



Test Report : SHP-10K-380

10KW 3 ψ 3W High Efficiency Digital Power Supply

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Control Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

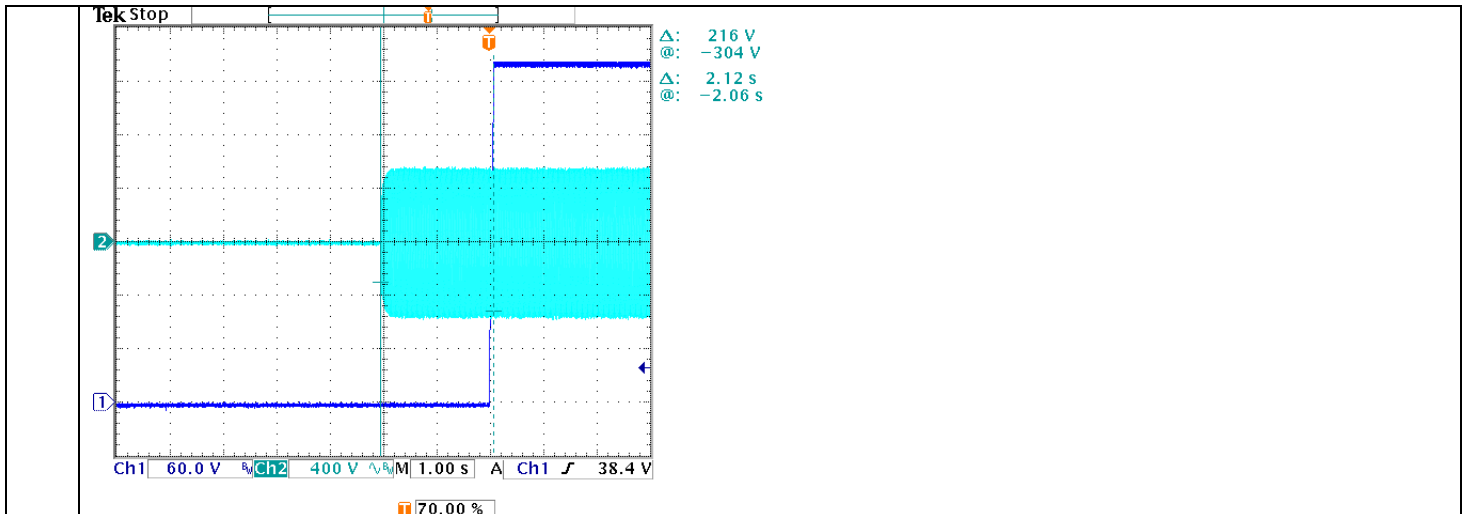
■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

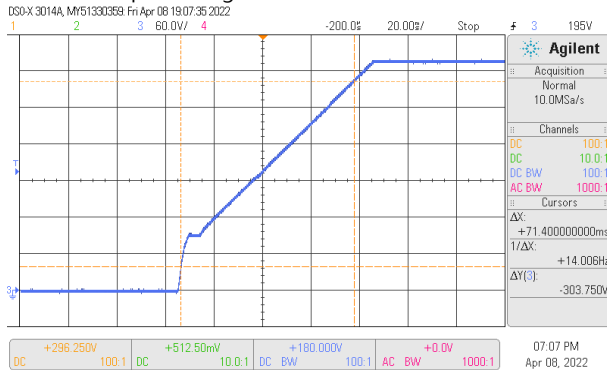
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 260V~ 400 V	I/P : 400VAC I/P : 340 VAC O/P : MIN LOAD Ta : 25°C	252.47V~411.5V/400VAC 252.47V~411.5V/340VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1 : 1%~ -1 %	I/P : 340VAC /530VAC O/P : FULL/ MIN. LOAD Ta : 25°C	V1 : -0.02% ~ -0.06%
3	LINE REGULATION (Max)	V1 : 0.5%~ -0.5 %	I/P : 340VAC~ 530VAC O/P : FULL LOAD Ta : 25°C	V1 : 0%~0%
4	LOAD REGULATION(Max)	V1 : 0.5%~ -0.5 %	I/P : 400VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.005%~-0.013%
5	OVER/UNDERSHOOT TEST	< \pm 10%	I/P : 400VAC O/P : FULL LOAD Ta : 25°C	< \pm 10%
6	RIPPLE & NOISE(Max)	V1 : 1Vp-p	I/P : 400VAC O/P : FULL LOAD Ta : 25°C	V1 : 560 mVp-p
<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p>high frequency :</p> </div> <div style="width: 45%;"> <p>low frequency :</p> </div> </div>				
7	SET UP TIME(Max)	400VAC/3000ms	I/P : 400 VAC O/P : FULL LOAD Ta : 25°C	2120ms
INPUT=400VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2~CH4 : AC Input Voltage				



8	RISE TIME (Max)	400VAC/100ms	I/P : 400VAC O/P : FULL LOAD Ta : 25°C	400VAC/71ms
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INPUT=400VAC/50HZ @ FULL LOAD

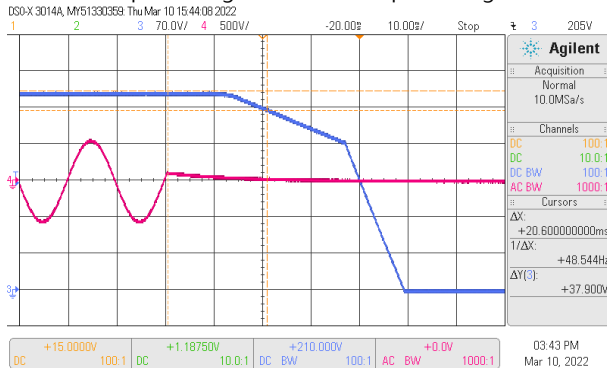
CH1 : Output Voltage



9	HOLD UP TIME (Typ.)	20ms / 400VAC at full load 25ms / 400VAC at 75% load	I/P : 400VAC O/P : FULL LOAD/75% load Ta : 25°C	400VAC/ 20.6ms at full load 400VAC/ 27.8ms at 75% load
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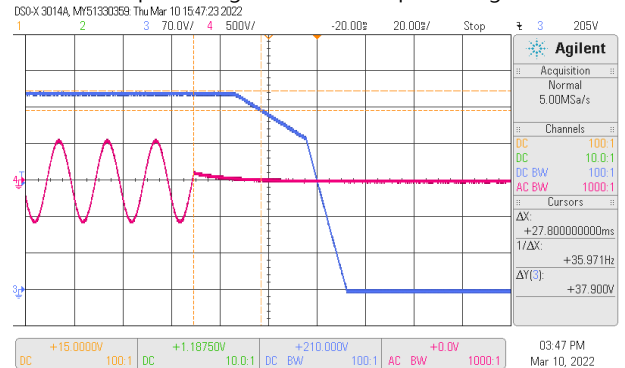
INPUT=400VAC/50HZ @ FULL LOAD

CH3 : Output Voltage CH4 : AC Input Voltage

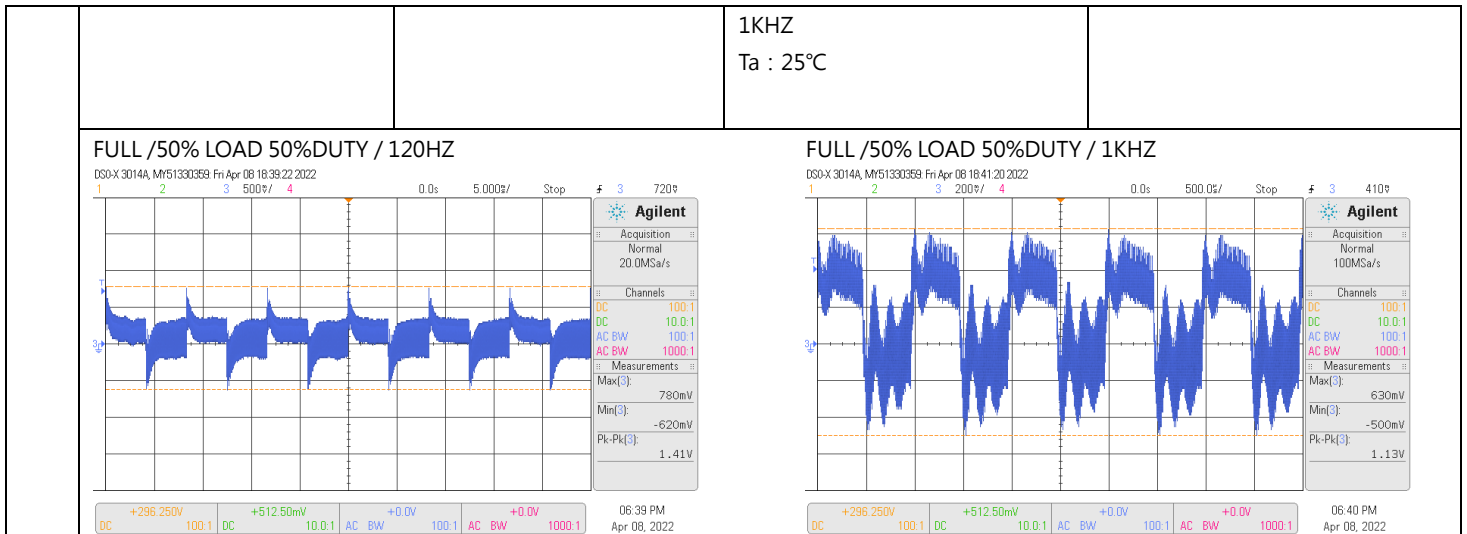


INPUT=400VAC/50HZ @ 75% LOAD

CH3 : Output Voltage CH4 : AC Input Voltage

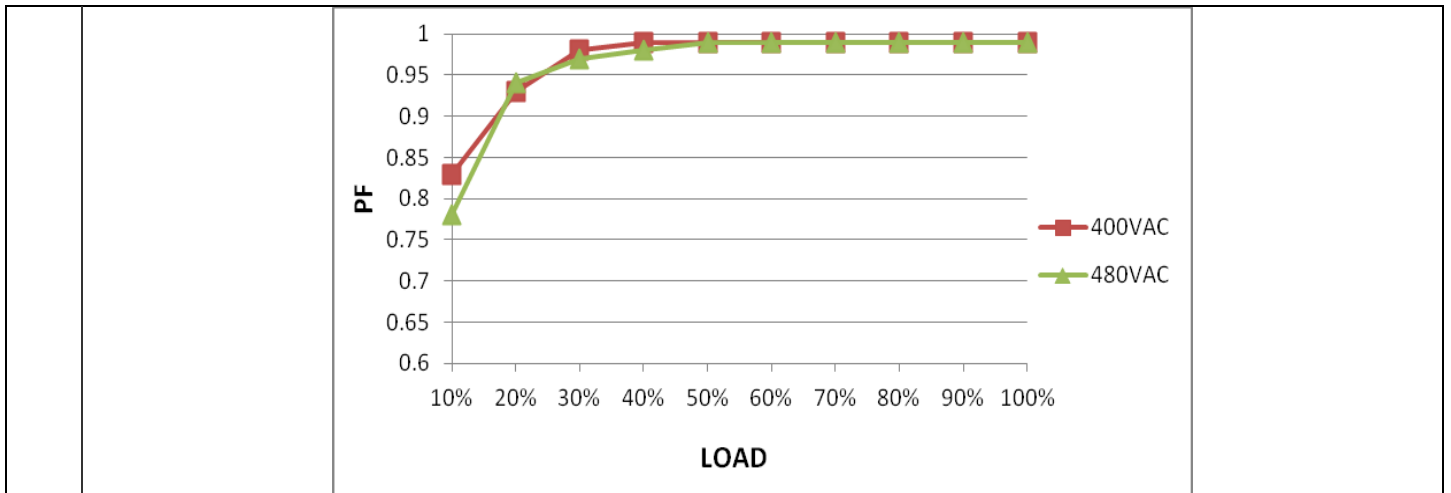


10	DYNAMIC LOAD	V1 : 38Vp-p	I/P : 400VAC O/P : (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY /	1.41Vp-p 1.13Vp-p
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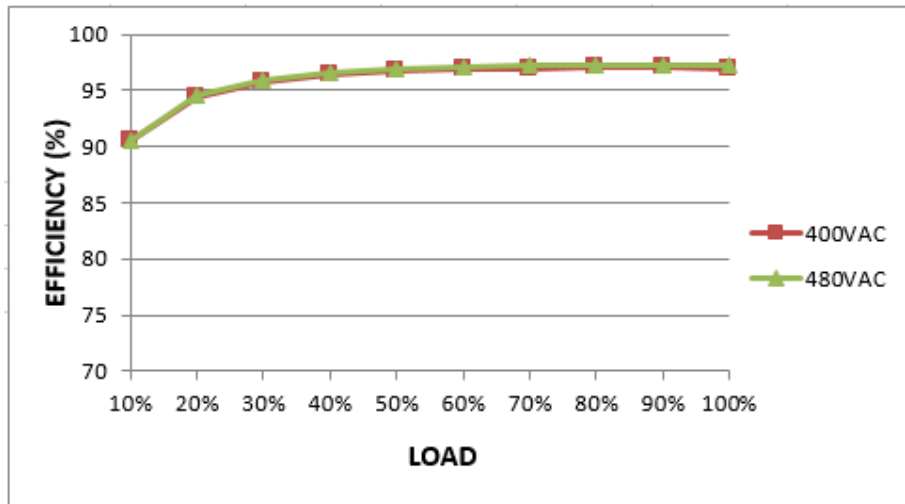
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	340VAC~530VAC	(1) I/P : TESTING O/P : FULL LOAD Ta : 25°C	(1) 332.6V~530V
			I/P : LOW-LINE-3V=337V HIGH-LINE+10V=540 V O/P : FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON : 30 Sec OFF : 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST : OK ◦
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P : 340 VAC ~530 VAC O/P : FULL~MIN LOAD Ta : 25°C	TEST : OK ◦
3	INPUT CURRENT (Typ.)	400V / 15.7A 480V/ 13A	I/P : 400VAC I/P : 480 VAC O/P : FULL LOAD Ta : 25°C	I =14.93A/ 400VAC I =12.43A/ 480VAC
4	LEAKAGE CURRENT	< 6.5mA / 530 VAC	I/P : 530 VAC O/P : Min LOAD Ta : 25°C	L1-FG : 5.2mA peak L2-FG : 5.2mA peak L3-FG : 5.2mA peak
5	POWER FACTOR (Typ.)	≥ 0.98 / 400VAC ≥ 0.98 /480VAC	I/P : 400VAC I/P : 480 VAC O/P : FULL LOAD Ta : 25°C	PF=0.9983/400VAC PF=0.9962/480VAC
	P.F vs LOAD			



6	EFFICIENCY(Typ.)	96.5%	I/P : 480VAC O/P : FULL LOAD Ta : 25°C	96.87%
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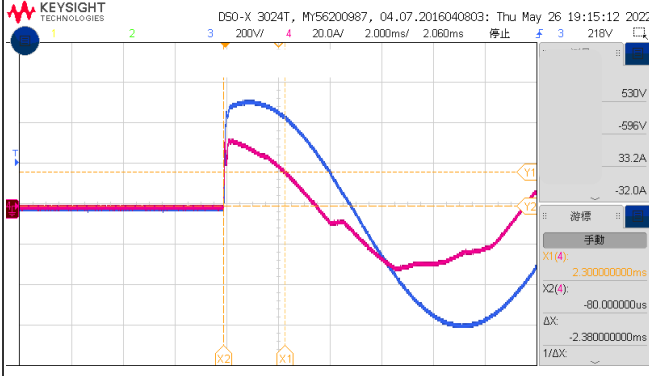
EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	40A@400VAC 65A@480VAC COLD START	I/P : 400VAC I/P : 480 VAC O/P : FULL LOAD Ta : 25°C	I = 33.2A/ 400VAC T50=2380ms I = 43.6A/ 480VAC T50=2580ms
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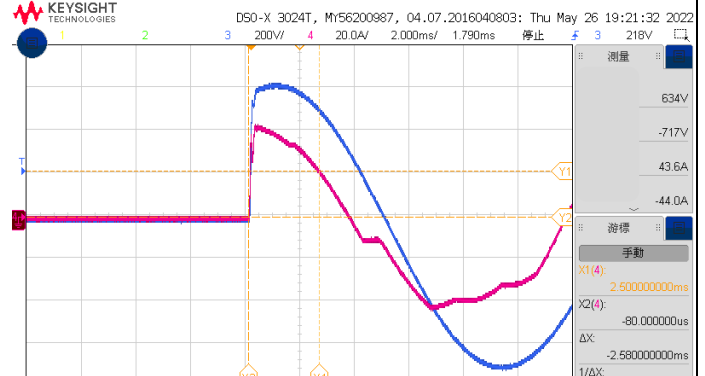
INPUT=400VAC/50HZ @ FULL LOAD

CH4 : AC Input Voltage CH3 : Input current



INPUT=480VAC/ 60HZ @ FULL LOAD

CH3 : AC Input Voltage CH4 : Input current



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	100%~ 105 % PROTECTION TYPE : Constant current limiting, unit will shutdown after 5 sec. re-power on to recover	I/P : 530 VAC I/P : 400VAC I/P : 340VAC O/P : TESTING Ta : 25°C	102.58%/ 530 VAC 102.5%/ 400VAC 102.47%/340VAC PROTECTION TYPE : constant current limiting or constant current limiting with delay shutdown after 5 seconds, re-power on to recover
2	OVER VOLTAGE PROTECTION	420V~460V PROTECTION TYPE : Shut down o/p voltage, re-power on to recover	I/P : 530 VAC I/P : 400VAC I/P : 340 VAC O/P : MIN LOAD Ta : 25°C	430.44V/ 530 VAC 432.27V/ 400VAC 433.68V/ 340VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	Protection type : Shut down o/p voltage, recovers automatically after temperature goes down	I/P : 530 VAC I/P : 340 VAC O/P : FULL LOAD	O.T.P. Active OK Protection type : Shut down o/p voltage, recovers automatically after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P : 530 VAC I/P : 340 VAC O/P : FULL LOAD Ta : 25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, unit will shutdown after 5 sec. re-power on to recover

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT								
1	AUXILIARY POWER (AUX)	Auxiliary voltage output, 11.4~12.6V, referenced to GND-AUX (pin15 & 16). The maximum load current is 1A. This output is not controlled by "Remote ON-OFF" . I/P : 400VAC O/P : FULL LOAD Ta : 25°C Test Result : PASS										
		<table border="1"> <thead> <tr> <th>AUX</th> <th>TOLERANCE</th> <th>RIPPLE</th> <th>TEST RESULT</th> </tr> </thead> <tbody> <tr> <td>12V / 1A</td> <td>11.4~12.6V</td> <td>150mVp-p</td> <td>No Load : 12.049V Full Load : 11.734V Ripple : 80mV</td> </tr> </tbody> </table>			AUX	TOLERANCE	RIPPLE	TEST RESULT	12V / 1A	11.4~12.6V	150mVp-p	No Load : 12.049V Full Load : 11.734V Ripple : 80mV
AUX	TOLERANCE	RIPPLE	TEST RESULT									
12V / 1A	11.4~12.6V	150mVp-p	No Load : 12.049V Full Load : 11.734V Ripple : 80mV									

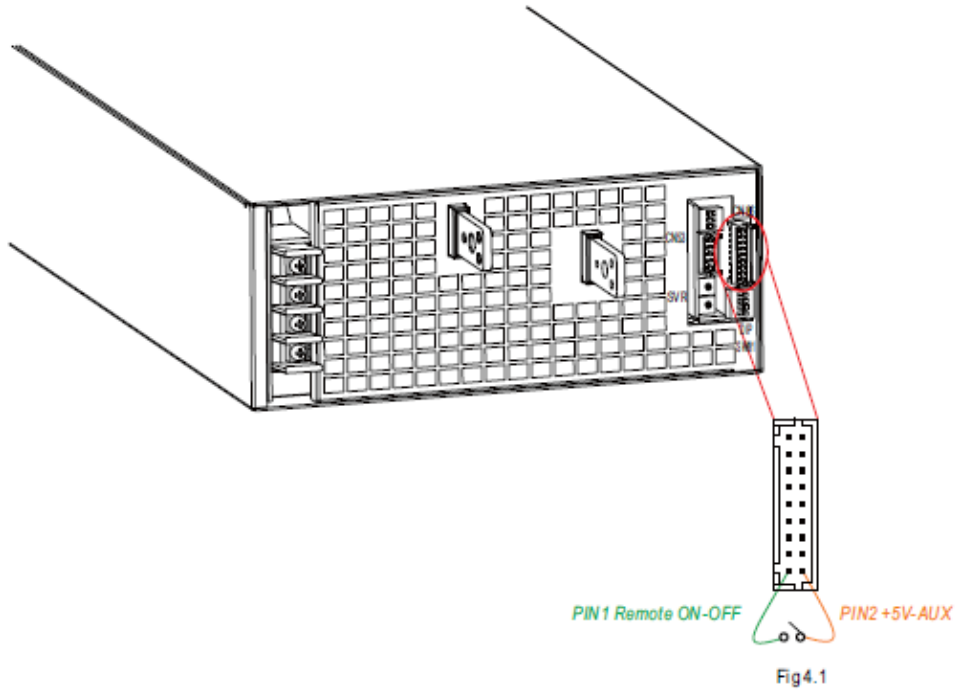
2 REMOTE ON/OFF CONTROL

4.Remote ON-OFF Control

※ The power supply can be turned ON-OFF by using the "Remote ON-OFF" function.

Between Remote ON-OFF(CN86 pin1) and 5V-AUX(CN86 pin2)	Output Status
Switch close (Short)	power supply ON
Switch open (Open)	power supply OFF

Table 4.1



I/P : 400VAC
 O/P : FULL LOAD
 Ta : 25°C
 Test Result : PASS

Between Remote ON-OFF(CN86 pin1) and 5V-AUX(CN86 pin2)	Output Status
Switch close (Short)	power supply ON
Switch open (Open)	power supply OFF

3 ALARM SIGNAL

5. Alarm Signal Output

※ There are 4 alarm signals, DC-OK, T-ALARM, Fan Fail and AC-OK, in TTL signal form, on CN86. These signals are isolated from output.

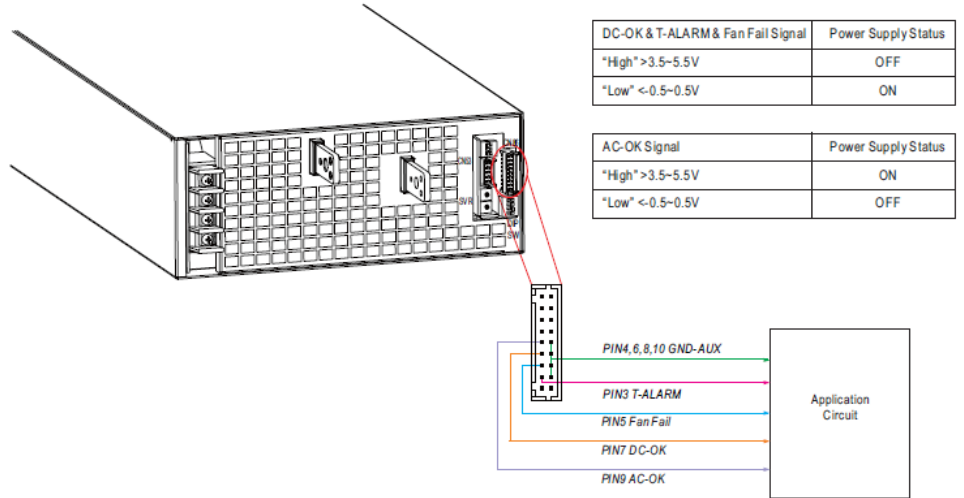


Fig 5.1

※ DC OK might mis-triggered when the voltage difference between PSU and the load, please minimized the unnecessary voltage difference.

1. DC OK SIGNAL

High (3.5 ~ 5.5V) : When the $V_{out} \leq 80\% \pm 6\%$.

Low (-0.5 ~ 0.5V) : When the $V_{out} \geq 80\% \pm 6\%$.

The maximum sourcing current is 10mA and only for output.

I/P : 400VAC

O/P : FULL LOAD

Ta : 25°C

Test Result :

Vout	DC OK SIGNAL
$V_{out} \leq 74\%$	5.05V
$V_{out} \geq 86\%$	0V

2. T-ALARM

High (3.5 ~ 5.5V) : When the internal temperature exceeds the limit of temperature alarm.

Low (-0.5 ~ 0.5V) : When the internal temperature is normal.

The maximum sourcing current is 10mA and only for output.(Note)

I/P : 400VAC

O/P : FULL LOAD

Ta : 25°C

Test Result :

PSU STATUS	T-ALARM SPEC	T-ALARM TEST
NORMAL	-0.5 ~ 0.5V	0V
OTP	3.5~5.5V	5.02V

3. AC OK
 High (3.5 ~ 5.5V): When AC input $\geq 335 \pm 1.5\%$ Vac, PSU works normally.
 Low (-0.5 ~ 0.5V): When AC input $\leq 320 \pm 1.5\%$ Vac, PSU shut down.
 The maximum sourcing current is 10mA and only for output.(Note)
 I/P : 400VAC
 O/P : FULL LOAD
 Ta : 25°C
 Test Result :

AC	AC OK SIGNAL
$AC \leq 320V$	0V
$AC \geq 335V$	5.06V

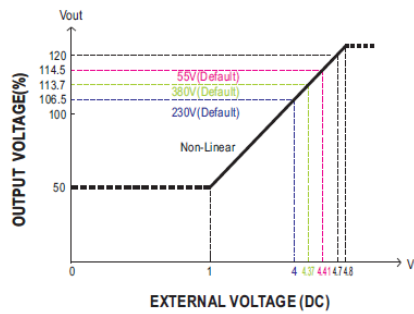
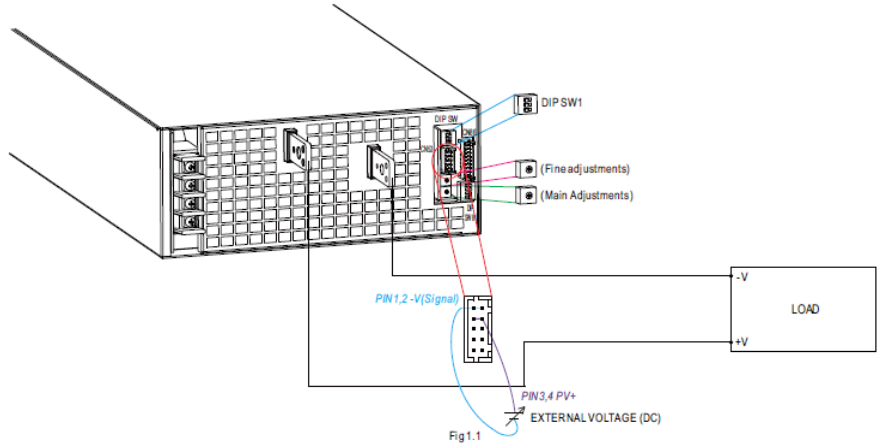
4. FAN FAIL
 High(3.5~5.5V):When the fan fail.
 Low(-0.5~0.5V):When the fan works normally.
 The maximum sourcing current is 10mA and only for output.(Note)
 I/P : 400VAC
 O/P : FULL LOAD
 Ta : 25°C
 Test Result :

FAN	AC OK SIGNAL
Fan works	0V
Fan lock	5.05V

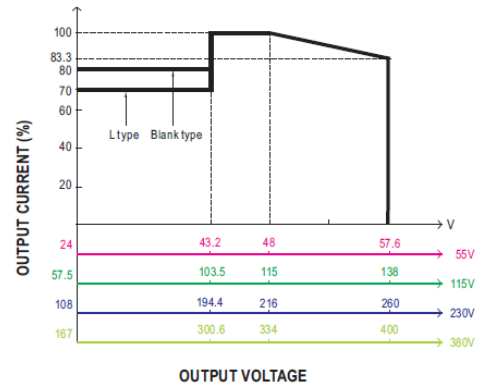
4 OUTPUT VOLTAGE PROGRAMMABLE(PV)

1. Output Voltage Programming (or, PV / remote voltage programming / remote adjust / margin programming / dynamic voltage trim)

- (1) by potentiometer (SVR)
 - (a) Have the DIP switch position-3 set as
 - (b) Output voltage can be trimmed by SVR.
- (2) by Output Voltage Programming
 - (a) Have the DIP switch position-3 set as
 - (b) The output voltage can be trimmed to 50~120% by applying EXTERNAL VOLTAGE between PV+ and PV- on CN53.



© The 100% output voltage is 48/115/216/334V.



© The rated current should change with the Output Voltage Programming accordingly.

I/P: 400VAC
 O/P: FULL LOAD
 Ta: 25°C
 TEST RESULT :

PV / MODEL	1V	5V
SPEC	167V \pm 5%	400V \pm 5%
Vout	166.92V	407.47V

5 OUTPUT CURRENT PROGRAMMABLE (PC)

2. Constant Current Programming (or, PC / remote current programming / dynamic current trim)

(1) Default Overload Protection(OLP) value

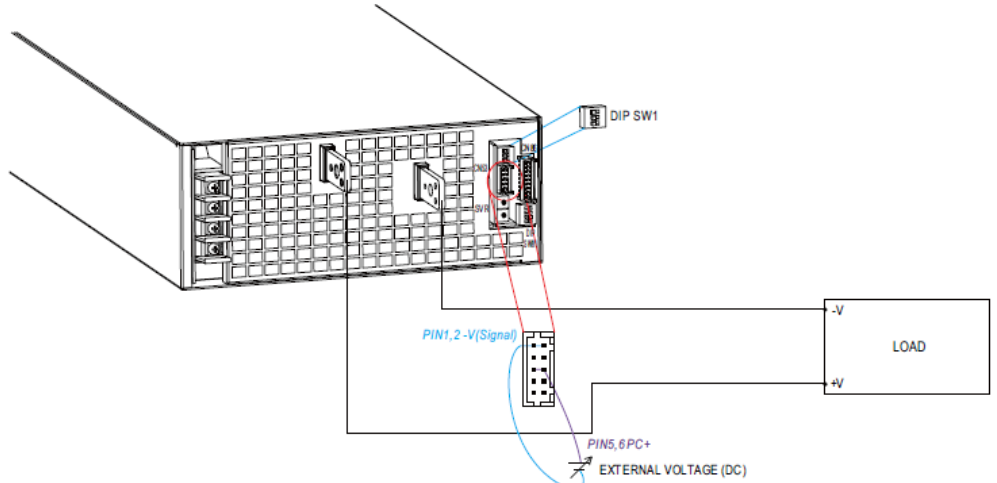
(a) Have the DIP switch position-2 set as

(b) Output current is set default value.

(2) by Constant Current Level Programming

(a) Have the DIP switch position-2 set as

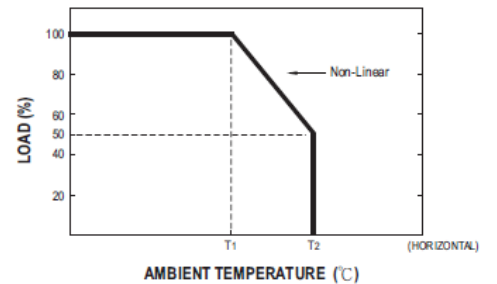
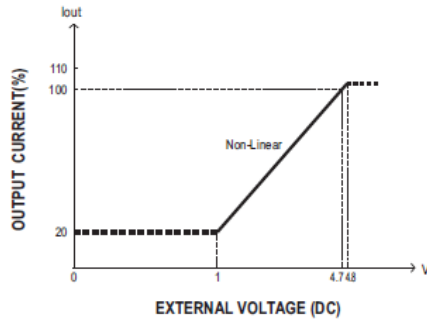
(b) The constant current level can be trimmed to 20~100% of the rated current by applying EXTERNAL VOLTAGE between PC+ and PC- on CN53.



※ Under PC function at wattage < 4KW, the power supply might enter burst mode and cause output unstable, please increase the load to minimized the effect.
 ※ Auto de-rating function covered by over temperature protection, it works either in PC mode or under control by communication protocol.

T₁(Typ.): Maximum ambient temperature of full load.

T₂(Typ.): T₁+5°C.



I/P : 400VAC

O/P : TESTING (factory default)

T_a : 25°C

MODEL \ PC	1V	5V
SPEC	6A±10%	26.87A±10%
l _{out}	6.09A	27.06A

6	CURRENT SHARING	CURRENT SHARING TOLERANCE $\pm 10\%$	I/P : 400 VAC O/P : 380V (factory default) 100/50% LOAD Ta : 25°C	O/P : 100% PSU1 : 26.3 A PSU2 : 26.5 A PSU3 : 26.3 A PSU4 : 25.1 A O/P : 50% PSU1 : 13.1 A PSU2 : 12.9 A PSU3 : 13.1 A PSU4 : 12.2 A
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COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q401 Rated : 95A/1200V VGS : -10V~+22V	AC ON/OFF I/P : High-Line +3V =533V VDS : <u>VO : 334V</u> O/P : (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→120% Load. Ta : 25°C	Q401 <u>VO : 334V</u> VDS : (1) 954V (2) 954V (3) 954V (4) 962V (5) 962V (6) 986V (7) 978V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q163 Rated : 119A/650V VGS : -10~+22V	I/P : High-Line +3V =533V AC ON/OFF <u>VO : 334V</u> O/P : (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→120% Load.	<u>VO : 334V</u> VDS : (1) 513V (2) 513V (3) 493V (4) 489V (5) 497V (6) 481V (7) 509V

			Ta : 25°C		
3	P.F.C DIODE	D163 Rated : 15A/1200V	I/P : High-Line +3V =533V AC ON/OFF <u>VO : 334V</u> O/P : (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta : 25°C	<u>VO : 334V</u> (1) 914V (2) 938V (3) 897V (4) 889V	
4	Diode Peak Voltage	D610 Rated : 15A/1200V D613 Rated : 15A/1200V D616 Rated : 15A/1200V D619 Rated : 15A/1200V	AC ON/OFF I/P : High-Line +3V =533V <u>VO : 380V</u> O/P : (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→120% Load. (8).NO LOAD Ta : 25°C	D610 : <u>VO : 380V</u> VDS : (1) 923V (2) 923V (3) 931V (4) 931V (5) 939V (6) 931V (7) 898V (8) 882V D616 : <u>VO : 380V</u> VDS : (1) 898V (2) 915V (3) 923V (4) 939V (5) 939V (6) 915V (7) 907V (8) 882V	D613 : <u>VO : 380V</u> VDS : (1) 939V (2) 939V (3) 955V (4) 955V (5) 955V (6) 939V (7) 931V (8) 882V D619 : <u>VO : 380V</u> VDS : (1) 915V (2) 915V (3) 939V (4) 931V (5) 931V (6) 939V (7) 931V (8) 866V

■ SAFETY& E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P : 3.75KVAC/min I/P-FG : 2KVAC/min O/P-FG : 1.25KVAC/min	I/P-O/P : 4.125KVAC/min I/P-FG : 2.4 KVAC/min O/P-FG : 1.5 KVAC/min Ta : 25°C	I/P-O/P : 18.8mA I/P-FG : 15.09mA O/P-FG : 16.23mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100M Ω I/P-FG : 500VDC>100M Ω O/P-FG : 500VDC>100M Ω	I/P-O/P : 500 VDC I/P-FG : 500 VDC O/P-FG : 500 VDC Ta : 25°C	I/P-O/P : 5.31G Ω I/P-FG : 6.02G Ω O/P-FG : 6.48G Ω NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 m Ω	40A / 2min Ta : 25°C	22 m Ω

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P : 400VAC/50HZ O/P : FULL LOAD Ta : 25°C	PASS
2	CONDUCTION	EN55032 /EN55011 CLASS B	I/P : 400VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS
3	RADIATION	EN55032 /EN55011 CLASS A	I/P : 400VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS
4	E.S.D	EN61000-4-2 <u>INDUSTRY</u> AIR : 8KV / Contact : 4KV	I/P : 400VAC/50HZ O/P : FULL LOAD Ta : 25°C	PASS
5	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 400VAC/50HZ O/P : FULL LOAD Ta : 25°C	PASS
6	SURGE	IEC61000-4-5 INDUSTRY L-N : 2KV L,N-PE : 4KV	I/P : 400VAC/50HZ O/P : FULL LOAD Ta : 25°C	PASS
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

■ **RELIABILITY TEST**

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																																																
1	TEMPERATURE RISE TEST	MODEL : SHP-10K-115 1. ROOM AMBIENT BURN-IN : 1.5 HRS I/P : 400VAC O/P : FULL LOAD Ta= 25 °C 2. HIGH AMBIENT BURN-IN : 2HRS I/P : 400VAC O/P : FULL LOAD Ta= 50 °C																																																																																																																																		
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			32	L40 wire	49.5°C	90.8°C
			33	D610	81.0°C	101.6°C
			34	D614	79.7°C	99.3°C
			35	D618	52.5°C	98.1°C
			36	D619	83.1°C	77.9°C
			37	RT61	38.7°C	64.4°C
			38	RT64	47.6°C	77.7°C
			39	RT65	53.5°C	72.9°C
			40	RTH6	42.2°C	60.6°C
			41	RTH7	35.0°C	61.3°C
			42	C643	28.1°C	55.2°C
			43	C635	26.4°C	55.1°C
			44	C518	27.2°C	50.1°C
			45	U504	27.8°C	50.6°C
			46	T900	33.0°C	54.3°C
			47	T901	30.9°C	51.3°C
			48	Q930	36.4°C	56.7°C
			49	D951	43.2°C	65.0°C
			50	CK12	29.8°C	50.1°C
			51	C951	31.6°C	52.3°C
			52	C439	40.1°C	62.3°C
			53	C440	44.3°C	66.7°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 400 VAC O/P : 101%LOAD Ta : 25°C		TEST : OK	
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 530VAC/340VAC O/P : 100 %LOAD Ta= -35°C		TEST : OK	
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C/95 %R.H NO DAMAGE	I/P : 540 VAC O/P : FULL LOAD Ta= 50°C HUMIDITY= 95 %R.H		TEST : OK	
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C(0~50°C)	I/P : 400 VAC O/P : FULL LOAD		± 0.004 %/°C(0~50°C)	
6	STORAGE TEMPERATURE TEST	-40~85°C	1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : STATIC			
7	THERMAL SHOCK TEST	-30~50°C	1. Thermal shock Temperature : -35°C~ +55°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 16 CYCLE 5. Input/Output condition : 15cycle:380V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:380V/ FULL LOAD Burn In Test			

8	VIBRATION TEST	10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 3G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C643 IS THE MOST CRITICAL COMPONENT (1) I/P : 400VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 400VAC O/P : FULL LOAD Ta= 50 °C LIFE TIME (3) I/P : 400VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 400VAC O/P : 50% LOAD Ta= 50 °C LIFE TIME	(1) 1255888HRS (2) 190611HRS (3) 343879HRS (4) 509875HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 281.2K hrs min. Telcordia SR-332 (Bellcore) ; 28K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 380VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 50,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT TSENG

2020.10.1 TAG-QA-009