


## Manufacture Declaration for RD1699

Micro-generator Type reference	X1-3.0-T-D(L) X1-3.0-T-N(L)	X1-3.3-T-D(L) X1-3.3-T-N(L)	X1-3.6-T-D(L) X1-3.6-T-N(L)	X1-4.2-T-D(L) X1-4.2-T-N(L)	X1-4.6-T-D(L) X1-4.6-T-N(L)	X1-5.0-T-D(L) X1-5.0-T-N(L)
Maximum continuous rating	3000VA	3300VA	3600VA	4200VA	4600VA	5000VA
Voltage (nominal)	MAX. PV input: 600Vdc Nominal AC voltage: 230Vac					
Rated power	According to model: 3.0KW, 3.3KW, 3.6KW,4.2KW, 4.6KW, 5.0KW					
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	<a href="mailto:info@solaxpower.com">info@solaxpower.com</a>					
Web site	<a href="http://www.solaxpower.com">www.solaxpower.com</a>					
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.					
<p>SSEG manufacturer/supplier declaration.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>These functions have been tested and certified according to DIN V VDE V 0126-1-1:2006:02.</p> <p>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"</p> <p>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.</p>						

**Under/over frequency**

Parameter	Under frequency		Over frequency	
	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)	47.99Hz	3.38s	50.51Hz	0.486s

**Under /Over voltage**

Parameter	Under Voltage (stage 2)		Over Voltage (stage 1)		Over Voltage (stage 2)	
	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)	195.5V	1.454s	253.0V	1.465s	264.4V	0.173s

**DC injection**

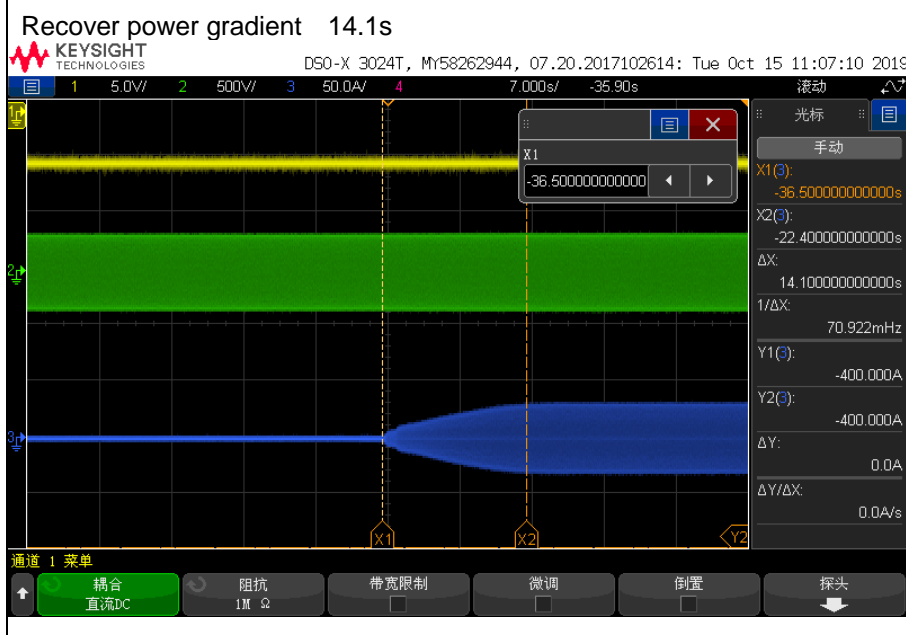
P <sub>E</sub> max in %		33% ±5% Trip Time	66% ±5% Trip Time	100% ±5% Trip Time	Limit	Result
5.0KW	+1A	126ms	106ms	130ms	200 ms	P
	-1A	125ms	127ms	124ms	200 ms	P

**Power factor**

Output power model	25%P <sub>n</sub>	50% P <sub>n</sub>	75% P <sub>n</sub>	100% P <sub>n</sub>	Limit	Result
5.0KW	0.9979	0.9984	0.9942	0.9957	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	
<b>Test:</b>			
		<b>Voltage conditions</b>	
In voltage range after voltage failure	85%U <sub>n</sub> for twice of setting observation time	110%U <sub>n</sub> for twice of setting observation time	
Reconnection time[s]	195.8V	206s	252.8V 209.5s
Limit:	Reconnection after setting observation time(180s)		
		<b>Frequency conditions</b>	
In frequency range after frequency failure	48,0Hz for twice of setting observation time	50,00Hz for twice of setting observation time	
Reconnection time[s]	48.01Hz	209	50.03Hz 205s
Limit:	Reconnection after setting observation time(180s)		



**Harmonic**

Harmonic	At 100% of rated output		At 50% of rated output		5.0KW Limit in BS EN 61000-3-2 in Amps	P Limit of percent (%)
	Measured Value (MV) in Amps	Measured Value in lhdf (%)	Measured Value (MV) in Amps	Measured Value in lhdf (%)		
2	0.0841	0.3902	0.0393	0.3626	1.080	1
3	0.1527	0.7075	0.0903	0.8305	2.300	4
4	0.0455	0.2111	0.0112	0.1031	0.430	1
5	0.1875	0.8687	0.1117	1.0256	1.140	4
6	0.0295	0.1366	0.0139	0.1274	0.300	1
7	0.1572	0.7286	0.1164	1.0683	0.770	4
8	0.0190	0.0879	0.0075	0.0685	0.230	1
9	0.2789	1.2930	0.1462	1.3430	0.400	4
10	0.0109	0.0503	0.0080	0.0737	0.184	1
11	0.1992	0.9233	0.0994	0.9111	0.330	2
12	0.0136	0.0631	0.0082	0.0756	0.153	0.5
13	0.1194	0.5540	0.0699	0.6404	0.210	2
14	0.0100	0.0463	0.0056	0.0516	0.131	0.5
15	0.0660	0.3059	0.0520	0.4767	0.150	2
16	0.0068	0.0316	0.0070	0.0637	0.115	0.5
17	0.0576	0.2670	0.0407	0.3735	0.132	1.5
18	0.0070	0.0325	0.0065	0.0596	0.102	0.375
19	0.0435	0.2015	0.0354	0.3246	0.118	1.5
20	0.0087	0.0402	0.0052	0.0474	0.092	0.375
21	0.0360	0.1667	0.0330	0.3036	0.107	1.5
22	0.0080	0.0370	0.0041	0.0375	0.084	0.375
23	0.0379	0.1755	0.0262	0.2408	0.098	0.6
24	0.0058	0.0268	0.0070	0.0646	0.077	0.15
25	0.0355	0.1647	0.0197	0.1806	0.090	0.6
26	0.0065	0.0302	0.0051	0.0472	0.071	0.15
27	0.0290	0.1343	0.0114	0.1059	0.083	0.6
28	0.0058	0.0268	0.0038	0.0347	0.066	0.15
29	0.0214	0.0993	0.0087	0.0800	0.078	0.6
30	0.0053	0.0244	0.0041	0.0377	0.061	0.15
31	0.0178	0.0826	0.0102	0.0937	0.073	0.6
32	0.0062	0.0286	0.0039	0.0356	0.058	0.15
33	0.0153	0.0709	0.0097	0.0891	0.068	0.6
34	0.0049	0.0228	0.0031	0.0281	0.054	0.15
35	0.0155	0.0719	0.0082	0.0752	0.064	0.3
36	0.0049	0.0229	0.0030	0.0277	0.051	0.075
37	0.0156	0.0722	0.0103	0.0947	0.061	0.3
38	0.0056	0.0258	0.0046	0.0424	0.048	0.075
39	0.0153	0.0708	0.0102	0.0937	0.058	0.3
40	0.0063	0.0292	0.0031	0.0282	0.046	0.075
lthd		2.2108		2.5134	5	5

Harmonic	At 100% of rated output		At 50% of rated output		3.0KW Limit in BS EN 61000-3-2 in Amps	P Limit of percent (%)
	Measured Value (MV) in Amps	Measured Value in lhdf (%)	Measured Value (MV) in Amps	Measured Value in lhdf (%)		
2	0.0590	0.4566	0.0365	0.5654	1.080	1
3	0.0761	0.5887	0.0640	0.9736	2.300	4
4	0.0314	0.2432	0.0185	0.2813	0.430	1
5	0.1201	0.9292	0.0906	1.3887	1.140	4
6	0.0326	0.2525	0.0183	0.2787	0.300	1
7	0.1350	1.0441	0.0983	1.4983	0.770	4
8	0.0296	0.2290	0.0222	0.3400	0.230	1
9	0.2014	1.5591	0.1094	1.6651	0.400	4
10	0.0137	0.1059	0.0107	0.1623	0.184	1
11	0.0991	0.7674	0.0683	1.0436	0.330	2
12	0.0166	0.1287	0.0144	0.2199	0.153	0.5
13	0.0635	0.4910	0.0520	0.7938	0.210	2
14	0.0174	0.1349	0.0117	0.1794	0.131	0.5
15	0.0508	0.3930	0.0341	0.5218	0.150	2
16	0.0102	0.0787	0.0082	0.1258	0.115	0.5
17	0.0425	0.3288	0.0267	0.4059	0.132	1.5
18	0.0074	0.0571	0.0092	0.1397	0.102	0.375
19	0.0347	0.2682	0.0253	0.3856	0.118	1.5
20	0.0052	0.0400	0.0067	0.1040	0.092	0.375
21	0.0288	0.2232	0.0200	0.3055	0.107	1.5
22	0.0058	0.0451	0.0049	0.0743	0.084	0.375
23	0.0211	0.1631	0.0120	0.1824	0.098	0.6
24	0.0067	0.0516	0.0048	0.0734	0.077	0.15
25	0.0152	0.1172	0.0120	0.1832	0.090	0.6
26	0.0036	0.0282	0.0050	0.0760	0.071	0.15
27	0.0140	0.1085	0.0094	0.1445	0.083	0.6
28	0.0044	0.0343	0.0050	0.0770	0.066	0.15
29	0.0118	0.0911	0.0102	0.1560	0.078	0.6
30	0.0037	0.0285	0.0045	0.0682	0.061	0.15
31	0.0119	0.0925	0.0070	0.1069	0.073	0.6
32	0.0025	0.0194	0.0031	0.0482	0.058	0.15
33	0.0096	0.0741	0.0062	0.0953	0.068	0.6
34	0.0031	0.0240	0.0021	0.0325	0.054	0.15
35	0.0093	0.0721	0.0042	0.0647	0.064	0.3
36	0.0026	0.0199	0.0024	0.0366	0.051	0.075
37	0.0087	0.0669	0.0050	0.0759	0.061	0.3
38	0.0028	0.0217	0.0035	0.0542	0.048	0.075
39	0.0076	0.0587	0.0039	0.0600	0.058	0.3
40	0.0026	0.0203	0.0025	0.0378	0.046	0.075
lthd		2.4066		3.0995	5	5

**Active anti-islanding protection**

Islanding protection -Load imbalance (real, reactive load) for test condition A (EUT output = 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	--	5000	443,75	1,00	140	BL
2	100	100	-10	-10	--	5000	443,75	0,90	100	IB
3	100	100	-10	-5	--	5000	443,75	0,94	130	IB
4	100	100	-10	0	--	5000	443,75	0,99	180	IB
5	100	100	-10	+5	--	5000	443,75	1,05	185	IB
6	100	100	-10	+10	--	5000	443,75	1,10	165	IB
7	100	100	-5	-10	--	5000	443,75	0,90	115	IB
8	100	100	-5	-5	--	5000	443,75	0,95	120	IB
9	100	100	-5	0	--	5000	443,75	1,00	150	IB
10	100	100	-5	+5	--	5000	443,75	1,04	185	IB
11	100	100	-5	+10	--	5000	443,75	1,09	180	IB
12	100	100	0	-10	--	5000	443,75	0,91	140	IB
13	100	100	0	-5	--	5000	443,75	0,96	100	IB
14	100	100	0	+5	--	5000	443,75	1,03	200	IB
15	100	100	0	+10	--	5000	443,75	1,10	150	IB
16	100	100	+5	-10	--	5000	443,75	0,90	155	IB
17	100	100	+5	-5	--	5000	443,75	0,95	110	IB
18	100	100	+5	0	--	5000	443,75	1,00	195	IB
19	100	100	+5	+5	--	5000	443,75	1,05	145	IB
20	100	100	+5	+10	--	5000	443,75	1,09	170	IB
21	100	100	+10	-10	--	5000	443,75	0,90	135	IB

22	100	100	+10	-5	--	5000	443,75	0,96	145	IB
23	100	100	+10	0	--	5000	443,75	1,00	150	IB
24	100	100	+10	+5	--	5000	443,75	1,05	205	IB
25	100	100	+10	+10	--	5000	443,75	1,10	110	IB

Parameter at 0% per phase	L= 36,69 mH	R= 11,52 Ω	C= 276,45 μF
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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 =  $X + 0,75 \times (Y - X)$ , Y shall not exceed  $0,8 \times$  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 nominal]	QAC 3) [% of nominal]	IAC 4) [A]	PEUT [W]	VDC [V]	Qf [1]	Run on Time [ms]	Remarks 5)
1	66	66	0	-5	--	3300	337,5	0,95	185	IB
2	66	66	0	-4	--	3300	337,5	0,96	145	IB
3	66	66	0	-3	--	3300	337,5	0,97	165	IB
4	66	66	0	-2	--	3300	337,5	0,98	170	IB
5	66	66	0	-1	--	3300	337,5	0,99	160	IB
6	66	66	0	0	--	3300	337,5	1,00	180	BL
7	66	66	0	1	--	3300	337,5	1,01	150	IB
8	66	66	0	2	--	3300	337,5	1,02	165	IB
9	66	66	0	3	--	3300	337,5	1,03	155	IB
10	66	66	0	4	--	3300	337,5	1,04	135	IB
11	66	66	0	5	--	3300	337,5	1,05	145	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 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 nominal]	QAC 3) [% of nominal]	IAC 4) [A]	PEUT [W per phase]	VDC [V]	Qf [1]	Run on Time [ms]	Remarks 5)
1	33	33	0	-5	--	1650	210	0,95	135	IB
2	33	33	0	-4	--	1650	210	0,96	130	IB
3	33	33	0	-3	--	1650	210	0,97	160	IB
4	33	33	0	-2	--	1650	210	0,98	185	IB
5	33	33	0	-1	--	1650	210	0,99	470	IB
6	33	33	0	0	--	1650	210	1,00	145	BL
7	33	33	0	1	--	1650	210	1,01	160	IB
8	33	33	0	2	--	1650	210	1,02	145	IB
9	33	33	0	3	--	1650	210	1,03	135	IB
10	33	33	0	4	--	1650	210	1,04	130	IB
11	33	33	0	5	--	1650	210	1,05	165	IB
Parameter at 0% per phase			L= 111,18 mH		R= 34,91 Ω		C= 91,23 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 = 25 % – 33 % 6) of maximum  
 EUT input voltage 7) = <20 % of rated input voltage range  
 6) Or minimum allowable EUT output level if greater than 33 %,  
 7) Based on EUT rated input operating range, For example, If range is between X volts and Y volts, 10 % of range =  $X + 0,2 \times (Y - X)$ , Y shall not exceed  $0,8 \times$  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.

### 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 $\leq$ 30 kVA 10mA per kVA for output power >30 kVA	Measured Disconnection time	Limit
+ PV to N:			
120.5	300	230	300
143.3	300	230	300
110.7	300	230	300
127.5	300	230	300
131.5	300	230	300
- PV to N:			
140.2	300	230	300
121.7	300	230	300
135.4	300	230	300
127.8	300	230	300
130.9	300	230	300

**Note:**

- maximum 300mA for inverters with continuous output power rating  $\leq 30$  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	Limit (ms)
	Disconnection time (ms)	
30	95	300
30	105	300
30	100	300
30	95	300
30	110	300
60	115	150
60	105	150
60	95	150
60	90	150
60	85	150
150	30	40
150	14.3	40
150	8.4	40
150	22.6	40
150	17.7	40
-PV to N		
Limit (mA)	Un	Limit (ms)
	Disconnection time (ms)	
30	120	300
30	110	300
30	100	300
30	115	300
30	105	300
60	100	150
60	110	150
60	115	150
60	90	150
60	100	150
150	20.8	40
150	19.5	40
150	16.0	40
150	33.0	40
150	17.2	40

**Note:**

The capacitive current is raised until disconnection.

Test condition:  $I_c + 30/60/150\text{mA} \leq I_{c\text{max}}$ . 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(KΩ)	Required Insulation resistance $R = (V_{MAX PV} / 30mA)$ (KΩ)	Result
<b>DC+(MPP tracker1)</b>				
60	70	3590	19.3	P
60	200	3590	19.3	P
60	460	3590	19.3	P
60	580	3590	19.3	P
60	600	3590	19.3	P
<b>DC-(MPP tracker 1)</b>				
60	70	3280	19.3	P
60	200	3280	19.3	P
60	460	3280	19.3	P
60	580	3280	19.3	P
60	600	3280	19.3	P
<b>DC+(MPP tracker2)</b>				
60	70	3590	19.3	P
60	200	3590	19.3	P
60	460	3590	19.3	P
60	580	3590	19.3	P
60	600	3590	19.3	P
<b>DC-(MPP tracker 2)</b>				
60	70	3280	19.3	P
60	200	3280	19.3	P
60	460	3280	19.3	P
60	580	3280	19.3	P
60	600	3280	19.3	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