Manufacture Declaration for RD1699

Micro-generator Type reference	X1-2.5-S-D(L) X1-2.5-S-N(L)	X1-3.0-S-D(L) X1-3.0-S-N(L)	X1-3.3-S-D(L) X1-3.3-S-N(L)
Maximum continuous rating	2500VA	3000VA	3300VA
Voltage (nominal)	MAX. PV input: 600Vdc Nominal AC voltage: 230Vac		
Rated power	According to model: 2.5KW, 3.0KW, 3.3KW		
Manufacturer	SolaX Power Network Technology (Zhe jiang) Co. , Ltd.		
Address	No.288 Shizhu Road,Tonglu Economic Development Zone, Dongxing District,Tonglu City, Zhejiang Province, China.		
Tel	+86(0571)-56260011		
Fax	+86(0571)-56075753		
Email	info@soalxpower.com		
Web site	www.solaxpower.com		
Reference standard No.	RD1699:2011 with modification according to RD413:2014 for RD1699		
Signed			
On behalf of	SolaX Power Network Technology (Zhe jiang) Co. , Ltd.		

SSEG manufacturer/supplier declaration.

I certify on behalf of the company named above as a manufacturer/supplier of Small Scale Embedded Generators, that all products manufactured/supplied by the company with the above SSEG Type reference number will be manufactured and tested to ensure that they perform as stated in this Type Verification Test Report, prior to shipment to site and that no site modifications are required to ensure that the product meets all the requirements of RD1699:2011.

These inverters incorporate a residual current monitoring unit (RCMU: Residual Current, RCMU: Residual Current Monitoring Unit), sensitive to all leakage currents, which acts with a response threshold of 30 mA.

Alternating current relays safely disconnect the mains in the event of a fault.They also have an Insulation monitoring device and an earth detector on the direct current side before connection to the mains.

These functions have been tested and certified according to DIN V VDE V 0126-1-1:2006:02.

The direct current fed into the distribution network by the inverter is less than 0.5% of the RMS value of the inverter. nominal output current, measured as indicated in the "Separation Equivalence Interpretation Note galvanic ".

The reconnection time of the inverters is at least 3 minutes according to IEC 61727:2001, once the inverter has been reconnected. that the network parameters are again within the allowed margins. There is no possibility that the users can modify the setting values of the protections by means of software. The equipment has protection against island operation.

Under/over frequency

	Under frequency		Over frequency	
Parameter	Frequency	Time	Frequency	Time
Protection limit (RD1699)	48.0Hz	≥3.0s	50.5Hz	≤0.5s
Actual Setting	48.0Hz		50.5Hz	
Trip value (test result)	48.01Hz	3.3s	50.50Hz	0.424s

Under /Over voltage

	Under Voltage (stage 2)		Over Voltage (stage 1)		Over Voltage (stage 2)	
Parameter	Voltage	Time	Voltage	Time	Voltage	Time
Protection limit	195.5V	≤1.5s	253.0V	≤1.5s	264.5V	≤0.2s
Actual Setting	195.5V		253.0V		264.5V	
Trip value (test result)	195.3V	1.444s	253.0V	1.453s	264.5V	0.191s

DC injection

P_{Emax} in %		33% ±5% Trip Time	66% ±5% Trip Time	100% ±5% Trip Time	Limit	Result
3.3KW	+1A	164ms	165ms	165ms	200 ms	P
	-1A	165ms	165ms	166ms	200 ms	P

Power factor

Output power / model	25%Pn	50% Pn	75% Pn	100% Pn	Limit	Result
3.3KW	0.9925	0.9977	0.9987	0.9991	1	P

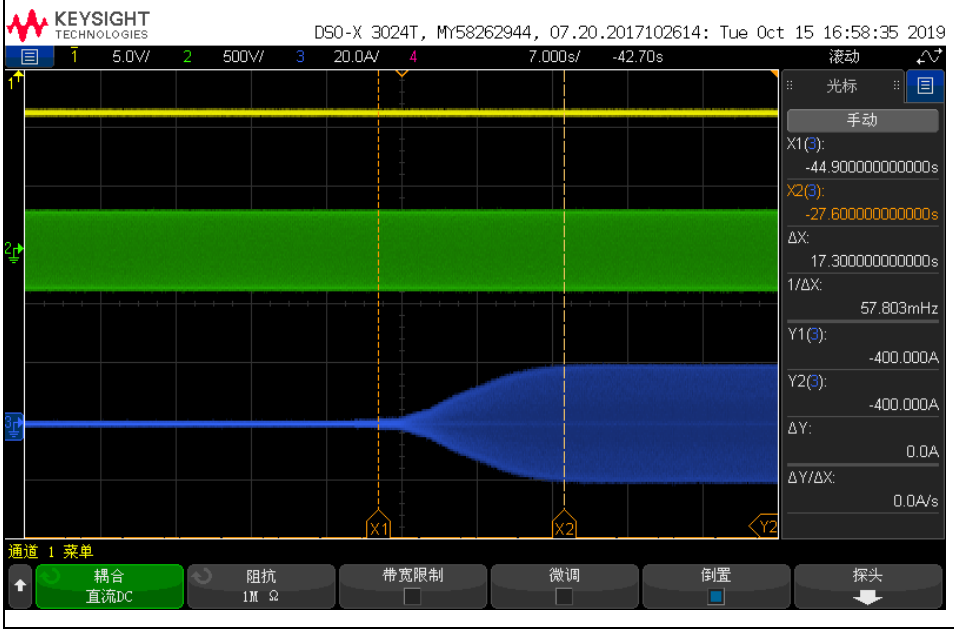
Reconnection

Reconnection generate electrical power		**P**
Setting value	Min.voltage for connected to grid.....:	195.5V
	Max.voltage for connected to grid.....:	253.0 V
	Min.Frequency for connected to grid.....:	48.0Hz
	Max.Frequency for connected to grid..... .....:	50.0Hz
	Observation time(180s).....:	180s

Test:

	Voltage conditions			
In voltage range after voltage failture	85%U_n for twice of setting observation time		110%U_n for twice of setting observation time	
Reconnection time[s]	195.8V	209s	252.8V	206.5s
Limit:	Reconnection after setting observation time(180s)			
	Frequency conditions			
In frequency range after frequency failture	48,0Hz for twice of setting observation time		50,00Hz for twice of setting observation time	
Reconnection time[s]	48.02Hz	208.5	50.02Hz	207.5s
Limit:	Reconnection after setting observation time(180s)			

Recover power gradient 17.3s



Harmonic

Harmonic	At 100% of rated output		At 50% of rated output		2.5KW	P
	Measured Value (MV) in Amps	Measured Value in Ihdf (%)	Measured Value (MV) in Amps	Measured Value in Ihdf (%)	Limit in BS EN 61000-3-2 in Amps	Limit of percent (%)
2	0.0307	0.2893	0.0231	0.4225	1.080	1
3	0.0216	0.2029	0.0799	1.4632	2.300	4
4	0.0057	0.0534	0.0106	0.1933	0.430	1
5	0.0305	0.2873	0.0345	0.6324	1.140	4
6	0.0131	0.1237	0.0137	0.2499	0.300	1
7	0.0837	0.7886	0.0694	1.2682	0.770	4
8	0.0061	0.0573	0.0087	0.1578	0.230	1
9	0.1493	1.4077	0.1115	2.0399	0.400	4
10	0.0062	0.0587	0.0054	0.0981	0.184	1
11	0.1111	1.0462	0.0694	1.2676	0.330	2
12	0.0091	0.0855	0.0069	0.1266	0.153	0.5
13	0.0834	0.7853	0.0444	0.8115	0.210	2
14	0.0053	0.0495	0.0046	0.0849	0.131	0.5
15	0.0631	0.5936	0.0257	0.4695	0.150	2
16	0.0054	0.0505	0.0041	0.0752	0.115	0.5
17	0.0471	0.4433	0.0171	0.3127	0.132	1.5
18	0.0053	0.0499	0.0044	0.0801	0.102	0.375
19	0.0362	0.3405	0.0109	0.1986	0.118	1.5
20	0.0057	0.0538	0.0048	0.0880	0.092	0.375
21	0.0292	0.2747	0.0065	0.1177	0.107	1.5
22	0.0050	0.0471	0.0037	0.0675	0.084	0.375
23	0.0227	0.2142	0.0064	0.1167	0.098	0.6
24	0.0058	0.0542	0.0040	0.0723	0.077	0.15
25	0.0181	0.1704	0.0060	0.1097	0.090	0.6
26	0.0040	0.0372	0.0030	0.0555	0.071	0.15
27	0.0147	0.1386	0.0059	0.1076	0.083	0.6
28	0.0039	0.0366	0.0029	0.0529	0.066	0.15
29	0.0113	0.1068	0.0061	0.1113	0.078	0.6
30	0.0035	0.0325	0.0030	0.0542	0.061	0.15
31	0.0089	0.0842	0.0051	0.0922	0.073	0.6
32	0.0036	0.0339	0.0024	0.0440	0.058	0.15
33	0.0079	0.0745	0.0052	0.0945	0.068	0.6
34	0.0029	0.0276	0.0022	0.0408	0.054	0.15
35	0.0057	0.0535	0.0032	0.0589	0.064	0.3
36	0.0030	0.0279	0.0022	0.0405	0.051	0.075
37	0.0055	0.0522	0.0046	0.0841	0.061	0.3
38	0.0036	0.0342	0.0026	0.0473	0.048	0.075
39	0.0043	0.0403	0.0039	0.0720	0.058	0.3
40	0.0029	0.0273	0.0024	0.0441	0.046	0.075
Ithd		2.2398		3.2003	5	5

Harmonic	At 100% of rated output		At 50% of rated output		3.3KW	P
	Measured Value (MV) in Amps	Measured Value in Ihdf （%）	Measured Value (MV) in Amps	Measured Value in Ihdf （%）	Limit in BS EN 61000-3-2 in Amps	Limit of percent（%）
2	0.0443	0.3086	0.0252	0.3506	1.080	1
3	0.0395	0.2759	0.0766	1.0684	2.300	4
4	0.0075	0.0524	0.0102	0.1420	0.430	1
5	0.0580	0.4051	0.0342	0.4757	1.140	4
6	0.0114	0.0795	0.0137	0.1913	0.300	1
7	0.1011	0.7061	0.0795	1.1071	0.770	4
8	0.0086	0.0602	0.0210	0.2925	0.230	1
9	0.1555	1.0865	0.1287	1.7941	0.400	4
10	0.0073	0.0511	0.0110	0.1529	0.184	1
11	0.1232	0.8593	0.0893	1.2438	0.330	2
12	0.0090	0.0627	0.0135	0.1877	0.153	0.5
13	0.0919	0.6407	0.0664	0.9241	0.210	2
14	0.0085	0.0589	0.0185	0.2578	0.131	0.5
15	0.0676	0.4717	0.0488	0.6785	0.150	2
16	0.0074	0.0520	0.0089	0.1242	0.115	0.5
17	0.0520	0.3631	0.0287	0.4000	0.132	1.5
18	0.0064	0.0444	0.0052	0.0729	0.102	0.375
19	0.0419	0.2925	0.0223	0.3106	0.118	1.5
20	0.0058	0.0406	0.0053	0.0734	0.092	0.375
21	0.0360	0.2516	0.0170	0.2364	0.107	1.5
22	0.0064	0.0444	0.0074	0.1033	0.084	0.375
23	0.0305	0.2132	0.0108	0.1505	0.098	0.6
24	0.0077	0.0538	0.0050	0.0697	0.077	0.15
25	0.0240	0.1676	0.0078	0.1081	0.090	0.6
26	0.0061	0.0423	0.0063	0.0873	0.071	0.15
27	0.0184	0.1284	0.0057	0.0790	0.083	0.6
28	0.0051	0.0358	0.0048	0.0674	0.066	0.15
29	0.0163	0.1136	0.0043	0.0598	0.078	0.6
30	0.0065	0.0452	0.0046	0.0638	0.061	0.15
31	0.0152	0.1058	0.0054	0.0757	0.073	0.6
32	0.0070	0.0485	0.0029	0.0403	0.058	0.15
33	0.0108	0.0753	0.0044	0.0616	0.068	0.6
34	0.0080	0.0555	0.0036	0.0494	0.054	0.15
35	0.0166	0.1157	0.0048	0.0664	0.064	0.3
36	0.0061	0.0427	0.0027	0.0383	0.051	0.075
37	0.0192	0.1336	0.0076	0.1062	0.061	0.3
38	0.0047	0.0330	0.0024	0.0333	0.048	0.075
39	0.0226	0.1577	0.0079	0.1105	0.058	0.3
40	0.0052	0.0363	0.0031	0.0433	0.046	0.075
Ithd		1.8613		2.8553	5	5

Active anti-islanding protection

Islanding protection -Load imbalance (real, reactive load) for test condition A (EUT ouput = 100%)										**P**
Disconnection limit			2s							
No	PEUT 1) [% of EUT rating]	Reactive load [% of QL in 6,1,d) 1]	PAC 2) [% of nominal]	QAC 3) [% of nominal]	IAC 4) [A]	PEUT [W]	VDC [V]	Qf [1]	Run on Time [ms]	Remarks 5)
1	100	100	0	0	--	3300	452,5	1,00	195	BL
2	100	100	-10	-10	--	3300	452,5	0,90	150	IB
3	100	100	-10	-5	--	3300	452,5	0,94	160	IB
4	100	100	-10	0	--	3300	452,5	0,99	140	IB
5	100	100	-10	+5	--	3300	452,5	1,05	195	IB
6	100	100	-10	+10	--	3300	452,5	1,10	140	IB
7	100	100	-5	-10	--	3300	452,5	0,90	120	IB
8	100	100	-5	-5	--	3300	452,5	0,95	165	IB
9	100	100	-5	0	--	3300	452,5	1,00	155	IB
10	100	100	-5	+5	--	3300	452,5	1,04	220	IB
11	100	100	-5	+10	--	3300	452,5	1,09	180	IB
12	100	100	0	-10	--	3300	452,5	0,91	135	IB
13	100	100	0	-5	--	3300	452,5	0,96	130	IB
14	100	100	0	+5	--	3300	452,5	1,03	160	IB
15	100	100	0	+10	--	3300	452,5	1,10	125	IB
16	100	100	+5	-10	--	3300	452,5	0,90	115	IB
17	100	100	+5	-5	--	3300	452,5	0,95	170	IB
18	100	100	+5	0	--	3300	452,5	1,00	190	IB
19	100	100	+5	+5	--	3300	452,5	1,05	225	IB
20	100	100	+5	+10	--	3300	452,5	1,09	120	IB
21	100	100	+10	-10	--	3300	452,5	0,90	140	IB

22	100	100	+10	-5	--	3300	452,5	0,96	135	IB
23	100	100	+10	0	--	3300	452,5	1,00	170	IB
24	100	100	+10	+5	--	3300	452,5	1,05	165	IB
25	100	100	+10	+10	--	3300	452,5	1,10	150	IB

Parameter at 0% per phase	L= 55,59 mH	R= 17,45 Ω	C= 182,46 µF

Note:
RLC is adjusted to min, +/-1% of the inverter rated output power
1) PEUT: EUT output power
2) PAC: Real power flow at S1 in Figure 1, Positive means power from EUT to utility, Nominal is the 0 % test condition value,
3) QAC: Reactive power flow at S1 in Figure 1, Positive means power from EUT to utility, Nominal is the 0 % test condition value,
4) Fundamental of IAC when RLC is adjusted
5) BL: Balance condition, IB: Imbalance condition,
Condition A:
EUT output power PEUT = Maximum 6)
EUT input voltage 6) = >75% of rated input voltage range
6) Maximum EUT output power condition should be achieved using the maximum allowable input power, Actual output power may exceed nominal rated output,
7) Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 90 % of range =X + 0,75 × (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.

Islanding protection – Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)										**P**
Disconnection limit			2s							
No	PEUT 1) [% of EUT rating]	Reactive load [% of QL in 6,1,d) 1]	PAC 2) [% of nomi	QAC 3) [% of nomi	IAC 4) [A]	PEUT [W]	VDC [V]	Qf [1]	Run on Time [ms]	Remarks 5)
1	66	66	0	-	--	2178	325	0,95	145	IB
2	66	66	0	-	--	2178	325	0,96	185	IB
3	66	66	0	-	--	2178	325	0,97	140	IB
4	66	66	0	-	--	2178	325	0,98	135	IB
5	66	66	0	-	--	2178	325	0,99	150	IB
6	66	66	0	0	--	2178	325	1,00	170	BL
7	66	66	0	1	--	2178	325	1,01	180	IB
8	66	66	0	2	--	2178	325	1,02	130	IB
9	66	66	0	3	--	2178	325	1,03	115	IB

10	66	66	0	4	--	2178	325	1,04	155	IB
11	66	66	0	5	--	2178	325	1,05	130	IB
Parameter at 0% per phase			L= 84,2 mH			R= 26,5 Ω			C= 120,4 µF	

Note:
RLC is adjusted to min, +/-1% of the inverter rated output power
1) PEUT: EUT output power
2) PAC: Real power flow at S1 in Figure 1, Positive means power from EUT to utility, Nominal is the 0 % test condition value,
3) QAC: Reactive power flow at S1 in Figure 1, Positive means power from EUT to utility, Nominal is the 0 % test condition value,
4) Fundamental of IAC when RLC is adjusted
5) BL: Balance condition, IB: Imbalance condition,
Condition B:
EUT output power PEUT = 50 % – 66 % of maximum
EUT input voltage 6) = 50 % of rated input voltage range, ±10 %
6) Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 50 % of range =X + 0,5 × (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.

Islanding protection– Load imbalance (reactive load) for test condition C (EUT output = 25 % – 33 %)										**P**
Disconnection limit			2s							
No	PEUT 1) [% of EUT rating]	Reactive load [% of QL in 6,1,d) 1]	PAC 2) [% of .	QAC 3) [% of .	IAC 4) [A]	PEUT [W per phase]	VDC [V]	Qf [1]	Run on Time [ms]	Remarks 5)
1	33	33	0	-	--	1089	172	0,95	185	IB
2	33	33	0	-	--	1089	172	0,96	180	IB
3	33	33	0	-	--	1089	172	0,97	160	IB
4	33	33	0	-	--	1089	172	0,98	150	IB
5	33	33	0	-	--	1089	172	0,99	150	IB
6	33	33	0	0	--	1089	172	1,00	170	BL
7	33	33	0	1	--	1089	172	1,01	140	IB
8	33	33	0	2	--	1089	172	1,02	135	IB
9	33	33	0	3	--	1089	172	1,03	115	IB
10	33	33	0	4	--	1089	172	1,04	155	IB
11	33	33	0	5	--	1089	172	1,05	190	IB
Parameter at 0% per phase			L= 168,45 mH			R= 52,89 Ω			C= 60,21 µF	

Residual current monitoring test

Test for detection of excessive continuous residual current			**p**
Fault Current (mA)		Disconnection time (ms)	
Measured Fault Current	Limit 300mA for output power ≤ 30 kVA 10mA per kVA for output power >30 kVA	Measured Disconnection time	Limit
+ PV to N:			
154.0	300	105	300
152.7	300	115	300
153.4	300	120	300
152.3	300	119	300
153.2	300	115	300
-PV to N:			
153.7	300	250	300
151.4	300	145	300
152.7	300	154	300
151.2	300	156	300
152.3	300	143	300

Note:

– maximum 300mA for inverters with continuous output power rating ≤30 kVA;

– maximum 10mA per kVA of rated continuous output power for inverters with continuous output power rating > 30 kVA.

This test shall be repeated 5 times, and for all 5 tests the time to disconnect shall not exceed 0,3s.

The test is repeated for each PV input terminal. It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel.

Test for detection of sudden changes in residual current		**p**
+PV to N		
Limit (mA)	Un Disconnection time (ms)	Limit (ms)
30	59	300
30	62	300
30	57	300
30	67	300
30	50	300
60	53	150
60	58	150
60	63	150
60	65	150
60	60	150
150	21	40

150	12	40
150	13	40
150	12	40
150	20	40
-PV to N		
Limit (mA)	Un Disconnection time (ms)	Limit (ms)
30	72	300
30	68	300
30	78	300
30	74	300
30	78	300
60	31	150
60		150
60	32	150
60	64	150
60	26	150
150	33	40
150	36	40
150	24	40
150	37	40
150	26	40

Note:
The capacitive current is raised until disconnection.
Test condition: Ic + 30/60/150mA <= Icmax. R1 is set that 30/60/150mA Flow and switch S is closed.

Isolation measurement

DC Voltage below minimum operating voltage(V)	DC Voltage for inverter begin operation(V)	Resistance between ground and PV input terminal(MΩ)	Required Insulation resistance R = (VMAX PV/30mA) (KΩ)	Result
DC+				
69	70	4.5	33.3	P
69	200	4.5	33.3	P
69	460	4.5	33.3	P
69	580	4.5	33.3	P
69	600	4.5	33.3	P
DC-				
69	70	3.3	33.3	P
69	200	3.3	33.3	P
69	460	3.3	33.3	P
69	580	3.3	33.3	P
69	600	3.3	33.3	P

Note:

For isolated inverters, shall indicate a fault in accordance with 13.9 (operation is allowed); the fault indication shall be maintained until the array insulation resistance has recovered to a value higher than the limit above.

For non-isolated inverters, or inverters with isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30, shall indicate a fault in accordance with 13.9, and shall not connect to the mains; the inverter may continue to make the measurement, may stop indicating a fault and may connect to the mains if the array insulation resistance has recovered to a value higher than the limit above.

It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel.

Supplementary information:

Additional comments