

Explanation of the residual voltage problem when the single phase is open

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Product description

The SUN2000MA inverter meets the EU safety standards::

IEC-62109-1: Safety of power converters for use in photovoltaic power systems - Part 1: General requirements

IEC-62116:2004 : Photovoltaic(PV) systems-Characteristics of the utility interface



Zertifikat		Certificate	
Zertifikat Nr. Certificate No.	Blatt Sheet		
R 50419578	0007		
Ihr Zeichen Client Reference	Unser Zeichen Our Ref.		
David Yang	01-YY-50183361		
Genehmigungsinhaber License Holder			
HUAWEI TECHNOLOGIES CO., LTD. Administration Building, Headquarter of Huawei Technologies Co., Ltd. Bantian, Longgang District, Shenzhen 518129 P. R. China			
Prüfzeichen Test Mark		Geprüft nach Tests	
		IEC 62109-1:2 IEC 62109-2:2 EN 62109-1:2C EN 62109-2:2C	
Zertifiziertes Produkt (Geräteidentifikation) Certified Product (Product Identification)			
PV-Wechselrichter (Hybrid Inverter)			
Type Designation : SUN2000-xKTL-M0 SUN2000-yKTL-M1 x,y			
Vmax PV[Vd.c.] : 1100 Isco PV[Ad.c.] : 15 MPP Voltage Range[Vd.c.] : 140-980 Max. Input Current[Ad.c.] : 11 Overvoltage Category (OVC) : II for PV			
Rated Output Voltage[Va.c.] : 3(N) - 220/380 v. Rated Output Frequency [Hz] : 50/60 Rated Output Power [W] : 12000 100l Max. Output Current[Aa.c.] : 18.4 16.1 Power factor : [-0.80, 0.80] Overvoltage Category (OVC) : III for AC Main			
continued on page 0008			
ANLAGE (Appendix) : 1.1			
<small>Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde und es best des Produktes mit den oben genannten Standards und Prüfgrundlagen. Zusätzlich in Ländern, in denen das Produkt in Verkehr gebracht werden soll, müssen zusätzl betrachtet werden. Die Herstellung des zertifizierten Produktes wird überwacht. This certificate is based on our Testing and Certification Regulation and states the of the product with the standards and testing requirements as indicated above. Any requirements in countries where the product is going to be marketed have to be co additionally. The manufacturing of the certified product is subject to surveillance.</small>			
TÜV Rheinland LGA Products GmbH, Tillystraße 2, 90431 NÜ Tel.: +49 221 806-1371 e-mail: cert-validity@tuev.rwth Fax: +49 221 806-3935 http://www.tuv.com/safety			

IEC IEC CB SCHEME		Ref. Certif. No.	
			
Certificate of compliance			
Trade mark (if any)		Applicant:	
		Huawei Technologies Co., Ltd. Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129 P.R.C	
Model type Ref.		Product:	
		SOLAR INVERTER	
		Model:	
		SUN2000-8KTL-M0, SUN2000-10KTL-M0, SUN2000-12KTL-M0, SUN2000-15KTL-M0, SUN2000-17KTL-M0, SUN2000-20KTL-M0, SUN2000-8KTL-M2, SUN2000-10KTL-M2, SUN2000-12KTL-M2, SUN2000-15KTL-M2, SUN2000-17KTL-M2, SUN2000-20KTL-M2	
A sample of the product was tested and found to be in conformity with			
as shown in the Test Report Ref. No. which forms part of this certificate			
Ratings and principal characteristics (continue			
Use in accordance with regulations:			
Automatic disconnection device with three -phase mains surveillance in accordance with IEC 61727:2004 and IEC62116:2014 for photovoltaic systems with a three-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverters.			
Applied rules and standards :			
IEC 61727:2004 Photovoltaic (PV) systems - Characteristics of the utility interface			
IEC 62116:2014 Test procedure of islanding prevention measures for utility-interconnected photovoltaic inverters			
At the time of issue of this certificate the safety concept of an aforementioned representative product corresponds to the valid safety specifications for the specified use in accordance with regulations.			
Report number:		PV190424N048 PV190424N048-1	
Certificate number:		U19-0309	
Date of issue:		2019-05-24	
CB 041829 4029 Rev. 00 Date, 2020-03-20		 Holger Schaffner	
Page 4 of 4 TUV SUD Product Service GmbH • Certificate		Certification body of Bureau Veritas Consumer Products Services Germany GmbH Accredited according to DIN EN ISO/IEC 17065	

European PV inverter safety regulations and installation standards

Tested and verified by a third-party certification body, the SUN2000MA meets the requirements of IEC 62109-1 and IEC 62109-2, ensuring that there is no safety risk under normal operation and single failure. According to the standard, the following faults have been considered: component failure, transformer short circuit, output short circuit and overload, reverse polarity connection, PWB short circuit, etc.,



Test Report issued under the responsibility of:

NCB TÜV SÜD Product Service GmbH
Ridlerstr. 65
D – 80339 München
Germany

In addition, during the installation process, the inverter safety protection fully meets the requirements of IEC60364-7-712 (IEC 60364-7-712 Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems) Including safety protection, electric shock protection, direct and indirect contact protection, fault protection, DC side overload protection, short circuit protection, etc.

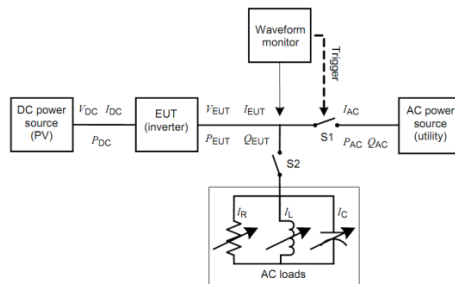
TEST REPORT IEC 62109-1 Safety of Power Converter for use in Photovoltaic Power Systems Part 1: General requirements		
Report Number.....:	Tests performed (name of test and test clause): Family products design, full tests were conducted on representative model SUN2000-20KTL-M0 , additional test of electrical ratings on all other models. <input checked="" type="checkbox"/> Visual inspection – clauses as available; <input checked="" type="checkbox"/> Mains supply electrical data in normal condition & electrical ratings tests – 4.2.2.6 & 4.7; <input checked="" type="checkbox"/> Durability and legibility of marking – 5.1.2; <input checked="" type="checkbox"/> Thermal test and single fault test – 4.3 & 4.4; <input checked="" type="checkbox"/> Humidity preconditioning – 4.5; <input checked="" type="checkbox"/> Voltage Back-feed Protection, as combined with –4.4; <input checked="" type="checkbox"/> Enclosure integrity – 6.3; <input checked="" type="checkbox"/> Non-accessibility – 7.3.4.2.3; <input checked="" type="checkbox"/> Protective bonding – 7.3.6.3.3; <input checked="" type="checkbox"/> Capacitor discharge – 7.3.5.3.2 & 7.3.9; <input checked="" type="checkbox"/> Clearance and creepage distances - 7.3.7; <input checked="" type="checkbox"/> Capacitor discharge – 7.3.9 & 7.4; <input checked="" type="checkbox"/> Energy hazards – 7.4; <input checked="" type="checkbox"/> Electrical tests – 7.5; <input type="checkbox"/> Stability test – 8.3; <input checked="" type="checkbox"/> Provisions for lifting and carrying – 8.4; <input checked="" type="checkbox"/> Wall mounting loading – 8.5; <input type="checkbox"/> Material tests – 9.1.3; <input checked="" type="checkbox"/> Limited power sources – 9.2; <input checked="" type="checkbox"/> Sonic pressure hazards – 10; <input checked="" type="checkbox"/> Actuating parts of controls (Knob pull and limitation of movement) – 13.1; <input type="checkbox"/> Physical tests on power supply cords – 13.3.2.5; <input checked="" type="checkbox"/> 8 mm stripping test – 13.3.3.6; <input type="checkbox"/> Mould stress relief test – 13.6.2.1; <input checked="" type="checkbox"/> Deformation tests – 13.7; <input type="checkbox"/> Battery – 14.8; <input checked="" type="checkbox"/> Annex B operational test as combined with 4.4; Remark: Touch current test was conducted at nominal frequency 60Hz(considered more severity), and other tests were conducted at nominal frequency 50Hz.	Testing location: CQC - Trusted(Jiangsu) Testing Technology Co., Ltd. No.99, Wenlan Road, Xianlin University Zone, Xianlin Street, Qixia District, NanJing, China
Date of issue.....:		
Total number of pages.....:		
CB Testing Laboratory.....:		
Address.....:		
Applicant's name.....:		
Address.....:		
Test specification:		
Standard.....:		
Test procedure.....:		
Non-standard test method.....:		
Test Report Form No.....:		
Test Report Form(s) Originator.....:		
Master TRF.....:		
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Passed the LoM test --- will not endanger the safety of the power grid when the phase is missing

SUN2000MA can pass the IEC62116:2014 certification. The inverter will shutdown within 2 seconds and does not transmit energy to the power grid when the phase is missing, and ensures the safety of the power grid system. And when the fault recovers, the inverter can be automatically connected to the grid.

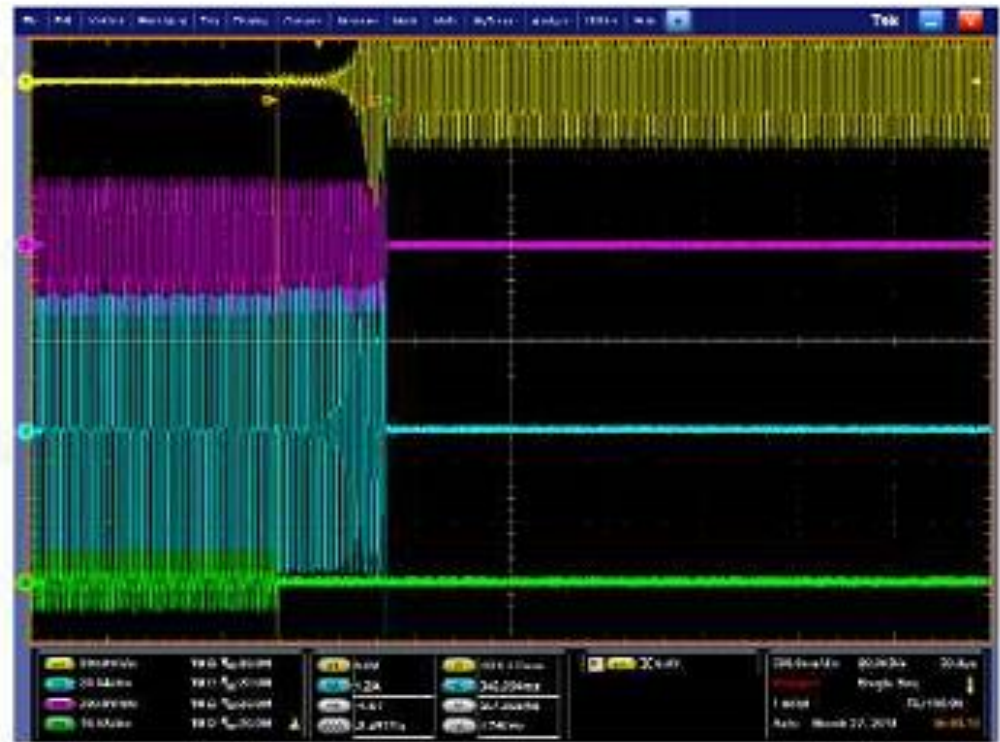
Block diagram test circuit IEC 62116:2008



IEC 1567/08

Figure 1 – Test circuit for islanding detection function in a power conditioner (inverter)

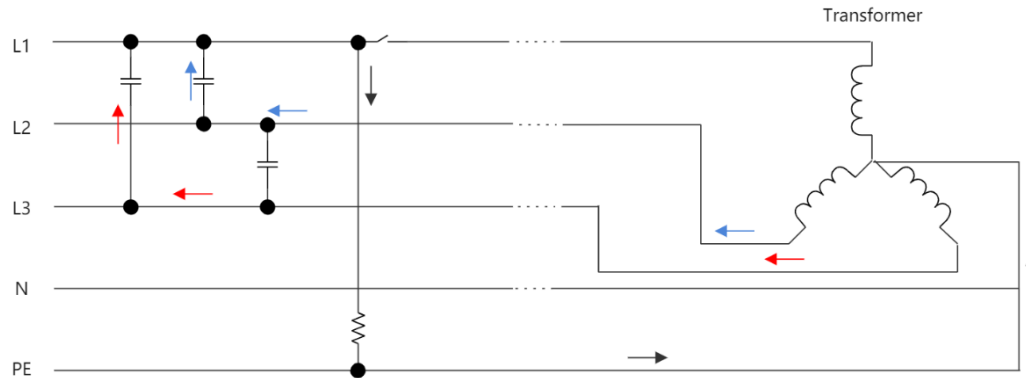
Disconnection at P_{AC} -10% and Q_{AC} 0% reactive load and 100% nominal power



6.1 Islanding protection according Table 7 – Load imbalance (reactive load) for test condition B (EUT output = 50 % – 66 %)										p
Test conditions		Frequency: 50±0.1Hz U _N =230±3V _{AC} Distortion factor of chokes < 2% Quality = 1								
Disconnection limit		2s								
No	P _{OUT} [% of EUT rating]	Reactive load [% of Q _N in 6.1.d.1]	P _{AC} [% of nominal]	Q _{AC} [% of nominal]	I _{AC} [A]	P _{OUT} [W per phase]	V _{OC} [V]	Q _i [l]	Run on Time [ms]	Remarks
1	66	66	0	-5	0,144	4400	512	0,977	252,6	IB
2	66	66	0	-4	0,136	4400	512	0,982	267,7	IB
3	66	66	0	-3	0,129	4400	512	0,987	284,4	IB
4	66	66	0	-2	0,125	4400	512	0,992	323,7	IB
5	66	66	0	-1	0,122	4400	512	0,997	325,0	IB
6	66	66	0	0	0,121	4400	512	1,002	362,4	BL
7	66	66	0	1	0,122	4400	512	1,007	317,9	IB
8	66	66	0	2	0,125	4400	512	1,012	261,5	IB
9	66	66	0	3	0,130	4400	512	1,017	291,6	IB
10	66	66	0	4	0,137	4400	512	1,022	261,5	IB
11	66	66	0	5	0,146	4400	512	1,027	243,1	IB
Parameter at 0% per phase		L= 38,19 mH		R= 12,02 Ω		C= 265,29 μF				

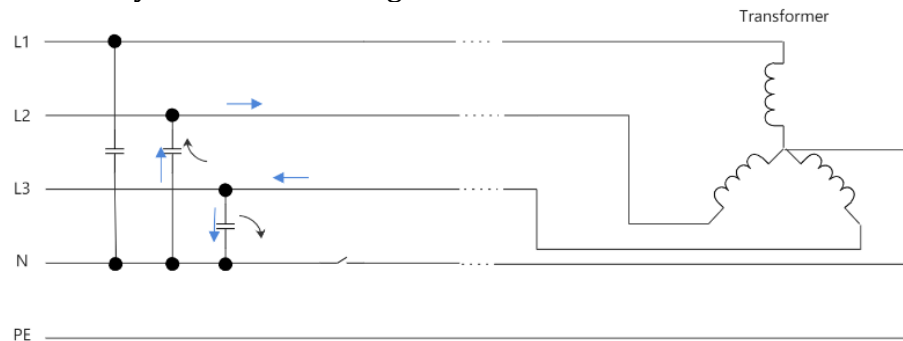
Root cause analysis

The port filter capacitor of the inverter adopts the delta connection method. When the phase is missing, L2/L3 forms a voltage divider on L1. When the remote transformer N line is grounded, L1 can measure the voltage to ground



In this design, when the three-phase three-wire system or the N-line is in poor contact, the voltage assumed by each capacitor is the line voltage. This voltage is relatively stable, which can significantly improve reliability and reduce failure rate;

If the star connection method is used, generally, the capacitor withstand voltage design is lower, and the two capacitors will bear the line voltage at the same time. From a long-term perspective, if one of the capacitors decays, the voltage of the other capacitor will rise significantly, which will easily lead to overvoltage failure.



Thank you

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