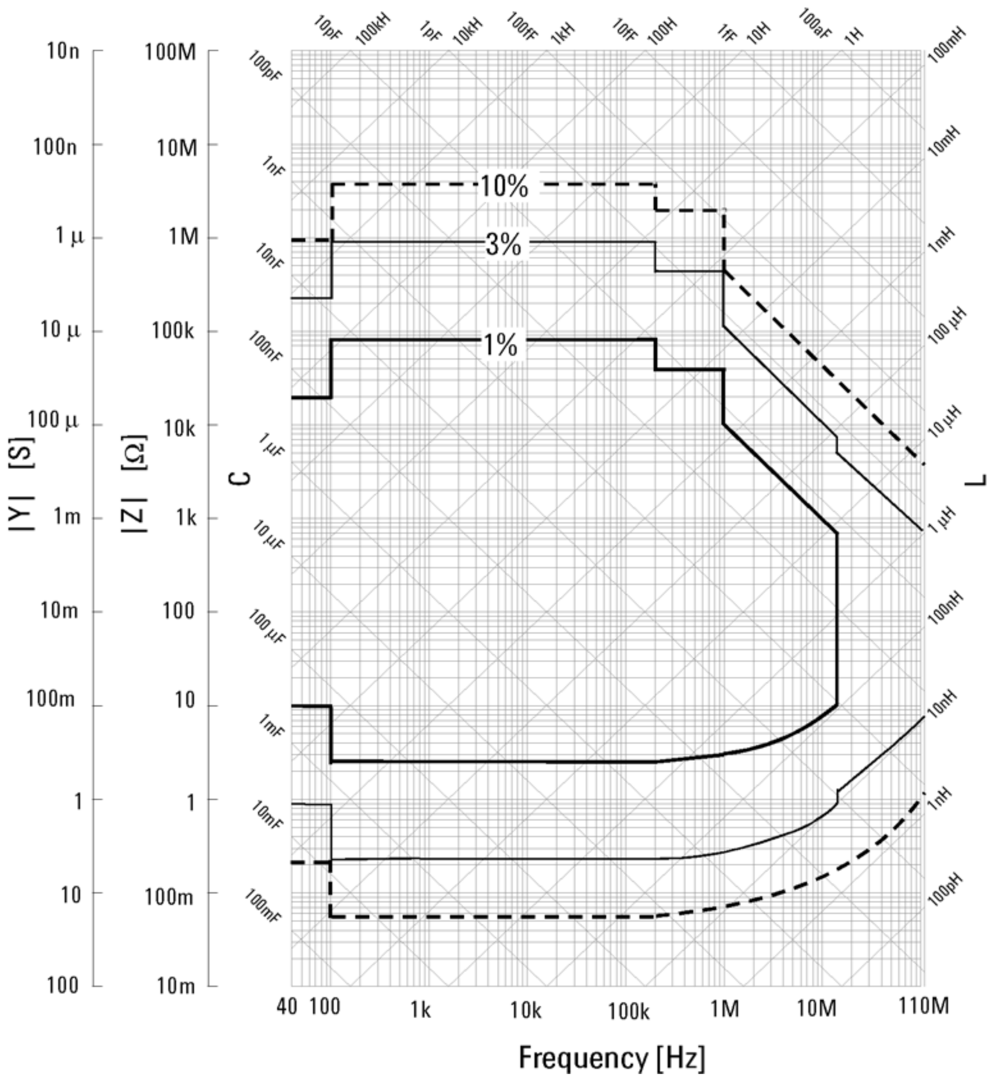


Figure 6. Impedance Measurement Accuracy at 3.5-mm port of the Agilent 42941A Impedance Probe Connected to the Agilent 4294A (Oscillator Level = 0.5 Vrms)

Display Function

Display	
Size/Type	8.4 inch color LCD (TFT)
Number or pixels	640 × 480 (VGA)
Scale type	
X axis scale	Linear and Log
Y axis scale	Linear and Log (depends on the sweep type)
Number of traces	
Data trace	2 traces (trace A and trace B)
Memory trace	2 traces (trace A and trace B)
Split display	Available (trace A: upper half, trace B: lower half)
Instrument/IBASIC display selection	All Instrument, Half Instrument and half IBASIC, all IBASIC, or Instrument and IBASIC status.
Other display function	Inactive trace off, Trace accumulation, Phase expansion
Data math function	Data—Memory, Data/Memory[1], Delta%[2], Offset

1. Complex Z-Y measurement only.
2. Except for Complex Z-Y measurement.

Marker Function

Marker type and number	
Main marker	One for each trace (A and B).
Sub marker	Seven for each trace (A and B).
Δ marker	One for each trace (A and B).
Marker search	
Search type	Maximum, Minimum, Target, Peak, Trace bandwidth analysis
Search track	Performs search by each sweep
Marker X-axis display	Sweep parameter value, Sweep elapsed time, or Relaxation time (1/2πf)
Others	Marker continuous mode, Δ marker mode, Marker coupled mode, Marker value substitution (Marker→), Marker zooming, Marker list, Marker statistics, Marker signal/dc bias monitor

Equivalent Circuit Analysis

Circuit model	3 component model (4 models), 4 component model (1 model)
Analysis type	Equivalent circuit parameters calculation, Frequency characteristics simulation

Limit Line Test

Available setup parameters for each segment	Sweep start value, sweep stop value, upper limit (middle value) and lower limit (delta limit) for sweep start, upper limit (middle value) and lower limit (delta limit) for sweep stop
Number of segments	1 to 18
Other functions	Beep fail, Limit line offset

Mass Storage

Flexible disk drive	
Type	3.5 inch, Built-in
Size	1.44 MB
Format	DOS
Formatting	Available
Volatile memory disk	
Size	512 KB
Non-volatile memory disk (Flash memory)	
Size	10 MB
Stored data	State (binary), Data (binary or ASCII), Display graphics (TIFF)

Printer Parallel Port

Interface Standard	IEEE 1284 Centronics
Printer control language	HP PCL3 printer control language
Connector type	25 pin D-SUB connector

GPIB

Standard conformity	IEEE 448.1-1987, IEEE 488.2-1987, IEC 625, JIS C ,1901-1987
Available functions (function code)[1]	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C11, E2
Numeric data transfer format	ASCII, 32 or 64 bit IEEE 754 floating point format, DOS PC format (32 bit IEEE reversed byte order)

1. See document of the standard for the meaning of each code.

Instrument BASIC

Keyboard	
Type	PS/2 style 101 English
Connector Type	Mini-DIN connector

8 Bit I/O Port

Connector type	15 pin D-SUB connector
Signal level	TTL
Number of I/O bit	4 bit for input, 8 bit for output
Pin assignment	(see Figure 7)

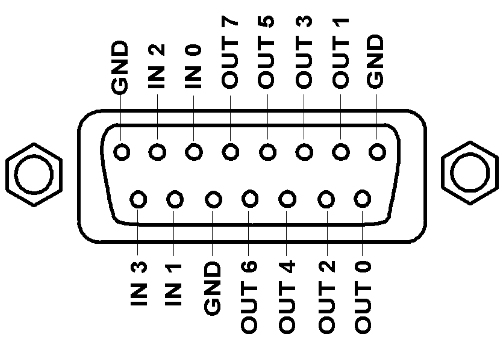


Figure 7. 8 Bit I/O Port Pin Assignment

24 Bit I/O Port (Handler Interface)

Connector type	36 pin D-SUB connector
Signal level	TTL
Number of I/O bit	8 bit for input or output, 16 bit for output
Pin Assignment	(see Figure 8 and Table 1)

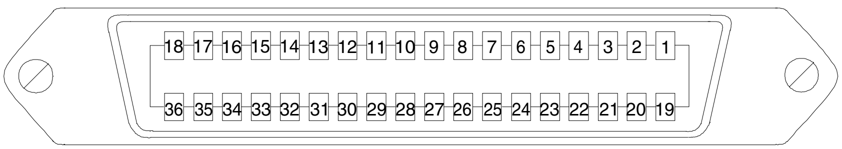


Figure 8. 24 Bit I/O Port Pin Assignment

Table 1. 24 Bit I/O Port Pin Assignment

Pin No.	Signal Name	Signal Standard
1	GND	0 V
2	INPUT1	TTL level, pulse input, pulse width: 1 µs or above
3	OUTPUT1	TTL level, latch output
4	OUTPUT2	TTL level, latch output
5	Output port A0	TTL level, latch output
6	Output port A1	TTL level, latch output
7	Output port A2	TTL level, latch output
8	Output port A3	TTL level, latch output
9	Output port A4	TTL level, latch output
10	Output port A5	TTL level, latch output
11	Output port A6	TTL level, latch output
12	Output port A7	TTL level, latch output
13	Output port B0	TTL level, latch output
14	Output port B1	TTL level, latch output
15	Output port B2	TTL level, latch output
16	Output port B3	TTL level, latch output

Table 1. 24 Bit I/O Port Pin Assignment

Pin No.	Signal Name	Signal Standard
17	Output port B4	TTL level, latch output
18	Output port B5	TTL level, latch output
19	Output port B6	TTL level, latch output
20	Output port B7	TTL level, latch output
21	Input/Output port C0	TTL level, latch output
22	Input/Output port C1	TTL level, latch output
23	Input/Output port C2	TTL level, latch output
24	Input/Output port C3	TTL level, latch output
25	Input/Output port D0	TTL level, latch output
26	Input/Output port D1	TTL level, latch output
27	Input/Output port D2	TTL level, latch output
28	Input/Output port D3	TTL level, latch output
29	Port C status	TTL level, input mode; LOW, output mode: HIGH
30	Port D status	TTL level, input mode; LOW, output mode: HIGH
31	Write strobe signal	TTL level, active low, pulse output (width: 10 μs, typical)
32	+5 V pullup	
33	SWEEP END signal	TTL level, active low, pulse output (width: 20 μs, typical)
34	+5 V	+5 V, 100 mA MAX
35	PASS/FAIL signal	TTL level, PASS: HIGH, FAIL; LOW, latch output
36	PASS/FAIL write strobe signal	TTL level, active low, pulse output (width: 10 μs, typical)

LAN Interface

Standard conformity	10 Base-T Ethertwist, RJ45 connector
Protocol	TCP/IP
Supported application	Telnet, FTP, FTP with automatic execution

General Characteristics

External Reference Input

Frequency	10 MHz ±10 ppm (typical)
Level	– 5 dBm to +5 dBm (typical)
Input impedance	50 Ω (nominal)
Connector type	BNC (female)

Internal Reference Output

Frequency	10 MHz (nominal)
Level	0 dBm (typical)
Output impedance	50 Ω (nominal)
Connector type	BNC (female)

High Stability Frequency Reference Output (Option 4294A-1D5)

Frequency	10 MHz (nominal)
Level	0 dBm (typical)
Output impedance	50 Ω (nominal)
Connector type	BNC (female)

External Trigger Input

Level	TTL
Pulse width (Tp)	≥2 μs (typical); see Figure 9 for the definition of Tp.
Polarity	Positive or Negative (selective)
Connector type	BNC (female)

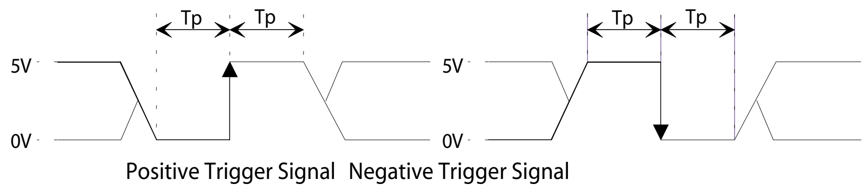


Figure 9. Required Pulse Width (Tp) for External Trigger Input

External Program RUN/CONT Input

Level	TTL
Connector type	BNC (female)

External Monitor Output

Connector type	D-SUB, 15 pin HD
Display resolution	640 × 480 (VGA)

Operating Conditions

Temperature	
Disk drive non-operating condition	0 °C to 40 °C
Disk drive operating condition	10 °C to 40 °C
Humidity (at wet bulb temperature ≤29 °C, without condensation)	
Disk drive non-operating condition	15% to 95% RH
Disk drive operating condition	15% to 80% RH
Altitude	0 m to 2,000 m
Warm-up time	30 minutes

Non-operating Conditions

Temperature	–20 °C to +60 °C
Humidity (at wet bulb temperature ≤45 °C, without condensation)	15% to 95% RH
Altitude	0 m to 4,572 m

Others

EMC	EN 55011(1991)/CISPR 11(1990) Group 1, Class A EN 50082-1(1992)/IEC 61000-4-2(1995) 4 kV CD, 8 kV AD EN 50082-1(1992)/IEC 61000-4-3(1995) 3 V/m, 27 MHz to 1 GHz EN 50082-1(1992)/IEC 61000-4-4(1995) 0,5 kV Signal Line, 1 kV Power Line EN 61000-3-2(1995)/IEC 61000-3-2(1995) EN 61000-3-3(1995)/IEC 61000-3-3(1994)z
Safety	EN 61010-1(1993) +Amd2(1995)/IEC61010-1(1990) +Am1(1992) +Am2(1995) CSA-C22.2 N0.1010.1-92
Power requirement	90 V to 132 V, or 198 V to 264 V (automatically switched), 47 Hz to 63 Hz, 300 VA max.
Weight	25 kg (SPC)
Dimensions	See Figures 10 through 12.

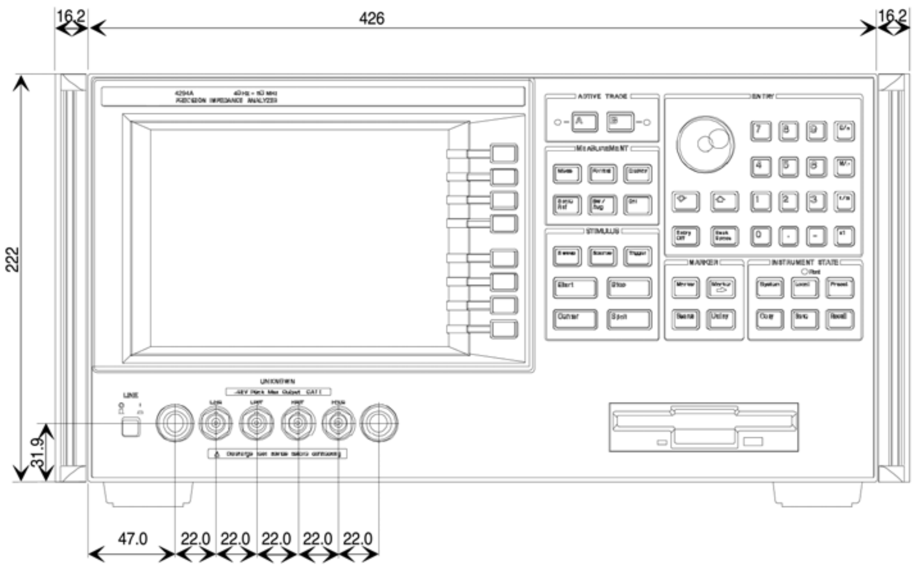


Figure 10. Agilent 4294A dimensions (front view, with Option 4294A-1CN/4294A-1D5, typical, in millimeters)

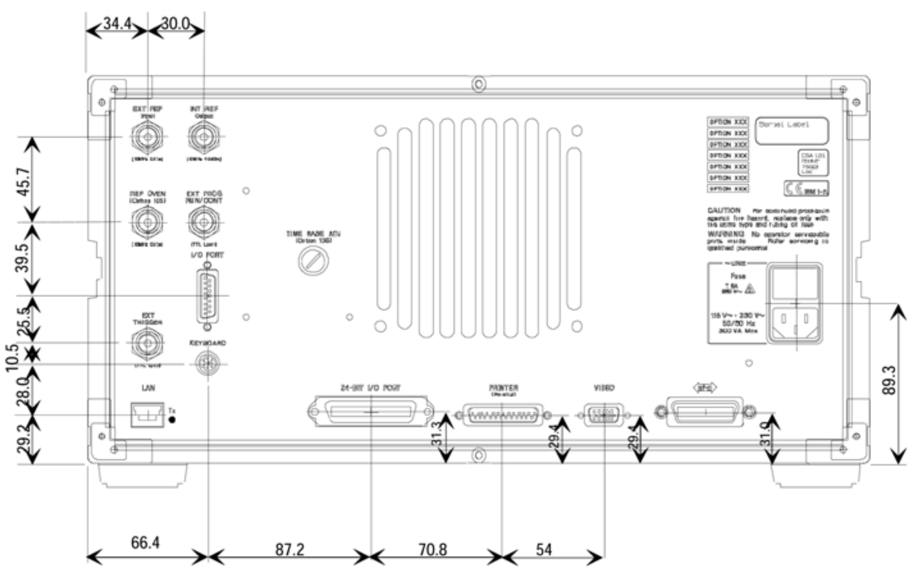


Figure 11. Agilent 4294A dimensions (rear view, with Option 4294A-1CN/4294A-1D5, typical, in millimeters)

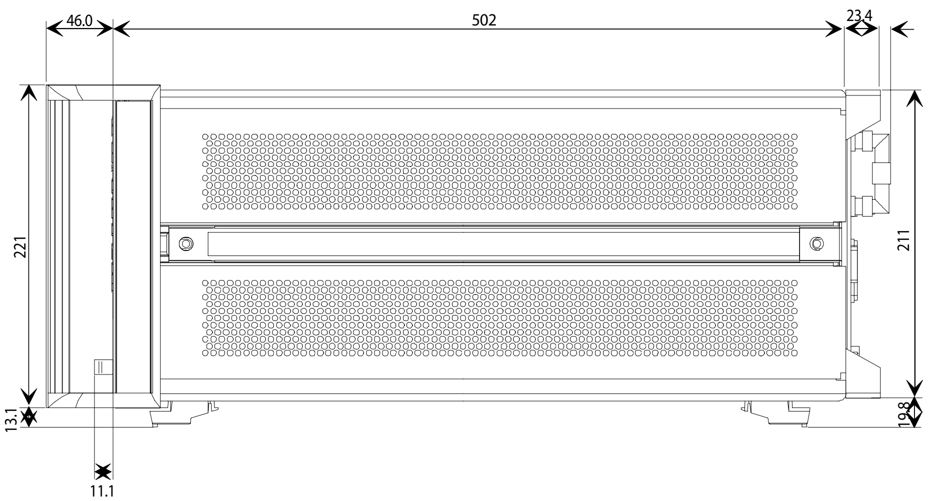


Figure 12. Agilent 4294A dimensions (side view, with Option 4294A-1CN/4294A-1D5, typical, in millimeters)

Furnished Accessories

Agilent Part Number	Description	Qty
04294-90040/04294-97040	Operation Manual (English/Japanese)[1]	1
04294-90041/04294-97031	Programming Manual (English/Japanese)[1]	1
E2083-90005	Instrument BASIC User's Handbook[1]	1
04294-90100	Service Manual[2]	1
04294-18000	Sample Program Disk (3.5 inch)[1]	1
04294-61001	100 Ω Resister	1
C3757-60401	Mini-DIN Keyboard[3]	1
———	Power Cable[4]	1
1250-1859	BNC Adapter[5]	1
5062-3991	Handle Kit[6]	1
5062-3979	Rackmount Kit[7]	1
5062-3985	Rackmount & Handle Kit[8]	1

1. Not furnished if Option 4294A-ABA/ABJ (English/Japanese manual) is not designated.
2. Option 4294A-0BW (Add service manual) only.
3. Not furnished if Option 4294A-810 (add keyboard) is not designated.
4. The power cable depends on which country the instrument is used in.
5. Option 4294A-1D5 (high stability frequency reference) only.
6. Option 4294A-1CN (handle kit) only.
7. Option 4294A-1CM (rackmount kit) only.
8. Option 4294A-1CP (rackmount and handle kit) only.

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