

2260B Series

www.keithley.com

360W and 720W Multi-Range Programmable DC Power Supplies

Verification Procedure

Rev. A / March 2014

A Greater Measure of Confidence



Series 2260B

360W and 720W Multi-Range Programmable DC Power Supplies

VERIFICATION PROCEDURE



ISO-9001 CERTIFIED MANUFACTURER

This manual contains proprietary information, which is protected by copyright. All rights are reserved. No part of this manual may be photocopied, reproduced or translated to another language without prior written consent of the Keithley company.

The information in this manual was correct at the time of printing. However, Keithley continues to improve products and reserves the right to change specifications, equipment, and maintenance procedures at any time without notice.

VERIFICATION

Test equipment 1. DMMs (2) with minimum performance of 5- ½ digit resolution and 0.012% DC volt accuracy 2. DC Load or pure load 3. Oscilloscope with minimum bandwidth of 100MHz 4. AC Power Source 5. Insulation resistance/Hipot tester 7. 200A Shunt 8. 400A Shunt 9. PC (personal computer)				
Item	Test	Test conditions	Limits	Notes
Initial Test 1	Insulation Resistance	+ output terminal and ground, - output terminal and ground.	DC500V \geq 20M Ω	Power off
		AC Neutral and ground, AC line and ground.	DC500V \geq 30M Ω	
Initial Test 2	Withstanding Voltage Test	1. short-circuit + output terminal and ground 2. short-circuit AC Neutral and AC line 3. Test AC line and Ground	DC 2kV 1MIN < 4mA	Power on
1	Overshoot Verification	1. Set the current to the maximum. 2. Set the voltage to 3.0V 3. Set the DSO to single mode. 4. Set the DSO vertical range to 0.5V/Div. 5. Turn the output on and see that the maximum voltage is \leq 3.3V.	\leq 3.3V	CV mode.
2	Voltage Programming Accuracy	1. Turn the power on. 2. Set the current to maximum. 3. Set voltage to: 31.50V for 2260B-30XX 84.00V for 2260B-80XX. 4. Turn the output on. 5. Verify that the difference between the voltage on the DMM reading and the 2260B setting is within limits.	With less than 8hr warmup period: 30-36: \leq 0.05%+10mV 30-72: \leq 0.1%+10mV 80-13: \leq 0.05%+10mV 80-27: \leq 0.1%+10mV	CV mode.
			With more than 8hr warmup period: 30-36: \leq 0.05%+25mV 30-72: \leq 0.1%+25mV 80-13: \leq 0.05%+50mV 80-27: \leq 0.1%+50mV	
3	Voltage Measurement Accuracy	1. Turn the power on. 2. Set the current to maximum. 3. Set voltage to: 31.50V for 2260B-30XX 84.00V for 2260B-80XX. 4. Turn the output on. 5. Verify that the difference between the voltage on the DMM and the remote reading on the PC is within limits.	With less than 8hr warmup period: \leq 0.1%+10mV	CV mode.
			With more than 8hr warmup period: 30Volt models: \leq 0.1%+25mV 80Volt models: \leq 0.1%+50mV	

4	Voltage display accuracy	<ol style="list-style-type: none"> 1. Turn the power on. 2. Set the current to max 3. Set the voltage to any value. 4. Turn the output on. 5. Verify that the reading on the DMM and the display are within limits. 6. Note: Verification procedure applies to all voltages between 3V to rating voltage. 	$\leq 0.1\% + 2 \text{ digits.}$	CV mode.
5	OVP verification	<ol style="list-style-type: none"> 1. Hold the function key and turn the power on. This will enter the "Power On Configuration" settings. F-90 will be displayed on screen when you have successfully entered the "Power on Configuration" settings. 2. Set F-95 to 1 (Power switch trip disable) Procedure: Turn the voltage knob until F-95 is shown. Turn the current knob until 1 is shown. Press the voltage knob to save the setting. 3. Turn the power off. 4. Turn the power on. 5. Press the OVP/OCV key and set the OVP value. 6. Press the Set key and then set the output voltage to a value lower than the OVP voltage level. 7. Turn the output on. 8. Progressively increase the output voltage until the OVP is tripped. 9. Verify the OVP function over the entire OVP range. 	$\leq 1\%$	CV mode OVP setting range 2260B-30XX: 3V~33V 2260B-80XX: 8V~88V
6	Load Regulation (Load effect)	<ol style="list-style-type: none"> 1. Set the current to the maximum. 2. Set the voltage to: 2260B 30XX: 10V, 30V, 2260B 80XX: 26.7V, 80V. (30-36&80-13: 360W, 30-72&80-27: 720W) 4. Set the DC load to CC mode and turn on. 5. Measure the output voltage on the DMM. (record the voltage from the sense terminals.) 6. Turn the load off. 7. Record the output voltage again. Calculate the difference in voltage output between full load and no load. Verify that the voltage output difference is within limits. 	$\leq 0.05\% + 5\text{mV.}$	CV Mode
7	Line Regulation (Source Effect)	<ol style="list-style-type: none"> 1. Set the line input voltage to 90V. 2. Follow steps 1-5 of item 6 to record the output voltage. 	$\leq .05\% + 3\text{mV}$	CV Mode

		3. Change the line input voltage from 90V to 265V. 4. Record the output voltage. Verify that the output voltage doesn't differ more than limits.		
8	Voltage Ripple and Noise	1. Follow steps 1-4 of item 6. 2. Set the scope BW limit to 20MHz. 3. Use the scope to measure from the "Sense" terminals. 4. Confirm that the voltage ripple and noise meets the specifications. 5. Use a pure DC load if necessary for the noise measurement.	RIPPLE: mVrms 30-36&80-13: ≤ 7 30-72&80-27: ≤ 11 NOISE: mVp-p 30-36&80-13: ≤ 60 30-72&80-27: ≤ 80	CV Mode.
9	Current Programming Accuracy	1. Turn the power on. 2. Set the voltage to the maximum setting. 3. Set the current to the following values: 2260B 30-36: 37.80A 2260B 30-72: 75.60A 2260B 80-13: 14.18A 2260B 80-27: 28.36A 4. Turn the output on. 5. Check the difference between the setting current and the measured current across the shunt resistor (DMM voltage across shunt/shunt R = measured current). (200A shunt)	With less than 8hr warmup period: 30-36: $\leq 0.1\% + 30 \text{ mA}$ 30-72: $\leq 0.1\% + 60 \text{ mA}$ 80-13: $\leq 0.1\% + 10 \text{ mA}$ 80-27: $\leq 0.1\% + 30 \text{ mA}$ With more than 8hr warmup period: 30-36: $\leq 0.1\% + 48 \text{ mA}$ 30-72: $\leq 0.1\% + 96 \text{ mA}$ 80-13: $\leq 0.1\% + 17 \text{ mA}$ 80-27: $\leq 0.1\% + 44 \text{ mA}$	CC mode
10	Current Measurement Accuracy (readback accuracy)	1. Follow steps 1-4 of item 9. 2. Verify that the difference between the current calculated across the shunt resistor to that of the remote reading on the PC is within limits.	With less than 8hr warmup period: 30-36: $\leq 0.1\% + 30 \text{ mA}$ 30-72: $\leq 0.1\% + 60 \text{ mA}$ 80-13: $\leq 0.1\% + 10 \text{ mA}$ 80-27: $\leq 0.1\% + 30 \text{ mA}$ With more than 8hr warmup period: 30-36: $\leq 0.1\% + 48 \text{ mA}$ 30-72: $\leq 0.1\% + 96 \text{ mA}$ 80-13: $\leq 0.1\% + 17 \text{ mA}$ 80-27: $\leq 0.1\% + 44 \text{ mA}$	
11	Front Panel Display Accuracy	1. Follow steps 1-4 of item 9. 2. Calculate the difference between the measured current across the shunt resistor and the displayed value.	30-36: $\leq 0.1\% + 4 \text{ digits}$ 30-72: $\leq 0.1\% + 7 \text{ digits}$ 80-13: $\leq 0.1\% + 2 \text{ digits}$ 80-27: $\leq 0.1\% + 4 \text{ digits}$	CC Mode CV mode (with load)
12	OCP function check	1. Hold the function key and turn the power on. This will enter the "Power On Configuration" settings. F-90 will be displayed on screen when you have successfully entered the "Power on Configuration" settings. 2. Set F-95 to 1 (Power switch	$\leq 1\%$	CC mode OCP SET range = 10%~110 rating range.

		trip disable) Procedure: Turn the voltage knob until F-95 is shown. Turn the current knob until 1 is shown. Press the voltage knob to save the setting. 3. Turn the power off. 4. Turn the power on. 5. Press the OVP/OCV key and set the OCP value. 6. Press the Set key and set the output current less than the OCP value. 7. Turn the output on. 8. Progressively increase the output current until the OCP is tripped. 9. Verify the OCP function over the entire OCP range.		
13	Current load effect	1. Set the voltage to: 2260B 30XX: 10V, 30V; 2260B 80XX: 26.7V, 80V. 2. Set the current values to any value. 3. Turn the load on. 4. Set the DC load to CR mode. 5. Note the power rating of the power supply. 6. Turn the electronic load on. 7. Modify the DC load to make 2260B output change from CV to CC. 8. Short the DC load. 9. Compare the difference in output current before/after the DC load was shorted. (From the DMM current measurement)	$\leq 0.1\% + 5\text{mA}$	CC mode
14	Current source effect	1. Follow steps 1-4 of item 9. 2. Vary the line input voltage from 90V to 265V. 3. Confirm that the output current does not change more than limits	$\leq 0.1\% + 5\text{mA}$	CC mode
15	Ripple Current measurement	1. Set the voltage to: 2260B 30XX: 10V, 30V. 2260B 80XX: 26.7V, 80V. 2. Set the current any value. 3. Turn the output on. 4. Set the DC load to CR mode. 5. Note the power rating of the power supply. 6. Turn the load on. 7. Modify the current on the 2260B until the mode changes from CV to CC mode. 8. Calculate DCA by measuring the DCV across the shunt resistor with the DMM. 9. Measure the voltage (DCV) from the sense terminals and calculate R by $R = \text{DCV} / \text{DCA}$.	RIPPLE: mVrms 30-36: ≤ 72 30-72: ≤ 144 80-13: ≤ 27 80-27: ≤ 54 Unit: mArms	CC mode

		<p>10. Set the DMM to ACV measurement(DMM connected to the sense terminals).</p> <p>11. Record the AC voltage on the DMM.</p> <p>12. Calculate the ACA value . (ACA=ACV/R)</p>		
16	Recovery Time	<p>1. Use an electronic load to test the dynamic response. (time taken for the voltage to recover from a 50% change in load current. (50% to 100%)).</p> <p>2. Set the DC load to CC mode.</p>	< 1ms	CV mode.
17	Rise Time Full Load	<p>1. Set the voltage to: 2260B 30XX: 10V, 30V; 2260B 80XX: 26.7V, 80V</p> <p>2. Set the current to the maximum.</p> <p>3. Turn the output on.</p> <p>4. Note the power rating of the power supply.</p> <p>5. The load should be set to CR mode.</p> <p>6. Use the DSO to measure from the sense terminals.</p> <p>7. Turn the DC load on.</p> <p>8. Turn the output on again.</p> <p>9. Verify the 10%~90% output rise time for the waveform.</p>	≤50mS	CV mode.
18	Fall Time Full Load	<p>1. Follow steps 1-7 for item 17.</p> <p>2. Turn the output off.</p> <p>3. measure the 10%~90% fall time of the output with full load.</p>	≤50mS	CV mode.
19	Fall Time No Load	<p>1. Set the voltage to the rating setting.</p> <p>2. make a load go from On→Off.</p> <p>3. Verify the 10%~90% fall time for the output with no load.</p>	≤500mS	CV mode.
20	EXT Voltage , Voltage Out	<p>1. Hold the function key and turn the power on. This will enter the “Power On Configuration” settings. F-90 will be displayed on screen when you have successfully entered the “Power on Configuration” settings.</p> <p>2. Set F-90 to 1 (CV control – Ext voltage). Do this by turning the current knob until 1 is shown. Press the voltage knob to save the setting.</p> <p>3. The external voltage should be connected as per the user manual.</p> <p>4. Turn the power off.</p> <p>5. Turn the power on.</p> <p>6. Set the external power supply voltage from 0.1V to 10V.</p> <p>7. Make sure you have an external DMM to monitor the actual output value from the</p>	<p>≤ 8 hrs warm up: ≤0.5%</p> <p>>8hrs warm up: 30XX: ≤1.5%±15mV 80XX: ≤1.5%±40mV</p>	CV mode.

		external power supply. 8. Make sure the relative voltage output is within limits.		
21	Ext R ∇ Voltage out	1. Hold the function key and turn the power on. This will enter the "Power On Configuration" settings. F-90 will be displayed on screen when you have successfully entered the "Power on Configuration" settings. 2. Set F-90 to 2 (Ext-R ∇ – CV control) Turn the current knob until 2 is shown. Press the voltage knob to save the setting. 3. The external resistance should be connected as per the user manual. 4. Turn the power off. 5. Turn the power on. 6. Set the external resistance from 0.1k Ω to 10k Ω . 7. Make sure the relative voltage output is within limits.	<div> ≤ 8 hrs warm up: $\leq 1.5\%$ </div> <div> >8hrs warm up: 30XX: $\leq 1.5\% \pm 15\text{mV}$ 80XX: $\leq 1.5\% \pm 40\text{mV}$ </div>	CV mode.
22	Ext R ∇ Voltage out	1. Follow the steps for item 21 except set F-90 to 3 (Ext-R ∇ – CV control)	<div> ≤ 8 hrs warm up: $\leq 1.5\%$ </div> <div> >8hrs warm up: 30XX: $\leq 1.5\% \pm 15\text{mV}$ 80XX: $\leq 1.5\% \pm 40\text{mV}$ </div>	CV mode.
23	VMON	1. Hold the function key and turn the power on. This will enter the "Power On Configuration" settings. F-90 will be displayed on screen when you have successfully entered the "Power on Configuration" settings. 2. Set F-90 to 0 (panel control) to disable the external control configuration. Do this by turning the current knob until 0 is shown. Press the voltage knob to save the setting. 3. The DMM should be connected as per the user manual. 4. Turn the power off. 5. Turn the power on. 6. The monitor output voltage ranges from 1% to 100% of fullscale. 7. Make sure the relative voltage output is within limits.	$\leq 1\%$	CV Mode.
24	EXT Voltage, Current Out	1. Hold the function key and turn the power on. This will enter the "Power On Configuration" settings. F-90 will be displayed on screen when you have successfully entered the "Power on	<div> ≤ 8 hrs warm up: $\leq 1\%$ </div> <div> >8hrs warm up: 30-36: $\leq 1\% \pm 18\text{mA}$ 30-72: $\leq 1\% \pm 36\text{mA}$ 80-13: $\leq 1\% \pm 6\text{mA}$ 80-27: $\leq 1\% \pm 13\text{mA}$ </div>	CC mode.

		<p>Configuration” settings.</p> <p>2. Turn the Voltage knob until F-91 is displayed.</p> <p>Set F-91 to 1 (CC control – Ext voltage) by turning the current knob until 1 is shown. Press the voltage knob to save the setting.</p> <p>3. The external voltage should be connected as per the user manual.</p> <p>4. Turn the power off.</p> <p>5. Turn the power on.</p> <p>6. Set the external power supply voltage from 0.1V to 10V.</p> <p>7. Make sure you have an external DMM to monitor the actual output value from the external power supply.</p> <p>8. Make sure the relative current output is within limits.</p>		
25	Ext R _{ext} Current out	<p>1. Hold the function key and turn the power on.</p> <p>This will enter the “Power On Configuration” settings.</p> <p>F-90 will be displayed on screen when you have successfully entered the “Power on Configuration” settings.</p> <p>2. Turn the Voltage knob until F-91 is displayed.</p> <p>Set F-91 to 2 (Ext-R_{ext} – CC control) by turning the current knob until 2 is shown. Press the voltage knob to save the setting.</p> <p>3. The external resistance should be connected as per the user manual.</p> <p>4. Turn the power off.</p> <p>5. Turn the power on.</p> <p>6. Set the external resistance from 0.1kΩ to 10kΩ.</p> <p>7. Make sure the relative current output is within limits.</p>	<p>≤ 8 hrs warm up: ≤1.5%</p> <p>>8hrs warm up: 30-36: ≤1.5%±18mA 30-72: ≤1.5%±36mA 80-13: ≤1.5%±6mA 80-27: ≤1.5%±13mA</p>	CC mode.
26	Ext R _{ext} Voltage out	<p>1. Follow the steps for item 21 except set F-91 to 3 (Ext-R_{ext} – CC control)</p>	<p>≤ 8 hrs warm up: ≤1.5%</p> <p>>8hrs warm up: 30-36: ≤1.5%±18mA 30-72: ≤1.5%±36mA 80-13: ≤1.5%±6mA 80-27: ≤1.5%±13mA</p>	CC mode.
27	IMON	<p>1. Hold the function key and turn the power on.</p> <p>This will enter the “Power On Configuration” settings.</p> <p>F-90 will be displayed on screen when you have successfully entered the “Power on Configuration” settings.</p> <p>2. Turn the Voltage knob until F-91 is displayed.</p> <p>Set F-91 to 0 (panel control) by</p>	≤1%	CC Mode.

		<p>turning the current knob until 0 is shown. Press the voltage knob to save the setting.</p> <p>3. The DMM should be connected as per the user manual.</p> <p>4. Turn the power off.</p> <p>5. Turn the power on.</p> <p>6. The monitor output voltage ranges from 1% to 100% of fullscale.</p> <p>7. Make sure the relative voltage output is within limits.</p>		
28	Series Operation Verification	<p>1. Hold the function key and turn the power on. This will enter the "Power On Configuration" settings. F-90 will be displayed on screen when you have successfully entered the "Power on Configuration" settings.</p> <p>2. Turn the Voltage knob until F-93 is displayed. Set F-93 to 0 for the master unit, and to 4 for the slave units. Do this by turning the current knob until 0 or 4 is shown. Press the voltage knob to save the setting.</p> <p>3. The units should be connected in series as per the user manual.</p> <p>4. Series connection: Master +terminal to slave -terminal.</p> <p>5. Connect the DMM across the Master+ and Slave – terminals.</p> <p>6. Set the voltage from the Master unit and verify the series operation.</p> <p>7. Verify the series operation with the bleeder control set to Off & On on the master unit. (bleeder control for Slave units is fixed to On.)</p>		CV Mode.
29	Parallel Operation Verification	<p>1. Hold the function key and turn the power on. This will enter the "Power On Configuration" settings. F-90 will be displayed on screen when you have successfully entered the "Power on Configuration" settings.</p> <p>2. Turn the Voltage knob until F-93 is displayed. Set F-93 to 2 for the master unit, and to 3 for the slave units. Do this by turning the current knob until 2 or 3 is shown. Press the voltage knob to save the setting.</p> <p>3. The units should be connected in parallel as per the</p>		CC Mode.

		<p>user manual.</p> <p>4. From Master +terminal to slave +terminal, Master – terminal to slave -terminal.</p> <p>5. Connect the DMM across the Master+ and Master – terminal.</p> <p>6. Set the current from the Master unit and verify the parallel operation.</p> <p>7. Verify the parallel operation with the bleeder control set to Off & On on the master unit. (bleeder control for Slave units is fixed to off.)</p>		
30	Interface Verification	<p>1. Lan Verification. Use the LAN interface to remotely check the system information (model number, serial number, firmware, Mac address etc.).</p> <p>2. GPIB Verification. Use the optional GPIB-USB adapter and the NI Measurement and Automation Explorer to verify the GPIB functionality.</p> <p>3. Confirm that the USB port is functioning. The display should show “USB ON”</p>		

Specifications are subject to change without notice.
All Keithley trademarks and trade names are the property of Keithley Instruments, Inc.
All other trademarks and trade names are the property of their respective companies.

Keithley Instruments, Inc.

Corporate Headquarters • 28775 Aurora Road • Cleveland, Ohio 44139 • 440-248-0400 • Fax: 440-248-6168 • 1-888-KEITHLEY • www.keithley.com



A Greater Measure of Confidence