Prüfbericht-Nr.: *Test Report No.*:	50173799 001	**Auftrags-Nr.:** *Order No.*:	154348268	Seite 1 von 65 *Page 1 of 65*
Kunden-Referenz-Nr.: *Client Reference No.*:	616910	**Auftragsdatum:** *Order date*:	23.07.2018	
Auftraggeber: *Client*:	**Ningbo Ginlong technologies Co., Ltd.** No.57 Jintong Road, Binhai, (seafront) industrial Park, Xiangshan, Ningbo, zhejiang, 315712, P.R. China			
Prüfgegenstand: *Test item*:	Grid-connected PV Inverter			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	Solis-3P5K-4G, Solis-3P6K-4G, Solis-3P8K-4G, Solis-3P9K-4G, Solis-3P10K-4G, Solis-3P12K-4G ,Solis-3P15K-4G, Solis-3P17K-4G ,Solis-3P20K-4G			
Auftrags-Inhalt: *Order content*:	AK Certification			
Prüfgrundlage: *Test specification*:	NRS 097-2-1: 2017			

Wareneingangsdatum: *Date of receipt*:	23.07.2018
Prüfmuster-Nr.: *Test sample No.*:	1107E0187200003
Prüfzeitraum: *Testing period*:	23.07.2018 – 21.08.2018
Ort der Prüfung: *Place of testing*:	TÜV Rheinland (Shanghai) Co.,Ltd.
Prüflaboratorium: *Testing laboratory*:	TÜV Rheinland (Shanghai) Co.,Ltd.
Prüfergebnis*: *Test result**:	Pass

geprüft von / *tested by*:			**kontrolliert von** / *reviewed by*:		
23.08.2018	Thomas Qian / PE		23.08.2018	Billy Chen / Reviewer	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*:
N/A

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery*:	Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

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NRS 097-2-1
GRID INTERCONNECTION OF EMBEDDED GENERATION
PART 2: SMALL-SCALE EMBEDDED GENERATION
– Section 1: Utility interface

Report Reference No. .....:	50173799 001
Tested by (name + signature) .....:	See cove page .....
Approved by (name + signature)....:	See cove page .....
Date of issue.....:	See cove page
Testing Laboratory.....:	**TÜV Rheinland (Shanghai) Co., Ltd.**
Address .....:	No. 177, Lane 777 West Guangzhong Road, Jingan District, Shanghai, P.R.China
Testing location/ procedure .....:	CBTL☐ TMP☐ WMT☐ SMT☐ RMT☐ CCATL ☐
Testing location/ address .....:	**TÜV Rheinland (Shanghai) Co., Ltd.** No. 177, Lane 777 West Guangzhong Road, Jingan District, Shanghai, P.R.China
Applicant's name .....:	**Ningbo Ginlong technologies Co., Ltd.**
Address .....:	No.57 Jintong Road, Binhai, (seafront) industrial Park, Xiangshan, Ningbo, zhejiang, 315712, P.R. China
Test specification:	
Standard .....:	NRS 097-2-1: 2017
Test procedure .....:	AK
Non-standard test method……..:	N/A
Test Report Form No.....:	MS-0025008-appendix 2
Test Report Form(s) Originator .....:	TÜV Rheinland Group
Master TRF.....:	2017-05

Test item description .....:	Grid-connected PV Inverter
Trade Mark .....:	solis
Manufacturer .....:	Same as the applicant
Model/Type reference .....:	See cove page
Ratings .....:	See copy of marking plate for details

Equipment mobility:	☐ movable ☐ hand-held ☐ stationary ☒ fixed
Connection to the mains:	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Operating condition:	☒ continuous ☐ short-time ☐ intermittent
Over voltage category Mains:	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV:	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Tested for IT power systems :	☐ Yes ☒ No
IT testing, phase-phase voltage (V) :	N/A
Class of equipment :	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg):	63
Pollution degree	☐ PD 1 ☐ PD 2 ☒ PD 3
IP protection class :	IP65

Possible test case verdicts:

- test case does not apply to the test object..... : N/A
- test object does meet the requirement..... : Pass (P)
- test object does not meet the requirement..... : Fail (F)

Testing:

Date of receipt of test items: See cover page

Date(s) of performance of tests: See cover page

General remarks

” The test result presented in this report relate only to the object(s) tested.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

"(see remark #)" refers to remark appended to the report.
"(see Annex #)" refers to an annex appended to the report.

Throughout this report a point is used as the decimal separator.

Attachement:

This report also includes attached photo documentation 16 pages.

Summary of testing:

All the test were performed on the Solis-3P20K-4G and Solis-3P5K-4G valid for other models.

Tests performed (name of test and test clause)

Clause(s)		Test(s)
☒	4.1	Utility compatibility
☒	4.1.5.1	Flicker
☒	4.1.5.3	Voltage change
☐	4.1.6.1	Apparent power unblance
☒	4.1.6.2	Voltage unblance
☒	4.1.7	Commutation notches
☒	4.1.8	DC injection
☒	4.1.10	Harmonics and waveform distortion
☒	4.1.11.2	Power factor for sub-categories A1 and A2
☒	4.1.11.4	Power factor for sub-categories A3
☒	4.1.11.9	Power factor characteristics curve for sub-categories A3
☒	4.2	Safety protection and controls
☒	4.2.2.3.2	Over/under voltage
☒	4.2.2.3.3	Over/under frequency
☒	4.2.2.3.3	Active power under over frequency
☒	4.2.2.4	Prevention of islanding (IEC 62116)
☒	4.2.2.5	DC current injection
☒	4.2.4	Utility Response to recovery
☒	5.2.1	Tolerance to sudden voltage drops and peaks for A3 (RPP Grid Code) & LVRT test

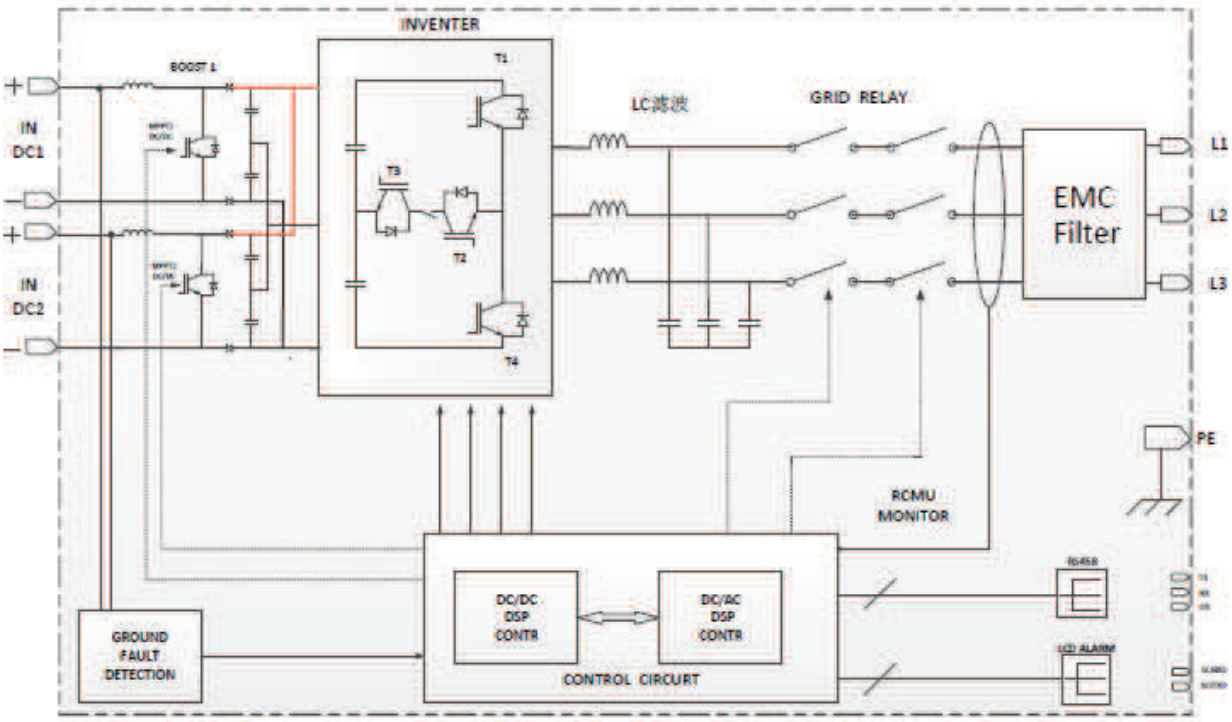
Testing location:

All tests as described in Test Case and Measurement Sections were performed at the laboratory described on page 2.

Description of the test item:

The PCEs under test models Solis-3P5K-4G, Solis-3P6K-4G, Solis-3P8K-4G, Solis-3P9K-4G, Solis-3P10K-4G, Solis-3P12K-4G, Solis-3P15K-4G, Solis-3P17K-4G, Solis-3P20K-4G are three-phase grid connected inverter for solar power generation. The Grid-connected PV Inverter utilize the advanced power conversion technology IGBT to convert the DC power normally from the photovoltaic array to stable three-phase AC power and then feed the power to the utility grid.

Block diagram:



Solis-3P20K-4G

The protection device makes up of two in series in each line and netural between inverter and gird. Inverter and back-up load communicative coupled AC relays so that the equipment could be effectively separated from utitlity even any one of relays short circuited or works abnormally.

Model list:

MODELS LIST		Solis-3P5K-4G	Solis-3P6K-4G	Solis-3P8K-4G	Solis-3P9K-4G
PV INPUT	V_{MAX} PV [Vdc]	1000	1000	1000	1000
	I_{SC} PV [A]	17.2/17.2	17.2/17.2	17.2/17.2	17.2/17.2
	MPP Voltage Range V_{MPP} [Vdc]	160-850	160-850	160-850	160-850
	Max. Input Current I_{MAX} [A] (A/B) (each MPPT)	11/11	11/11	11/11	11/11
	MPP Full Power Voltage Range [Vdc]	230-850	280-850	370-850	415-850
	Backfeed Current [A]	0	0	0	0
	Overvoltage Category (OVC)	II	II	II	II
AC OUTPUT	Rated Output Voltage Ur [Vac]	3/N/PE 400	3/N/PE 400	3/N/PE 400	3/N/PE 400
	Normal Operating Voltage Range Un[Vac]	340-440 U_{AVG}≥1.1Ur (<10min)	340-440 U_{AVG}≥1.1Ur (<10min)	340-440 U_{AVG}≥1.1Ur (<10min)	340-440 U_{AVG}≥1.1Ur (<10min)
	Rated Output Frequency F_{NETZ} [Hz]	50	50	50	50
	Normal Operating Frequency Range Fn [Hz]	47-52Hz or 57-62Hz	47-52Hz or 57-62Hz	47-52Hz or 57-62Hz	47-52Hz or 57-62Hz
	Operating Frequency Adjustable Range Fn [Hz]	45-55	45-55	45-55	45-55
	Rated Output Power P_E [kW]	5	6	8	9
	Max. Output Power P_{Emax} [kW]	5.5	6.6	8.8	9.9
	Max. Apparent power S_{Emax} [VA]	5500	6600	8800	9900
	PGS S_{Emax} [kVA]	No limit	No limit	No limit	No limit
	Rated Output Current Ir [A]	7.2	8.7	11.5	13

	Max. Output Current Imax [A]	8.4	10	13.4	15.1
	Power Factor cosφ [λ]	0.8under-excited - 0.8over-excited			
	Efficiency max. η_{max}	98.30%	98.30%	98.70%	98.70%
	Standby Power Consumption [W]	<10W	<10W	<10W	<10W
	Night Power Consumption [W]	<1W	<1W	<1W	<1W
	THD [V / I] (100% full power)	<3%	<3%	<3%	<3%
	Acoustic Noise [dB]	<30	<30	<30	<30
	Overvoltage Category (OVC)	III			
PV & GRID CONNECTION	Array Insulation Resistance Detection [Ω]	200k (> V_{MAX} PV/30mA)			
	The accuracy of resistance measurement [%/Ω]	1%			
	Continuous residual current threshold value [mA]	250 (I_{LIMIT}: 300)			
	Sudden residual current threshold value [mA]	25 (ILIMIT: 30) / 55 (ILIMIT: 60) / 130 (ILIMIT: 150)			
	Sudden residual current trip time [ms]	230 (TLIMIT: 300) / 130 (TLIMIT: 150) / 35 (TLIMIT: 40)			
	Voltage threshold value [V]	UMIN: 340 (ULIMITU: 340), UMAX: 440 (ULIMITO: 440)			
	The accuracy of voltage measurement[%/V]	Min (2.3Vrms, 1%)			
	Voltage trip time [ms]	UMIN: 160 (TLIMIT: 200), UMAX: 8500 (TLIMIT: 10000)			
	Frequency threshold value [Hz]	FMIN: 47(FLIMITU: 47), FMAX: 52 (FLIMITO: 52)			
	The accuracy of frequency	Min (0.01Hz, 0.1%)			

	measurement [%/Hz]				
	Frequency trip time [ms]	FMIN: 150 (TLIMIT: 200), FMAX: 4300 (TLIMIT: 4500)			
	Active anti-islanding trip time [s]	<5.0 (T_{LIMIT}: 5)			
	DC Injection Current normal value [mA]	< 20			
	DC Injection Current threshold value [mA]	1000 (I_{LIMIT}: 1000)			
	DC Injection current trip time [ms]	160 (TLIMIT: 200)			
	Reconnection Voltage [V]	UMIN: 340 (ULIMITU: 340), UMAX: 440 (ULIMITO: 440)			
	Reconnection Frequency [Hz]	FMIN: 47 (FLIMITU: 47), FMAX: 50.5 (FLIMITO: 50.5)			
	Reconnection Time [s]	60 (T_{LIMIT} > 60)			
CONSTRUCTION	Type of inverter	Non-insulated			
	Type of NS Protection	Integrated			
	Separated by	Transformerless			
	MPPT strings	2	2	2	2
	MPPT tracking	2			
	Protective Class	I			
	Enclosure Protection (IP)	IP65			
	Operating Temperature Range [ºC]	-25 to 60 (> 45 derating)			
	Pollution degree (PD)	PD 2(inside), PD3(outside)			
	Altitude [m]	2000			
	Weight [kg]	13.6	13.6	14.1	14.1
	Firmware version	V18			

MODELS LIST		Solis-3P10K-4G	Solis-3P12K-4G	Solis-3P15K-4G	Solis-3P17K-4G
PV INPUT	V_{MAX} PV [Vdc]	1000	1000	1000	1000
	I_{SC} PV [A]	17.2/17.2	34.3/34.3	34.3/34.3	34.3/34.3

	MPP Voltage Range V_{MPP} [Vdc]	160-850	160-850	160-850	160-850
	Max. Input Current I_{MAX} [A] (A/B) (each MPPT)	11/11	22/22	22/22	22/22
	MPP Full Power Voltage Range [Vdc]	465-850	280-850	350-850	395-850
	Backfeed Current [A]	0	0	0	0
	Overvoltage Category (OVC)	II	II	II	II
AC OUTPUT	Rated Output Voltage Ur [Vac]	3/N/PE 400	3/N/PE 400	3/N/PE 400	3/N/PE 400
	Normal Operating Voltage Range Un[Vac]	340-440 U_{AVG}≥1.1Ur (<10min)	340-440 U_{AVG}≥1.1Ur (<10min)	340-440 U_{AVG}≥1.1Ur (<10min)	340-440 U_{AVG}≥1.1Ur (<10min)
	Rated Output Frequency F_{NETZ} [Hz]	50	50	50	50
	Normal Operating Frequency Range Fn [Hz]	47-52Hz or 57-62Hz	47-52Hz or 57-62Hz	47-52Hz or 57-62Hz	47-52Hz or 57-62Hz
	Operating Frequency Adjustable Range Fn [Hz]	45-55	45-55	45-55	45-55
	Rated Output Power P_E [kW]	10	12	15	17
	Max. Output Power P_{Emax} [kW]	11	13.2	16.5	18.7
	Max. Apparent power S_{Emax} [VA]	11000	13200	16500	18700
	PGS S_{Emax} [kVA]	No limit	No limit	No limit	No limit
	Rated Output Current Ir [A]	14.4	17.3	21.7	24.6
	Max. Output Current Imax [A]	16.7	20.1	25.1	28.4
	Power Factor cosφ [λ]	0.8under-excited - 0.8over-excited			

	Efficiency max. η_{max}	98.70%	98.70%	98.70%	98.70%
	Standby Power Consumption [W]	<10W	<10W	<10W	<10W
	Night Power Consumption [W]	<1W	<1W	<1W	<1W
	THD [V / I] (100% full power)	<3%	<3%	<3%	<3%
	Acoustic Noise [dB]	<30	<30	<30	<30
	Overvoltage Category (OVC)	III			
PV & GRID CONNECTION	Array Insulation Resistance Detection [Ω]	200k (> V_{MAX} PV/30mA)			
	The accuracy of resistance measurement [%/Ω]	1%			
	Continuous residual current threshold value [mA]	250 (I_{LIMIT}: 300)			
	Sudden residual current threshold value [mA]	25 (ILIMIT: 30) / 55 (ILIMIT: 60) / 130 (ILIMIT: 150)			
	Sudden residual current trip time [ms]	230 (TLIMIT: 300) / 130 (TLIMIT: 150) / 35 (TLIMIT: 40)			
	Voltage threshold value [V]	UMIN: 340 (ULIMITU: 340), UMAX: 440 (ULIMITO: 440)			
	The accuracy of voltage measurement[%/V]	Min (2.3Vrms, 1%)			
	Voltage trip time [ms]	UMIN: 160 (TLIMIT: 200), UMAX: 8500 (TLIMIT: 10000)			
	Frequency threshold value [Hz]	FMIN: 47(FLIMITU: 47), FMAX: 52 (FLIMITO: 52)			
	The accuracy of frequency measurement [%/Hz]	Min (0.01Hz, 0.1%)			
	Frequency trip time [ms]	FMIN: 150 (TLIMIT: 200), FMAX: 4300 (TLIMIT: 4500)			

	Active anti-islanding trip time [s]	<5.0 (T_{LIMIT}: 5)			
	DC Injection Current normal value [mA]	< 20			
	DC Injection Current threshold value [mA]	1000 (I_{LIMIT}: 1000)			
	DC Injection current trip time [ms]	160 (TLIMIT: 200)			
	Reconnection Voltage [V]	UMIN: 340 (ULIMITU: 340), UMAX: 440 (ULIMITO: 440)			
	Reconnection Frequency [Hz]	FMIN: 47 (FLIMITU: 47), FMAX: 50.5 (FLIMITO: 50.5)			
	Reconnection Time [s]	60 (T_{LIMIT} > 60)			
CONSTRUCTION	Type of inverter	Non-insulated			
	Type of NS Protection	Integrated			
	Separated by	Transformerless			
	MPPT strings	2	4	4	4
	MPPT tracking	2			
	Protective Class	I			
	Enclosure Protection (IP)	IP65			
	Operating Temperature Range [ºC]	-25 to 60 (> 45 derating)			
	Pollution degree (PD)	PD 2(inside), PD3(outside)			
	Altitude [m]	2000			
	Weight [kg]	14.1	18.9	18.9	19.8
	Firmware version	V18			

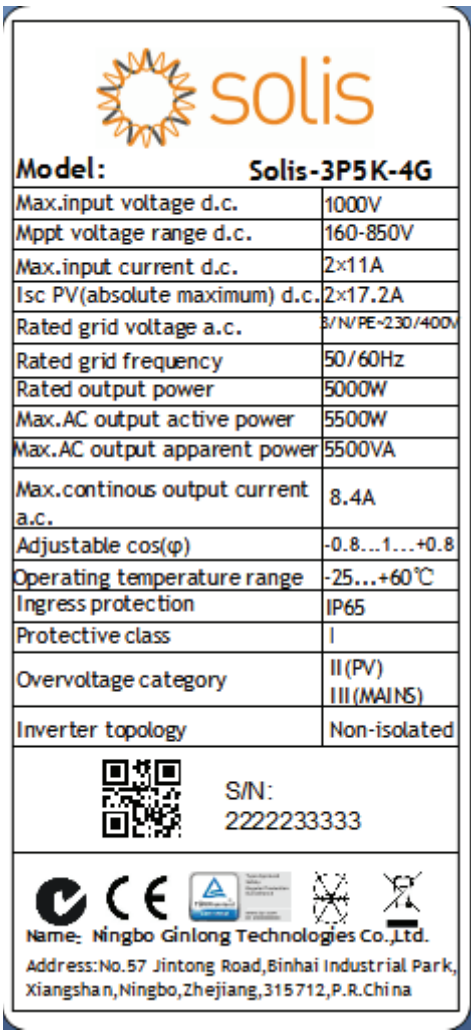
MODELS LIST		**Solis-3P20K-4G**
PV INPUT	V_{MAX} PV [Vdc]	1000
	I_{SC} PV [A]	34.3/34.3
	MPP Voltage Range V_{MPP} [Vdc]	160-850

	Max. Input Current I_{MAX} [A] (A/B) (each MPPT)	22/22
	MPP Full Power Voltage Range [Vdc]	465-850
	Backfeed Current [A]	0
	Overvoltage Category (OVC)	II
AC OUTPUT	Rated Output Voltage Ur [Vac]	3/N/PE 400
	Normal Operating Voltage Range Un[Vac]	340-440 U_{AVG}≥1.1Ur (<10min)
	Rated Output Frequency F_{NETZ} [Hz]	50
	Normal Operating Frequency Range Fn [Hz]	47-52Hz or 57-62Hz
	Operating Frequency Adjustable Range Fn [Hz]	45-55
	Rated Output Power P_E [kW]	20
	Max. Output Power P_{Emax} [kW]	22
	Max. Apparent power S_{Emax} [VA]	22000
	PGS S_{Emax} [kVA]	No limit
	Rated Output Current Ir [A]	28.9
	Max. Output Current Imax [A]	33.5
	Power Factor cosφ [λ]	0.8under-excited - 0.8over-excited
	Efficiency max. η_{max}	98.70%

	Standby Power Consumption [W]	<10W
	Night Power Consumption [W]	<1W
	THD [V / I] (100% full power)	<3%
	Acoustic Noise [dB]	<30
	Overvoltage Category (OVC)	III
PV & GRID CONNECTION	Array Insulation Resistance Detection [Ω]	200k (> V_{MAX} PV/30mA)
	The accuracy of resistance measurement [%/Ω]	1%
	Continuous residual current threshold value [mA]	250 (I_{LIMIT}: 300)
	Sudden residual current threshold value [mA]	25 (ILIMIT: 30) / 55 (ILIMIT: 60) / 130 (ILIMIT: 150)
	Sudden residual current trip time [ms]	230 (TLIMIT: 300) / 130 (TLIMIT: 150) / 35 (TLIMIT: 40)
	Voltage threshold value [V]	UMIN: 340 (ULIMITU: 340), UMAX: 440 (ULIMITO: 440)
	The accuracy of voltage measurement[%/V]	Min (2.3Vrms, 1%)
	Voltage trip time [ms]	UMIN: 160 (TLIMIT: 200), UMAX: 8500 (TLIMIT: 10000)
	Frequency threshold value [Hz]	FMIN: 47(FLIMITU: 47), FMAX: 52 (FLIMITO: 52)
	The accuracy of frequency measurement [%/Hz]	Min (0.01Hz, 0.1%)
	Frequency trip time [ms]	FMIN: 150 (TLIMIT: 200), FMAX: 4300 (TLIMIT: 4500)

	Active anti-islanding trip time [s]	<5.0 (T_{LIMIT}: 5)
	DC Injection Current normal value [mA]	< 20
	DC Injection Current threshold value [mA]	1000 (I_{LIMIT}: 1000)
	DC Injection current trip time [ms]	160 (TLIMIT: 200)
	Reconnection Voltage [V]	UMIN: 340 (ULIMITU: 340), UMAX: 440 (ULIMITO: 440)
	Reconnection Frequency [Hz]	FMIN: 47 (FLIMITU: 47), FMAX: 50.5 (FLIMITO: 50.5)
	Reconnection Time [s]	60 (T_{LIMIT} > 60)
CONSTRUCTION	Type of inverter	Non-insulated
	Type of NS Protection	Integrated
	Separated by	Transformerless
	MPPT strings	4
	MPPT tracking	2
	Protective Class	I
	Enclosure Protection (IP)	IP65
	Operating Temperature Range [ºC]	-25 to 60 (> 45 derating)
	Pollution degree (PD)	PD 2(inside), PD3(outside)
	Altitude [m]	2000
	Weight [kg]	19.8
	Firmware version	V18

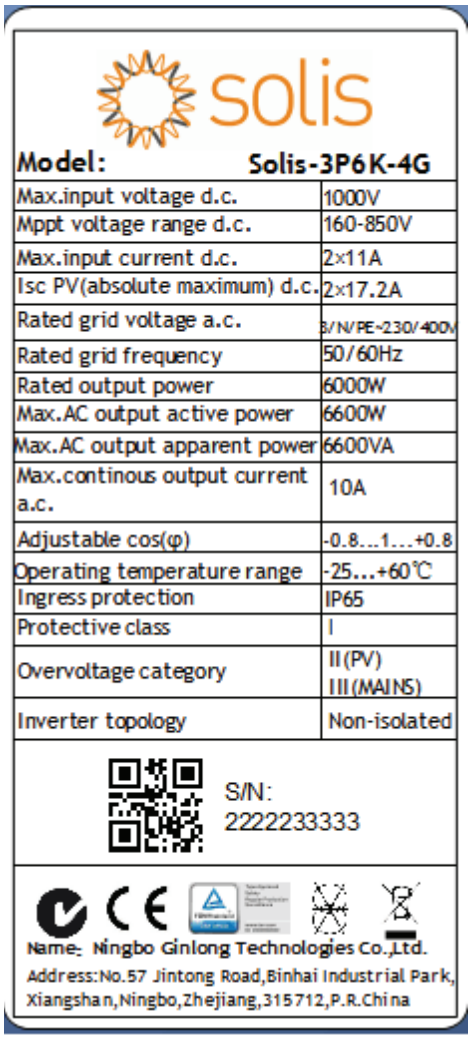
Copy of marking plate:



Model:	Solis-3P5K-4G
Max.input voltage d.c.	1000V
Mppt voltage range d.c.	160-850V
Max.input current d.c.	2×11A
Isc PV(absolute maximum) d.c.	2×17.2A
Rated grid voltage a.c.	3/N/PE~230/400V
Rated grid frequency	50/60Hz
Rated output power	5000W
Max.AC output active power	5500W
Max.AC output apparent power	5500VA
Max.continous output current a.c.	8.4A
Adjustable cos(φ)	-0.8...1...+0.8
Operating temperature range	-25...+60℃
Ingress protection	IP65
Protective class	I
Overvoltage category	II(PV) III(MAINS)
Inverter topology	Non-isolated

S/N:
2222233333

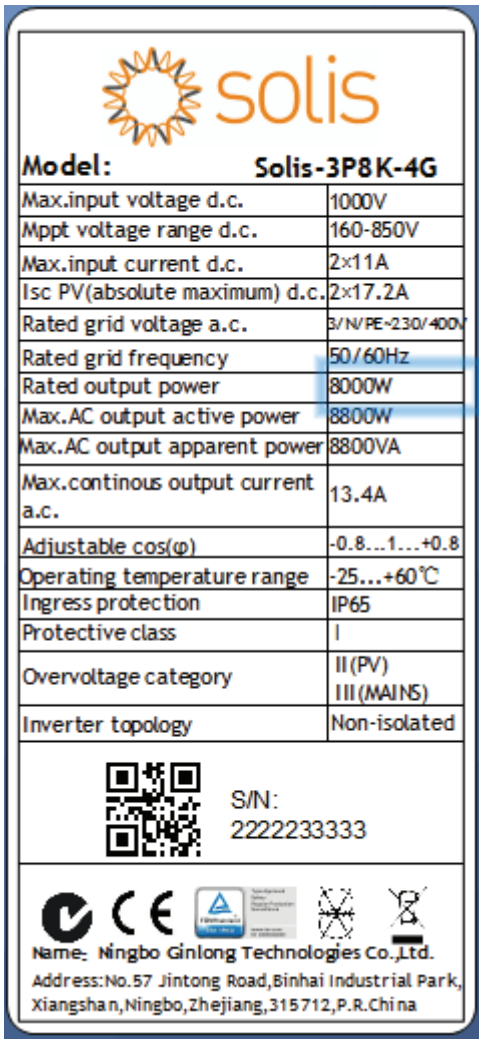
Name: Ningbo Ginlong Technologies Co.,Ltd.
Address:No.57 Jintong Road,Binhai Industrial Park,
Xiangshan,Ningbo,Zhejiang,315712,P.R.China



Model:	Solis-3P6K-4G
Max.input voltage d.c.	1000V
Mppt voltage range d.c.	160-850V
Max.input current d.c.	2×11A
Isc PV(absolute maximum) d.c.	2×17.2A
Rated grid voltage a.c.	3/N/PE~230/400V
Rated grid frequency	50/60Hz
Rated output power	6000W
Max.AC output active power	6600W
Max.AC output apparent power	6600VA
Max.continous output current a.c.	10A
Adjustable cos(φ)	-0.8...1...+0.8
Operating temperature range	-25...+60℃
Ingress protection	IP65
Protective class	I
Overvoltage category	II(PV) III(MAINS)
Inverter topology	Non-isolated

S/N:
2222233333

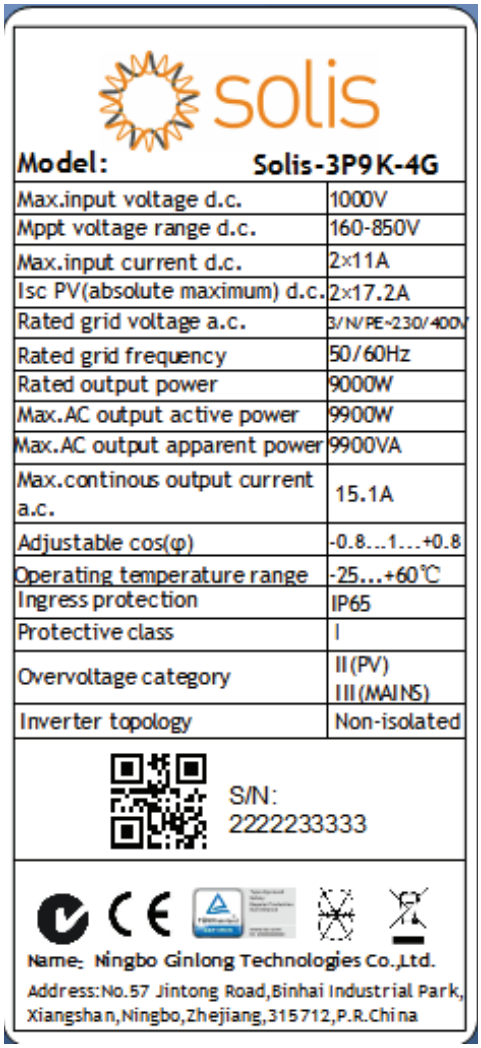
Name: Ningbo Ginlong Technologies Co.,Ltd.
Address:No.57 Jintong Road,Binhai Industrial Park,
Xiangshan,Ningbo,Zhejiang,315712,P.R.China



Model:	Solis-3P8K-4G
Max.input voltage d.c.	1000V
Mppt voltage range d.c.	160-850V
Max.input current d.c.	2×11A
Isc PV(absolute maximum) d.c.	2×17.2A
Rated grid voltage a.c.	3/N/PE~230/400V
Rated grid frequency	50/60Hz
Rated output power	8000W
Max.AC output active power	8800W
Max.AC output apparent power	8800VA
Max.continous output current a.c.	13.4A
Adjustable cos(φ)	-0.8...1...+0.8
Operating temperature range	-25...+60℃
Ingress protection	IP65
Protective class	I
Overvoltage category	II(PV) III(MAINS)
Inverter topology	Non-isolated

S/N:
2222233333

Name: Ningbo Ginlong Technologies Co.,Ltd.
Address:No.57 Jintong Road,Binhai Industrial Park,
Xiangshan,Ningbo,Zhejiang,315712,P.R.China



Model:	Solis-3P9K-4G
Max.input voltage d.c.	1000V
Mppt voltage range d.c.	160-850V
Max.input current d.c.	2×11A
Isc PV(absolute maximum) d.c.	2×17.2A
Rated grid voltage a.c.	3/N/PE~230/400V
Rated grid frequency	50/60Hz
Rated output power	9000W
Max.AC output active power	9900W
Max.AC output apparent power	9900VA
Max.continous output current a.c.	15.1A
Adjustable cos(φ)	-0.8...1...+0.8
Operating temperature range	-25...+60℃
Ingress protection	IP65
Protective class	I
Overvoltage category	II(PV) III(MAINS)
Inverter topology	Non-isolated

S/N:
2222233333

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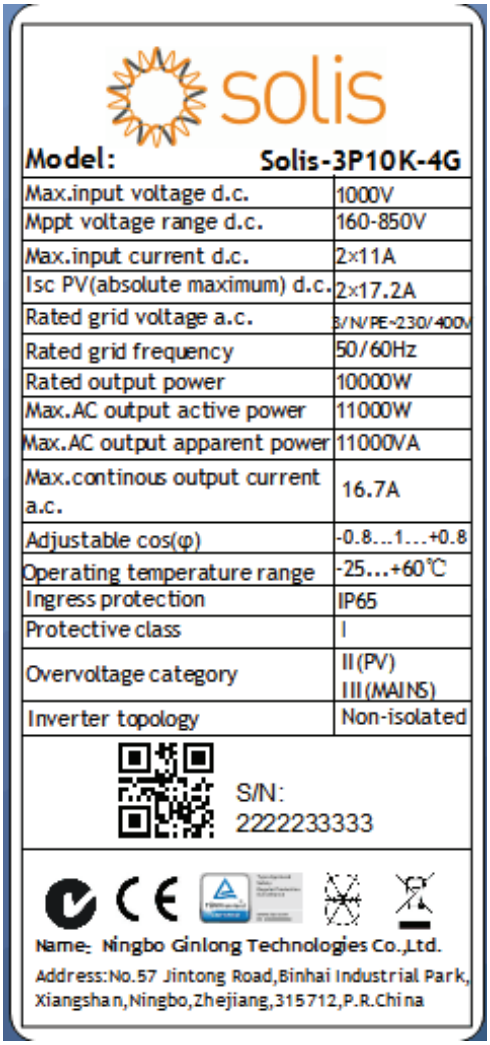

solis

Model:	Solis-3P10K-4G
Max.input voltage d.c.	1000V
Mppt voltage range d.c.	160-850V
Max.input current d.c.	2×11A
Isc PV(absolute maximum) d.c.	2×17.2A
Rated grid voltage a.c.	3/N/PE~230/400V
Rated grid frequency	50/60Hz
Rated output power	10000W
Max.AC output active power	11000W
Max.AC output apparent power	11000VA
Max.continous output current a.c.	16.7A
Adjustable cos(φ)	-0.8...1...+0.8
Operating temperature range	-25...+60℃
Ingress protection	IP65
Protective class	I
Overvoltage category	II(PV) III(MAINS)
Inverter topology	Non-isolated

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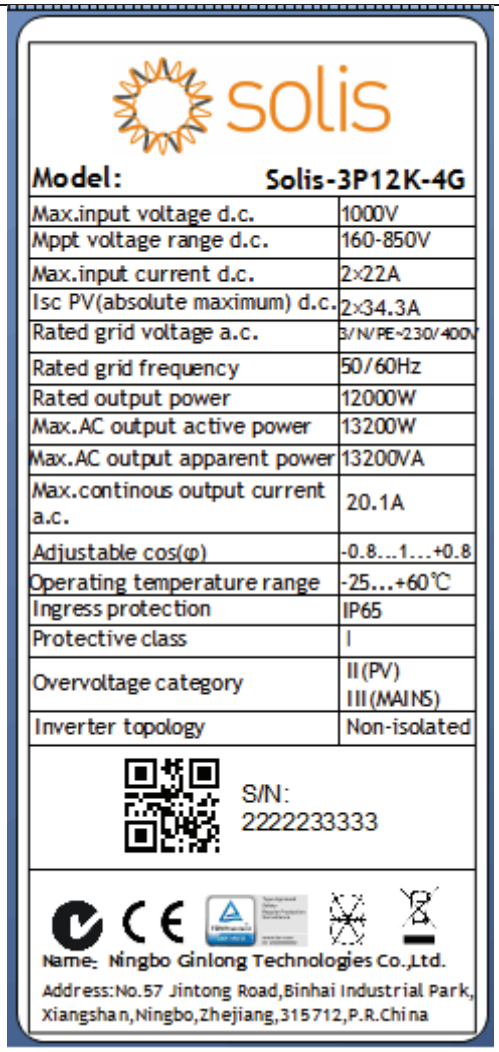

solis

Model:	Solis-3P12K-4G
Max.input voltage d.c.	1000V
Mppt voltage range d.c.	160-850V
Max.input current d.c.	2×22A
Isc PV(absolute maximum) d.c.	2×34.3A
Rated grid voltage a.c.	3/N/PE~230/400V
Rated grid frequency	50/60Hz
Rated output power	12000W
Max.AC output active power	13200W
Max.AC output apparent power	13200VA
Max.continous output current a.c.	20.1A
Adjustable cos(φ)	-0.8...1...+0.8
Operating temperature range	-25...+60℃
Ingress protection	IP65
Protective class	I
Overvoltage category	II(PV) III(MAINS)
Inverter topology	Non-isolated

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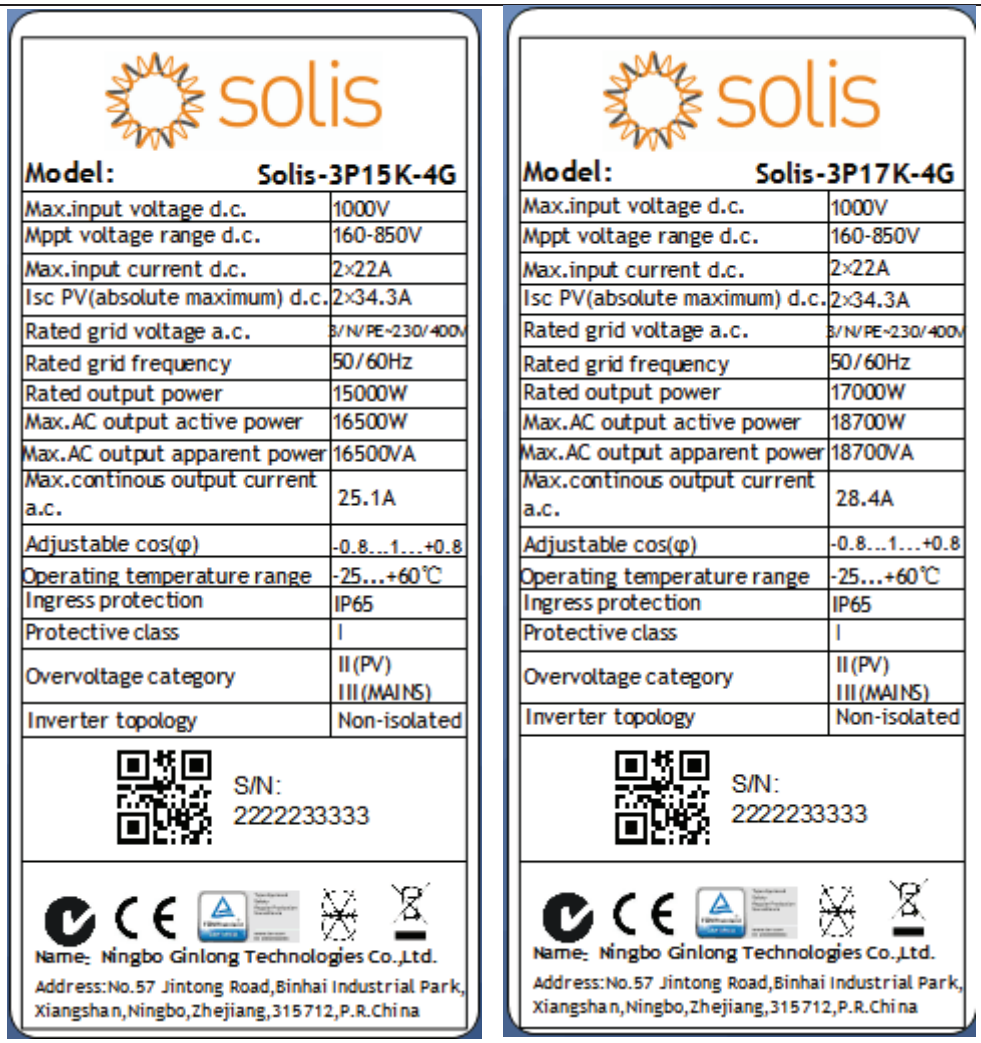

Model:	Solis-3P15K-4G
Max.input voltage d.c.	1000V
Mppt voltage range d.c.	160-850V
Max.input current d.c.	2×22A
Isc PV(absolute maximum) d.c.	2×34.3A
Rated grid voltage a.c.	3/N/PE~230/400V
Rated grid frequency	50/60Hz
Rated output power	15000W
Max.AC output active power	16500W
Max.AC output apparent power	16500VA
Max.continous output current a.c.	25.1A
Adjustable cos(φ)	-0.8...1...+0.8
Operating temperature range	-25...+60℃
Ingress protection	IP65
Protective class	I
Overvoltage category	II(PV) III(MAINS)
Inverter topology	Non-isolated

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Model:	Solis-3P17K-4G
Max.input voltage d.c.	1000V
Mppt voltage range d.c.	160-850V
Max.input current d.c.	2×22A
Isc PV(absolute maximum) d.c.	2×34.3A
Rated grid voltage a.c.	3/N/PE~230/400V
Rated grid frequency	50/60Hz
Rated output power	17000W
Max.AC output active power	18700W
Max.AC output apparent power	18700VA
Max.continous output current a.c.	28.4A
Adjustable cos(φ)	-0.8...1...+0.8
Operating temperature range	-25...+60℃
Ingress protection	IP65
Protective class	I
Overvoltage category	II(PV) III(MAINS)
Inverter topology	Non-isolated

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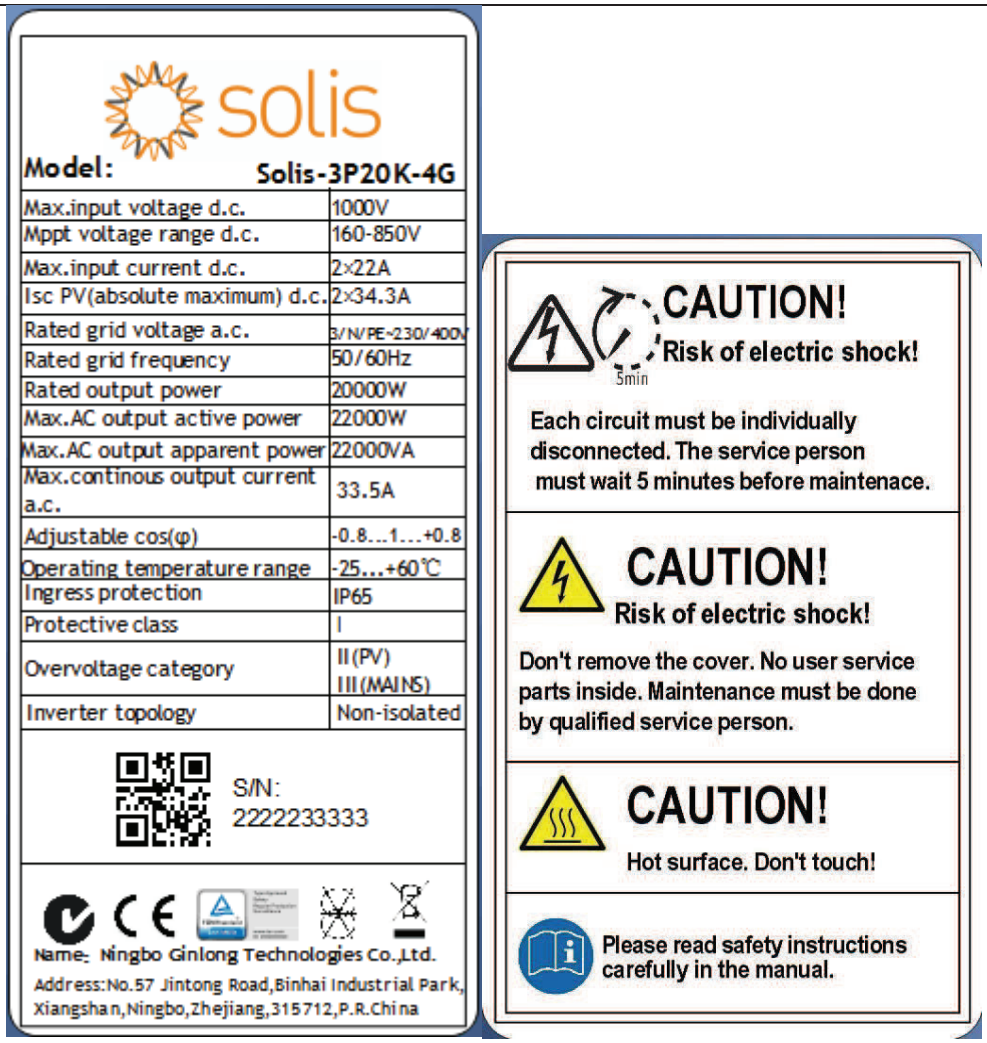
solis
Model: Solis-3P20K-4G
Max.input voltage d.c. 1000V
Mppt voltage range d.c. 160-850V
Max.input current d.c. 2×22A
Isc PV(absolute maximum) d.c. 2×34.3A
Rated grid voltage a.c. 3/N/PE~230/400V
Rated grid frequency 50/60Hz
Rated output power 20000W
Max.AC output active power 22000W
Max.AC output apparent power 22000VA
Max.continous output current a.c. 33.5A
Adjustable cos(φ) -0.8...1...+0.8
Operating temperature range -25...+60℃
Ingress protection IP65
Protective class I
Overvoltage category II(PV) III(MAINS)
Inverter topology Non-isolated
S/N: 222233333
Name: Ningbo Ginlong Technologies Co.,Ltd.
Address:No.57 Jintong Road,Binhai Industrial Park, Xiangshan,Ningbo,Zhejiang,315712,P.R.China
CAUTION!
Risk of electric shock!
5min
Each circuit must be individually disconnected. The service person must wait 5 minutes before maintenace.
CAUTION!
Risk of electric shock!
Don't remove the cover. No user service parts inside. Maintenance must be done by qualified service person.
CAUTION!
Hot surface. Don't touch!
Please read safety instructions carefully in the manual.

NRS 097-2-1			
Clause	Requirement – Test	Result – Remark	Verdict

4.1	**Utility compatibility**		**P**
4.1.1	**General**		**P**
4.1.1.1	This clause describes the technical issues and the responsibilities related to interconnecting an embedded generator to a utility network.		**P**
4.1.1.2	The quality of power provided by the embedded generator in the case of the on-site a.c. loads and the power delivered to the utility is governed by practices and standards on voltage, flicker, frequency, harmonics and power factor. Deviation from these standards represents out-ofbounds conditions. The embedded generator is required to sense the deviation and might need to disconnect from the utility network.		**P**
4.1.1.3	All power quality parameters (voltage, flicker, frequency and harmonics) shall be measured at the POC, unless otherwise specified (see annex A).	See appended table at the end of report for detailed test.	**P**
4.1.1.4	The embedded generator's a.c. voltage, current and frequency shall be compatible with the utility at the POC.		**P**
4.1.1.5	The embedded generator shall be type approved, unless otherwise agreed upon with the utility (see annex A).		**P**
4.1.1.6	The maximum size of the embedded generator is limited to the rating of the supply point on the premises.	Shall be evaluated in final installation.	**N/A**
4.1.1.7	The utility will approve the size of the embedded generator and will decide on the connection point and conditions. In some cases it may be required to create a separate supply point.	Three-phase inverter.	**P**
4.1.1.8	Embedded generators larger than 13,8 kVA shall be of the balanced three-phase type unless only a single-phase network supply is available, in which case NRS 097-2-3 recommendations can be applied based on the NMD. NOTE 1 This value refers to the maximum export potential of the generation device/system. NOTE 2 In the case of long feeder spurs the maximum desired capacity of the EG might require approval by the utility and might result in the requirement for a three-phase connection for smaller units.	Three-phase inverter.	**P**
4.1.1.9	A customer with a multiphase connection shall split the embedded generator in a balanced manner over all phases if the EG is larger than 4,6 kVA. NOTE Balancing phases in a multiphase embedded generator is deemed desirable.	Three phase balance inverter. The max unbalance power is 42W.	**P**
4.1.1.10	Embedded generators or generator systems larger than 100 kVA may have additional requirements, for example, they must be able to receive communication signals for ceasing generation/disconnection from the utility supply, if the utility requires such. Communication facilities	Considered	**P**

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Clause	Requirement – Test	Result – Remark	Verdict

	shall be provided to utility at no charge for integration with SCADA or other system when required. See Annex G (G.1). NOTE The RPP Grid Code requires category A3 units to be able to interface with the utility in order to receive stop and start signals.		
4.1.1.11	In line with the current Renewable Power Plant Grid Code, embedded generators smaller than 1000 kVA connected to low-voltage form part of Category A generators, with the following subcategories: a) Category A1: 0 – 13,8 kVA; b) Category A2: 13,8 kVA – 100 kVA; c) Category A3: 100 kVA – 1 MVA.	Category A1/A2/A3	**P**
4.1.1.12	In accordance with SANS 10142-1, all generators shall be wired permanently.	Considered	**P**
4.1.1.13	Any UPS/generating device that operates in parallel with the grid may only connect to the grid when it complies fully with the requirements of this part of NRS 097. This includes UPS configurations with or without EG.	Considered	**P**
4.1.1.14	Standby-generators are covered by SANS 10142-1.	Considered	**P**
4.1.1.15	All generators larger than 100 kVA will be controllable, i.e. be able to control the active output power dependent on network conditions/abnormal conditions. This includes several smaller units that totals more than 100 kVA at a single POC.	Considered the parallel operation.	**P**
4.1.1.16	Maximum DC Voltage may not exceed 1000V. This is the voltage on the DC side of the inverter, for example when no load is taken and maximum source energy is provided, e.g. peak solar radiation occurs on the solar panels.	Maximum DC voltage 1100Vdc	**P**
4.1.2	**Normal voltage operating range**	See appended table	**P**
4.1.3	**Reference source impedance and short-circuit levels (fault levels)**		**P**
4.1.4	**General QOS requirements**		**P**
4.1.5	**Flicker and voltage changes**	See appended table	**P**
4.1.6	**Voltage unbalance**	See appended table	**P**
4.1.7	**Commutation notches**	See appended table	**P**
4.1.8	**DC injection**	See appended table	**P**
4.1.9	**Normal frequency operating range**	See appended table	**P**
4.1.10	**Harmonics and waveform distortion**	See appended table	**P**
4.1.11	**Power factor**		**P**
4.1.11.1	Irrespective of the number of phases to which an embedded generator is connected, it shall comply with the power factor requirements in accordance with 4.1.11.2 to 4.1.11.12 on each phase for system normal conditions when the output power exceeds 20 % of rated active power:		**P**

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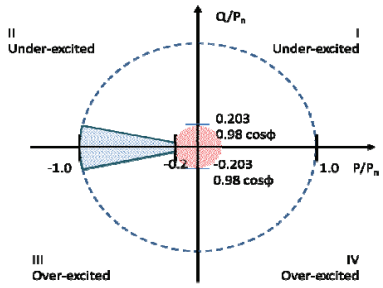
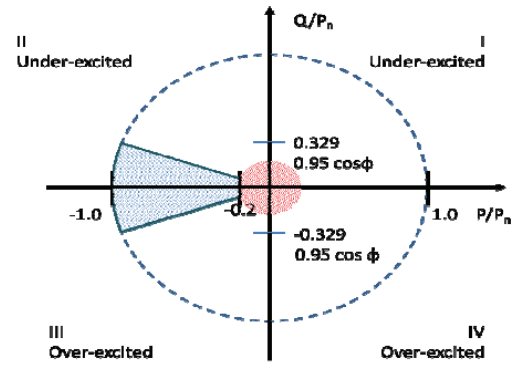
Clause	Requirement – Test	Result – Remark	Verdict
4.1.11.2	For static power converter embedded generators and synchronous embedded generators of sub-categories A1 and A2, the power factor shall remain above 0,98 as shown in Figure 1. The embedded generator shall operate anywhere in the shaded area of figure 1.  NOTE At the time of publication, this is in contradiction with the RPP Grid Code.	See appended table	**P**
4.1.11.3	For asynchronous embedded generators of sub-categories A1 and A2, which cannot control the power factor over any range, the power factor shall reach the shaded area of figure 1 within 60 s. The power factor shall remain above 0,98 as shown in figure 1. The embedded generator shall operate anywhere in the shaded area. NOTE At the time of publication, this is in contradiction with the RPP Grid Code.		**P**
4.1.11.4	For static power converter embedded generators and synchronous embedded generators of sub-category A3, the power factor shall remain above 0,95 as shown in Figure 2. The embedded generator shall operate anywhere in the shaded area of Figure 2.  	Considered the parallel operation.	**P**
4.1.11.5	For asynchronous embedded generators of sub-category A3, which cannot control the power factor over any range, the power factor shall reach the shaded area of Figure 2 within 60 s. The power factor shall remain above 0,95 as shown in Figure 2. The embedded generator shall operate anywhere in the shaded area.		**P**
4.1.11.6	Where the EG is capable of controlling the power factor at the POC, the EG should improve the power factor at the POC towards unity.		**P**

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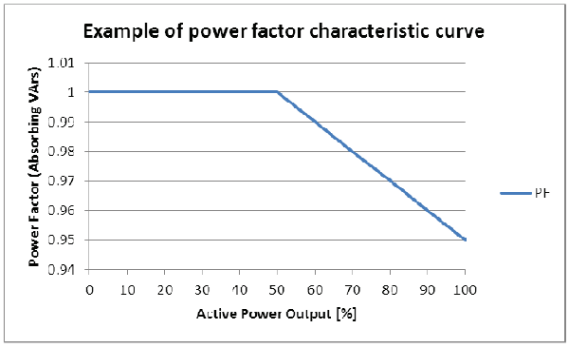
Clause	Requirement – Test	Result – Remark	Verdict

4.1.11.7	Unless otherwise agreed with the utility, the standard power factor setting shall be unity for the full power output range.		**P**
4.1.11.8	The maximum tolerance on the reactive power setting is 5 % of the rated active power.		**P**
4.1.11.9	For embedded generators of sub-category A3, the power factor shall be settable to operate according to a characteristic curve provided by the utility, if required by the utility, within the range 0,95 leading and 0,95 lagging; An example of a standard characteristic curve is shown in figure 3. 	Considered the parallel operation.	**P**
4.1.11.10	These limits apply, unless otherwise agreed upon with the utility (see annex A).		**P**
4.1.11.11	Equipment for reactive power compensation shall either: a) be connected or disconnected with the embedded generator, or b) operated via automatic control equipment for disconnection when not required.		**P**
4.1.11.12	The requirement for and type of detuning for reactive power compensation devices will be agreed upon by the owner of the generator and utility.	Confirmed	**P**
4.1.12	**Synchronization**		**P**
4.1.13	**Electromagnetic compatibility (EMC)**	Refer to EMC report.	**P**
4.1.14	**Mains signalling (e.g. PLC and ripple control)**	External use PLC will be used, shall be re-evaluated in final installation.	**N/A**

4.2	**Safety and protection**		**P**
4.2.1	**General**		**P**
4.2.2	**Safety disconnect from utility network**		**P**
4.2.2.1	General		**P**
4.2.2.1.1	All SSEG shall comply with the safety requirements in accordance with SANS/IEC 62109-1 and IEC 62109-2. NOTE In principle, IEC 62109 documents only apply to PV inverters. However, other SSEG shall prove compliance to these safety requirements to the satisfaction of the utility.	Refer to IEC 62109-1 and IEC 62109-2 reports.	**P**
4.2.2.1.2	The embedded generator shall automatically and safely disconnect from the grid in the event of an abnormal condition.		**P**

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Clause	Requirement – Test	Result – Remark	Verdict

4.2.2.2	**Disconnection device (previously disconnection switching unit)**		**P**
4.2.2.2.1	The embedded generator shall be equipped with a disconnection device, which separates the embedded generator from the grid due to abnormal conditions. The disconnection unit may be integrated into one of the components of the embedded generator (for example the PV utility. interconnected inverter) or may be an independent device installed between the embedded generator and the utility interface.	PV inverter provided two relays in series used in each line and neutral as disconnection devices.	**P**
4.2.2.2.2	The disconnection switching unit shall be able to operate under all operating conditions of the utility network.	Simulated fault test has been performed, see appended table.	**P**
4.2.2.2.3	A failure within the disconnection switching unit shall lead to disconnection and indication of the failure condition.	Refer to IEC 62109-1 and IEC 62109-2 reports.	**P**
4.2.2.2.4	A single failure within the disconnection switching unit shall not lead to failure to disconnect. Failures with one common cause shall be taken into account and addressed through adequate redundancy.	Refer to IEC 62109-1 and IEC 62109-2 reports.	**P**
4.2.2.2.5	The disconnection device shall disconnect the generator from the network by means of two series connected robust automated load disconnect switches.	PV inverter provided two relays in series used in each line and neutral as disconnection devices.	**P**
4.2.2.2.6	Both switches shall be electromechanical switches.	Relays with suitable rating provided.	**P**
4.2.2.2.7	Each electromechanical switch shall disconnect the embedded generator on the neutral and the live wire(s). NOTE The switching unit need not disconnect its sensing circuits.	Considered.	**P**
4.2.2.2.8	All rotating generating units, e.g. synchronous or asynchronous generating units shall have adequate redundancy in accordance with 4.2.2.2.5.	PV inverter	**N/A**
4.2.2.2.9	A static power converter without simple separation shall make use of two series connected electromechanical disconnection switches.	PV inverter provided two relays in series used in each line and neutral as disconnection devices.	**P**
4.2.2.2.10	The current breaking capacity of each disconnecting switch shall be appropriately sized for the application. In cases where the disconnecting device is an electromechanical switching device such as a contractor, this requires suitable coordination with the upstream short circuit protection device (circuit breaker).	Considered.	**P**
4.2.2.2.11	Any programmable parameters of the disconnection switching unit shall be protected from interference by third-parties, i.e. password protected or access physically sealed.	Considered.	**P**
4.2.2.2.12	In order to allow customers to supply their own load in isolated operation (islanded)	Considered.	**P**

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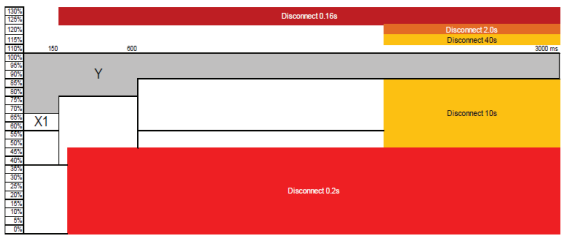
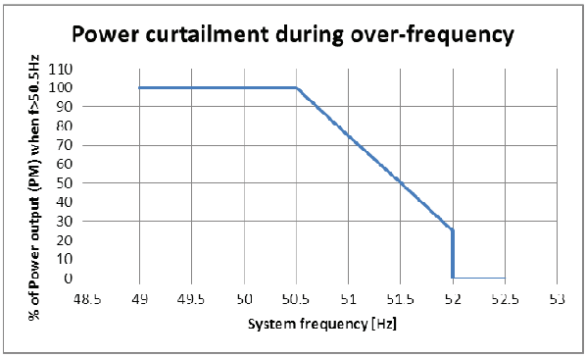
Clause	Requirement – Test	Result – Remark	Verdict

	where this is feasible and required, the disconnection device may be incorporated upstream of part of or all of a customers' loads, provided that none of the network disconnection requirements in this document are violated.		
4.2.2.2.13	All EG installations larger than 30 kVA shall have a central disconnection device.	The models more than 30kVA have a central disconnection device.	**P**
4.2.2.2.14	The network and system grid protection voltage and frequency relay for the central disconnection device will be type-tested and certified on its own (stand-alone tested). All clauses of 4.2.2, except 4.2.2.4 (anti-islanding) apply.		**P**
4.2.2.3	**Overvoltage, undervoltage and frequency**		**P**
4.2.2.3.1	**General**		**P**
	The values in 4.2.2.3 relate to SSEG in sub-categories A1 and A2. These are kept from a historical perspective. The Grid Code requirements will override values and requirements in this category. Sub-category A3 generators shall disconnect from the network according to the RPP Grid Code for all abnormal conditions as well as stay connected in accordance with the voltage ride-through requirements of the RPP Grid Code.	See appended table. Considered the parallel operation.	**P**
4.2.2.3.2	**Overvoltage and undervoltage**		**P**
	The embedded generator in sub-category A1 and A2 shall cease to energize the utility distribution system should the network voltage deviate outside the conditions specified in table 2. The following conditions shall be met, with voltages in r.m.s. and measured at the POC.	See appended table	**P**
4.2.2.3.3	**Overfrequency and underfrequency**		**P**
	This requirement is in line with the RPP Grid Code (version 2.8) and applies to all EG in category A.	See appended table.	**P**

1	2
Voltage range (at point of connection)	**Maximum trip time S**
V < 50 %	0,2 s
50 % ≤ V < 85 %	10 s
85 % ≤ V ≤ 110 %	Continuous operation
110 % < V < 115 %	40 s
115% ≤ V < 120%	2 s
120 % ≤ V	0,16 s
NOTE If multi-voltage control settings are not possible, the more stringent trip time should be implemented, e.g. 2 s between 110% and 120% of voltage.	



NRS 097-2-1			
Clause	Requirement – Test	Result – Remark	Verdict

4.2.2.3.3.1	Relaxation for non-controllable generators		**P**
	Non-controllable generators may disconnect randomly within the frequency range 50.5 Hz to 52 Hz. The disconnect frequency for non-controllable generators will each be set at a random value by the manufacturer, with the option of changing this to a utility provided setting. The random disconnect frequency shall be selected so that all generators from any specific manufacturer will disconnect uniformly over the range with 0,1 Hz increments. When the utility frequency is more than the non-controllable generator over-frequency setpoint for longer than 4 seconds, the non-controllable generator shall cease to energise the utility line within 0,5 s. 	See appended table.	**P**
4.2.2.4	**Prevention of islanding**		**P**
4.2.2.4.1	A utility distribution network can become de-energized for several reasons: for example, a substation breaker that opens due to a fault condition or the distribution network might be switched off for maintenance purposes. Should the load and (embedded) generation within an isolated network be closely matched, then the voltage and frequency limits may not be triggered. If the embedded generator control system only made use of passive voltage and frequency out-of-bounds detection, this would result in an unintentional island that could continue beyond the allowed time limits.	See appended table.	**P**
4.2.2.4.2	In order to detect an islanding condition, the embedded generator shall make use of at least one active islanding detection method. An active islanding detection method intentionally varies an output parameter and monitors the response or it attempts to cause an abnormal condition at the utility interface to trigger an out-of-bounds condition. If the utility supply is available, the attempt to vary an output parameter or cause an abnormal condition will fail and no response will be detected. However, if the utility supply network is de-energized, there will be a response	See appended table.	**P**

NRS 097-2-1			
Clause	Requirement – Test	Result – Remark	Verdict
	to the change which can be detected. This signals an island condition to the embedded generator upon detection of which the embedded generator shall cease to energize the utility network within a specific time period.		
4.2.2.4.3	Active islanding shall be detected in all cases where the EG interfaces with the utility network.		**P**
4.2.2.4.4	An islanding condition shall cause the embedded generator to cease to energize the utility network within 2 s, irrespective of connected loads or other embedded generators. The embedded generator employing active islanding detection shall comply with the requirements of IEC 62116 (ed.1). NOTE Prevention of islanding measures is only considered on the embedded generator side, i.e. no utility installed anti-islanding measures are considered.	See appended table.	**P**
4.2.2.4.5	All rotating generators shall use a minimum of two islanding detection methods (e.g. rate-of-change-of-frequency and voltage vector shift detection due to the dead bands (slow detection) of islands in both methods). NOTE It is possible for a condition to exist, where a mains-excited generator becomes self-excited due to capacitance of the network (either cable capacitance or power factor correction). Under such conditions, the mains-excited generator will not disconnect from an island, hence effective islanding detection is required for all rotating generators.	Not rotating generator	**N/A**
4.2.2.4.6	Passive methods of islanding detection shall not be the sole method to detect an island condition. When used, passive methods of islanding detection shall be done by three-phase voltage detection and shall be verified by an AC voltage source.	Considered	**P**
4.2.2.4.7	The embedded generator shall physically disconnect from the utility network in accordance with the requirements in 4.2.2.2.	Two series connected relays used as the disconnection device in both line and neutral	**P**
4.2.2.5	**DC current injection**		**P**
	The embedded generator shall not inject d.c. current greater than 0,5 % of the rated a.c. output current into the utility interface under any operating condition, measured over a 1-minute interval. The EG shall cease to energize the utility network within 500 ms if this threshold is exceeded.	See appended table.	**P**
4.2.3	**Emergency personnel safety**		**N/A**
	No requirements for emergency personnel safety (e.g. fire brigade) existed at the time of publication. It is expected that such issues will be dealt with in other documents, e.g. OHS Act, SANS 10142-1.		**N/A**
4.2.4	**Response to utility recovery**		**P**

NRS 097-2-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.2.4.1	The embedded generator shall ensure synchronisation before re-energizing at all times in accordance with 4.1.12.		**P**
4.2.4.2	After a voltage or frequency out-of-range condition that has caused the embedded generator to cease energizing the utility network, the generator shall not re-energize the utility network until the utility service voltage and frequency have remained within the specified ranges for a continuous and uninterrupted period of 60 s. The reconnection shall commence as follows:	See appended table.	**P**
4.2.4.2.1	Non-controllable generators may connect randomly within the 1 minute to 10 minute period after voltage and frequency recovery (period includes the 60 s to confirm recovery). The delay for non-controllable generators will each be set at a random value by the manufacturer, with the option of changing this to a utility provided setting. The random value shall be selected so that no more than 2 % of generators from any specific manufacturer will reconnect within 10s of each other.	Considered	**P**
4.2.4.2.2	Controllable generators may reconnect immediately after the 60 s delay confirming recovery of the system voltage and frequency at a maximum rate of 10 % of rated power per minute, i.e. full power output will only be reached after 10 minutes. This ramp rate may be modified at the request of the utility or in consultation with the utility.	Not controllable generator.	**N/A**
4.2.5	**Isolation**		**P**
4.2.5.1	In line with SANS 10142-1 (as amended), each energy source should have its own, appropriately rated, isolation device.	Isolation device is not integral part of the unit. The installation instructions specify a isolation device for the final installation. This shall be re-evaluated in final installation.	**P**
4.2.5.2	It is expected that isolation requirements will be dealt with in more detail in future in e.g. SANS 10142-1/3. Such requirements shall supersede 4.2.5.	Requirement specified in the installation instruction, shall be re-evaluated in final installation	**P**
4.2.5.3	The embedded generator shall provide a means of isolating from the utility interface in order to allow for safe maintenance of the EG. The disconnection device shall be a double pole for a single-phase EG, a three-pole for a three-phase delta-connected EG, and a four-pole for a three phase star-connected EG. The grid supply side shall be wired as the source.	The installation instructions specify a isolation device for the final installation. This shall be re-evaluated in final installation.	**P**
4.2.5.4	The breaking capacity of the isolation circuit-breaker closest to the point of utility connection shall be rated appropriately for the installation point in accordance with SANS 60947-2. This disconnection device does not need to be	The installation instructions specify a isolation device for the final installation. This shall be re-evaluated in final installation.	**P**

NRS 097-2-1			
Clause	Requirement – Test	Result – Remark	Verdict
	accessible to the utility.		
4.2.5.5	For dedicated supplies, a means shall be provided of isolating from the point of supply in order to allow for safe maintenance of the utility network. The disconnection device shall be a double pole for a single-phase EG, a three-pole for a three-phase delta-connected EG, and a four-pole for a three-phase star-connected EG.	The installation instructions specify a isolation device for the final installation. This shall be re-evaluated in final installation.	**P**
4.2.6	**Earthing**		**P**
4.2.6.1	The electrical installation shall be earthed in accordance with SANS 10142-1. The earthing requirements for different embedded generation configurations in conjunction with the customer network are described in annex B for the most common earthing systems	Requirement specified in the installation instruction, shall be re-evaluated in final installation.	**N/A**
4.2.6.2	Installations with utility-interconnected inverters without simple separation shall make use of earth leakage protection which are able to respond to d.c. fault currents including smooth d.c. fault currents (i.e. without zero crossings) according to IEC 62109-2 unless the inverter can exclude the occurrence of d.c. earth fault currents on any phase, neutral or earth connection through its circuit design1). This function may be internal or external to the inverter.	Refer to IEC 62109-2 report.	**P**
4.2.6.3	Where an electrical installation includes a PV power supply system without at least simple separation between the AC side and the DC side, an integrated RCD function shall be present to provide fault protection by automatic disconnection of supply shall be type B according to IEC/TR 60755, amendment 2. Where the PV inverter by construction is not able to feed DC fault currents into the electrical installation, an RCD of type B according to IEC/TR 60755 amendment 2 is not required.	Requirement specified in the installation instruction, shall be re-evaluated in final installation.	**P**
4.2.7	**Short-circuit protection**		**P**
4.2.7.1	The embedded generator shall have suitably rated short-circuit protection at the connection to the AC mains in accordance with SANS 10142-1 and 3.	Requirement for using circuit breaker specified in the installation instruction, shall be re-evaluated in final installation	**P**
4.2.7.2	The short-circuit characteristics for the SSEG shall be supplied to the utility.	See instruction manual	**P**
4.2.8	**Maximum short-circuit contribution**		**P**
	Embedded generators have the potential to increase the fault level of the network to which it is connected. In order to limit the fault level changes in low voltage networks and allow coordination of fault levels with the utility, no generator will exceed the following fault level contribution: a) for synchronous generators: 8 times the rated current; b) for asynchronous generators: 6 times the rated	1 times of the rated current for PV inverter.	**P**

NRS 097-2-1			
Clause	Requirement – Test	Result – Remark	Verdict

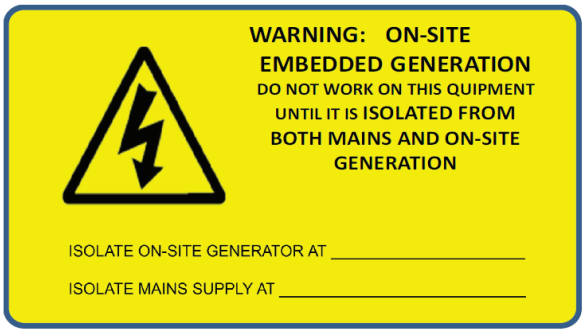
	current; and c) for generators with inverters: 1 times the rated current.		
4.2.9	**Labelling**		**P**
4.2.9.1	A label on the distribution board of the premises where the embedded generator is connected, shall state: "ON-SITE EMBEDDED GENERATION (EG) CONNECTED. THE EG IS FITTED WITH AN AUTOMATIC DISCONNECTION SWITCH WHICH DISCONNECTS THE EG IN THE CASE OF UTILITY NETWORK DE-ENERGIZATION."  	Requirement specified in the installation instruction, shall be re-evaluated in final installation.	**P**
4.2.9.2	The label shall be permanent, coloured red, and with white lettering of height at least 8 mm.		**P**
4.2.9.3	The label shall comply to requirements of SABS 1186-1.		**P**
4.2.9.4	The absence of emergency shutdown capabilities will be indicated on signage in accordance with 4.2.2.  	Requirement specified in the installation instruction, shall be re-evaluated in final installation.	**P**
4.2.10	Robustness requirements		**P**
	According to 4.2.2.1 all SSEG shall comply with safety requirements in accordance to SANS/IEC 62109-1 and IEC 62109-2.	Refer to IEC 62109-1 and IEC 62109-2 reports.	**P**
4.3	**Metering**	Shall be re-evaluated in final installation.	**N/A**
Annex A	**Notes to purchase**		**--**
Annex B	**Earthing system**	Shall be re-evaluated in final installation.	**N/A**

Table 4.1.5	Voltage fluctuations and flicker		P
Reference Impedance used:	L=0.15+0.15j, N=0.1+0.1j		
Pst (Limits: 0.35)			
Interval	Phase A	Phase B	Phase C
1	0.21	0.31	0.30
2	0.22	0.31	0.30
3	0.22	0.32	0.30
4	0.22	0.31	0.30
5	0.22	0.31	0.30
6	0.23	0.31	0.30
7	0.22	0.31	0.30
8	0.22	0.31	0.30
9	0.22	0.31	0.30
10	0.22	0.31	0.30
11	0.23	0.32	0.30
12	0.23	0.31	0.30
P_{lt} =	0.22	0.31	0.30

TABLE 4.1.5.3	Rapid voltage change	P
Mains voltage: 230V		
Switching actions		Ki
Marking operation without default (to primary energy carrier)		0.5
Marking operation at reference conditions(of primary energy carrier)		1.0
Breaking operation at nominal power		1.0
Worst case value of all switching operations Ki max		1.0

Table 4.1.7	Commutation notches		P
Test condition	Commutation notches current [A]		
Between 25% P_{Emax} and 35% P_{Emax}	1.4	1.3	1.5
Between 65% P_{Emax} and 75% P_{Emax}	1.7	1.4	1.5
> 90 P_{Emax}	2.6	2.4	2.4

TABLE 4.1.8	DC injection			P
Rated output current [A]	Measured value [mA]			Limit [mA]
	Phase A	Phase B	Phase C	
100% output				
29	11	32	29	145
75% output				
29	8	27	33	145
50% output				
29	8	25	34	145
25% output				
29	5	25	34	145
10% output				
29	5	24	33	145
Injected DC current exceeded 1% rated current [A]	Turn off time measured [ms]			Limit [ms]
	Phase A	Phase B	Phase C	
0.15	162	182	172	500
Remark:				

4.1.10 Harmonics and waveform distortion(phase A)						P
Harmonics	100%Pn	Limits		Harmonics	100%Pn	Limits
Order	I[%]	I[%]		Frequency [Hz]	I[%]	I[%]
2	0.373	1		75	0.084	0.1
3	0.276	4		125	0.025	0.1
4	0.434	1		175	0.054	0.1
5	1.123	4		225	0.035	0.1
6	0.139	1		275	0.032	0.1
7	0.463	4		325	0.017	0.1
8	0.218	1		375	0.037	0.1
9	0.104	4		425	0.026	0.1
10	0.112	1		475	0.014	0.1
11	0.346	2		525	0.028	0.1
12	0.065	0.5		575	0.037	0.25
13	0.133	2		625	0.027	0.25
14	0.071	0.5		675	0.013	0.25
15	0.075	2		725	0.039	0.25
16	0.046	0.5		775	0.046	0.25
17	0.167	1.5		825	0.052	0.25
18	0.118	0.38		875	0.067	0.19
19	0.148	1.5		925	0.039	0.19

20	0.053	0.38		975	0.053	0.19
21	0.092	1.5		1025	0.037	0.19
22	0.059	0.38		1075	0.053	0.19
23	0.202	0.6		1125	0.029	0.19
24	0.105	0.38		1175	0.037	0.08
25	0.106	0.6		1225	0.067	0.08
26	0.063	0.15		1275	0.039	0.08
27	0.067	0.6		1325	0.031	0.08
28	0.100	0.15		1375	0.031	0.08
29	0.188	0.6		1425	0.030	0.08
30	0.068	0.15		1475	0.056	0.08
31	0.116	0.6		1525	0.016	0.08
32	0.052	0.15		1575	0.036	0.08
33	0.047	0.6		1625	0.018	0.08
34	0.072	0.15		1675	0.028	0.08
35	0.113	0.3		1725	0.021	0.08
36	0.042	0.08		1775	0.019	0.03
37	0.058	0.3		1825	0.017	0.03
38	0.038	0.08		1875	0.025	0.03
39	0.036	0.3		1925	0.009	0.03
40	0.045	0.08		1975	0.016	0.03
42	0.045	0.3		--	--	--
43	0.026	0.08		--	--	--
44	0.033	0.3		--	--	--
45	0.062	0.08		--	--	--
46	0.033	0.3		--	--	--
47	0.032	0.08		--	--	--
48	0.035	0.3		--	--	--
49	0.031	0.08		--	--	--
50	0.050	0.3		--	--	--
THD	1.558	5		--	--	--
4.1.10 Harmonics and waveform distortion (**phase B**)						P
Harmonics	100%Pn	Limits		Harmonics	100%Pn	Limits
Order	I[%]	I[%]		Frequency [Hz]	I[%]	I[%]
2	0.587	1		75	0.054	0.1
3	0.125	4		125	0.065	0.1
4	0.253	1		175	0.046	0.1
5	0.949	4		225	0.027	0.1
6	0.045	1		275	0.038	0.1
7	0.403	4		325	0.037	0.1
8	0.108	1		375	0.041	0.1
9	0.063	4		425	0.028	0.1
10	0.099	1		475	0.071	0.1
11	0.363	2		525	0.024	0.1
12	0.031	0.5		575	0.034	0.25

13	0.167	2		625	0.098	0.25
14	0.048	0.5		675	0.015	0.25
15	0.049	2		725	0.035	0.25
16	0.030	0.5		775	0.084	0.25
17	0.212	1.5		825	0.037	0.25
18	0.085	0.38		875	0.046	0.19
19	0.181	1.5		925	0.068	0.19
20	0.037	0.38		975	0.044	0.19
21	0.038	1.5		1025	0.035	0.19
22	0.064	0.38		1075	0.084	0.19
23	0.168	0.6		1125	0.034	0.19
24	0.064	0.38		1175	0.046	0.08
25	0.114	0.6		1225	0.065	0.08
26	0.041	0.15		1275	0.035	0.08
27	0.041	0.6		1325	0.016	0.08
28	0.067	0.15		1375	0.027	0.08
29	0.117	0.6		1425	0.031	0.08
30	0.049	0.15		1475	0.026	0.08
31	0.099	0.6		1525	0.027	0.08
32	0.034	0.15		1575	0.034	0.08
33	0.038	0.6		1625	0.017	0.08
34	0.048	0.15		1675	0.022	0.08
35	0.070	0.3		1725	0.031	0.08
36	0.031	0.08		1775	0.016	0.03
37	0.053	0.3		1825	0.021	0.03
38	0.033	0.08		1875	0.014	0.03
39	0.035	0.3		1925	0.013	0.03
40	0.032	0.08		1975	0.005	0.03
42	0.045	0.3		--	--	--
43	0.028	0.08		--	--	--
44	0.039	0.3		--	--	--
45	0.036	0.08		--	--	--
46	0.028	0.3		--	--	--
47	0.040	0.08		--	--	--
48	0.034	0.3		--	--	--
49	0.027	0.08		--	--	--
50	0.041	0.3		--	--	--
THD	1.388	5		--	--	--
4.1.10 Harmonics and waveform distortion (**phase C**)						P
Harmonics	100%Pn	Limits		Harmonics	100%Pn	Limits
Order	I[%]	I[%]		Frequency [Hz]	I[%]	I[%]
2	0.267	1		75	0.066	0.1
3	0.300	4		125	0.021	0.1
4	0.375	1		175	0.057	0.1
5	0.956	4		225	0.073	0.1

6	0.105	1		275	0.074	0.1
7	0.446	4		325	0.039	0.1
8	0.165	1		375	0.055	0.1
9	0.067	4		425	0.059	0.1
10	0.034	1		475	0.051	0.1
11	0.283	2		525	0.028	0.1
12	0.081	0.5		575	0.064	0.25
13	0.215	2		625	0.084	0.25
14	0.051	0.5		675	0.068	0.25
15	0.042	2		725	0.081	0.25
16	0.054	0.5		775	0.068	0.25
17	0.207	1.5		825	0.091	0.25
18	0.046	0.38		875	0.035	0.19
19	0.112	1.5		925	0.046	0.19
20	0.044	0.38		975	0.064	0.19
21	0.098	1.5		1025	0.013	0.19
22	0.039	0.38		1075	0.086	0.19
23	0.223	0.6		1125	0.035	0.19
24	0.067	0.38		1175	0.016	0.08
25	0.079	0.6		1225	0.038	0.08
26	0.049	0.15		1275	0.046	0.08
27	0.071	0.6		1325	0.056	0.08
28	0.074	0.15		1375	0.067	0.08
29	0.181	0.6		1425	0.064	0.08
30	0.055	0.15		1475	0.046	0.08
31	0.093	0.6		1525	0.045	0.08
32	0.060	0.15		1575	0.041	0.08
33	0.041	0.6		1625	0.034	0.08
34	0.065	0.15		1675	0.021	0.08
35	0.075	0.3		1725	0.019	0.08
36	0.038	0.08		1775	0.013	0.03
37	0.075	0.3		1825	0.008	0.03
38	0.042	0.08		1875	0.013	0.03
39	0.033	0.3		1925	0.025	0.03
40	0.053	0.08		1975	0.016	0.03
42	0.035	0.3		--	--	--
43	0.029	0.08		--	--	--
44	0.044	0.3		--	--	--
45	0.052	0.08		--	--	--
46	0.029	0.3		--	--	--
47	0.043	0.08		--	--	--
48	0.031	0.3		--	--	--
49	0.028	0.08		--	--	--
50	0.032	0.3		--	--	--
THD	1.373	5				

TABLE4.1.11.2	Power factor for generators of sub-categories A1 and A2					P
P/Pn (%)	DC input Voltage(V)	DC input current (A)	Output voltage (V)	Output current (A)	Power factor	Limit
10%	602	3.47	A:230.10	A:3.01	A:0.973	--
			B:230.04	B:3.01	B:0.972	
			C:230.20	C:2.99	C:0.973	
25%	602	8.58	A:230.13	A:7.34	A:0.995	0.98
			B:230.14	B:7.34	B:0.995	
			C:230.24	C:7.31	C:0.995	
50%	600	17.01	A:230.20	A:14.59	A:0.998	0.98
			B:230.19	B:14.59	B:0.998	
			C:230.33	C:14.55	C:0.998	
75%	602	25.49	A:230.28	A:21.86	A:0.999	0.98
			B:230.27	B:21.86	B:0.999	
			C:230.41	C:21.78	C:0.999	
100%	603	34.05	A:230.33	A:29.21	A:0.998	0.98
			B:230.27	B:29.21	B:0.998	
			C:230.50	C:29.13	C:0.998	
Remark:						

TABLE4.1.11.2	Power factor for generators of sub-categories A1 and A2（Solis-3P5K-4G)					P
P/Pn (%)	DC input Voltage(V)	DC input current (A)	Output voltage (V)	Output current (A)	Power factor	Limit
10%	557	0.96	A:229.87	A:0.87	A:0.970	--
			B:230.04	B:0.85	B:0.961	
			C:230.14	C:0.85	C:0.974	
25%	557	2.34	A:229.99	A:1.91	A:0.987	0.98
			B:230.03	B:1.89	B:0.985	
			C:230.16	C:1.89	C:0.988	
50%	557	4.59	A:230.02	A:3.67	A:0.991	0.98
			B:230.06	B:3.65	B:0.990	
			C:230.18	C:3.65	C:0.991	
75%	557	6.87	A:230.05	A:5.49	A:0.995	0.98
			B:230.12	B:5.47	B:0.995	
			C:230.19	C:5.47	C:0.995	
100%	557	9.29	A:230.09	A:7.39	A:0.997	0.98
			B:230.16	B:7.36	B:0.997	
			C:230.24	C:7.36	C:0.997	
Remark:						

4.1.11.4	TABLE: Power Factor for generators of sub-categories A3								P
No.	Test condition			Measurement					
	P/Pn	U/Un	cos ϕ	U_{L1} [V]	U_{L2} [V]	U_{L3} [V]	P [W]	Q [Var]	cos ϕ
1	50%	91%	0.95 under-excited	209.49	209.44	209.58	10205	3199	0.954
2	50%	100%	0.95 under-excited	230.19	230.15	230.30	10210	3165	0.955
3	50%	109%	0.95 under-excited	250.85	250.87	251.01	10215	3123	0.956
4	$P_{Emax0.9)}$	91%	0.95 under-excited	209.62	209.59	209.76	18618	5939	0.953
5	$P_{Emax0.9)}$	100%	0.95 under-excited	230.33	230.26	230.49	20449	6527	0.953
6	$P_{Emax0.9)}$	109%	0.95 under-excited	250.56	250.55	250.76	20710	6522	0.954
7	50%	100%	0.96 under-excited	230.15	230.13	230.31	10200	2886	0.962
8	50%	100%	0.97 under-excited	230.16	230.16	230.32	10200	2445	0.973
9	50%	100%	0.98 under-excited	230.16	230.06	230.34	10200	1945	0.982
10	50%	100%	0.99 under-excited	230.20	230.17	230.40	10227	991	0.995
11	50%	100%	1.00	230.13	230.15	230.33	10229	657	0.998
12	50%	100%	0.99 over-excited	230.19	230.16	230.32	10200	1225	0.993
13	50%	100%	0.98 over-excited	230.18	230.15	230.31	10200	1856	0.984
14	50%	100%	0.97 over-excited	230.18	230.15	230.30	10200	2432	0.973
15	50%	100%	0.96 over-excited	230.17	230.13	230.33	10223	2692	0.967
16	50%	91%	0.95 over-excited	209.48	209.52	209.69	10212	3123	0.956
17	50%	100%	0.95 over-excited	250.94	250.86	251.04	10225	3232	0.954
18	50%	109%	0.95 over-excited	230.18	230.17	230.34	10221	3168	0.955
19	$P_{Emax0.9)}$	91%	0.95 over-excited	209.66	209.61	209.78	18971	6588	0.945
20	$P_{Emax0.9)}$	100%	0.95 over-excited	230.34	230.33	230.48	20157	6874	0.946
21	$P_{Emax0.9)}$	109%	0.95 over-excited	250.64	250.63	250.78	20204	7002	0.945
Remark: Each point stay for 30s. $P_{Emax0.9)}$ means the possible maximum active power under 0.95 displacement factor condition.									

4.1.11.9	TABLE: Power factor characteristics curve for sub-categories A3					P
P/Pn [%]	P	Q	S	cos ϕ	Δ cos ϕ	Limitation
20	4029.0	379.1	4046.9	0.996	0.004	1
30	6010.6	452.0	6029.6	0.997	0.003	1
40	8022.6	544.8	8042.0	0.998	0.002	1
50	10010.0	608.5	10028.7	0.998	0.002	1
60	12002.8	1282.4	12071.5	0.994	0.004	0.99
70	14008.0	-2661.8	14258.9	0.982	0.002	0.98
80	15994.9	-3997.0	16487.3	0.970	0.000	0.97
90	18005.2	-5358.2	18786.0	0.958	0.002	0.96

100	20029.5	-6764.1	21141.1	0.947	0.003	0.95

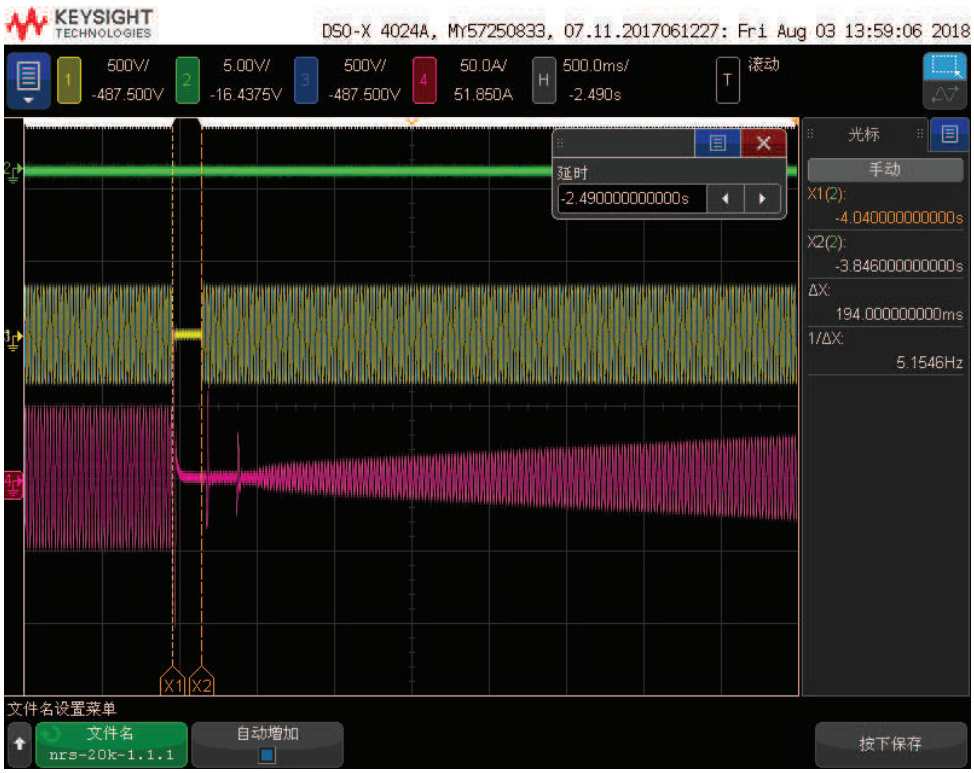
5.2.1 of RPP Grid Code	**Tolerance to sudden voltage drops and peaks-CAT A3**

Summary of tests

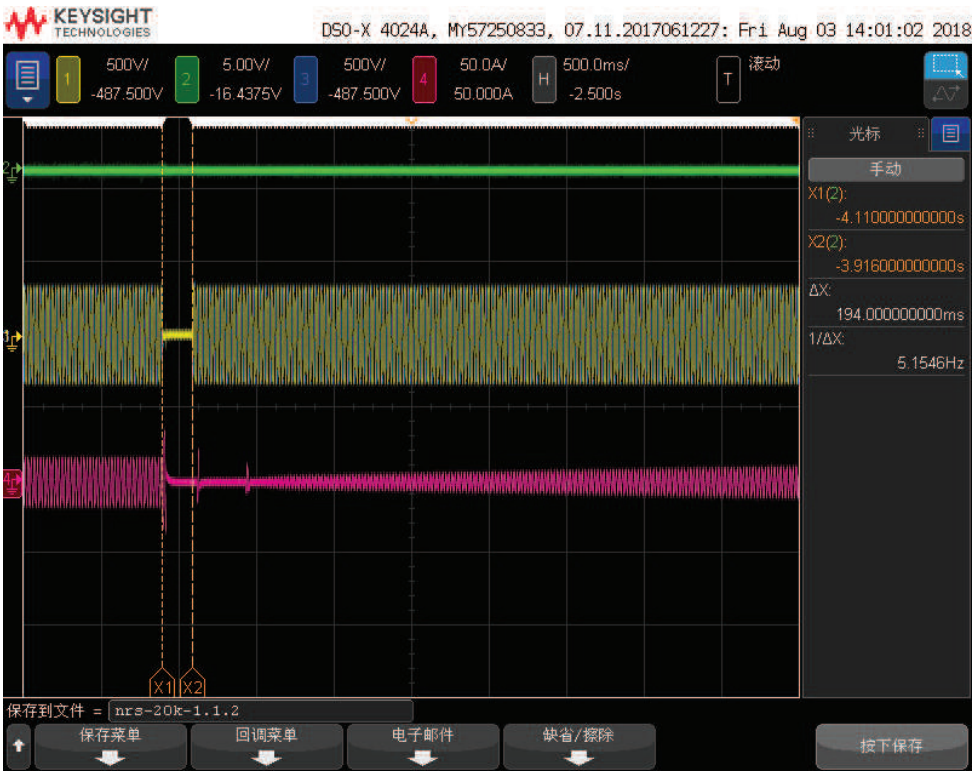
Test no.	Remaining voltage	Type	Output power level		K factor	Test number
			P requirement	Required duration [ms]		
1	2%	Three-phase short circuit	$P \geq 0{,}9P_n$	194	--	1.1.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	1.1.2
		Two-phase short circuit	$P \geq 0{,}9P_n$		--	1.2.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	1.2.2
		Single-phase short circuit	$P \geq 0{,}9P_n$		--	1.3.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	1.3.2
2	25%	Three-phase short circuit	$P \geq 0{,}9P_n$	694	--	2.1.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	2.1.2
		Two-phase short circuit	$P \geq 0{,}9P_n$		--	2.2.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	2.2.2
		Single-phase short circuit	$P \geq 0{,}9P_n$		--	2.3.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	2.3.2
3	55%	Three-phase short circuit	$P \geq 0{,}9P_n$	1347	--	3.1.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	3.1.2
		Two-phase short circuit	$P \geq 0{,}9P_n$		--	3.2.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	3.2.2
		Single-phase short circuit	$P \geq 0{,}9P_n$		--	3.3.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	3.3.2
4	86%	Three-phase short circuit	$P \geq 0{,}9P_n$	20000	--	3.1.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	4.1.2
		Two-phase short circuit	$P \geq 0{,}9P_n$		--	4.2.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	4.2.2
		Single-phase short circuit	$P \geq 0{,}9P_n$		--	4.3.1
			$0{,}1P_n \leq P \leq 0{,}3P_n$		--	4.3.2

Note:

Test 1.2.1/1.2.2:
phase L1: 0 degree, 2%; phase L2: 269.3degree, 87%;phase L3: 90.7degree, 87%
Test 2.2.1/2.2.2:
phase L1: 0 degree, 25%; phase L2: 261.8degree, 88%;phase L3: 98.2degree, 88%
Test 3.2.1/3.2.2:
phase L1: 0 degree, 55%; phase L2: 252.4degree, 91%;phase L3: 107.6degree, 91%
Test 4.2.1/4.2.2:
phase L1: 0 degree, 86%; phase L2: 243.6degree, 97%;phase L3: 116.4degree, 97%



1.1.1(Channel 2: signal, channel 1: L2; channel 3: L1; channel 4: I1)



1.1.2

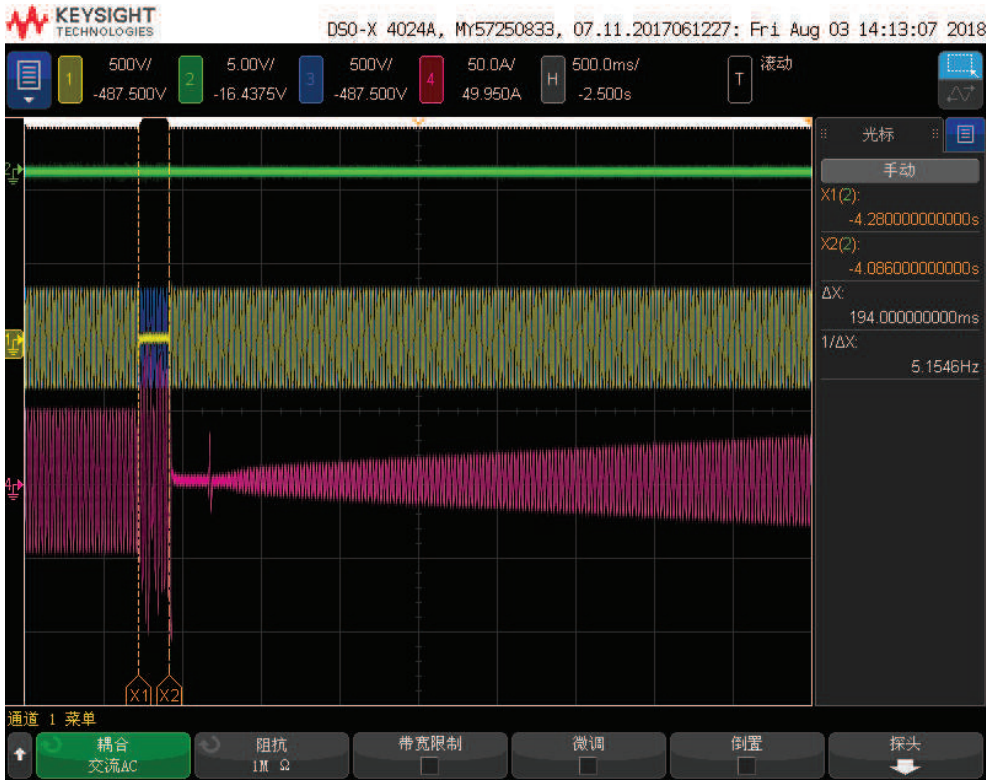

KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Fri Aug 03 14:08:05 2018
500V/
-487.500V
5.00V/
-16.4375V
500V/
-487.500V
50.0A/
50.000A
500.0ms/
-2.500s
滚动
光标
手动
X1(2):
-4.250000000000s
X2(2):
-4.056000000000s
ΔX:
194.000000000ms
1/ΔX:
5.1546Hz
通道 3 菜单
耦合
交流AC
阻抗
1M Ω
带宽限制
微调
倒置
探头

1.2.1

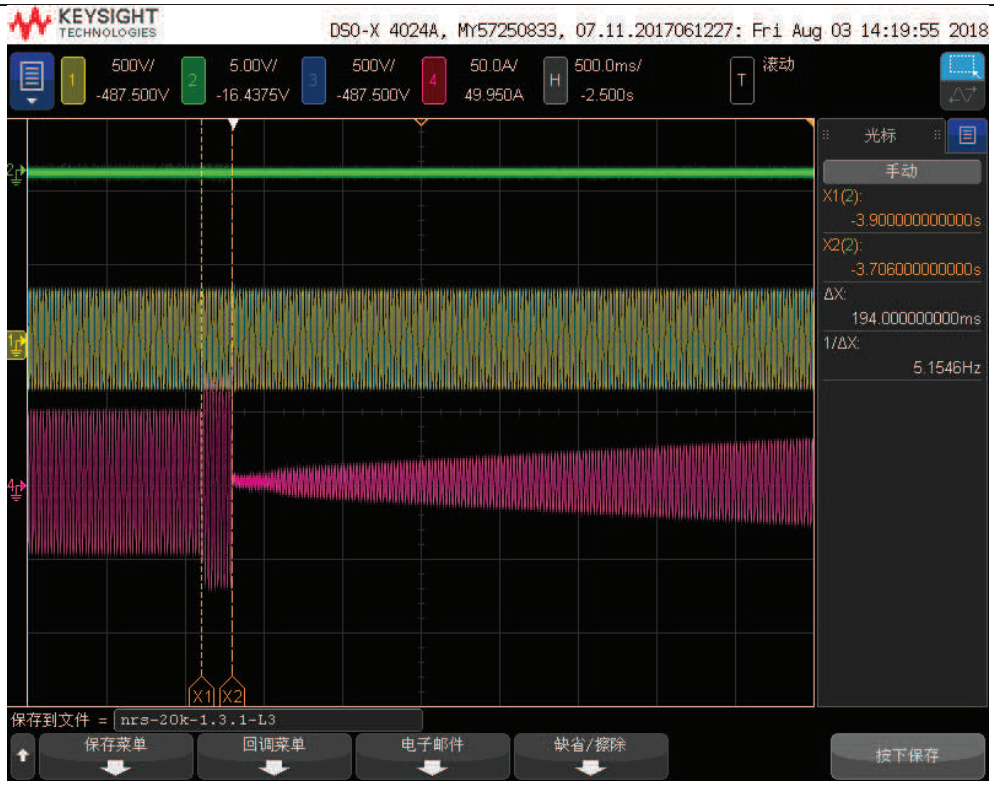

KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Fri Aug 03 14:08:48 2018
500V/
-487.500V
5.00V/
-16.4375V
500V/
-487.500V
50.0A/
49.950A
500.0ms/
-2.500s
滚动
光标
手动
X1(2):
-4.480000000000s
X2(2):
-4.286000000000s
ΔX:
194.000000000ms
1/ΔX:
5.1546Hz
通道 4 探头菜单: 0.0150V/A (66.7 : 1)
单位
安培
探头
0.0150V/A
时滞
0.0s
无源探头检查

1.2.2

1.3.1-L1



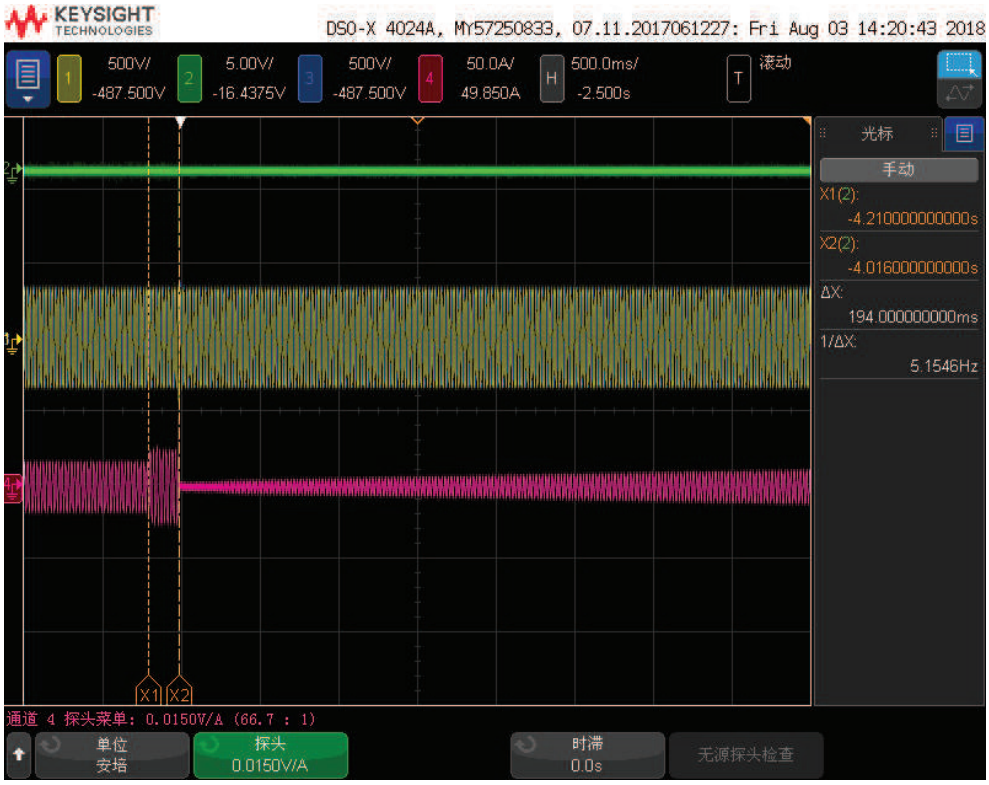
1.3.1-L2(Channel 2: signal, channel 1: L2; channel 3: L1; channel 4: I1)



1.3.1-L3(Channel 2: signal, channel 1: L2; channel 3: L1; channel 4: I1)

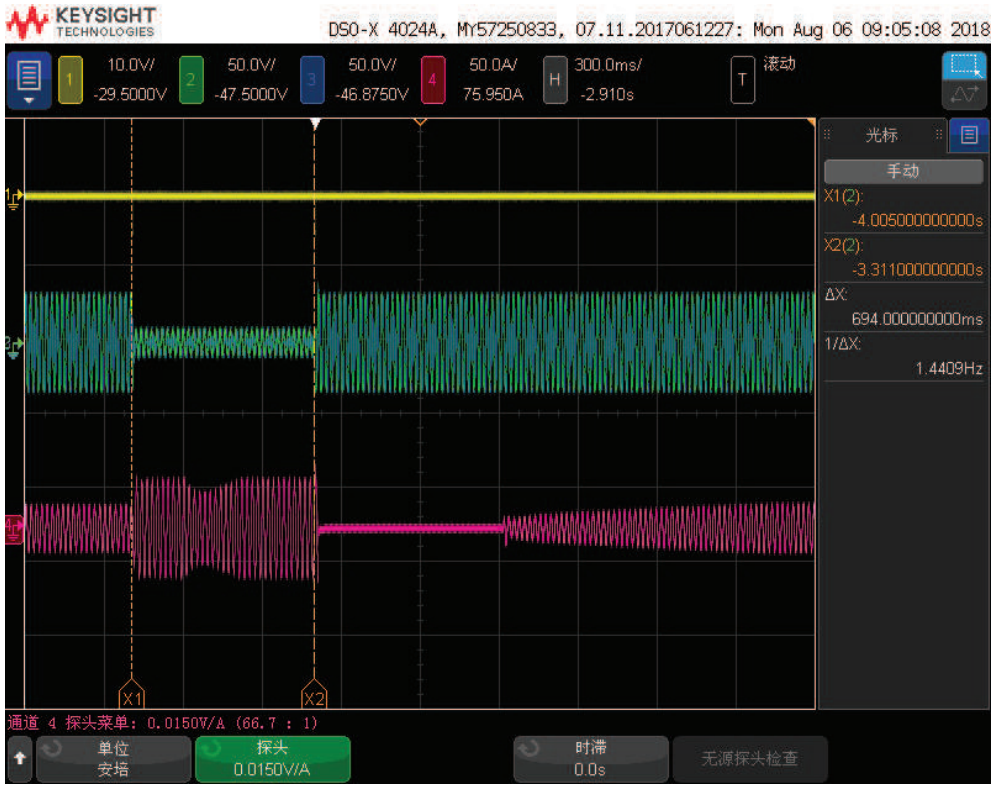
1.3.2-L1(Channel 2: signal, channel 1: L2; channel 3: L1; channel 4: I1)

1.3.2-L2(Channel 1: signal, channel 2: L2; channel 3: L1; channel 4: I1)



1.3.2-L3(Channel 2: signal, channel 1: L2; channel 3: L1; channel 4: I1)

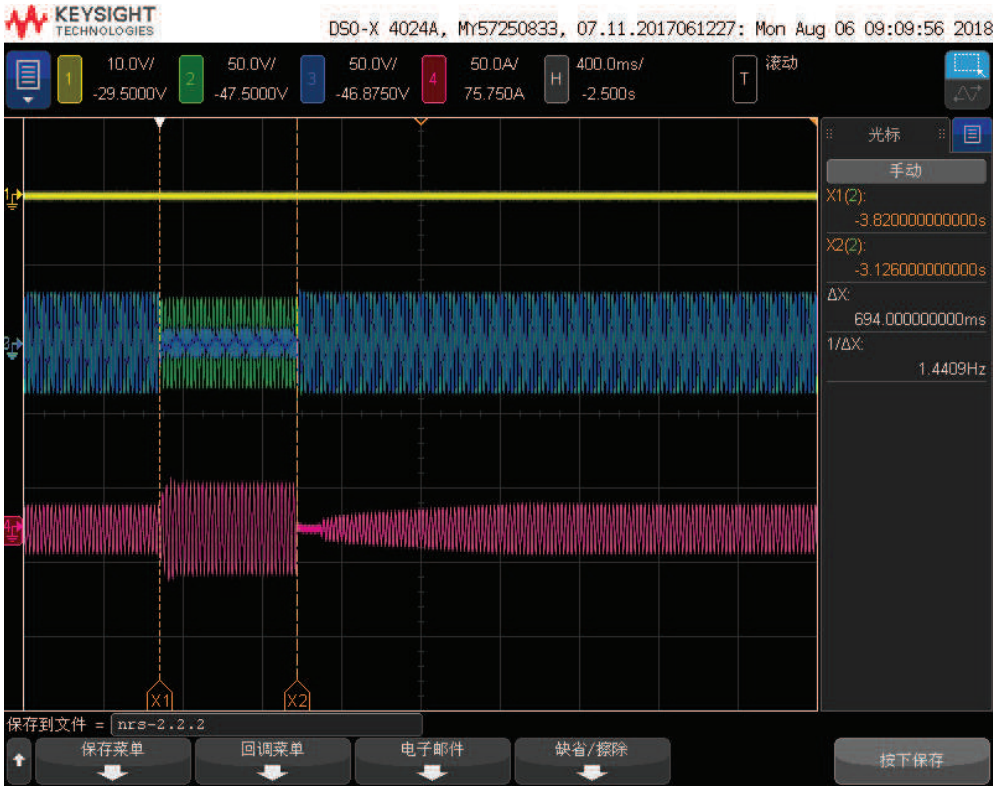
2.1.1(Channel 1: signal, channel 2: L2; channel 3: L1; channel 4: I1)



2.1.2


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:07:19 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.950A
400.0ms/ -2.500s
滚动
光标
手动
X1(2): -3.850000000000s
X2(2): -3.156000000000s
ΔX: 694.000000000ms
1/ΔX: 1.4409Hz
通道 3 菜单
耦合 交流AC
阻抗 1M Ω
带宽限制
微调
倒置
探头

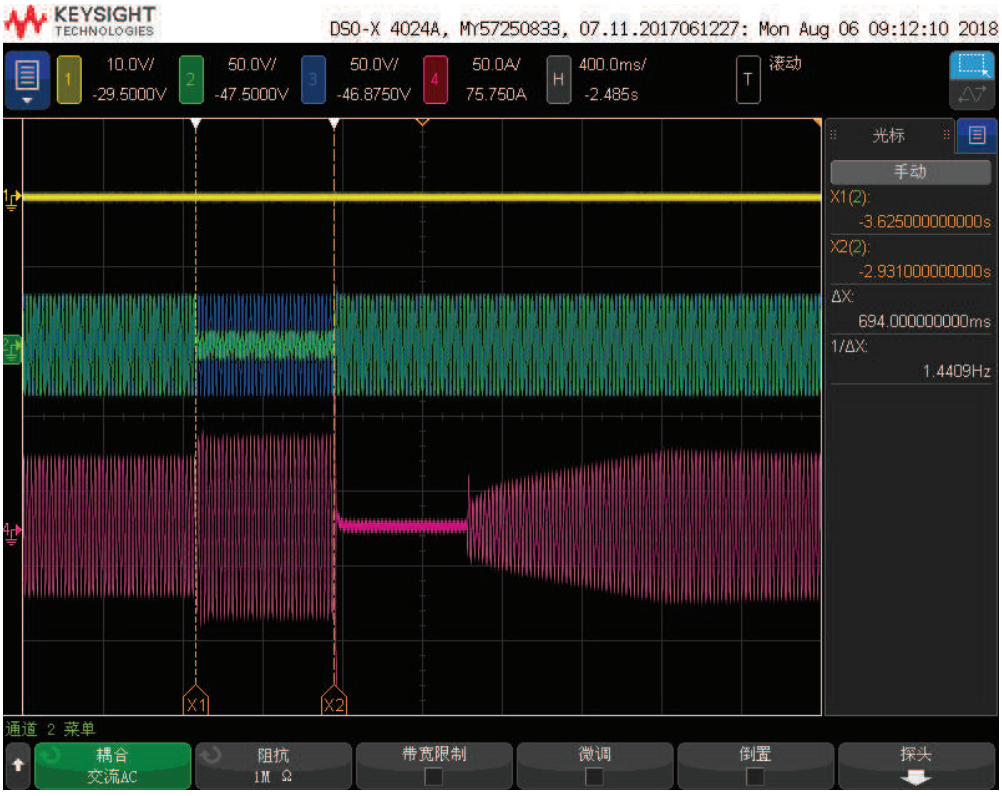
2.2.1


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:09:56 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.750A
400.0ms/ -2.500s
滚动
光标
手动
X1(2): -3.820000000000s
X2(2): -3.126000000000s
ΔX: 694.000000000ms
1/ΔX: 1.4409Hz
保存到文件 = nrs-2.2.2
保存菜单
回调菜单
电子邮件
缺省/擦除
按下保存

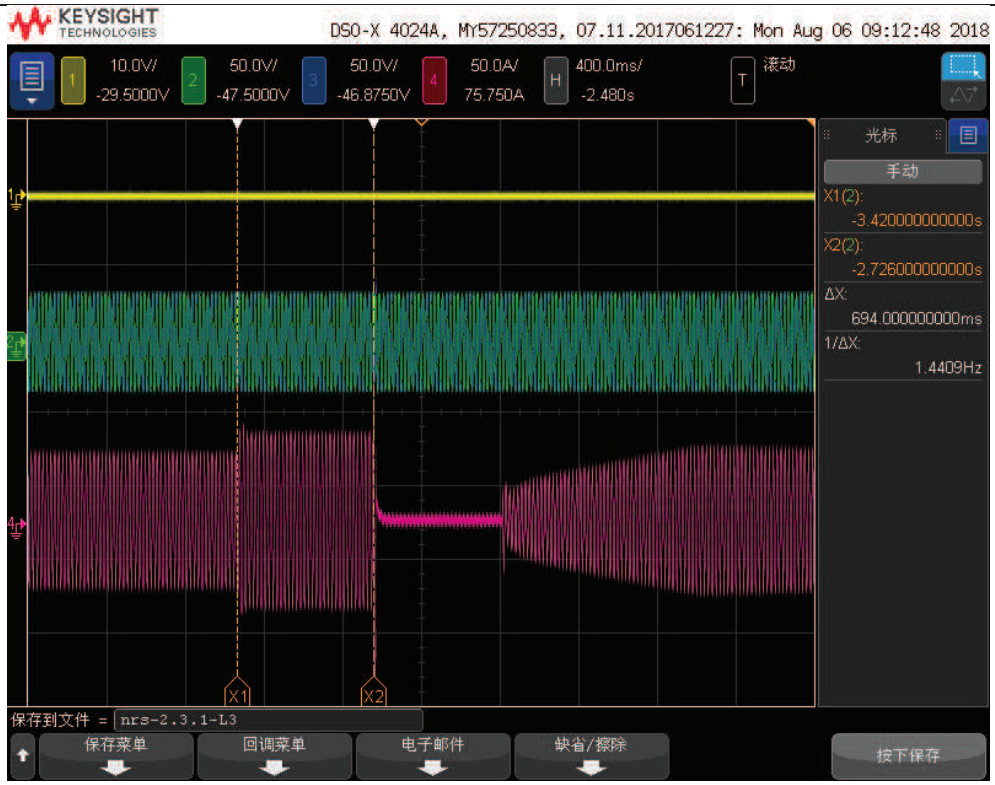
2.2.2


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:11:24 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.750A
300.0ms/ -2.810s
滚动
光标
手动
X1(2):
-3.945000000000s
X2(2):
-3.251000000000s
ΔX:
694.000000000ms
1/ΔX:
1.4409Hz
X1
X2
文件名设置菜单
文件名
nrs-2.3.1-L1
自动增加
按下保存

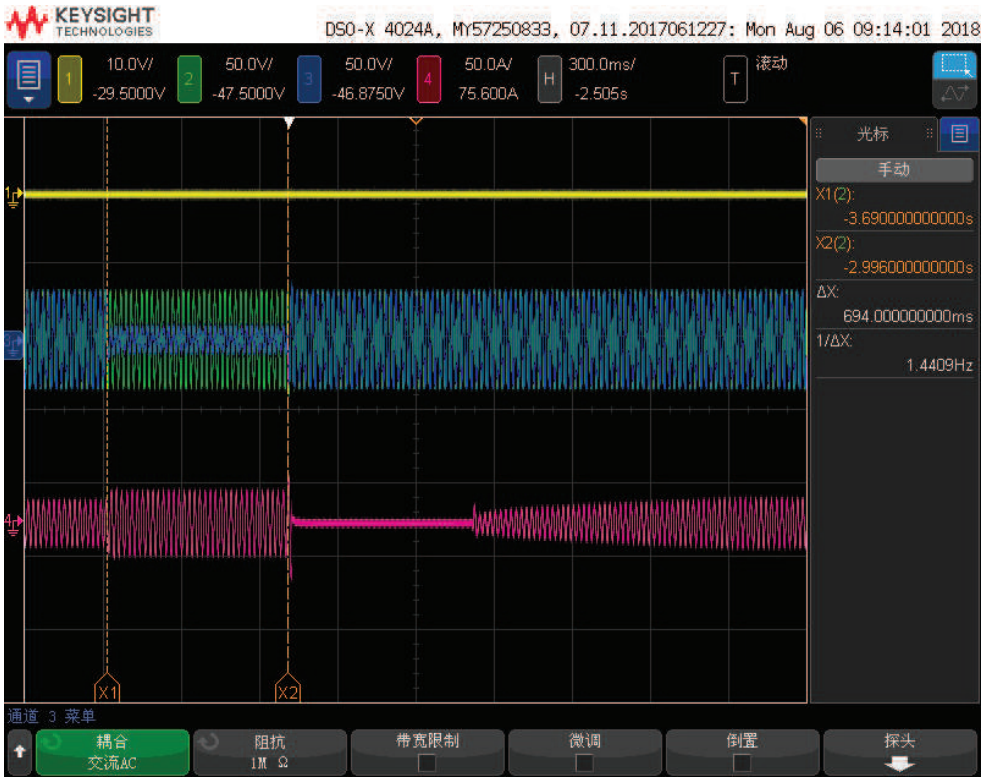
2.3.1-L1


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:12:10 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.750A
400.0ms/ -2.485s
滚动
光标
手动
X1(2):
-3.625000000000s
X2(2):
-2.931000000000s
ΔX:
694.000000000ms
1/ΔX:
1.4409Hz
X1
X2
通道 2 菜单
耦合
交流AC
阻抗
1M Ω
带宽限制
微调
倒置
探头

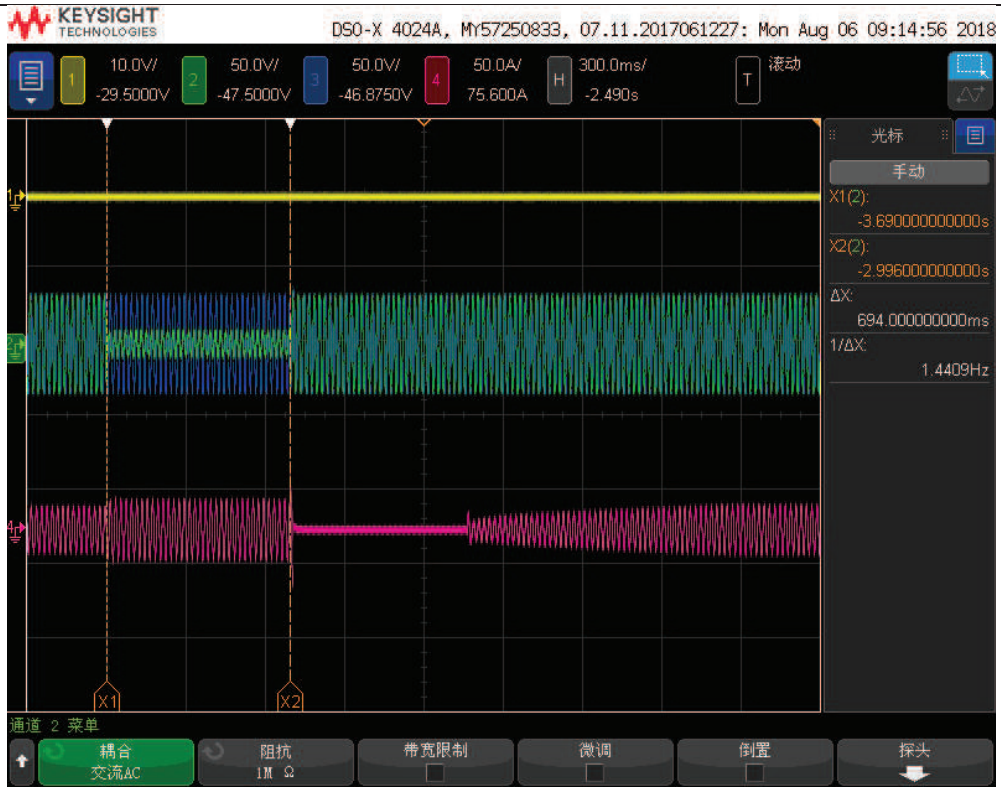
2.3.1-L2


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:12:48 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.750A
400.0ms/ -2.480s
滚动
光标
手动
X1(2):
-3.420000000000s
X2(2):
-2.726000000000s
ΔX:
694.000000000ms
1/ΔX:
1.4409Hz
保存到文件 = nrs-2.3.1-L3
保存菜单
回调菜单
电子邮件
缺省/擦除
按下保存

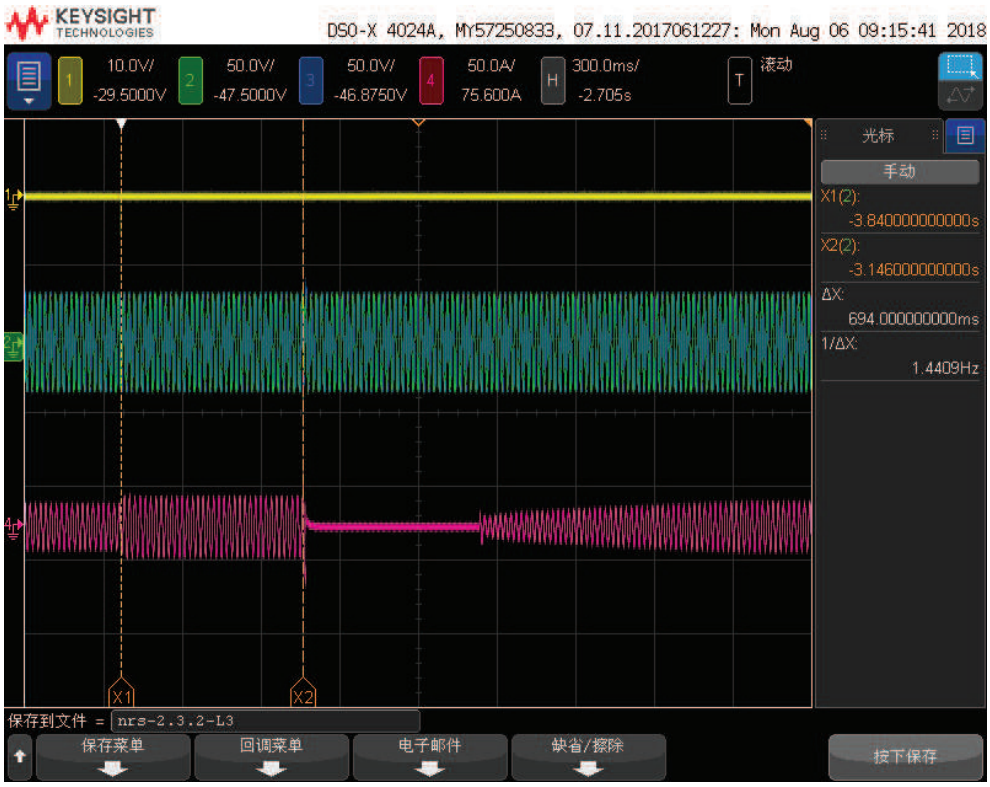
2.3.1-L3


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:14:01 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.600A
300.0ms/ -2.505s
滚动
光标
手动
X1(2):
-3.690000000000s
X2(2):
-2.996000000000s
ΔX:
694.000000000ms
1/ΔX:
1.4409Hz
通道 3 菜单
耦合 交流AC
阻抗 1M Ω
带宽限制
微调
倒置
探头

2.3.2-L1


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:14:56 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.600A
300.0ms/ -2.490s
滚动
光标
手动
X1(2):
-3.690000000000s
X2(2):
-2.996000000000s
ΔX:
694.000000000ms
1/ΔX:
1.4409Hz
X1
X2
通道 2 菜单
耦合 交流AC
阻抗 1M Ω
带宽限制
微调
倒置
探头

2.3.2-L2


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:15:41 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.600A
300.0ms/ -2.705s
滚动
光标
手动
X1(2):
-3.840000000000s
X2(2):
-3.146000000000s
ΔX:
694.000000000ms
1/ΔX:
1.4409Hz
X1
X2
保存到文件 = nrs-2.3.2-L3
保存菜单
回调菜单
电子邮件
缺省/擦除
按下保存

2.3.2-L3

3.1.1(Channel 2: signal, channel 1: L2; channel 3: L1; channel 4: I1)

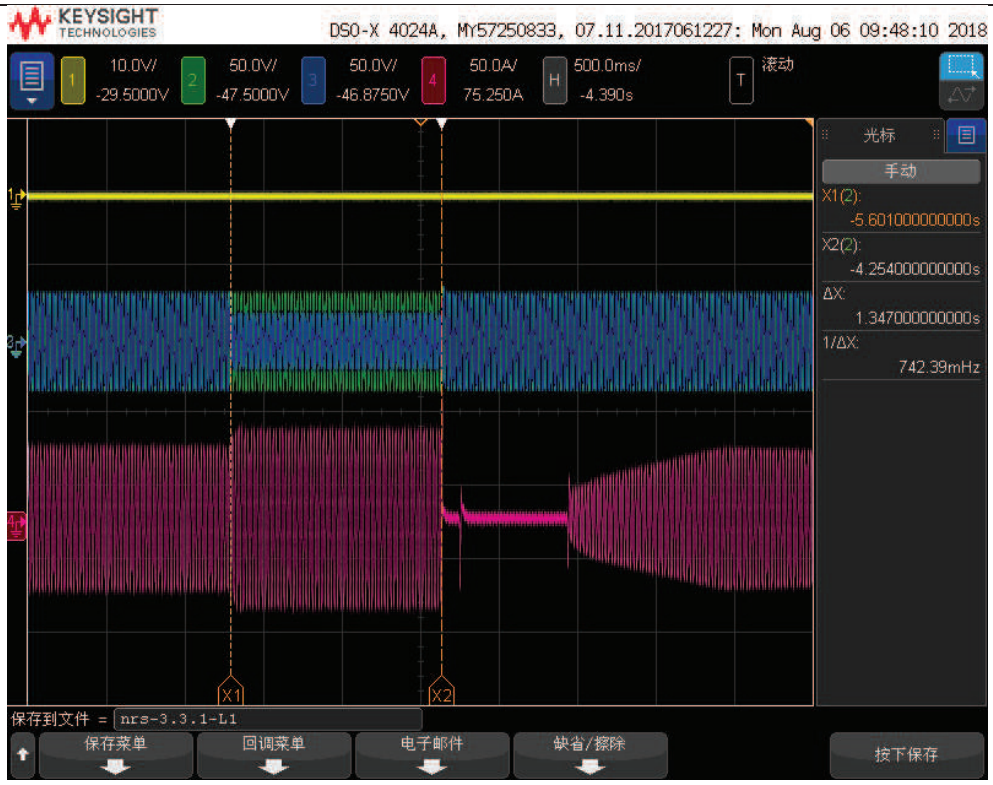
3.1.2


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:50:04 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.250A
400.0ms/ -2.170s
滚动
光标
手动
X1(2): -3.585000000000s
X2(2): -2.238000000000s
ΔX: 1.347000000000s
1/ΔX: 742.39mHz
X1
X2
文件名设置菜单
文件名 nrs-3.2.1
自动增加
按下保存

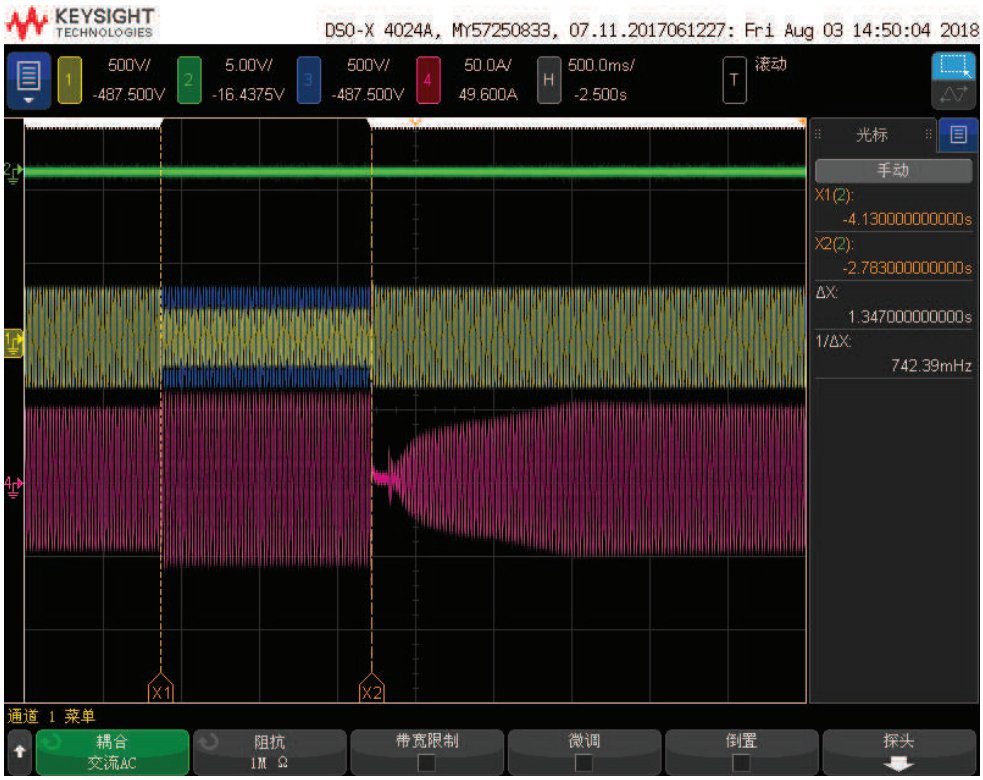
3.2.1


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Fri Aug 03 14:41:59 2018
500V/ -487.500V
5.00V/ -16.4375V
500V/ -487.500V
50.0A/ 49.600A
500.0ms/ -2.500s
滚动
光标
手动
X1(2): -4.340000000000s
X2(2): -2.993000000000s
ΔX: 1.347000000000s
1/ΔX: 742.39mHz
X1
X2
保存到文件 = nrs-20k-3.2.2
保存菜单
回调菜单
电子邮件
缺省/擦除
按下保存

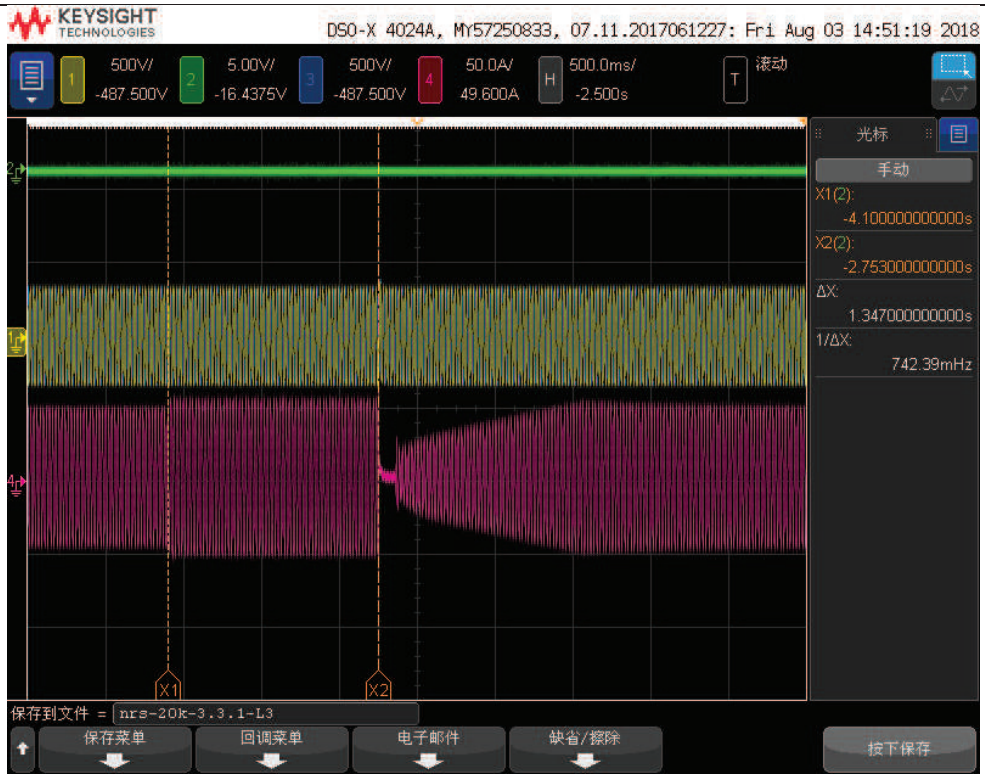
3.2.2



3.3.1-L1(Channel 1: signal, channel 2: L2; channel 3: L1; channel 4: I1)



3.3.1-L2(Channel 2: signal, channel 1: L2; channel 3: L1; channel 4: I1)


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Fri Aug 03 14:51:19 2018
500V/
-487.500V
5.00V/
-16.4375V
500V/
-487.500V
50.0A/
49.600A
500.0ms/
-2.500s
滚动
光标
手动
X1(2):
-4.100000000000s
X2(2):
-2.753000000000s
ΔX:
1.347000000000s
1/ΔX:
742.39mHz
X1
X2
保存到文件 = nrs-20k-3.3.1-L3
保存菜单
回调菜单
电子邮件
缺省/擦除
按下保存

3.3.1-L3


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Fri Aug 03 14:52:27 2018
500V/
-487.500V
5.00V/
-16.4375V
500V/
-487.500V
50.0A/
49.500A
500.0ms/
-2.500s
滚动
光标
手动
X1(2):
-4.180000000000s
X2(2):
-2.833000000000s
ΔX:
1.347000000000s
1/ΔX:
742.39mHz
X1
X2
通道 3 菜单
耦合
交流AC
阻抗
1M Ω
带宽限制
微调
倒置
探头

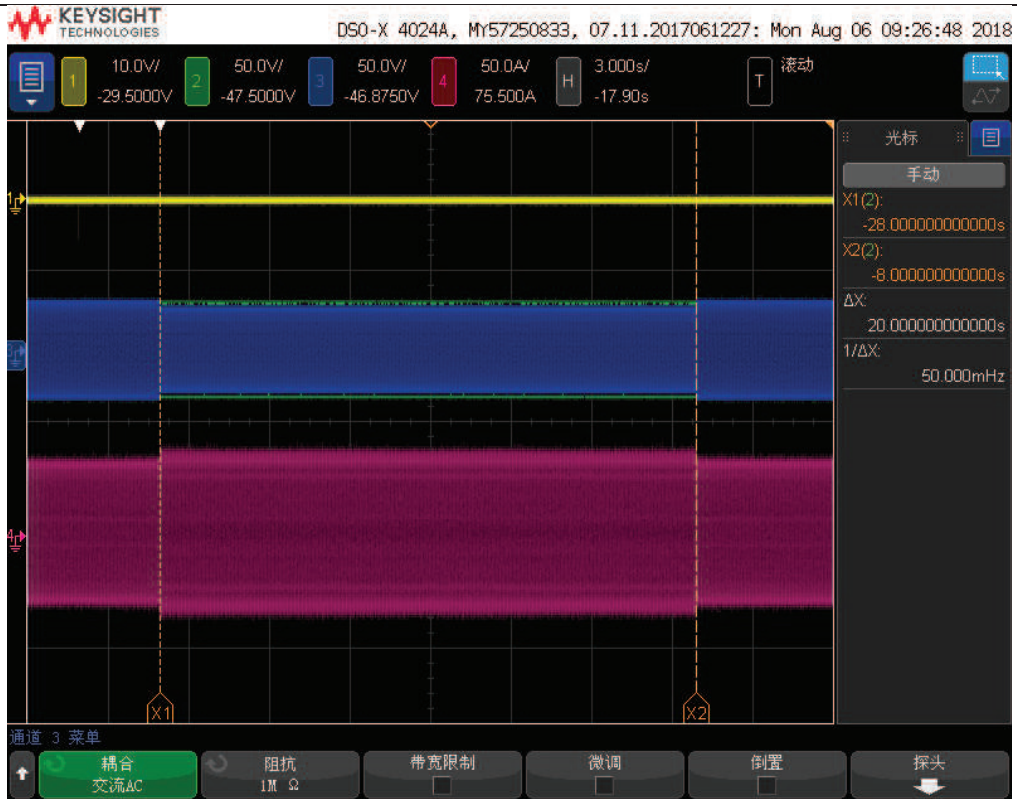
3.3.2-L1

3.3.2-L2

3.3.2-L3(Channel 2: signal, channel 1: L2; channel 3: L1; channel 4: I1)

4.1.1(Channel 1: signal, channel 2: L2; channel 3: L1; channel 4: I1)

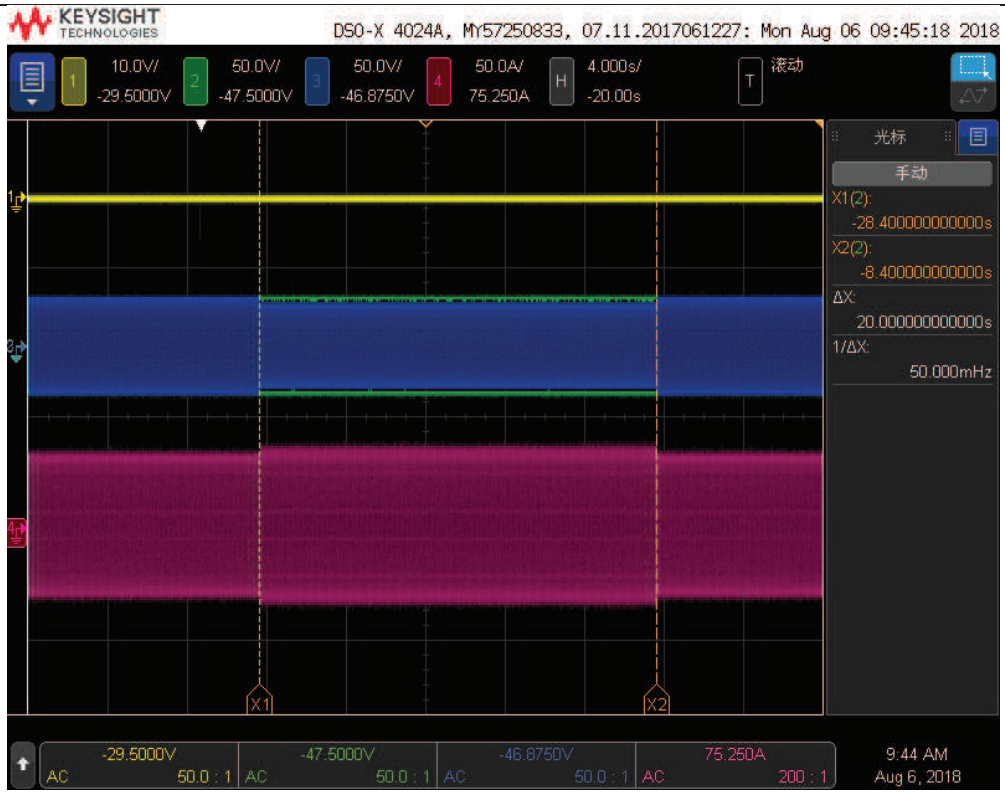
4.1.2


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:26:48 2018
10.0V/
-29.5000V
50.0V/
-47.5000V
50.0V/
-46.8750V
50.0A/
75.500A
3.000s/
-17.90s
滚动
光标
手动
X1(2):
-28.000000000000s
X2(2):
-8.000000000000s
ΔX:
20.000000000000s
1/ΔX:
50.000mHz
X1
X2
通道 3 菜单
耦合
交流AC
阻抗
1M Ω
带宽限制
微调
倒置
探头

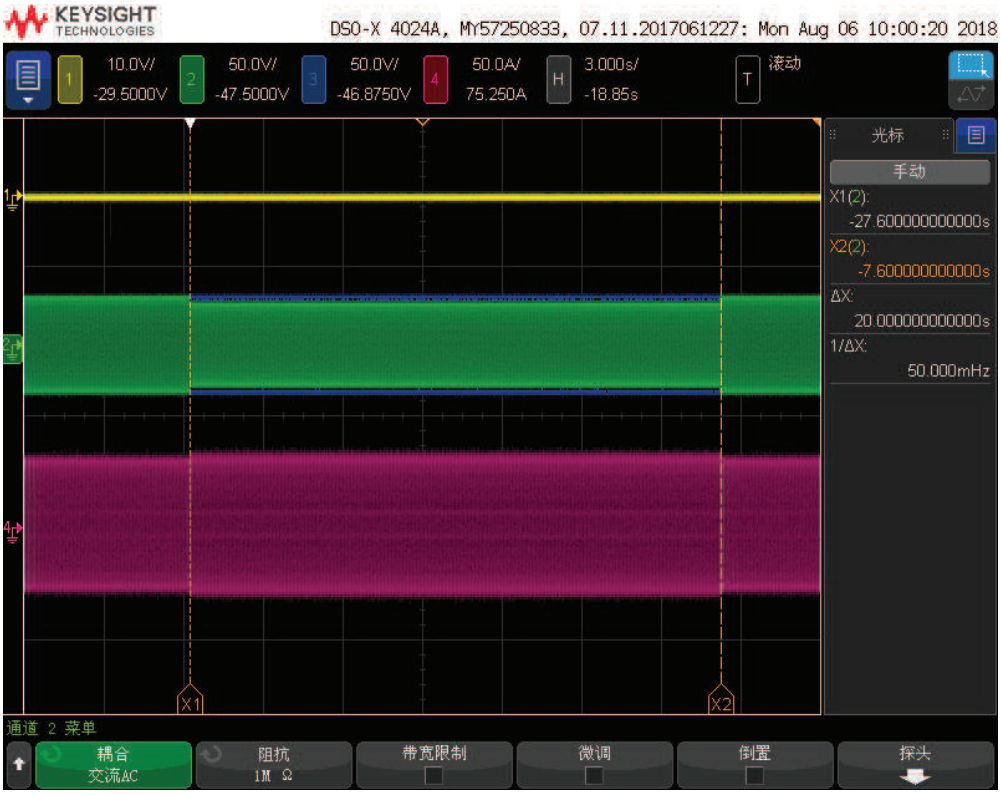
4.2.1


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:27:58 2018
10.0V/
-29.5000V
50.0V/
-47.5000V
50.0V/
-46.8750V
50.0A/
75.350A
4.000s/
-20.00s
滚动
光标
手动
X1(2):
-29.300000000000s
X2(2):
-9.300000000000s
ΔX:
20.000000000000s
1/ΔX:
50.000mHz
X1
X2
保存到文件 = nrs-4.2.2
保存菜单
回调菜单
电子邮件
缺省/擦除
按下保存

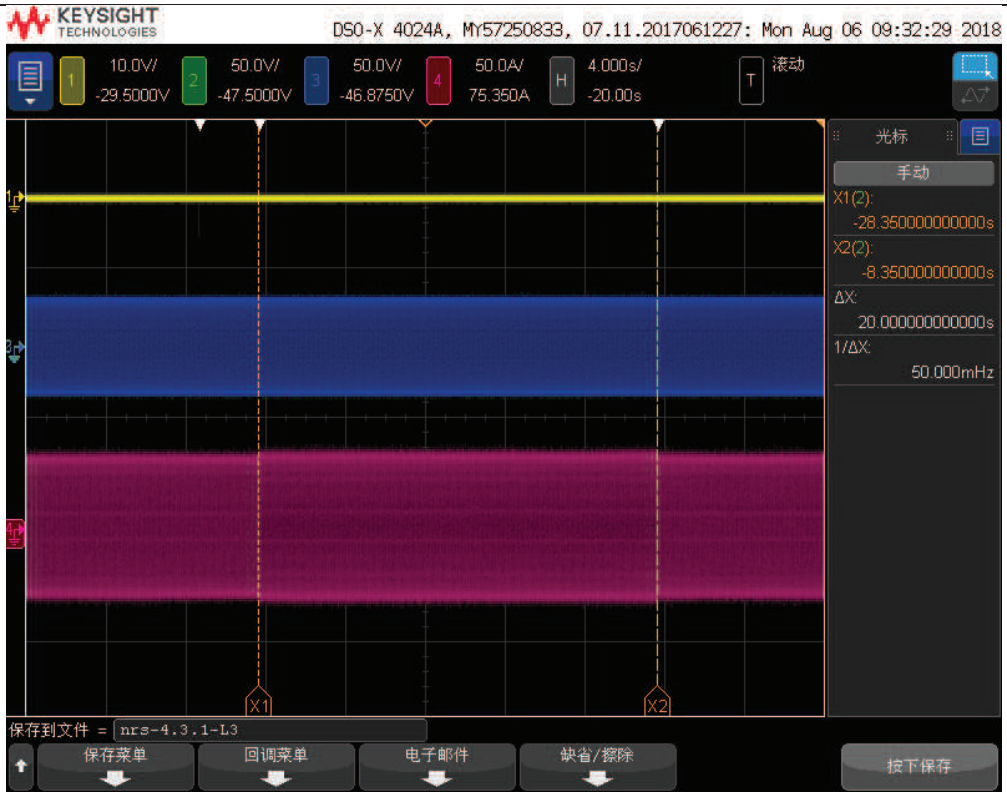
4.2.2


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:45:18 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.250A
4.000s/ -20.00s
滚动
光标
手动
X1(2):
-28.400000000000s
X2(2):
-8.400000000000s
ΔX:
20.000000000000s
1/ΔX:
50.000mHz
X1
X2
-29.5000V AC 50.0 : 1
-47.5000V AC 50.0 : 1
-46.8750V AC 50.0 : 1
75.250A AC 200 : 1
9:44 AM Aug 6, 2018

4.3.1-L1


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 10:00:20 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.250A
3.000s/ -18.85s
滚动
光标
手动
X1(2):
-27.600000000000s
X2(2):
-7.600000000000s
ΔX:
20.000000000000s
1/ΔX:
50.000mHz
X1
X2
通道 2 菜单
耦合 交流AC
阻抗 1M Ω
带宽限制
微调
倒置
探头

4.3.1-L2


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:32:29 2018
10.0V/
-29.5000V
50.0V/
-47.5000V
50.0V/
-46.8750V
50.0A/
75.350A
4.000s/
-20.00s
滚动
光标
手动
X1(2):
-28.350000000000s
X2(2):
-8.350000000000s
ΔX:
20.000000000000s
1/ΔX:
50.000mHz
保存到文件 = nrs-4.3.1-L3
保存菜单
回调菜单
电子邮件
缺省/擦除
按下保存

4.3.1-L3


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:34:07 2018
10.0V/
-29.5000V
50.0V/
-47.5000V
50.0V/
-46.8750V
50.0A/
75.250A
4.000s/
-20.00s
滚动
光标
手动
X1(2):
-29.050000000000s
X2(2):
-9.050000000000s
ΔX:
20.000000000000s
1/ΔX:
50.000mHz
文件名设置菜单
文件名
nrs-4.3.2-L1
自动增加
按下保存

4.3.2-L1


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:35:14 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.250A
4.000s/ -20.00s
滚动
光标
手动
X1(2):
-30.050000000000s
X2(2):
-10.050000000000s
ΔX:
20.000000000000s
1/ΔX:
50.000mHz
通道 2 菜单
耦合 交流AC
阻抗 1M Ω
带宽限制
微调
倒置
探头

4.3.2-L2


KEYSIGHT TECHNOLOGIES
DSO-X 4024A, MY57250833, 07.11.2017061227: Mon Aug 06 09:36:44 2018
10.0V/ -29.5000V
50.0V/ -47.5000V
50.0V/ -46.8750V
50.0A/ 75.250A
4.000s/ -20.00s
滚动
光标
手动
X1(2):
-29.000000000000s
X2(2):
-9.0000000000000s
ΔX:
20.000000000000s
1/ΔX:
50.000mHz
通道 3 菜单
耦合 交流AC
阻抗 1M Ω
带宽限制
微调
倒置
探头

4.3.2-L3

4.2.2.3.2	Table: Overvoltage and under-voltage/ Voltage-ride-through (the test performed on the Solis-3P20K-4G)	P

Target value U	Trip value (V)	Trip value limit	Trip time(s)	Limit(s)	Remark
U<50%Ur	114	49%Ur≤U<50%	0.136	≤0.2	Trip vlaue : 112.7V to 115V
50 %Ur ≤ U < 85 %Ur	195	84%Ur≤U<85%	8.040	0.6 to 10	Trip vlaue : 193.2V to 195.5V
85 %Ur ≤ U ≤ 110 % Ur	--	--	--	--	Continuous operation
110 % Ur < U < 115 % Ur	254	110%Ur<U≤111%	1.238	≤40	Trip vlaue : 253V to 255.3V
115 %Ur ≤ U < 120%Ur	265	115%Ur≤U≤116%	1.234	≤2	Trip vlaue : 264.5V to 266.8V
120%Ur ≤ U	277	120%Ur≤U≤121%	0.105	≤0.16	Trip vlaue : 276V to 278.3V

4.2.2.3.3	Over-frequency and under-frequency	P

Target value F	Trip value (Hz)	Trip value limits (Hz)	Trip time(s)	Limit (s)	Remark
F< 47 Hz	46.96	46.95 ≤ F< 47	0.122	≤0.2	
47≤ F≤ 50.5Hz	--	--	--	--	Normal operation
F> 52Hz	52.02	52 <F≤ 52.05	4.29	4 to 4.5	

Step #	Set output power [%]	frequency [Hz] [± 10 mHz]	Expected power value [W]	Actual power values [W]	Limit	Graph point
1	100	47.50	22000	21690	± 2.5% Pn	t1
2	100	50.40	22000	21722		t2
3	100	50.55	21267	21391		t3
4	100	51.00	16500	16243		t4
5	100	51.50	11000	10783		t5
6	100	50.11	22000	21729		t6
7	100	50.00	22000	21727	Pn	t7

Note:
50.5Hz: 100%P_M
52.0 Hz: 25%P_M
When the utility frequency exceeds 50.5 Hz. the active power available at the time shall be stored as the maximum power value P_M; this value P_M shall not be exceeded until the frequency has stabilized below 50.5 Hz for at least 4 seconds.

4.2.2.4	`TABLE: Prevention of islanding (IEC 62116)	P

Power 100%

Conditions	P_W [w]	Q_L [VA]	Q_C [VA]	Q_f	Trip time [ms]	Limitation [ms]
R: 90% L / C: 110%	L1: 20038	L1: 22772	L1: 22040	1.233	351	2000
	L2: 20109	L2: 23000	L2: 21948	1.240		
	L3: 20182	L3: 22886	L3: 22012	1.236		
R: 90% L / C: 105%	L1: 20149	L1: 21935	L1: 21037	1.184	373	2000
	L2: 20032	L2: 21668	L2: 20889	1.180		
	L3: 20111	L3: 21588	L3: 20996	1.175		
R: 90% L / C: 100%	L1: 20027	L1: 20437	L1: 19994	1.117	398	2000
	L2: 20162	L2: 20524	L2: 20041	1.122		
	L3: 20164	L3: 20880	L3: 19980	1.130		
R: 90% L / C: 95%	L1: 20191	L1: 19571	L1: 18991	1.066	306	2000
	L2: 20085	L2: 19473	L2: 18949	1.063		
	L3: 20046	L3: 19555	L3: 19029	1.062		
R: 90% L / C: 90%	L1: 20063	L1: 18630	L1: 18047	1.013	440	2000
	L2: 20196	L2: 18820	L2: 18024	1.014		
	L3: 20172	L3: 18690	L3: 17942	1.014		
R: 95% L / C: 110%	L1: 20103	L1: 23021	L1: 22129	1.178	332	2000
	L2: 20155	L2: 22612	L2: 22033	1.168		
	L3: 20050	L3: 22846	L3: 21932	1.170		
R: 95% L / C: 90%	L1: 20142	L1: 18323	L1: 17895	0.952	411	2000
	L2: 20169	L2: 18494	L2: 17980	0.952		
	L3: 20029	L3: 18530	L3: 18094	0.955		
R: 100% L / C: 110%	L1: 20056	L1: 22969	L1: 22084	1.117	383	2000
	L2: 20191	L2: 22630	L2: 22072	1.108		
	L3: 20098	L3: 22457	L3: 21894	1.105		
R: 95% L / C: 105%	L1: 20083	L1: 21403	L1: 20904	1.109	353	2000
	L2: 20077	L2: 21361	L2: 20936	1.111		
	L3: 20033	L3: 21611	L3: 21044	1.115		
R: 95% L / C: 100%	L1: 20101	L1: 20668	L1: 19971	1.061	170	2000
	L2: 20064	L2: 20504	L2: 20000	1.061		
	L3: 20158	L3: 20725	L3: 19991	1.065		
R: 95% L / C: 95%	L1: 20179	L1: 19412	L1: 19052	1.006	188	2000
	L2: 20092	L2: 19635	L2: 19074	1.010		
	L3: 20131	L3: 19840	L3: 18927	1.015		
R: 100%	L1: 20166	L1: 21720	L1: 21020	1.063	332	

L / C: 105%	L2:	20155	L2:	21474	L2:	20903	1.057		2000
	L3:	20196	L3:	21526	L3:	20934	1.058		
R: 100% L / C: 100%	L1:	20170	L1:	20529	L1:	19993	1.004	437	2000
	L2:	20092	L2:	20477	L2:	19963	1.010		
	L3:	20077	L3:	20458	L3:	19975	1.004		
R: 100% L / C: 95%	L1:	20062	L1:	19483	L1:	18877	0.956	411	2000
	L2:	20022	L2:	19445	L2:	18972	0.958		
	L3:	20077	L3:	19564	L3:	18979	0.961		
R: 105% L / C: 105%	L1:	20050	L1:	21423	L1:	20839	1.000	377	2000
	L2:	20117	L2:	21338	L2:	20933	0.999		
	L3:	20129	L3:	21599	L3:	20832	1.001		
R: 105% L / C: 100%	L1:	20021	L1:	20321	L1:	19835	0.952	401	2000
	L2:	20143	L2:	20504	L2:	19909	0.955		
	L3:	20134	L3:	20430	L3:	19710	0.953		
R: 105% L / C: 95%	L1:	20159	L1:	19502	L1:	18850	0.906	350	2000
	L2:	20121	L2:	19409	L2:	18946	0.905		
	L3:	20060	L3:	19338	L3:	18917	0.903		
R: 100% L / C: 90%	L1:	20173	L1:	18487	L1:	17944	0.904	332	2000
	L2:	20173	L2:	18333	L2:	17919	0.901		
	L3:	20052	L3:	18282	L3:	17777	0.900		
R: 105% L / C: 110%	L1:	20178	L1:	22620	L1:	21828	1.050	426	2000
	L2:	20127	L2:	22385	L2:	21753	1.047		
	L3:	20108	L3:	22450	L3:	21734	1.049		
R: 105% L / C: 90%	L1:	20074	L1:	18326	L1:	17879	0.855	401	2000
	L2:	20197	L2:	18222	L2:	17816	0.856		
	L3:	20054	L3:	18349	L3:	17805	0.859		
R: 110% L / C: 110%	L1:	20190	L1:	22651	L1:	21853	1.002	329	2000
	L2:	20088	L2:	22296	L2:	21790	0.998		
	L3:	20154	L3:	22473	L3:	21869	1.004		
R: 110% L / C: 105%	L1:	20132	L1:	21485	L1:	20892	0.958	398	2000
	L2:	20045	L2:	21190	L2:	20806	0.951		
	L3:	20021	L3:	21508	L3:	20748	0.958		

R: 110% L / C: 100%	L1: 20107 L2: 20174 L3: 20129	L1: 20683 L2: 20241 L3: 20483	L1: 19991 L2: 19830 L3: 19843	0.916 0.908 0.910	383	2000
R: 110% L / C: 95%	L1: 20172 L2: 20121 L3: 20114	L1: 19542 L2: 19544 L3: 19221	L1: 18891 L2: 18791 L3: 18782	0.868 0.866 0.861	377	2000
R: 110% L / C: 90%	L1: 20190 L2: 20129 L3: 20057	L1: 18428 L2: 18329 L3: 18331	L1: 17796 L2: 17859 L3: 17758	0.820 0.818 0.819	170	2000
Power 66%						
Conditions	P_W [w]	Q_L [VA]	Q_C [VA]	Q_f	Trip time [ms]	Limitation [ms]
R: 100% L / C: 95%	L1: 13292 L2: 13281 L3: 13266	L1: 13090 L2: 12910 L3: 13354	L1: 12534 L2: 12497 L3: 12431	0.964 0.956 0.971	305	2000
R: 100% L / C: 96%	L1: 13292 L2: 13277 L3: 13331	L1: 13438 L2: 13365 L3: 13514	L1: 12602 L2: 12634 L3: 12662	0.979 0.979 0.981	420	2000
R: 100% L / C: 97%	L1: 13272 L2: 13240 L3: 13276	L1: 13396 L2: 13594 L3: 13437	L1: 12797 L2: 12760 L3: 12743	0.987 0.995 0.986	466	2000
R: 100% L / C: 98%	L1: 13286 L2: 13277 L3: 13226	L1: 13619 L2: 13655 L3: 13609	L1: 12853 L2: 12824 L3: 12773	0.996 0.997 0.997	314	2000
R: 100% L / C: 99%	L1: 13313 L2: 13230 L3: 13298	L1: 13698 L2: 13656 L3: 13774	L1: 13064 L2: 13019 L3: 12972	1.005 1.008 1.005	421	2000
R: 100% L / C: 100%	L1: 13230 L2: 13217 L3: 13213	L1: 13618 L2: 13547 L3: 13798	L1: 13121 L2: 13132 L3: 13157	1.010 1.009 1.020	470	2000
R: 100% L / C: 101%	L1: 13231 L2: 13320 L3: 13276	L1: 13852 L2: 14062 L3: 13749	L1: 13240 L2: 13363 L3: 13273	1.024 1.029 1.018	298	2000
R: 100% L / C: 102%	L1: 13243 L2: 13226 L3: 13221	L1: 14235 L2: 13869 L3: 14136	L1: 13419 L2: 13429 L3: 13416	1.044 1.032 1.042	339	2000
R: 100% L / C: 103%	L1: 13230 L2: 13292	L1: 14210 L2: 14145	L1: 13488 L2: 13564	1.046 1.042	304	2000

	L3: 13284	L3: 14204	L3: 13549	1.044		
R: 100% L / C: 104%	L1: 13224	L1: 14213	L1: 13697	1.055	418	2000
	L2: 13275	L2: 14584	L2: 13633	1.062		
	L3: 13237	L3: 14531	L3: 13660	1.064		
R: 100% L / C: 105%	L1: 13292	L1: 14315	L1: 13830	1.059	343	2000
	L2: 13254	L2: 14715	L2: 13864	1.078		
	L3: 13304	L3: 14679	L3: 13808	1.070		
Power 33%						
Conditions	P_W [w]	Q_L [VA]	Q_C [VA]	Q_f	Trip time [ms]	Limitation [ms]
R: 100% L / C: 95%	L1: 6648	L1: 6897	L1: 6169	0.981	282	2000
	L2: 6654	L2: 6966	L2: 6250	0.992		
	L3: 6612	L3: 6718	L3: 6105	0.969		
R: 100% L / C: 96%	L1: 6615	L1: 7063	L1: 6246	1.004	398	2000
	L2: 6628	L2: 6884	L2: 6300	0.993		
	L3: 6641	L3: 6786	L3: 6192	0.976		
R: 100% L / C: 97%	L1: 6623	L1: 7166	L1: 6353	1.019	322	2000
	L2: 6645	L2: 6878	L2: 6273	0.989		
	L3: 6659	L3: 7083	L3: 6346	1.007		
R: 100% L / C: 98%	L1: 6665	L1: 7161	L1: 6435	1.018	529	2000
	L2: 6650	L2: 7230	L2: 6392	1.022		
	L3: 6660	L3: 7024	L3: 6414	1.008		
R: 100% L / C: 99%	L1: 6629	L1: 6920	L1: 6456	1.008	411	2000
	L2: 6664	L2: 6934	L2: 6528	1.010		
	L3: 6616	L3: 6893	L3: 6428	1.006		
R: 100% L / C: 100%	L1: 6653	L1: 7330	L1: 6568	1.043	532	2000
	L2: 6612	L2: 7042	L2: 6447	1.019		
	L3: 6625	L3: 7273	L3: 6530	1.040		
R: 100% L / C: 101%	L1: 6631	L1: 7160	L1: 6576	1.035	293	2000
	L2: 6617	L2: 7015	L2: 6528	1.023		
	L3: 6619	L3: 7273	L3: 6486	1.038		
R: 100% L / C: 102%	L1: 6659	L1: 7583	L1: 6722	1.072	424	2000
	L2: 6629	L2: 7087	L2: 6708	1.040		
	L3: 6655	L3: 7356	L3: 6656	1.051		
R: 100% L / C: 103%	L1: 6664	L1: 7206	L1: 6722	1.044	397	2000
	L2: 6637	L2: 7205	L2: 6690	1.046		
	L3: 6619	L3: 7515	L3: 6738	1.075		
R: 100%	L1: 6607	L1: 7522	L1: 6737	1.077	499	

L / C: 104%	L2:	6645	L2:	7233	L2:	6802	1.056		2000
	L3:	6663	L3:	7522	L3:	6827	1.076		
R: 100% L / C: 105%	L1:	6623	L1:	7504	L1:	6780	1.077	294	
	L2:	6626	L2:	7291	L2:	6749	1.059		2000
	L3:	6623	L3:	7457	L3:	6887	1.082		

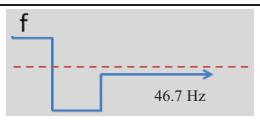
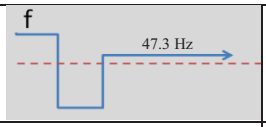
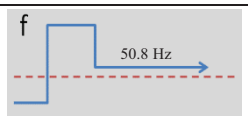
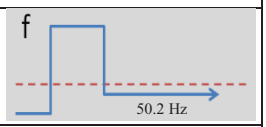
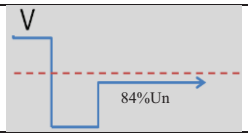
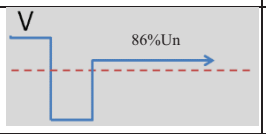
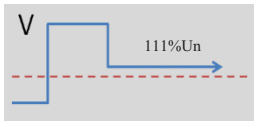
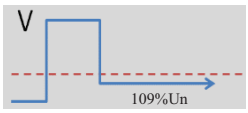
Remark:

Single phase test for multi phase **Generating Units**. Confirm that when generating in parallel with a network operating at around 50Hz with no network disturbance. that the removal of a single phase connection to the **Generating Unit**. with the remaining phases connected causes a disconnection of the generating unit within a maximum of 1s.

Note:
Note for technologies which have a substantial shut down time this can be added to the 0.5 seconds in establishing that the trip occurred in less than 0.5s. Maximum shut down time could therefore be up to 1.0 seconds for these technologies.
RLC is adjusted to min. +/-1% of the inverter rated output power
[1] P_{EUT}: EUT output power
[2] P_{AC}: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.
[3] Q_{AC}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.
[4] BL: Balance condition. IB: Imbalance condition.
Condition A:
EUT output power PEUT = Maximum [5]
EUT input voltage [6] = >90% of rated input voltage range
[5] Maximum EUT output power condition should be achieved using the maximum allowable input power. Actual output power may exceed nominal rated output.
[6] Based on EUT rated input operating range. For example. If range is between X volts and Y volts. 90 % of range =X + 0.9 × (Y – X). Y shall not exceed 0.8 × EUT maximum system voltage (i.e.. maximum allowable array open circuit voltage). In any case. the EUT should not be operated outside of its allowable input voltage range.

Condition B:
EUT output power PEUT = 50 % – 66 % of maximum
EUT input voltage [5] = 50 % of rated input voltage range. ±10 %
[5] Based on EUT rated input operating range. For example. If range is between X volts and Y volts. 90 % of range =X + 0.9 × (Y – X). Y shall not exceed 0.8 × EUT maximum system voltage (i.e.. maximum allowable array open circuit voltage). In any case. the EUT should not be operated outside of its allowable input voltage range.

Condition C:
EUT output power PEUT = 25 % – 33 % [5] of maximum
EUT input voltage [6] = <10 % of rated input voltage range
[5] Or minimum allowable EUT output level if greater than 33 %.
[6] Based on EUT rated input operating range. For example. If range is between X volts and Y volts. 90 % of range =X + 0.9 × (Y – X). Y shall not exceed 0.8 × EUT maximum system voltage (i.e.. maximum allowable array open circuit voltage). In any case. the EUT should not be operated outside of its allowable input voltage range.

4.2.4.2.2	TABLE: Response to utility recovery			P
Conditions-Frequency				
Connection	☐ Yes/ ☒ No	☒ Yes/ ☐ No	☐ Yes/ ☒ No	☒ Yes/ ☐ No
Time [s]	N/A	78s	N/A	77s
Limits	Not connected	>60 s	Not connected	>60 s
Power rate	N/A	9.3%	N/A	9.4%
Limits	N/A	≤10%Pn/min	N/A	≤10%Pn/min
Conditions-Voltage				
Connection	☐ Yes/ ☒ No	☒ Yes/ ☐ No	☐ Yes/ ☒ No	☒ Yes/ ☐ No
Time [s]	N/A	78s	N/A	122s
Limits	Not connected	>60 s	Not connected	>60 s
Power rate	N/A	9.7%	N/A	9.3%
Limits	N/A	≤10%Pn/min	N/A	≤10%Pn/min
Note:				

The end of report