双向直流源测试报告

Test Report of Bidirectional DC source

南京璞骏新能源技术有限公司

Nanjing Bridge New Energy Technology Co.,Ltd

TEST DATE： 2020/05/25

TESTER： Shawn

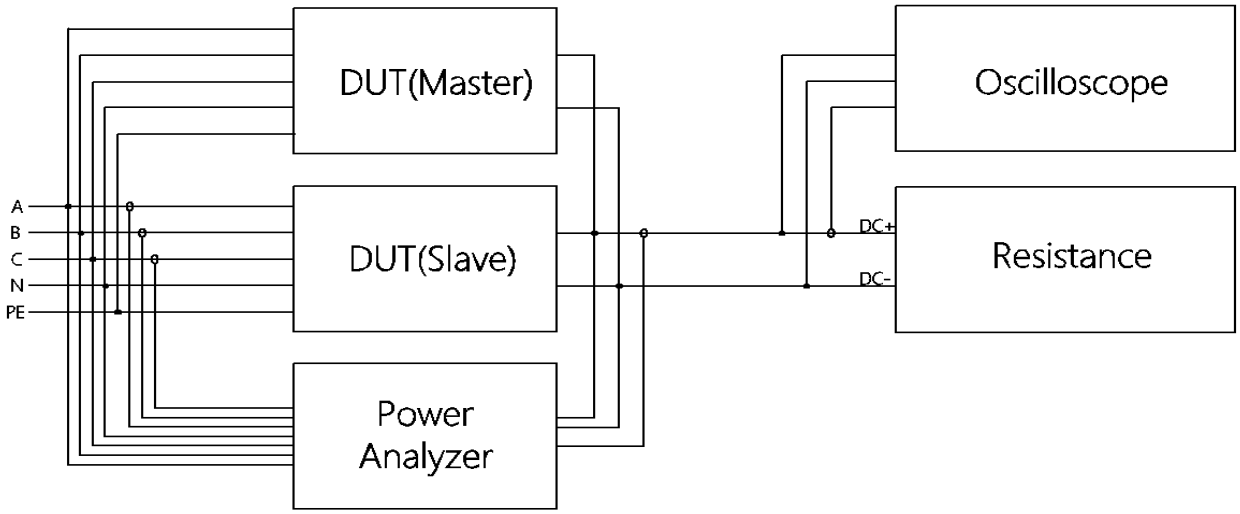
SERIAL NO： 20.20.113

MODEL： ESD 400-1000-400-R-BSS

Specification: V_{RATED}= 1000 V, I_{RATED}= 400 A, P_{RATED}= 400 KW

No.	Instruments	Model
1	Power analyzer	ZIMMER LMG670
2	Oscilloscope	Tektronix DPO2002B/ DS4000E
3	Voltage Probe	RIGOL RP1050D
4	Current Probe	CAT Ⅲ 600V/1000A
5	Noise Detector	SOUND LEVEL METER
6	Temperature Scanner	FLUKE MT4 MAX

Test system connection diagram



P1. Resistive load test

DUT: Device Under Test

Resistance

Power Analyzer

Oscilloscope

Contents

1 Appearance and Structural Inspection

When the power supply is in non-working state, it should be inspected by visual inspection or hand feeling method to ensure that there are no serious appearance defects caused by product assembly, or bad assembly seams and breakages that exceed the specifications. Such as scratch, indentation, color difference, paint drop. Relevant safety labels should meet the corresponding requirements of GB2894-2008 standard.

No.	Inspection contents	Confirmation（√ or×）
1	No serious appearance defects caused by product assembly, such as assembly seams and breaks beyond specifications, etc.	√
2	No serious defects affecting the appearance of products: scratches, indentations, color differences, paint dropping	√
3	Relevant safety labels should meet the requirements of GB2894-2008	√
4	Complete certificates, instructions and warranty cards, no misuse of packaging materials or multiple accessories	√

Signature：

2 Voltage Range

Connect the tested power supply with pure resistive load, make the output current within the specified range of the product, change the output voltage, and record the voltage data on the power analyzer.

Facilities and instruments: power analyzer

No.	Setting Voltage(V)	Voltage measured by Power Analyzer(V)
1	100	100.6
2	200	200.94
3	300	300.23
4	400	399.62
5	500	500.28
6	600	600.59
7	700	700.48
8	800	799.79

9	900	900.03
10	1000	1000.3

Signature：

3 Voltage Accuracy

Connect the tested power supply with a pure resistive load, make the output current within the specified range of the product, change the output voltage, record the voltage data on the tester and the displayed value of the output voltage on the tested power supply. Test at the upper limit, lower limit and intermediate value (at least three points) of the specified output voltage range. Take the one with the largest error for calculation to determine its indication error.

Its accuracy is obtained from the following formula:

$$\delta_U = \frac{|U_0 - U_1|}{U_N} \times 100\%$$

And:

δ_U——Voltage Accuracy;

U_1——Voltage value measured via power analyzer, V;

U_0——Voltage value displayed on power supply, V;

U_N——Rated Voltage, V;

Facilities and instruments: power analyzer, resistor load (50Ohm)

No.	Setting Voltage(V)		Voltage measured by DC Source(V)	Voltage measured by Power Analyzer(V)	Voltage Accuracy
1	10% V_{RATED}	100	99.9	100.6	0.07%
2	20% V_{RATED}	200	199.9	200.94	0.10%
3	30% V_{RATED}	300	299.9	300.23	0.03%
4	40% V_{RATED}	400	399.9	399.62	0.03%
5	50% V_{RATED}	500	499.9	500.28	0.04%
6	60% V_{RATED}	600	599.9	600.59	0.07%
7	70% V_{RATED}	700	699.9	700.48	0.06%
8	80% V_{RATED}	800	799.9	799.79	0.01%

9	90% V_{RATED}	900	899.9	900.03	0.01%
10	100% V_{RATED}	1000	999.9	1000.3	0.04%

Signature：

4 Current Accuracy

Connect the tested power supply with a pure resistive load, make the output voltage within the specified range of the product, change the output voltage, record the current data on the tester and the display value of the output current on the tested power supply. Test at the upper limit, lower limit and intermediate value (at least three points) of the specified output current range. Take the one with the largest error for calculation to determine its indication error.

Its accuracy is obtained from the following formula:

$$\delta_I = \frac{|I_0 - I_1|}{I_N} \times 100\%$$

And：

δ_I——Current Accuracy;

I_1——Current value measured via power analyzer, A;

I_0——Current value displayed on power supply, A;

I_N——Rated Current, A;

Facilities and instruments: power analyzer, resistor load (0.68Ohm)

No.	Setting Voltage(V)		Current measured by DC Source(A)	Current measured by Power Analyzer(A)	Current Accuracy
1	1% V_{RATED}	10	29.30	29.46	0.04%
2	2% V_{RATED}	20	58.35	58.51	0.04%
3	3% V_{RATED}	30	87.35	87.70	0.09%
4	4% V_{RATED}	40	116.35	116.77	0.11%
5	5% V_{RATED}	50	145.85	145.88	0.01%
6	6% V_{RATED}	60	174.75	175.17	0.10%
7	7% V_{RATED}	70	204.10	204.48	0.10%
8	8% V_{RATED}	80	233.45	233.95	0.13%
9	9% V_{RATED}	90	262.45	262.97	0.13%

10	10% V_{RATED}	100	291.95	292.50	0.14%
11	11% V_{RATED}	110	321.25	321.89	0.16%
12	12% V_{RATED}	120	350.55	351.19	0.16%
13	13% V_{RATED}	130	379.80	380.42	0.15%
14	13.7% V_{RATED}	137	399.90	400.69	0.20%

Signature：

5 Power Accuracy

The host and slave of the tested power supply are connected in parallel at the input end and the output end. Set the output voltage stabilizing (CV) of the host within the specified range of the product, change the output of the slave current (CC), and record the power data on the tester and the displayed value of the output power on the tested power supply. Test at the upper limit, lower limit and intermediate value (at least three points) of the specified output current range. Take the one with the largest error for calculation to determine its indication error.

Its accuracy is obtained from the following formula:

$$\delta_P = \frac{|P_0 - P_1|}{P_N} \times 100\%$$

And：

δ_P——Power Accuracy;

P_1——Power value measured via power analyzer, kW;

P_0——Power value displayed on power supply, kW;

P_N——Rated Power, kW;

Facilities and instruments: power analyzer

No.	Setting Current（A）		Power measured by DC Source (KW)	Power measured by Power Analyzer (KW)	Power Accuracy
1	10% V_{RATED}	20	19.85	20.03	0.09%
2	20% V_{RATED}	40	39.85	40.09	0.12%

3	30% V_{RATED}	60	59.90	60.15	0.13%
4	40% V_{RATED}	80	79.95	80.19	0.12%
5	50% V_{RATED}	100	99.95	100.28	0.16%
6	60% V_{RATED}	120	119.95	120.32	0.18%
7	70% V_{RATED}	140	140.00	140.37	0.19%
8	80% V_{RATED}	160	160.00	160.42	0.21%
9	90% V_{RATED}	180	180.05	180.52	0.23%
10	100% V_{RATED}	200	200.05	200.58	0.27%

Signature：

6 Output Characteristic

The host and slave of the tested power supply are connected in parallel at the input end and the output end. Set the output voltage stabilizing (CV) of the main engine within the specified range of the product, change the output of the slave current (CC), read the parameter values, PF values and efficiency on the power analysis on the premise of meeting the performance characteristics specified in the product standard, and record them.

Facilities and instruments: power analyzer

Output	**Input**									**Efficiency**	**Power Factor**
ΣP_O	**Setting Current**		**ΣP_L**	**U/I of Phase A**		**U/I of Phase B**		**U/I of Phase C**			
39.85	10%Current	20	6.57	238.73	19.81	239.79	13.75	239.51	24.68	83.20%	0.99
79.90	20%Current	40	7.62	238.34	20.26	239.16	13.77	238.82	26.06	90.35%	0.99
119.95	30%Current	60	8.83	238.61	21.44	239.54	13.29	239.06	27.01	92.60%	0.99
160.00	40%Current	80	10.17	237.99	22.46	239.43	13.26	238.91	28.43	93.64%	0.99
200.00	50%Current	100	11.70	238.17	24.37	239.65	13.72	238.68	29.71	94.15%	0.99
240.00	60%Current	120	13.33	237.64	26.21	239.41	14.85	238.09	31.51	94.45%	0.99
280.05	70%Current	140	15.17	237.27	28.64	238.86	15.99	237.81	34.18	94.60%	0.99
320.00	80%Current	160	17.16	236.85	31.72	238.91	19.04	237.74	36.94	94.64%	0.99

360.00	90%Current	180	19.27	237.39	34.58	239.21	20.74	238.18	39.48	94.65%	0.99
399.95	100%Current	200	21.64	236.99	38.06	238.38	23.69	237.32	43.11	94.58%	0.99

Signature：

7 Load Regulation

The host and slave of the tested power supply are connected in parallel at the input end and the output end. Set the output voltage (CV) of the main engine within the specified range of the product, change the change of the slave current (CC) between 0-100%, and read the output voltage display value of the power analyzer at no-load and on load. Take its value for calculation to determine the load adjustment rate of its power supply.

The load adjustment rate is obtained from the following formula:

$$L = \frac{|U_0 - U_1|}{U_n} \times 100\%$$

And:

L——Voltage Accuracy;

U_1——On-load voltage, V;

U_0——No-load voltage, V;

U_n——Rated voltage, V;

Facilities and instruments: power analyzer

No.	Setting Voltage		On-load voltage	No-load voltage	Load Regulation
1	10% V_{RATED}	100	100.53	100.6	0.01%
2	20% V_{RATED}	200	200.91	200.94	0.00%
3	30% V_{RATED}	300	299.74	300.23	0.05%
4	40% V_{RATED}	400	398.81	399.62	0.08%
5	50% V_{RATED}	500	499.62	500.28	0.07%
6	60% V_{RATED}	600	600.11	600.59	0.05%

7	70% V_{RATED}	700	699.98	700.48	0.05%
8	80% V_{RATED}	800	799.24	799.79	0.05%
9	90% V_{RATED}	900	899.69	900.03	0.03%
10	100% V_{RATED}	1000	1000.94	1000.3	0.06%

Signature：

8 Ripple Test

Ripple voltage is the superposition of all AC voltage components at the output of power supply. When the power supply DC output, the tested power supply is connected with pure resistive load, so that the output voltage and output current are set at the maximum value specified by the product, read the AC voltage indication value, and take the maximum value in the test.

The ripple coefficient is obtained from the following formula:

$$Y = \frac{U_{mrs}}{U_N} \times 100\%$$

And:

Y ———Ripple coefficient;

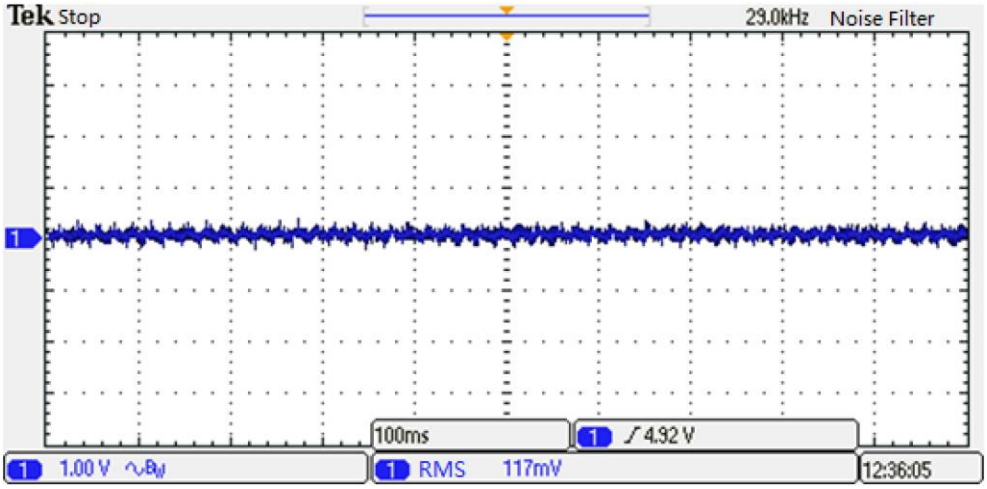
U_{mrs}———RMS of voltage ripple, V;

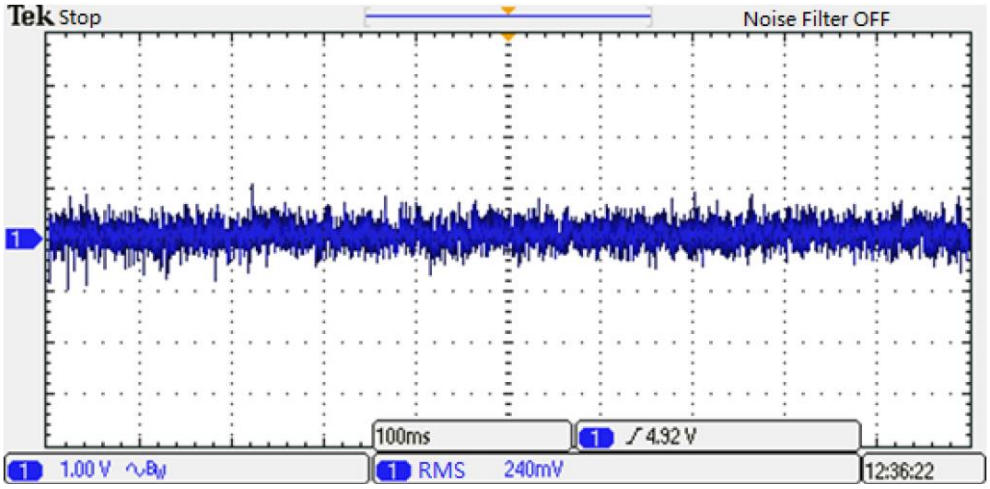
U_N ———Rated Voltage, V;

Facilities and instruments: resistor load, oscilloscopes(50Ohm)

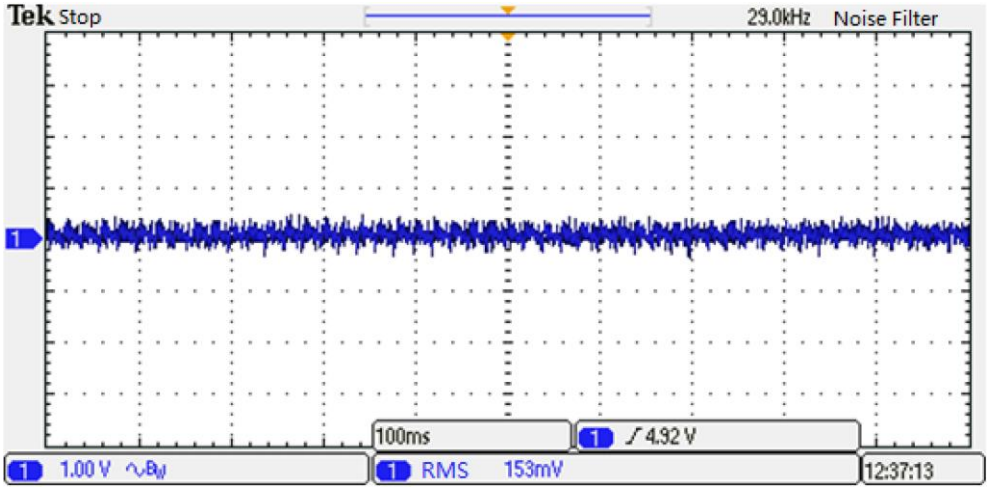
Setting Voltage		29KHz		70MHz		Waveform Recording
		U_{rms}	*Ripple coefficient*	U_{rms}	*Ripple coefficient*	
50% V_{RATED}	500	117mv	0.01%	153mv	0.02%	①
100% V_{RATED}	1000	240mv	0.02%	311mv	0.03%	②

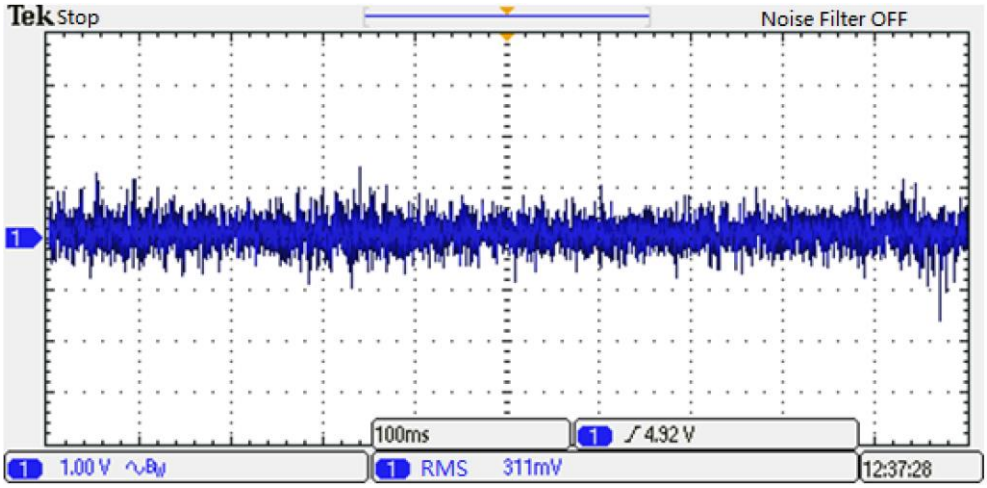
Oscilloscope setting: Channel coupling: AC, Bandwidth: 20MHz, Probe ratio: 500X, Noise filter: 29khz, Sampling depth: 1.25m, Sampling time: 100ms. Read voltage 500/1000v waveform is as follows:





Waveform② (500V filtered and unfiltered voltage ripple waveform)





Waveform③ (1000V filtered and unfiltered voltage ripple waveform)

Signature:

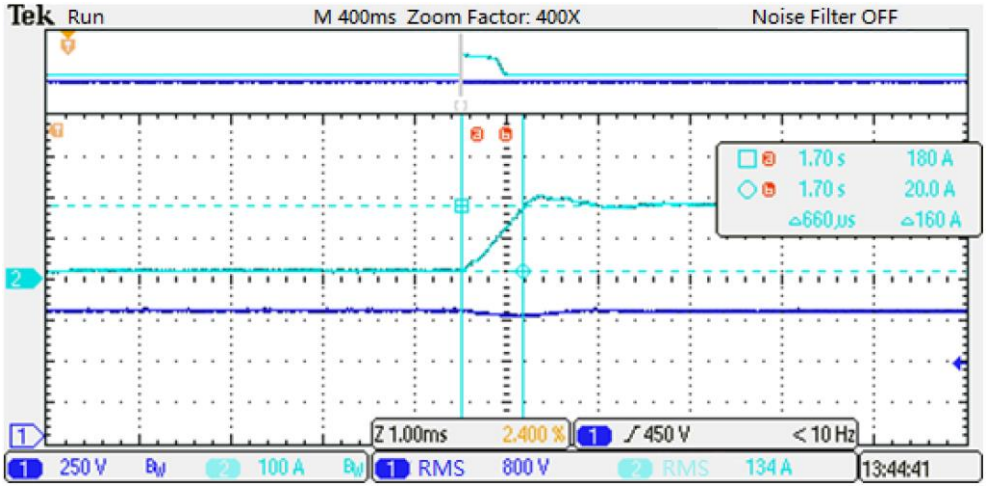
9 Current Rise Time

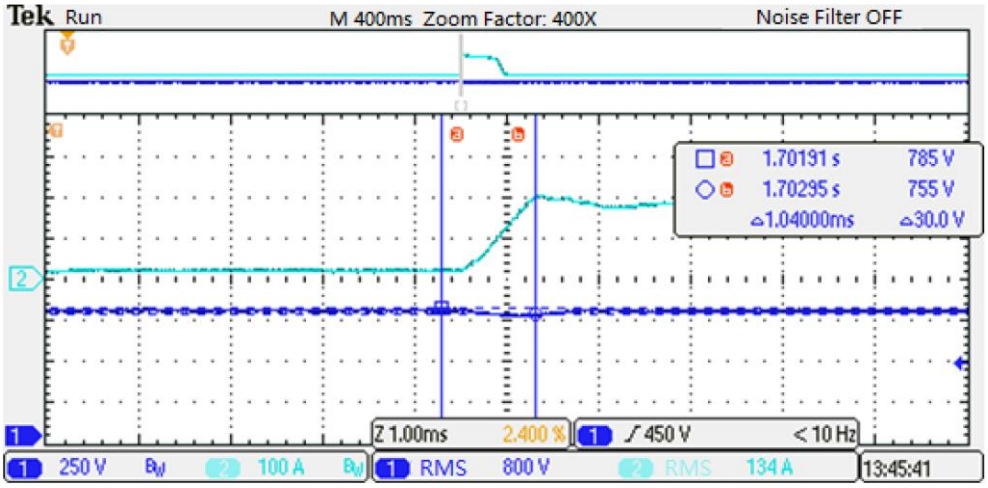
The host and slave of the tested power supply are connected in parallel at the input end and the output end. Set the output voltage (CV) of the main engine within the specified range of the product, change the change of the slave current (CC) between - 90% and 90%, and record the measurement waveform with an oscilloscope.

Facilities and instruments: oscilloscopes

Initial voltage	Current Rise Time	Climb time(us)	Waveform Recording
800V	10~90%	660us	①
	-90~90%	888us	②

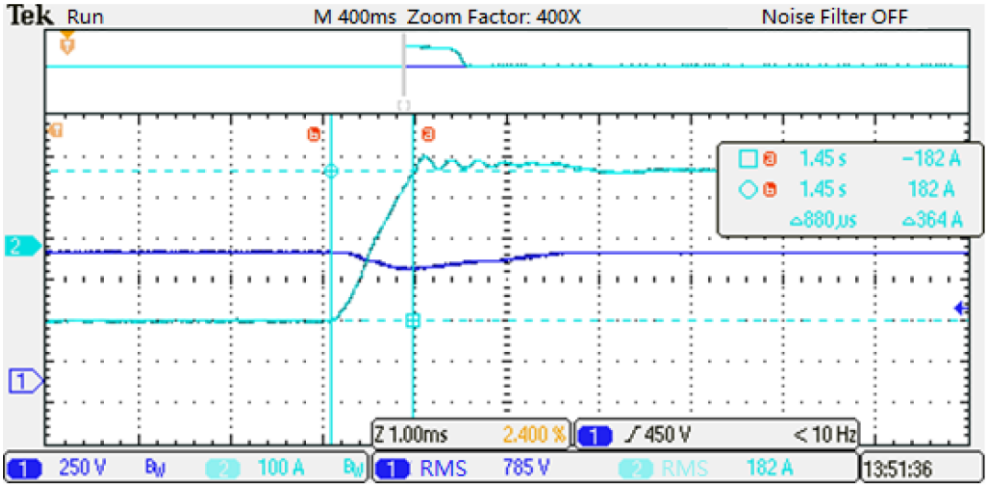
Oscilloscope setting: Channel coupling: DC, Bandwidth: 20MHz, Probe ratio: 500X, Noise filter: OFF, Sampling depth: 1.25M, Sampling time: 1ms. Read the conversion waveform as follows:

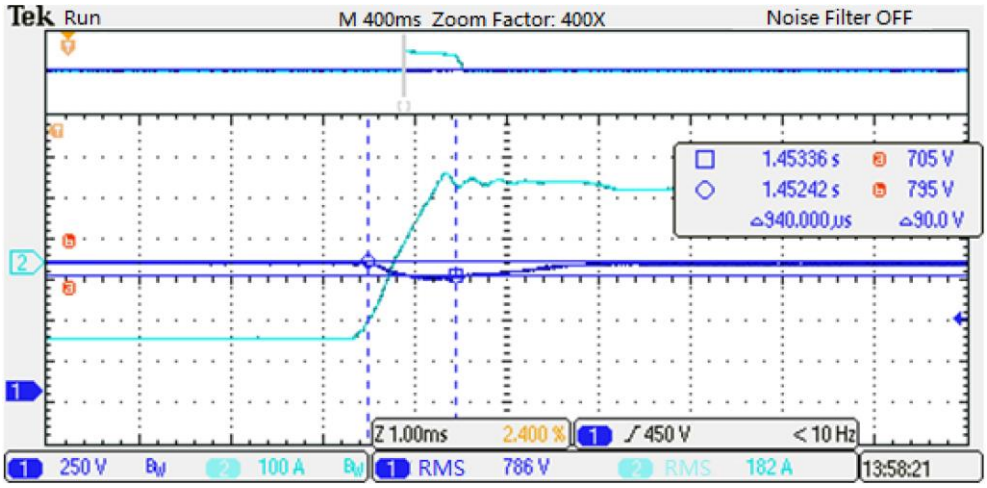




Waveform① Current Rise Time

(10~90% Load change. Channel 1 is voltage output and channel 2 is current output)





Waveform② Current Rise Time

(-90~90% Load change. Channel 1 is voltage output and channel 2 is current output)

Signature：

10 Regulation Time

The host and slave of the tested power supply are connected in parallel at the input end and the output end. Set the output voltage (CV) of the main engine within the specified range of the product, change the change of the slave current (CC) between 0% and 100%, and record the measurement waveform with an oscilloscope.

$$P_1 = U * I = 800 * 0 = 0KW$$

$$P_2 = U * I = 800 * 200 = 160KW$$

And:

P_1 ———Total output power of 0A;

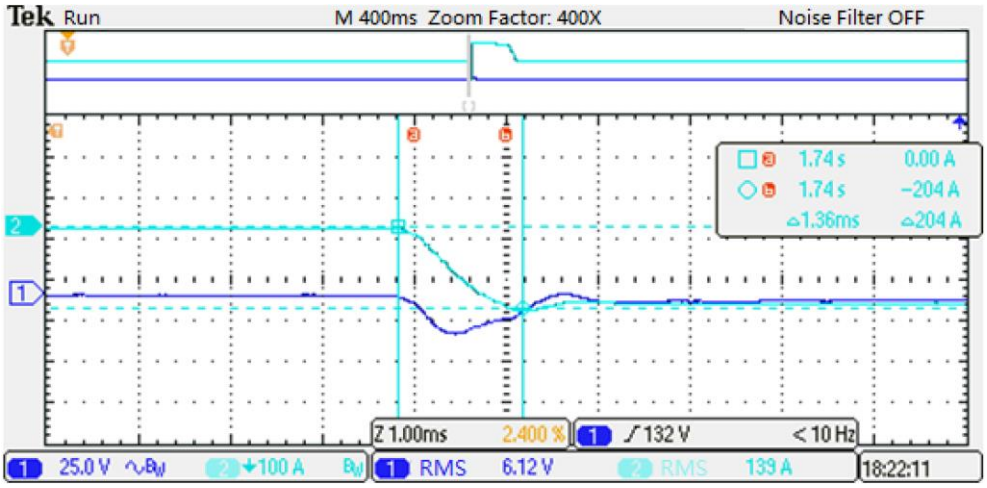
P_2 ———Total output power of 200A;

U ——— Setting Voltage Value, 800V;

Facilities and instruments: resistor load, oscilloscopes(3Ohm)

Initial voltage	Final voltage	Climb time(ms)	Waveform Recording
0%V_{RATED}	100%V_{RATED}	<1.36	①

Oscilloscope setting: Channel coupling: DC, Bandwidth: 20MHz, Probe ratio: 500X, Noise filter: OFF, Sampling depth: 1.25M, Sampling time: 1ms. Read the conversion waveform as follows:



Waveform① Regulation Time

(0~100% Load change. Channel 1 is voltage output and channel 2 is current output)

Signature:

11 Protections Function Test

No.	Test Items	Confirmation (√or×)
1	If the output voltage is set above the rated voltage specified by the power supply, the power supply should be able to limit the voltage output.	√
2	If the input voltage is set above the rated voltage specified by the power supply, the power supply should cut off the input immediately and give an alarm.	√
3	Adjust the load or output voltage so that the output current is more than 1.2 times the rated value. The power supply should be able to start protection immediately and cut off the output.	√

Signature：

12 Noise Test

NO.	Measured value	Equivalent calculation value
1	72.3	73.9
2	72.6	
3	73.4	
4	73.8	
5	74.7	
6	74.2	
7	73.8	
8	74.5	
9	75.0	
10	74.7	

Signature：

13 Temperature Test

Test time / NO.		Measured value					
		Master			Slave		
		Transformer	Inductance	IGBT	Transformer	Inductance	IGBT
1	0min	27.1	27.5	32.5	27.3	27.8	33.1
2	20 min	32.3	32.7	47.9	33.1	34.9	47.4
3	40 min	42.9	43.7	55.4	44.8	44.3	55.9
4	60 min	51.5	51.9	66.3	51.7	53.8	67.6
5	80 min	57.3	58.6	75.3	58.6	59.3	76.7
6	120min	62.6	63.5	81.4	63.3	64.7	82.1

Signature：

14 Log Function

Enter the settings interface to view log records and clear them before they leave the factory.

Signature：

15 Clock Function

Enter the settings interface to view and set the current time, year, month, day, hour and minute.

Signature：

16 LCD Display Test

In the setting and running state, there is no flicker and flower on LCD screen.

Signature：