海洋儀器

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2260B Series

Multi-Range Programming DC Power Supplies

Verification Procedure

077-1048-01/ August 2015

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Preparing for Verification

Note ⚠	In order to ensure performance accuracy, we recommend you to verify all items listed in this chapter at once.
When to verify the specification	• When using the power supply in a new environment • After replacing one of the major internal modules, such as front panel or power supply PCB • When you need to make sure that the power supply is malfunctioning or not
Verification Environment	• Location: Indoor, no direct sunlight, dust free • Relative Humidity: < 80% • Temperature: +18~+28°C • Warm-up time: ≥ 30 minutes
When the verification fails…	• Calibrate the instrument when a corresponding calibration item exists. • For other items, send the power supply back to the factory for repair.

Background	This test verifies that the voltage programming and measurement functions are within specifications.

List of Equipment for Verification

Here is the list of all equipment used in the service operations.

Type	Specifications	Recommended Model
Digital Voltmeter	• Resolution: 1 uV @ 1V • Readout: 6 1/2 digits	• Keithley Model 2000 or equivalent
Current Shunt	• 3A (0.1Ω) 0.02%, TC=10ppm/℃ • 30A (0.01Ω) 0.02%, TC=10ppm/℃ • 300A (0.001Ω) 0.02%, TC=10ppm/℃	
Oscilloscope	• Sensitivity: 1 mV • Bandwidth Limit: 20 MHz • Probe: 1:1 with JEITA RC-9131B	• Tektronix DPO4014B or equivalent
AC Power Source	• Adjustable to highest rated input voltage range. • Power: 3000 VA	• Ametek 3001i or equivalent
Electronic Load	• 60V, 240A minimum, with transient capability and a slew rate of 1A/us or better. • 500V, 60A minimum, with transient capability and a slew rate of 0.4A/us or better • 1000V, 12A minimum, with transient capability and a slew rate of 0.2A/us or better	• Ametek SLH, SLM or PLA series electronic loads or equivalent

Constant Voltage Tests

Voltage Programming and Measurement Accuracy

Connection

Fig. 1

Background	This test verifies that the voltage programming and measurement functions are within specifications.

Procedure

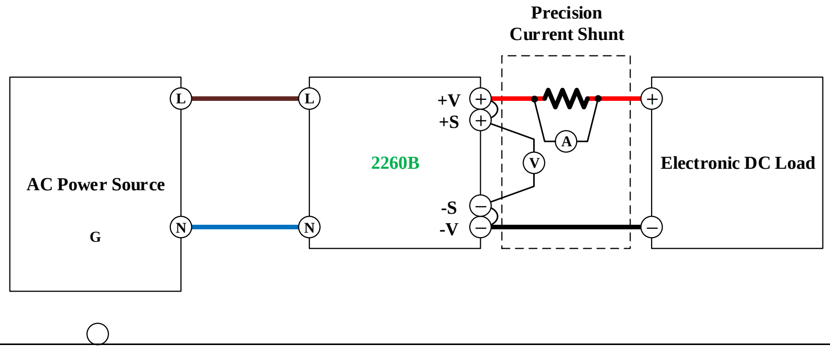
1. Turn off the power supply and connect the DVM from the PCS-1000 directly across the +S and -S terminals as shown in the fig. 1 connection.
2. Turn on the power supply and program the output voltage to zero and the output current to its maximum programmable value (Imax) with the load off. The CV indicator should be on and the output current reading should be approximately zero.
3. Record the output voltage readings on the digital voltmeter (DVM) and the voltage measured over the interface. The readings should be within the limits specified in the test record form for the appropriate model under Voltage Programming and Measurement, Minimum Voltage Vout.
4. Program the output voltage to its full-scale rating.
5. Record the output voltage readings on the DVM and the voltage measured over the interface. The readings should be within the limits specified in the test record form for the appropriate model under Voltage Programming and Measurement, Rated Voltage Vout.

Verifying Voltage Programming and Measurement Accuracy is complete

CV Load Regulation

Connection

Fig.2



Background — This test measures the change in output voltage resulting from a change in output current from full load to no load.

Procedure

1. Turn off the power supply and connect the DVM from the PCS-1000 and an electronic load as shown in the fig. 2 connection.
2. Turn on the power supply and program the output current to its maximum programmable value (Imax) and the output voltage to its full scale value.
3. Set the electronic load for the output's full-scale current. The CV indicator on the front panel must be on. If it is not, adjust the load so that the output current drops slightly.
4. Record the output voltage reading from the DVM.
5. Open the load and record the voltage reading from the DVM again. The difference between the DVM readings in steps 4 and 5 is the load effect, which should not exceed the value listed in the test record form for the appropriate model under CV Load Regulation.

CV Line Regulation

Connection

Fig. 3

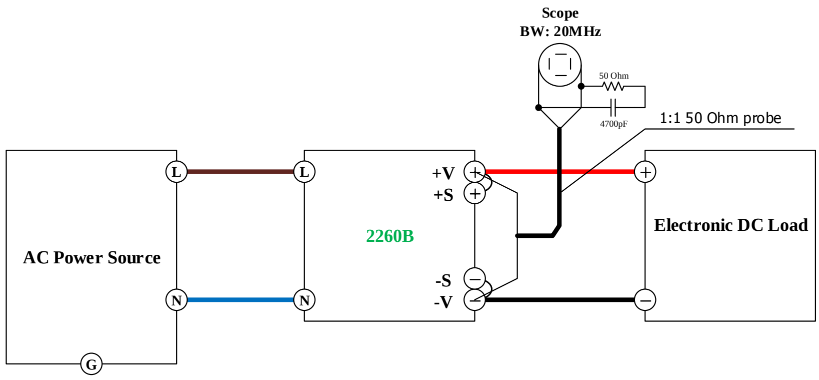
Background	This test measures the change in output voltage that results from a change in AC line voltage from the minimum to maximum value within the line voltage specifications.

Procedure

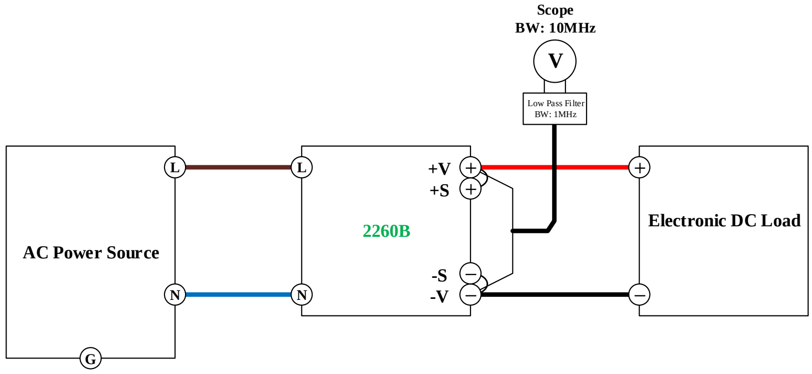
1. Turn off the power supply and connect the ac power source.
2. Connect the DVM from the PCS-1000 and an electronic load as shown in the fig. 3 connection. Set the variable ac voltage to nominal line voltage.
3. Turn on the power supply and program the output current to its maximum programmable value (Imax) and the output voltage to its full-scale value.
4. Set the electronic load for the output's full-scale current. The CV indicator on the front panel must be on. If it is not, adjust the load so that the output current drops slightly.
5. Adjust the ac power source to the low-line voltage (85 VAC for 100/120 nominal line; 170 VAC for 200/240 nominal line).
6. Record the output voltage reading from the DVM.
7. Adjust the ac power source to the high-line voltage (132 VAC for 100/120 nominal line; 265 VAC for 200/240 nominal line).
8. Record the output voltage reading on the DVM. The difference between the DVM reading in steps 5 and 7 is the source effect, which should not exceed the value listed in the test record form for the appropriate model under CV Line Regulation.

CV Ripple and Noise

Connection
Fig. 4



Connection
Fig. 5



Background

Measure the DC output voltage with the (1:1) probe on. Measurement frequency bandwidth is 10Hz to 20MHz for peak to peak. Measurement frequency bandwidth is 5Hz to 1MHz for rms.

Procedure

1. Turn off the power supply and connect the electronic load (or load resistor), probe, and an oscilloscope (ac coupled) to the output as shown in the fig. 4 connection.
2. Set the oscilloscope's bandwidth limit on 20 MHz, and set the sampling mode.
3. Program the power supply to output current to its maximum programmable value (Imax) and the output voltage to its full-scale value and enable the output. Let the oscilloscope run for a few seconds to generate enough measurement points. The result should not exceed the peak-to-peak limits the test record.
4. Use the oscilloscope to measure the RMS noise voltage using the bandwidth shown in fig. 5. The result should not exceed the rms limits in the test record form for the appropriate model under CV Ripple and Noise - rms.

Verifying CV Ripple and Noise is complete

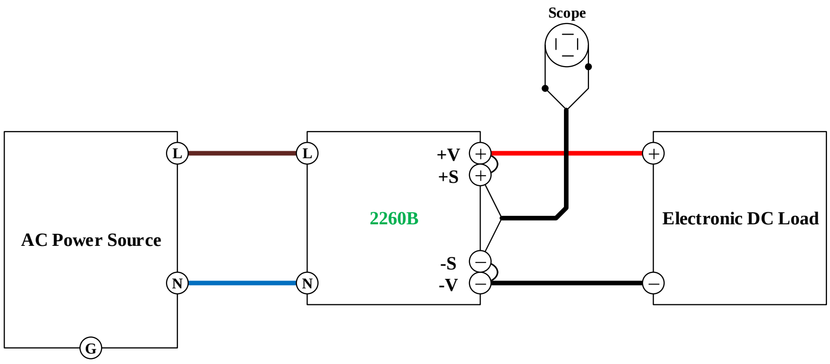
Transient Recovery Time

Background

This measures the time for the output voltage to recover to within the specified value following a 50% to 100% change in the load current.

Connection

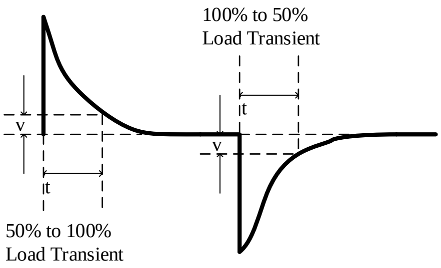
Fig. 6



Procedure

1. Turn off the power supply and connect the output as in the fig. 6 connection with the oscilloscope across the +S and –S terminals.
2. Turn on the power supply and program the output current to its maximum programmable value (Imax) and the output voltage to its full-scale value.
3. Set the electronic load to operate in constant current mode. Program its load current to 50% of the power supply's full scale current value.
4. Set the electronic load's transient generator frequency to 100 Hz and its duty cycle to 50%.
5. Program the load's transient current level to 100% of the power supply's full-scale current value. Turn the transient generator on.
6. Adjust the oscilloscope for a waveform similar to that shown in the following fig. 7.

Fig. 7



7. The output voltage should return to within the specified voltage in the specified time following the 50% to 100% load change. Check transients by triggering on the positive and negative slope. Record the voltage at time “t” in the performance test record form under Transient Response.

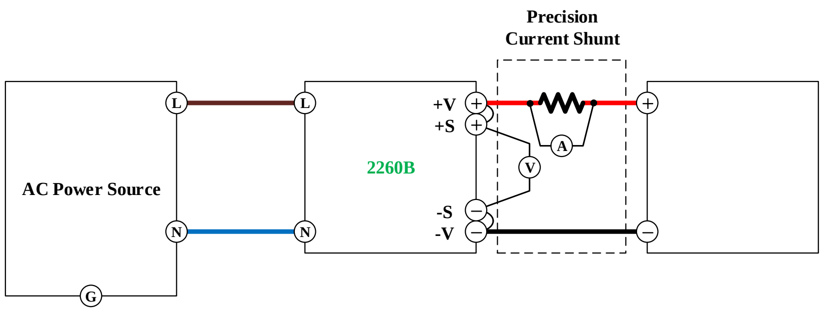
Verifying Transient Recovery Time Regulation is complete

Constant Current Tests

Current Programming and Measurement Accuracy

Connection

Fig. 8



Background

This test verifies that the current programming and measurement functions are within specifications.

Procedure

1. Turn off the power supply and connect the current shunt directly across the output as shown in the fig. 8 connection.
2. Turn on the power supply and program the output voltage to its full-scale value and the output current to zero. The CC indicator should be on and the output voltage reading should be approximately zero.
3. Record the output current readings on the precision current shunt (PCS-1000) and the current measured over the interface. The readings should be within the limits specified in the test record form for the appropriate model under Current Programming and Measurement, Minimum Current Iout.
4. Program the output current to its full-scale rating.
5. Record the output current readings on the precision current shunt (PCS-1000) and the voltage measured over the interface. The readings should be within the limits specified in the test record form for the appropriate model under Current Programming and Measurement, Rated Current Iout.

Verifying Current Programming and Measurement Accuracy is complete

CC Load Regulation

Connection	
Fig. 9	
Background	This test measures the change in output current resulting from a change in output voltage from full scale to short circuit.
Procedure	1. Turn off the power supply and connect the precision current shunt and electronic load as shown in the fig. 9 connection. 2. Turn on the power supply and program the output current to its maximum programmable value (Imax) and the output voltage to its full-scale value. 3. With the electronic load in CV mode, set it for the output's full scale voltage. The CC indicator on the front panel must be on. If it is not, adjust the load so that the voltage drops slightly. 4. Record the output current reading from the PCS-1000. 5. Short the electronic load. Record this value (Iout). The difference in the current readings in steps 3 and 4 is the load effect, which should not exceed the value listed in the test record form for the appropriate model under CC Load Regulation.

Verifying CC Load Regulation is complete

CC Line Regulation

Connection	
Fig. 10	
Background	This test measures the change in output current that results from a change in AC line voltage from the minimum to maximum value within the line voltage specifications.

Procedure

1. Turn off the power supply and connect the ac power source..
2. Connect the current shunt and electronic load as shown in the fig. 10 connection. Set the variable ac voltage to nominal line voltage.
3. Turn on the power supply and program the output current to its full-scale value and the output voltage to its maximum programmable value (Vmax).
4. With the electronic load in CV mode, set it for the output's full scale voltage. The CC indicator on the front panel must be on. If it is not, adjust the load so that the voltage drops slightly.
5. Adjust the ac power source to the low-line voltage (85 VAC for 100/120 nominal line; 170 VAC for 200/240 nominal line).
6. Record the output current reading from the PCS-1000.
7. Adjust the ac power source to the high-line voltage (132 VAC for 100/120 nominal line; 265 VAC for 200/240 nominal line).
8. Record the output current reading on the PCS-1000. The difference between the PCS-1000 reading in steps 5 and 7 is the source effect, which should not exceed the value listed in the test record form for the appropriate model under CC Line Regulation.

Verifying CC Line Regulation is complete

Verification Test Record Form

Print out these pages and record the results. Keep it with the power supply.

30V

Model	☐ 2260B-30-36	☐ 2260B-30-72	☐ 2260B-30-108
Serial number	____________________		
Date	Year___________	Month__________	Date___________
Verified by	Name____________________________		
	Company/Contact_________________________		
Environment	Temperature______°C Humidity______%		

Constant Voltage Test	Model	Min. Specs.	Results	Max. Specs.
Voltage Programming and Measurement				
Minimum Voltage V_{out}	All	- 10 mV	______	+ 10 mV
Measurement Accuracy	All	Vout - 10 mV	______	Vout + 10 mV
Rated Voltage Vout	All	29.960 V	______	30.040 V
Measurement Accuracy	All	Vout - 40 mV	______	Vout + 40 mV
CV Line Regulation	All	- 18 mV	______	+ 18 mV
CV Load Regulation	All	- 20 mV	______	+ 20 mV
CV Ripple and Noise				
peak-to-peak	30-36	N/A	______	60 mV
	30-72	N/A	______	80 mV
	30-108	N/A	______	100 mV
rms	30-36	N/A	______	7 mV
	30-72	N/A	______	11 mV
	30-108	N/A	______	14 mV
Transient Response Time				
Voltage @ 1ms	All	- 40 mV		+ 40 mV
Constant Current Test	Model	Min. Specs.	Results	Max. Specs.
Current Programming and Measurement				
Minimum Current Iout	30-36	- 30 mA	______	+ 30 mA
	30-72	- 60 mA	______	+ 60 mA
	30-108	- 100 mA	______	+ 100 mA
Measurement Accuracy	30-36	Iout - 30 mA	______	Iout + 30 mA
	30-72	Iout - 60 mA	______	Iout + 60 mA

	30-108	Iout - 100 mA	______	Iout + 100 mA
Rated Current Iout	30-36	35.934 A	______	36.066 A
	30-72	71.898 A	______	72.102 A
	30-108	107.862 A	______	108.138 A
Measurement Accuracy	30-36	Iout - 66 mA	______	Iout + 66 mA
	30-72	Iout - 102 mA	______	Iout + 102 mA
	30-108	Iout - 138 mA	______	Iout + 138 mA
CC Line Regulation	30-36	- 41 mA	______	+ 41 mA
	30-72	- 77 mA	______	+ 77 mA
	30-108	- 108 mA	______	+ 108 mA
CC Load Regulation	30-36	- 41 mA	______	+ 41 mA
	30-72	- 77 mA	______	+ 77 mA
	30-108	- 108 mA	______	+ 108 mA

80V

Model	2260B-80-13	2260B-80-27	2260B-80-40
Serial number	________________		
Date	Year__________	Month__________	Date__________
Verified by	Name______________________		
	Company/Contact____________________		
Environment	Temperature_____°C Humidity_____%		

Constant Voltage Test	Model	Min. Specs.	Results	Max. Specs.
Voltage Programming and Measurement				
Minimum Voltage V_{out}	All	- 10 mV	________	+ 10 mV
Measurement Accuracy	All	Vout - 10 mV	________	Vout + 10 mV
Rated Voltage Vout	All	79.910 V	________	80.090 V
Measurement Accuracy	All	Vout - 90 mV	________	Vout + 90 mV
CV Line Regulation	All	- 43 mV	________	+ 43 mV
CV Load Regulation	All	- 45 mV	________	+ 45 mV
CV Ripple and Noise				
peak-to-peak	80-13	N/A	________	60 mV
	80-27	N/A	________	80 mV
	80-40	N/A	________	100 mV
rms	80-13	N/A	________	7 mV
	80-27	N/A	________	11 mV
	80-40	N/A	________	14 mV
Transient Response Time				
Voltage @ 1ms	All	- 90 mV		+ 90 mV

Constant Current Test	Model	Min. Specs.	Results	Max. Specs.
Current Programming and Measurement				
Minimum Current Iout	80-13	- 10 mA	________	+ 10 mA
	80-27	- 30 mA	________	+ 30 mA
	80-40	- 40 mA	________	+ 40 mA
Measurement Accuracy	80-13	Iout - 10 mA	________	Iout + 10 mA
	80-27	Iout - 30 mA	________	Iout + 30 mA
	80-40	Iout - 40 mA	________	Iout + 40 mA
Rated Current Iout	80-13	13.476 A	________	13.524 A
	80-27	26.943 A	________	27.057 A
	80-40	40.419 A	________	40.581 A

Measurement Accuracy	80-13	Iout - 24 mA	______	Iout + 24 mA
	80-27	Iout - 57 mA	______	Iout + 57 mA
	80-40	Iout - 81 mA	______	Iout + 81 mA
CC Line Regulation	80-13	- 18.5 mA	______	+ 18.5 mA
	80-27	- 32 mA	______	+ 32 mA
	80-40	- 45.5 mA	______	+ 45.5 mA
CC Load Regulation	80-13	- 18.5 mA	______	+ 18.5 mA
	80-27	- 32 mA	______	+ 32 mA
	80-40	- 45.5 mA	______	+ 45.5 mA

250V

Model	2260B-250-4	2260B-250-9	2260B-250-13
Serial number	____________________		
Date	Year__________	Month__________	Date__________
Verified by	Name__________________________		
	Company/Contact________________________		
Environment	Temperature_____°C Humidity_____%		

Constant Voltage Test	Model	Min. Specs.	Results	Max. Specs.
Voltage Programming and Measurement				
Minimum Voltage V_{out}	All	- 200 mV	______	+ 200 mV
Measurement Accuracy	All	Vout - 200 mV	______	Vout + 200 mV
Rated Voltage Vout	All	249.55 V	______	250.45 V
Measurement Accuracy	All	Vout - 450 mV	______	Vout + 450 mV
CV Line Regulation	All	- 128 mV	______	+ 128 mV
CV Load Regulation	All	- 130 mV	______	+ 130 mV
CV Ripple and Noise				
peak-to-peak	250-4	N/A	______	80 mV
	250-9	N/A	______	100 mV
	250-13	N/A	______	120 mV
rms	250-4	N/A	______	15 mV
	250-9	N/A	______	15 mV
	250-13	N/A	______	15 mV

Transient Response Time				
Voltage @ 1ms	All	- 260 mV		+ 260 mV
Constant Current Test	Model	Min. Specs.	Results	Max. Specs.
Current Programming and Measurement				
Minimum Current Iout	250-4	- 5 mA	________	+ 5 mA
	250-9	- 10 mA	________	+ 10 mA
	250-13	- 15 mA	________	+ 15 mA
Measurement Accuracy	250-4	Iout - 5 mA	________	Iout + 5 mA
	250-9	Iout - 10 mA	________	Iout + 10 mA
	250-13	Iout - 15 mA	________	Iout + 15 mA
Rated Current Iout	250-4	4.4905 A	________	4.5095 A
	250-9	8.9810 A	________	9.0190 A
	250-13	13.471 A	________	13.529 A
			________	
Measurement Accuracy	250-4	Iout - 9.5 mA	________	Iout + 9.5 mA
	250-9	Iout - 19 mA	________	Iout + 19 mA
	250-13	Iout - 29 mA	________	Iout + 29 mA
CC Line Regulation	250-4	- 9.5 mA	________	+ 9.5 mA
	250-9	- 14 mA	________	+ 14 mA
	250-13	- 18.5 mA	________	+ 18.5 mA
CC Load Regulation	250-4	- 9.5 mA	________	+ 9.5 mA
	250-9	- 14 mA	________	+ 14 mA
	250-13	- 18.5 mA	________	+ 18.5 mA

800V

Model	2260B-800-1	2260B-800-2	2260B-800-4
Serial number	____________________		
Date	Year___________	Month__________	Date___________
Verified by	Name____________________________		
	Company/Contact_________________________		
Environment	Temperature______°C Humidity______%		

Constant Voltage Test	Model	Min. Specs.	Results	Max. Specs.
Voltage Programming and Measurement				
Minimum Voltage V_{out}	All	- 400 mV		+ 400 mV
Measurement Accuracy	All	Vout - 400 mV		Vout + 400 mV
Rated Voltage Vout	All	798.8 V		201.2 V
Measurement Accuracy	All	Vout - 1.2 V		Vout + 1.2 V
CV Line Regulation	All	- 403 mV		+ 403 mV
CV Load Regulation	All	- 405 mV		+ 405 mV
CV Ripple and Noise				
peak-to-peak	800-1	N/A		150 mV
	800-2	N/A		200 mV
	800-4	N/A		200 mV
rms	800-1	N/A		30 mV
	800-2	N/A		30 mV
	800-4	N/A		30 mV
Transient Response Time				
Voltage @ 1ms	All	- 260 mV		+ 260 mV
Constant Current Test	Model	Min. Specs.	Results	Max. Specs.
Current Programming and Measurement				
Minimum Current Iout	800-1	- 2 mA		+ 2 mA
	800-2	- 4 mA		+ 4 mA
	800-4	- 6 mA		+ 6 mA
Measurement Accuracy	800-1	Iout - 2 mA		Iout + 2 mA
	800-2	Iout - 4 mA		Iout + 4 mA
	800-4	Iout - 6 mA		Iout + 6 mA
Rated Current Iout	800-1	1.4365 A		1.4435 A
	800-2	2.8731 A		2.8869 A
	800-4	4.3096 A		4.3304 A

Measurement Accuracy	800-1	Iout - 3.5 mA		Iout + 3.5 mA
	800-2	Iout - 6.9 mA		Iout + 6.9 mA
	800-4	Iout - 10.4 mA		Iout + 10.4 mA
CC Line Regulation	800-1	- 6.44 mA		+ 6.44 mA
	800-2	- 7.88 mA		+ 7.88 mA
	800-4	- 9.32 mA		+ 9.32 mA
CC Load Regulation	800-1	- 6.44 mA		+ 6.44 mA
	800-2	- 7.88 mA		+ 7.88 mA
	800-4	- 9.32 mA		+ 9.32 mA