

Keysight E4360 Modular Solar Array Simulator

E4361A–E4362A Output Modules
E4360A SAS Mainframe

Specifications Guide

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Where to Find the Latest Information

This document provides specification and supplemental characteristic information for the following instruments:

- Keysight E4361A through E4362A Output Modules
- Keysight E4360A SAS Mainframes

The web contains the most up to date version of this manual. Go to www.keysight.com/find/E4360 under Technical Support to obtain the latest version of the manual.

NOTE

You can contact Keysight Technologies at one of the following telephone numbers for warranty, service, or technical support information.

In the United States: (800) 829-4444

In Europe: 31 20 547 2111

In Japan: 0120-421-345

Or use our Web link for information on contacting Keysight in your country or specific location: www.keysight.com/find/assist

Or contact your Keysight Technologies Representative.

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Chapter 1

Keysight E4360A

Output Module Differences

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Output Module Differences

Model	Output Voltage (open circuit)	Output Current (short circuit)	Output Power (maximum)
E4361A	65 V	8.5 A	510 W
E4361A-J01	58 V	9.3 A	497.6 W
E4361A-J02	75 V	8 A	553.6 W
E4361A-J03	85 V	7 A	549.2 W
E4361A-J11*	40 V	2 A	73.8 W
E4362A	130 V	5 A	600 W
E4362A-J01	117 V	5.5 A	594 W
E4362A-J02	120 V	5.4 A	594 W
E4362A-J03	108 V	6 A	600 W
E4362A-J04	170 V	3.8 A	596.6 W
E4362A-J05	95 V	6.3 A	552.5 W
E4362A-J06	180 V	3.4 A	564.9 W
E4362A-J18	150 V	4 A	560 W
E4362A-J21	114 V	6.75 A	708.8 W

*This output module can only be installed in a Keysight E4360AJ01 1U mainframe.

Chapter 2

Keysight E4361A SAS

Output Modules

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Performance Specifications are warranted over a temperature range of 0 to 40°C unless specified otherwise. Unless otherwise noted, specifications apply to Fixed, SAS, and Table modes.

Refer to the Keysight E4360A Service Guide for the setup conditions for all performance specifications.

Supplemental characteristics are not warranted but are descriptions of performance determined either by design or by type testing. All supplemental characteristics are typical unless otherwise noted.

Performance Specifications

Parameter	Keysight E4361A	Keysight E4361A-J01	Keysight E4361A-J02	Keysight E4361A-J03	Keysight E4361A-J11
Output Ratings – SAS and Table mode					
Maximum power:	510 W	497.6 W	553.6 W	549.2 W	73.8 W
Maximum open-circuit voltage (Voc):	65 V	58 V	75 V	85 V	40 V
Maximum voltage point (Vmp):	60 V	53.5 V	69.2 V	78.5 V	36.9 V
Maximum short-circuit current (Isc)					
@ 220/240 VAC nominal:	8.5 A	9.3 A	8 A	7 A	2 A
@ 100/120 VAC nominal: ¹	4.25 A	4.65 A	4 A	3.5 A	2 A
Maximum current point (Imp)					
@ 220/240 VAC nominal:	8.5 A	9.3 A	8 A	7 A	1 A
@ 100/120 VAC nominal: ¹	4.25 A	4.65 A	4 A	3.5 A	1 A
Minimum impedance ($\Delta V/\Delta I$) ²	0.25 Ω	0.25 Ω	0.31 Ω	0.4 Ω	0.65 Ω
Output Ratings – Fixed mode					
Voltage:	0 – 60 V	0 – 53.5 V	0 – 69.2 V	0 – 78.5 V	0 – 36.9 V
Current @ 220/240 VAC nominal:	0 – 8.5 A	0 – 9.3 A	0 – 8 A	0 – 7 A	0 – 2 A
@ 100/120 VAC nominal: ¹	0 – 4.25 A	0 – 4.65 A	0 – 4 A	0 – 3.5 A	0 – 2 A
Current Derating – from 40°C to 55°C	0.11 A/°C	0.12 A/°C	0.10 A/°C	0.088 A/°C	0.03 A/°C
Output Voltage Ripple & Noise (from 20 Hz to 20 MHz with a resistive load, outputs ungrounded, or either output grounded)					
SAS and Table mode:	20 mV rms 125 mV p-p	20 mV rms 125 mV p-p	21 mV rms 136 mV p-p	22 mV rms 147 mV p-p	22 mV rms 99 mV p-p
Fixed mode (constant voltage):	24 mV rms 150 mV p-p	24 mV rms 150 mV p-p	25 mV rms 150 mV p-p	26 mV rms 150 mV p-p	22 mV rms 150 mV p-p
Programming Accuracy (@ 23°C $\pm 5^\circ$) ³					
Fixed mode voltage:	0.075% +25mV	0.075% +22mV	0.075% +29mV	0.075% +33mV	0.075% +16mV
Current:	0.20% +20 mA	0.20% +22 mA	0.20% +19 mA	0.20% +17 mA	0.20% +5 mA
Readback Accuracy ⁴ (from front panel or over GPIB with respect to actual output @ 23° $\pm 5^\circ$ C)					
Voltage:	0.08% +25 mV	0.08% +22 mV	0.08% +29 mV	0.08% +33 mV	0.08% +16 mV
+Current:	0.20% +20 mA	0.20% +23 mA	0.20% +19 mA	0.20% +17 mA	0.20% +5 mA
–Current:	0.35% +48 mA	0.35% +53 mA	0.35% +46 mA	0.35% +40 mA	0.35% +12 mA
Load Regulation – Fixed mode (change in output voltage or current for any load change within ratings)					
Constant voltage:	2 mV	2 mV	2 mV	2 mV	2 mV
Constant current:	1 mA	1 mA	1 mA	1 mA	1 mA
Line Regulation – Fixed mode (change in output voltage or current for any mains change within ratings)					
Constant voltage:	2 mV	2 mV	2 mV	2 mV	2 mV
Constant current:	1 mA	1 mA	1 mA	1 mA	1 mA

¹There is no current derating when only one output module is installed in the mainframe.

²There is no maximum impedance restriction. The programmed value of Imp can be less than or equal to Isc.

³In SAS mode, the output current is related to the readback output voltage by an internal algorithm. In Table mode, the output current is related to the readback output voltage by interpolation between points that are entered by the user.

Supplemental Characteristics

Parameter	Keysight E4361A	Keysight E4361A-J01	Keysight E4361A-J02	Keysight E4361A-J03	Keysight E4361A-J11
Output Current Ripple & Noise (from 20 Hz to 20 MHz with a resistive load, outputs ungrounded, or either output grounded)					
SAS and Table mode:	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p
Fixed mode (constant current):	2.5 mA rms 19 mA p-p	2.5 mA rms 19 mA p-p	2.5 mA rms 19 mA p-p	2.5 mA rms 19 mA p-p	2.5 mA rms 19 mA p-p
Output Programming Range (maximum programmable values)					
SAS and Table mode voltage:	0 – 65 V	0 – 58 V	0 – 75 V	0 – 85 V	0 – 40 V
Fixed mode voltage:	0 – 61.5 V	0 – 54.8 V	0 – 71.0 V	0 – 80.4 V	0 – 37.8 V
Output @ 220/240 VAC nominal:	0 – 8.67A	0 – 9.48 A	0 – 8.16 A	0 – 7.14 A	0 – 2.04 A
@ 100/120 VAC nominal: ¹	0 – 4.33 A	0 – 4.75 A	0 – 4.08 A	0 – 3.57 A	0 – 2.04 A
Over-voltage protection:	0 – 74 V	0 – 66.7 V	0 – 84.3 V	0 – 94.6 V	0 – 48.2 V
Over-current limit:	0 – 10.6 A	0 – 11.6 A	0 – 10.0 A	0 – 8.8 A	0 – 2.5 A
Programming Resolution (average values)					
Voltage:	19 mV	17 mV	21 mV	24 mV	11 mV
Current:	2.7 mA	3.0 mA	2.5 mA	2.2 mA	0.6 mA
Over-voltage protection:	325 mV	295 mV	367 mV	409 mV	219 mV
Over-current limit:	46 mA	52 mA	43 mA	38 mA	11 mA
Programming Accuracy					
Over-voltage protection:	0.65 V	0.60 V	0.73 V	0.82 V	0.44 V
Over-current limit:	0.5% +215 mA	0.5% +235 mA	0.5% +202 mA	0.5% +177 mA	0.5% +51 mA
Current monitor (referenced to P common):	1.0% +130 mA	1.0% +140 mA	1.0% +122 mA	1.0% +107 mA	1.0% +31 mA
Fixed Mode Analog Current Programming					
Analog programming:	1.0% +5.5 mA	1.0% +6 mA	1.0% +5.2 mA	1.0% +4.5 mA	1.0% +1.3 mA
+Ip to –Ip Differential Input (from 0 to full scale):	0 to –4 V	0 to –4 V	0 to –4 V	0 to –4 V	0 to –4 V
Maximum common mode voltage (referenced to +):	±18 V	±18 V	±18 V	±18 V	±18 V
Nominal input impedance:	20 kΩ	20 kΩ	20 kΩ	20 kΩ	20 kΩ
Drift/Temperature Stability (change in output over 8 hours under constant load, line, and ambient, following a 30-minute warmup)					
Voltage:	0.04% +1 mV	0.04% +0.9 mV	0.04% +1.2 mV	0.04% +1.3 mV	0.04% +0.6 mV
Current:	0.10% +0.85mA	0.10% +0.93mA	0.10% +0.8 mA	0.10% +0.7 mA	0.10% +200μA
Temperature Coefficients (output change per °C)					
Voltage:	0.01% +325 μV	0.01% +290 μV	0.01% +375 μV	0.01% +425 μV	0.01% +200μV
Current:	0.025% +215μA	0.025% +235μA	0.025% +202μA	0.025% +177μA	0.025% +51μA
Output Capacitance					
Capacitance:	< 100 nF	< 100 nF	< 100 nF	< 100 nF	< 100 nF
Maximum Reverse Diode Current (with fans running)					
Current:	8.5 A	9.3 A	8.0 A	7.0 A	2.0 A

¹There is no current derating when only one output module is installed in the mainframe, or with mainframe model E4360AJ01.

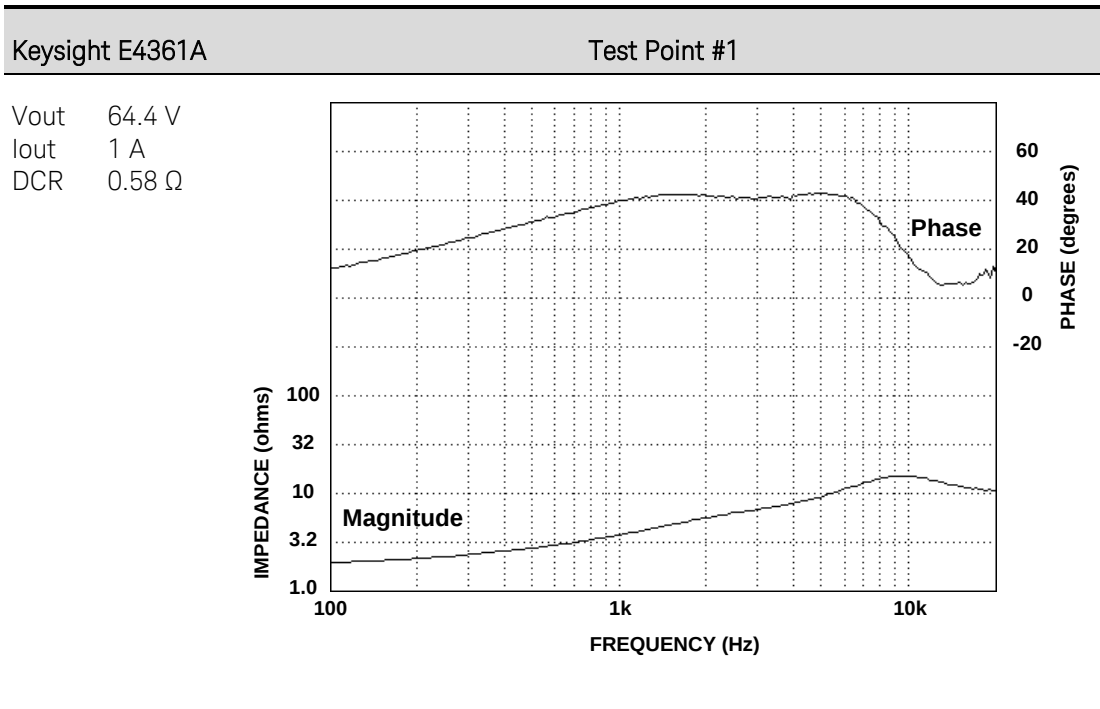
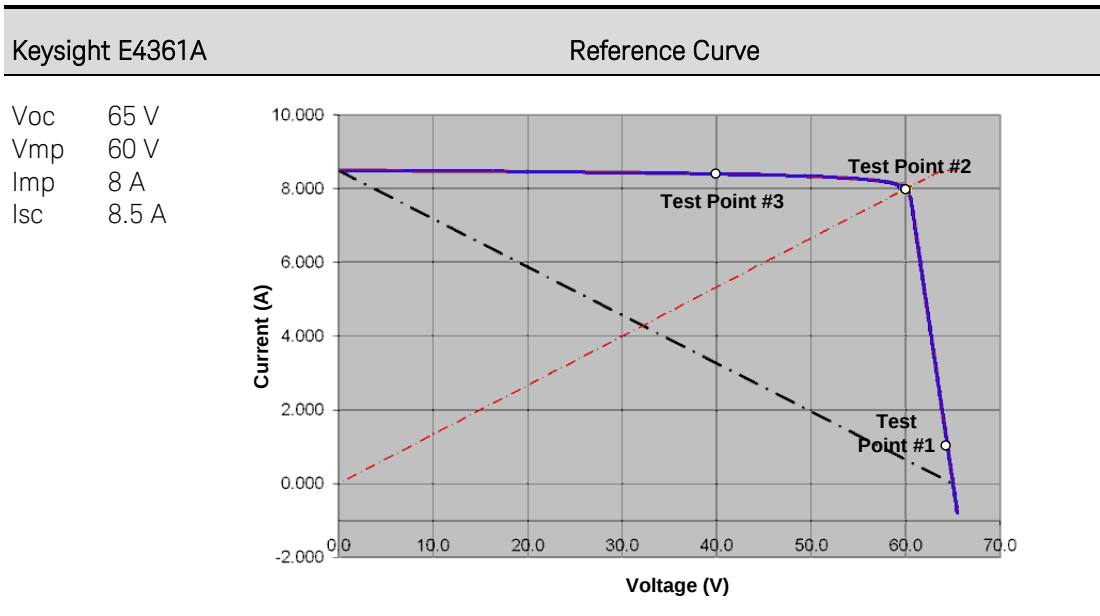
Supplemental Characteristics (continued)

Parameter	All E4361A Output Modules
Output Current Settling Time (recovery to within 1.5 A of an operating point on the I-V curve ($V < 90\%$ of VMP) after switching from a short circuit to a fixed load)	$< 5 \mu\text{s}$
Current Monitor Output (IM– with respect to P▽)	0 V to –4 V represents zero to the rated output current
Maximum Capacitive Load for stable operation	
SAS and Table mode:	No Restriction
Fixed mode:	2000 μF
Load Lead Drop with Remote Sensing	
SAS and Table mode:	up to 2 volts + ($V_{oc} - V_{mp}$)
Fixed mode:	up to 2 volts total
Current Sinking Capability	
SAS and Table mode:	560 mA for all except: 300 mA for E4361A–J11 only
Fixed mode:	440 mA for all except: 320 mA for E4361A–J11 only
Voltage Programming Rise/Fall Time (time for output to change from 90% to 10% or 10% to 90% of its total excursion)	$< 8 \text{ ms}$
Voltage Programming Settling Time (time for output change to settle within 0.1% of its Fixed mode voltage rating)	25 ms typical for all except: 30 ms typical for E4361A–J11 only
Monotonicity	Output is monotonic over entire rated voltage, current, and temperature range
Auto-Parallel Configuration	Up to 4 outputs
Series and Shunt Switching Frequency (frequency is controlling by a customer-supplied external series or shunt FET connected to the output.)	50 kHz maximum ² for all except: 4 kHz maximum ² for E4361A–J11 only
Output Terminal Isolation (from any terminal to chassis ground – this includes float plus output voltage)	$\pm 240 \text{ Vdc}$ maximum
Recommended Calibration Interval	1 year

²Higher switching frequencies may be possible given the right load conditions consisting of but not necessarily limited to the inductance of the load cable to the shunt switch and the on/off edge rate of the shunt switch.

Output Impedance in SAS Mode

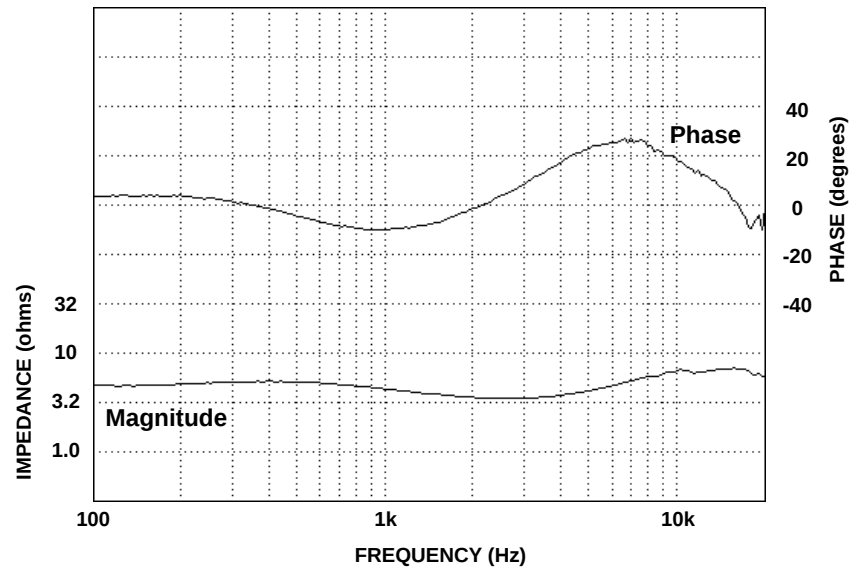
The following impedance graphs were generated at three points on Keysight Models E4361A operating in SAS mode. The reference curve shows the location of the three sample points on which the output impedance graphs are based.



Keysight E4361A

Test Point #2

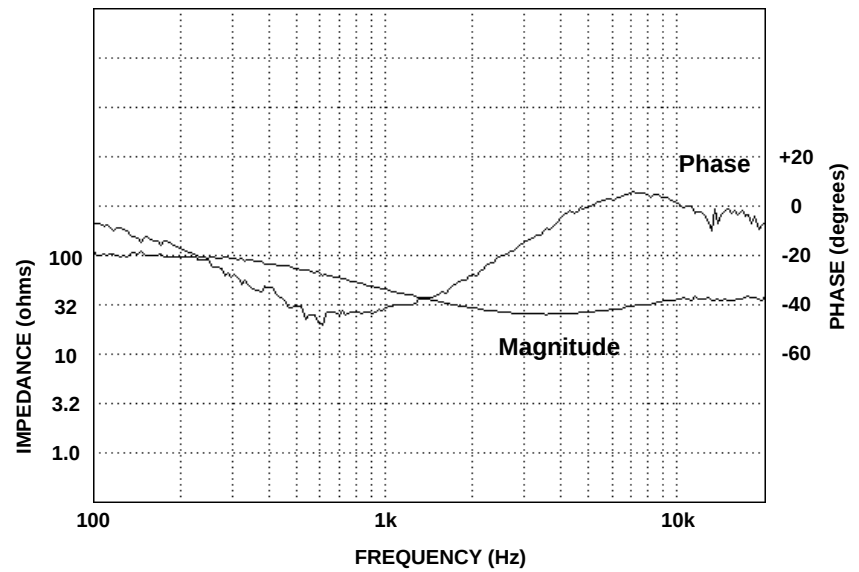
Vout 60 V
Iout 8 A
DCR 4.8 Ω



Keysight E4361A

Test Point #3

Vout 40 V
Iout 8.4 A
DCR 110 Ω



Chapter 3

Keysight E4362A SAS

Output Modules

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Performance Specifications are warranted over a temperature range of 0 to 40°C unless specified otherwise. Unless otherwise noted, specifications apply to Fixed, SAS, and Table modes.

Refer to the Keysight E4360A Service Guide for the setup conditions for all performance specifications.

Supplemental characteristics are not warranted but are descriptions of performance determined either by design or by type testing. All supplemental characteristics are typical unless otherwise noted.

Performance Specifications

Parameter	Keysight E4362A	Keysight E4362A-J01	Keysight E4362A-J02	Keysight E4362A-J03
Output Ratings – SAS and Table mode				
Maximum power:	600 W	594 W	594 W	600 W
Maximum open-circuit voltage (Voc):	130 V	117 V	120 V	108 V
Maximum voltage point (Vmp):	120 V	108 V	110 V	100 V
Maximum short-circuit current (Isc)				
@ 220/240 VAC nominal:	5.0 A	5.5 A	5.4 A	6 A
@ 100/120 VAC nominal: ¹	2.5 A	2.75 A	2.7 A	3 A
Maximum current point (Imp)				
@ 220/240 VAC nominal:	5.0 A	5.5 A	5.4 A	6 A
@ 100/120 VAC nominal: ¹	2.5 A	2.75 A	2.7 A	3 A
Minimum impedance ($\Delta V/\Delta I$) ²	1 Ω	1 Ω	1 Ω	1 Ω
Output Ratings – Fixed mode				
Voltage:	0 – 120 V	0 – 108 V	0 – 110 V	0 – 100 V
Current				
@ 220/240 VAC nominal:	0 – 5.0 A	0 – 5.5 A	0 – 5.4 A	0 – 6.0 A
@ 100/120 VAC nominal: ¹	0 – 2.5 A	0 – 2.75 A	0 – 2.7 A	0 – 3.0 A
Current Derating – from 40°C to 55°C	0.063 A/°C	0.069 A/°C	0.068 A/°C	0.075 A/°C
Output Voltage Ripple & Noise (from 20 Hz to 20 MHz with a resistive load, outputs ungrounded, or either output grounded)				
SAS and Table mode:	24 mV rms 195 mV p-p	24 mV rms 195 mV p-p	24 mV rms 195 mV p-p	23 mV rms 172 mV p-p
Fixed mode (constant voltage):	30 mV rms 150 mV p-p	30 mV rms 150 mV p-p	30 mV rms 150 mV p-p	28 mV rms 150 mV p-p
Programming Accuracy (@ 23°C $\pm$ 5°C) ³				
Fixed mode voltage:	0.075% +50 mV	0.075% +50 mV	0.075% +50 mV	0.075% +42 mV
Current:	0.20% +10 mA	0.20% +11 mA	0.20% +11 mA	0.20% +12 mA
Readback Accuracy ⁴ (from front panel or over GPIB with respect to actual output @ 23° $\pm$ 5 °C)				
Voltage:	0.08% +50 mV	0.08% +50 mV	0.08% +50 mV	0.08% +42 mV
+Current:	0.20% +10 mA	0.20% +11 mA	0.20% +11 mA	0.20% +12 mA
–Current:	0.35% +24 mA	0.35% +26 mA	0.35% +26 mA	0.35% +29 mA
Load Regulation – Fixed mode (change in output voltage or current for any load change within ratings)				
Constant voltage:	2 mV	2 mV	2 mV	2 mV
Constant current:	1 mA	1 mA	1 mA	1 mA
Line Regulation – Fixed mode (change in output voltage or current for any mains change within ratings)				
Constant voltage:	2 mV	2 mV	2 mV	2 mV
Constant current:	1 mA	1 mA	1 mA	1 mA

¹There is no current derating when only one output module is installed in the mainframe.

²There is no maximum impedance restriction. The programmed value of Imp can be less than or equal to Isc.

³In SAS mode, the output current is related to the readback output voltage by an internal algorithm. In Table mode, the output current is related to the readback output voltage by interpolation between points that are entered by the user.

Performance Specifications (continued)

Parameter	Keysight E4362A-J04	Keysight E4362A-J05	Keysight E4362A-J06	Keysight E4362A-J18	Keysight E4362A-J21
Output Ratings – SAS and Table mode					
Maximum power:	596.6 W	552.5 W	564.9 W	560 W	708.8 W
Maximum open-circuit voltage (Voc):	170 V	95 V	180 V	150 V	114 V
Maximum voltage point (Vmp):	157 V	87.7 V	166.2 V	140 V	105 V
Maximum short-circuit current (Isc)					
@ 220/240 VAC nominal:	3.8 A	6.3 A	3.4 A	4 A	6.75 A
@ 100/120 VAC nominal: ¹	1.9 A	3.15 A	1.7 A	2 A	3.375 A
Maximum current point (Imp)					
@ 220/240 VAC nominal:	3.8 A	6.3 A	3.4 A	4 A	6.75 A
@ 100/120 VAC nominal: ¹	1.9 A	3.15 A	1.7 A	2 A	3.375 A
Minimum impedance ($\Delta V/\Delta I$) ²	1.72 Ω	1 Ω	2.04 Ω	1.44 Ω	0.8 Ω
Output Ratings – Fixed mode					
Voltage:	0 – 157 V	0 – 87.7 V	0 – 166.2 V	0 – 140 V	0 – 105 V
Current @ 220/240 VAC nominal:	0 – 3.8 A	6.3 A	0 – 3.4 A	0 – 4 A	0 – 6.75 A
@ 100/120 VAC nominal: ¹	0 – 1.9 A	3.15 A	0 – 1.7 A	0 – 2 A	0 – 3.375 A
Current Derating – from 40°C to 55°C	0.048 A/°C	0.079 A/°C	0.043 A/°C	0.05 A/°C	0.084 A/°C
Output Voltage Ripple & Noise (from 20 Hz to 20 MHz with a resistive load, outputs ungrounded, or either output grounded)					
SAS and Table mode:	27 mV rms 239 mV p-p	22 mV rms 158 mV p-p	28 mV rms 249 mV p-p	26 mV rms 217 mV p-p	24 mV rms 178 mV p-p
Fixed mode (constant voltage):	34 mV rms 150 mV p-p	27 mV rms 150 mV p-p	35 mV rms 150 mV p-p	32 mV rms 150 mV p-p	29 mV rms 150 mV p-p
Programming Accuracy (@ 23°C $\pm 5^\circ\text{C}$) ³					
Fixed mode voltage:	0.075% +66mV	0.075% +37mV	0.075% +70mV	0.075% +58mV	0.075% +44mV
Current:	0.20% +8 mA	0.20% +15 mA	0.20% +7 mA	0.20% +8 mA	0.20% +14 mA
Readback Accuracy ⁴ (from front panel or over GPIB with respect to actual output @ 23° $\pm 5^\circ\text{C}$)					
Voltage:	0.08% +66 mV	0.08% +37mV	0.08% +70 mV	0.08% +58 mV	0.08% +44 mV
+Current:	0.20% +8mA	0.20% +15mA	0.20% +7 mA	0.20% +8 mA	0.20% +14 mA
–Current:	0.35% +19mA	0.35% +36mA	0.35% +17 mA	0.35% +20 mA	0.35% +33 mA
Load Regulation – Fixed mode (change in output voltage or current for any load change within ratings)					
Constant voltage:	2 mV	2 mV	2 mV	2 mV	2 mV
Constant current:	1 mA	1 mA	1 mA	1 mA	1 mA
Line Regulation – Fixed mode (change in output voltage or current for any mains change within ratings)					
Constant voltage:	2 mV	2 mV	2 mV	2 mV	2 mV
Constant current:	1 mA	1 mA	1 mA	1 mA	1 mA

¹There is no current derating when only one output module is installed in the mainframe.

²There is no maximum impedance restriction. The programmed value of Imp can be less than or equal to Isc.

³In SAS mode, the output current is related to the readback output voltage by an internal algorithm. In Table mode, the output current is related to the readback output voltage by interpolation between points that are entered by the user.

Supplemental Characteristics

Parameter	Keysight E4362A	Keysight E4362A-J01	Keysight E4362A-J02	Keysight E4362A-J03
Output Current Ripple & Noise (from 20 Hz to 20 MHz with a resistive load, outputs ungrounded, or either output grounded)				
SAS and Table mode:	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p
Fixed mode (constant current):	2.5 mA rms 19 mA p-p	3 mA rms 20 mA p-p	3 mA rms 20 mA p-p	2.5 mA rms 19 mA p-p
Output Programming Range (maximum programmable values)				
SAS and Table mode voltage:	0 – 130 V	0 – 117 V	0 – 120 V	0 – 108 V
Fixed mode voltage:	0 – 123 V	0 – 110.7 V	0 – 112.75 V	0 – 102.5 V
Current @ 220/240 VAC nominal:	0 – 5.1 A	0 – 5.61 A	0 – 5.51 A	0 – 6.12 A
@ 100/120 VAC nominal: ¹	0 – 2.55 A	0 – 2.81 A	0 – 2.75 A	0 – 3.06 A
Over-voltage protection:	0 – 140 V	0 – 126.6 V	0 – 129 V	0 – 117.6 V
Over-current limit:	0 – 6.25 A	0 – 6.875 A	0 – 6.75 A	0 – 7.5 A
Programming Resolution (average values)				
Voltage:	37 mV	35 mV	35 mV	31 mV
Current:	1.6 mA	1.8 mA	1.7 mA	1.9 mA
Over-voltage protection:	600 mV	575 mV	575 mV	510 mV
Over-current limit:	27 mA	31 mA	30 mA	32 mA
Programming Accuracy				
Over-voltage protection:	1.2 V	1.1 V	1.1 V	1.0 V
Over-current limit:	0.5% +125 mA	0.5% +140 mA	0.5% +135 mA	0.5% +150 mA
Current monitor (referenced to P common):	1.0% +75 mA	1.0% +85 mA	1.0% +81 mA	1.0% +90 mA
Fixed Mode Analog Current Programming				
Analog programming:	1.0% +3.2mA	1.0% +3.5 mA	1.0% +3.4 mA	1.0% +3.9 mA
+Ip to –Ip Differential Input (0 to full scale):	0 to –4 V	0 to –4 V	0 to –4 V	0 to –4 V
Maximum common mode voltage (referenced to +):	±18 V	±18 V	±18 V	±18 V
Nominal input impedance:	20 k Ω	20 k Ω	20 k Ω	20 k Ω
Drift/Temperature Stability (change in output over 8 hours under constant load, line, and ambient, following a 30-minute warmup)				
Voltage:	0.04% +2 mV	0.04% +2 mV	0.04% +2 mV	0.04% +1.7 mV
Current:	0.10% +0.5 mA	0.10% +0.55 mA	0.10% +0.54 mA	0.10% +0.6 mA
Temperature Coefficients (output change per °C)				
Voltage:	0.01% +650 μ V	0.01% +650 μ V	0.01% +650 μ V	0.01% +540 μ V
Current:	0.025% +125 μ A	0.025% +140 μ A	0.025% +135 μ A	0.025% +150 μ A
Output Capacitance				
Capacitance:	< 50 nF	< 50 nF	< 50 nF	< 50 nF
Maximum Reverse Diode Current (with fans running)				
Current:	5.0 A	5.5 A	5.4 A	6.0 A

¹There is no current derating when only one output module is installed in the mainframe.

Supplemental Characteristics (continued)

Parameter	Keysight E4362A-J04	Keysight E4362A-J05	Keysight E4362A-J06	Keysight E4362A-J18	Keysight E4362A-J21
Output Current Ripple & Noise (from 20 Hz to 20 MHz with a resistive load, outputs ungrounded, or either output grounded)					
SAS and Table mode:	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p	4 mA rms 32 mA p-p
Fixed mode (constant current):	2.5 mA rms 19 mA p-p	2.5 mA rms 19 mA p-p	2.5 mA rms 19 mA p-p	2.5 mA rms 19 mA p-p	2.5 mA rms 19 mA p-p
Output Programming Range (maximum programmable values)					
SAS and Table mode voltage:	0 – 170 V	0 – 95 V	0 – 180 V	0 – 150 V	0 – 114 V
Fixed mode voltage:	0 – 160.9 V	0 – 89.9 V	0 – 170.3 V	0 – 143.5 V	0 – 107.6 V
Output @ 220/240 VAC nominal:	0 – 3.876 A	0 – 6.426 A	0 – 3.46 A	0 – 4.08 A	0 – 6.88 A
@ 100/120 VAC nominal: ¹	0 – 1.94 A	0 – 3.21 A	0 – 1.73 A	0 – 2.04 A	0 – 3.44 A
Over-voltage protection:	0 – 181.3 V	0 – 103.9 V	0 – 191.5 V	0 – 160.6 V	0 – 123.5 V
Over-current limit:	0 – 4.75 A	0 – 7.87 A	0 – 4.3 A	0 – 5 A	0 – 8.4 A
Programming Resolution (average values)					
Voltage:	48 mV	27 mV	51 mV	43 mV	32 mV
Current:	1.2 mA	2 mA	1.1 mA	1.3 mA	2.1 mA
Over-voltage protection:	769 mV	452 mV	811 mV	684 mV	532 mV
Over-current limit:	21 mA	34 mA	18 mA	22 mA	37 mA
Programming Accuracy					
Over-voltage protection:	1.54 V	0.9 V	1.62 V	1.37 V	1.07 V
Over-current limit:	0.5% +95 mA	0.5% +159 mA	0.5% +85 mA	0.5% +100 mA	0.5% +169 mA
Current monitor (referenced to P common):	1.0% +57 mA	1.0% +96 mA	1.0% +51 mA	1.0% +60 mA	1.0% +101 mA
Fixed Mode Analog Current Programming					
Analog programming:	1.0% +2.5 mA	1.0% +4.1 mA	1.0% +2.2 mA	1.0% +2.6 mA	1.0% +4.4 mA
+Ip to –Ip Differential Input (from 0 to full scale):	0 to –4 V	0 to –4 V	0 to –4 V	0 to –4 V	0 to –4 V
Maximum common mode voltage (referenced to +):	±18 V	±18 V	±18 V	±18 V	±18 V
Nominal input impedance:	20 kΩ	20 kΩ	20 kΩ	20 kΩ	20 kΩ
Drift/Temperature Stability (change in output over 8 hours under constant load, line, and ambient, following a 30-minute warmup)					
Voltage:	0.04% +2.6 mV	0.04% +1.5 mV	0.04% +2.8 mV	0.04% +2.3 mV	0.04% +1.8 mV
Current:	0.10% +380 μA	0.10% +630 μA	0.10% +340 μA	0.10% +400 μA	0.10% +675 μA
Temperature Coefficients (output change per °C)					
Voltage:	0.01% +850 μV	0.01% +475 μV	0.01% +900 μV	0.01% +750 μV	0.01% +570 μV
Current:	0.025% +950 μA	0.025% +159 μA	0.025% +85 μA	0.025% +100 μA	0.025% +169 μA
Output Capacitance					
Capacitance:	< 50 nF	< 100 nF	< 50 nF	< 50 nF	< 50 nF
Maximum Reverse Diode Current (with fans running)					
Current:	3.8 A	6.3 A	3.4 A	4 A	6.75 A

¹There is no current derating when only one output module is installed in the mainframe.

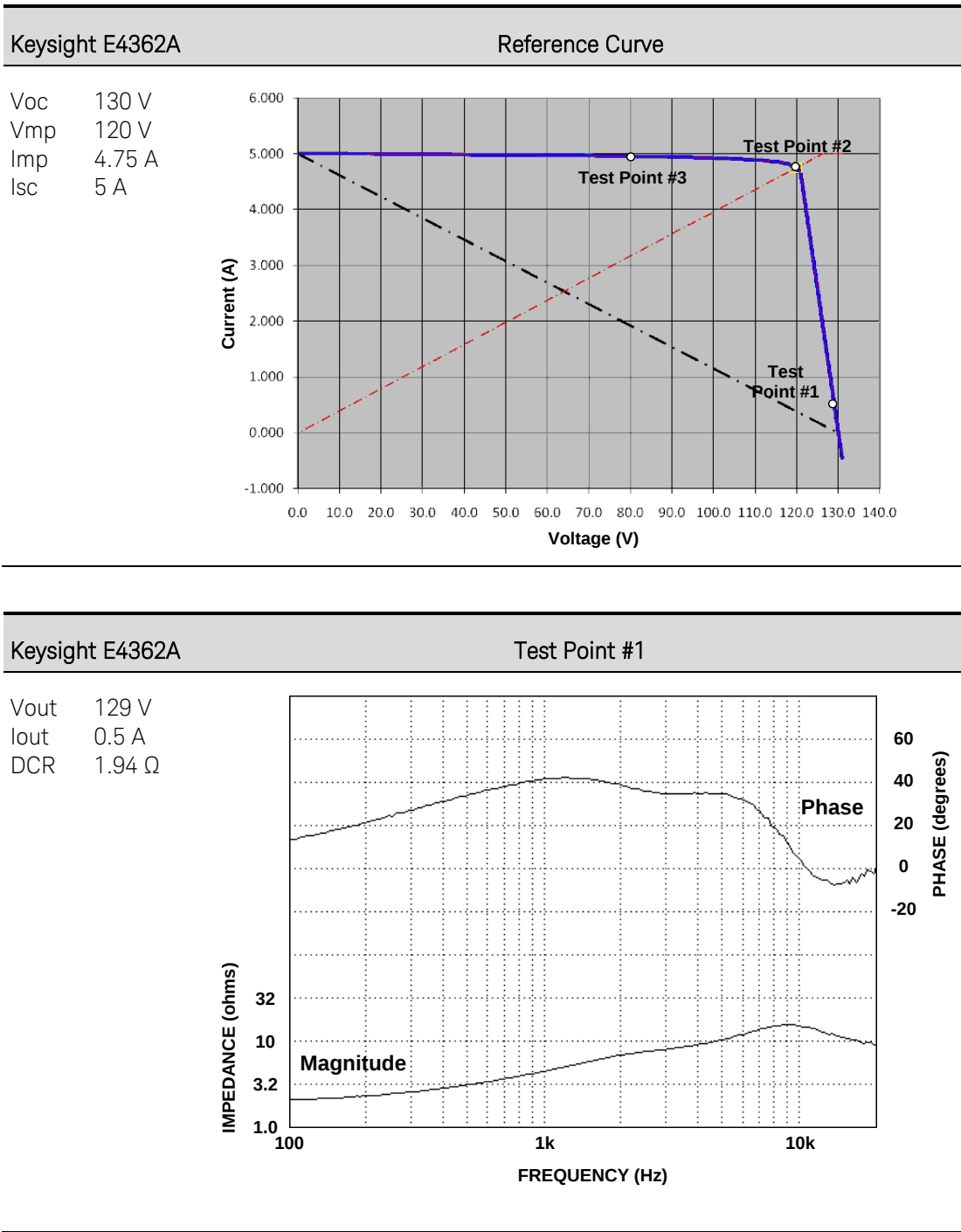
Supplemental Characteristics (continued)

Parameter	All E4362A Output Modules
Output Current Settling Time (recovery to within 1.5 A of an operating point on the I-V curve ($V < 90\%$ of VMP) after switching from a short circuit to a fixed load)	$< 5 \mu\text{s}$
Current Monitor Output (IM– with respect to P▽)	0 V to –4 V represents zero to the rated output current
Maximum Capacitive Load for stable operation	
SAS and Table mode:	No Restriction
Fixed mode:	2000 μF
Load Lead Drop with Remote Sensing	
SAS and Table mode:	up to 2 volts + ($V_{oc} - V_{mp}$)
Fixed mode:	up to 2 volts total
Current Sinking Capability	
SAS and Table mode:	560 mA for all except: 400 mA for E4362A–J04 only 365 mA for E4362A–J06 only 420 mA for E4362A–J18 only 567 mA for E4362A–J21 only
Fixed mode:	440 mA for all except: 340 mA for E4362A–J04 only 340 mA for E4362A–J06 only 365 mA for E4362A–J18, J21 only
Voltage Programming Rise/Fall Time (time for output to change from 90% to 10% or 10% to 90% of its total excursion)	$< 8 \text{ ms}$
Voltage Programming Settling Time (time for output change to settle within 0.1% of its Fixed mode voltage rating)	25 ms typical
Monotonicity	Output is monotonic over entire rated voltage, current, and temperature range
Auto-Parallel Configuration	Up to 4 outputs
Series and Shunt Switching Frequency (frequency is controlling by a customer-supplied external series or shunt FET connected to the output.)	50 kHz maximum ² for all except: 45 kHz maximum ² for E4362A–J04 only 30 kHz maximum ² for E4362A–J06 only
Output Terminal Isolation (from any terminal to chassis ground – this includes float plus output voltage)	$\pm 240 \text{ Vdc}$ maximum
Recommended Calibration Interval	1 year

²Higher switching frequencies may be possible given the right load conditions consisting of but not necessarily limited to the inductance of the load cable to the shunt switch and the on/off edge rate of the shunt switch.

Output Impedance in SAS Mode

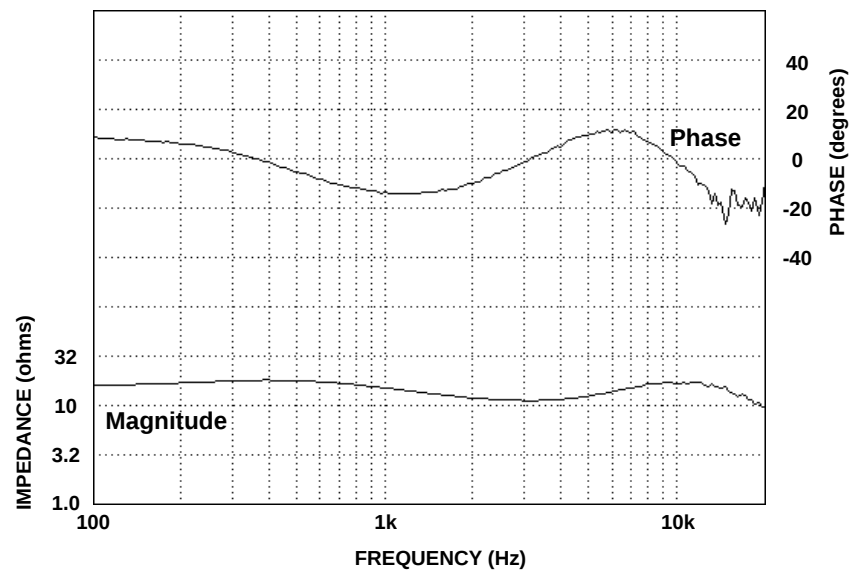
The following impedance graphs were generated at three points on Keysight Models E4362A operating in SAS mode. The reference curve shows the location of the three sample points on which the output impedance graphs are based.



Keysight E4362A

Test Point #2

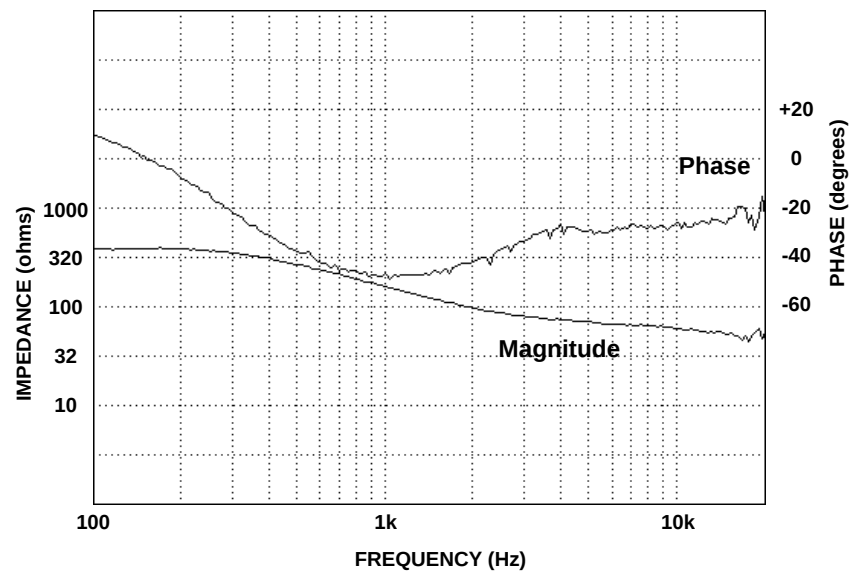
Vout 120 V
Iout 4.75 A
DCR 15.7 Ω



Keysight E4362A

Test Point #3

Vout 80 V
Iout 4.95 A
DCR 375 Ω



Chapter 4

Keysight E4360A SAS Mainframe

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Supplemental characteristics are not warranted but are descriptions of performance determined either by design or by type testing. All supplemental characteristics are typical unless otherwise noted.

Supplemental Characteristics

Parameter	E4360A
Command Processing Time	≤ 1 ms from receipt of command to start of output change
Savable States	
Memory locations:	2 (0 and 1)
Pre-stored state:	0
Protection Response Characteristics	
INH input:	5 μ s from receipt of inhibit to start of shutdown
Fault on coupled outputs:	< 10 μ s from receipt of fault to start of shutdown
Digital Control Characteristics	
Maximum voltage ratings:	+16.5 VDC/– 5 VDC between pins (pin 8 is internally connected to chassis ground).
Pins 1 and 2 as FLT output:	Maximum low-level output voltage = 0.5 V @ 4 mA Maximum low-level sink current = 4 mA Typical System-level leakage current = 1 mA @ 16.5 VDC
Pins 3 – 7 as digital/trigger outputs: (pin 8 = common)	Maximum low-level output voltage = 0.5 V @ 4 mA; 1 V @ 50 mA; 1.75 V @ 100 mA Maximum low-level sink current = 100 mA Typical System-level leakage current = 0.8 mA @ 16.5 VDC
Pins 1 – 7 as digital/trigger inputs and pin 3 as INH input: (pin 8 = common)	Maximum low-level input voltage = 0.8 V Minimum System-level input voltage = 2 V Typical low-level current = 2 mA @ 0 V (internal 2.2k pull-up) Typical System-level leakage current = 0.12 mA @ 16.5 VDC
Interface Capabilities	
GPIB:	SCPI – 1993, IEEE 488.2 compliant interface
LXI compliance:	Class C (only applies to units with LXI label on front panel)
USB 2.0:	Requires Keysight IO Library version M.01.01 or 14.0 and up
10/100 LAN:	Requires Keysight IO Library version L.01.01 or 14.0 and up
Built-in Web server:	Requires Internet Explorer 5+ or Netscape 6.2+
Environmental Conditions	
Operating environment:	Indoor use, installation category II (for AC input), pollution degree 2
Temperature range:	0°C to 55°C (output current is derated above 40°C ambient temperature)
Relative humidity:	Up to 95%
Altitude:	Up to 2000 meters
Storage temperature:	–30°C to 70°C
Acoustic Noise Declaration	
This statement is provided to comply with the requirements of the German Sound Emission Directive, from 18 January 1991.	Sound Pressure L_p <70 dB(A), At Operator Position, Normal Operation, According to EN 27779 (Type Test). Schalldruckpegel L_p <70 dB(A), Am Arbeitsplatz, Normaler Betrieb, Nach EN 27779 (Typprüfung).

Supplemental Characteristics (continued)

Parameter	E4360A
Regulatory Compliance	
EMC:	Complies with European EMC Directive for test and measurement products. • IEC/EN 61326-1 • CISPR 11, Group 1, class A • AS/NZS CISPR 11 • ICES/NMB-001 Complies with Australian standard and carries C-Tick mark. This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada.
Safety:	Complies with European Low Voltage Directive and carries the CE-marking. Conforms to UL 61010-1 and CSA C22.2 61010-1. Declarations of Conformity for this product and for other Keysight products may be downloaded from the Web. Go to http://www.keysight.com/go/conformity and click on “Declarations of Conformity.” You can then search by product number to find the latest Declaration of Conformity
AC Mains	
Input ratings:	~ 100 VAC – 240 VAC; 50/60/400Hz
Power consumption:	1440 VA (@ <, 180 VAC input) 2500 VA (@ >, 180 VAC input) 1440 VA (@100 VAC – 240 VAC input for E4360AJ01)
Power factor: ^{NOTE 1}	0.99 @ nominal input and rated power
AC line spike rating:	1 kV typical
Fuse:	15A / 250 VAC non-time delay (Keysight p/n 2110-0054)
100-180 VAC Note: AC mains circuits rated at nominal 100-180 VAC cannot supply enough current to power the E4360A mainframe when two output modules are installed. In this case, internal circuits will limit the output current of the modules to one half of their rating. For a single installed module, full output current will be available at nominal 100-180 VAC. This restriction does not apply to mainframe Model E4360AJ01	
Dimensions	
Height:	88.1 mm / 3.5 in. for E4360A 44.75 mm / 1.75 in for E4360AJ01
Width:	432.5 mm / 17.03 in.
Depth including handles:	633.9 mm / 24.96 in.
Net Weight	
E4360A with 2 output modules:	17.6 kg / 38.4 lbs.
E4360AJ01 with 2 output modules:	11.82 kg / 26 lbs
Single output module:	3.3 kg / 7.2 lbs.

¹ Under full load at 400 Hz, power factor drops from 0.99 @ 120 VAC to as low as 0.76 @ 265 VAC. Power factor degrades further under no load conditions.

Outline Diagram

