Compliance Document

No. D 15 05 80793 026

TÜV SÜD
Product Service

Holder of Certificate: **Huawei Technologies Co., Ltd**

Bantian
Administration Building
Headquarters of
Huawei Technologies Co., Ltd.
Longgang District

518129 Shenzhen
PEOPLE'S REPUBLIC OF CHINA

Product: **Converter**
SOLAR INVERTER

This Compliance document confirms the compliance with the listed standards on a voluntary basis. It refers only to the sample submitted for testing and certification and does not certify the quality or safety of the serial products. See also notes overleaf.

Test report no.: 704091506201-00

647535

Date, 2015-05-07 (Zhengdong Ma)

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A1 / 04.11

Product Service

Compliance Document
No. D 15 05 80793 026

Model(s):   **SUN2000-33KTL**

Parameters:

d.c. Max. Input Voltage:	1000 Vd.c.
d.c. MPP Range:	250-850 Vd.c.
d.c. Max. Input Current:	23 A/23 A/23 A
Isc PV:	34,5 A /34,5 A/34,5 A
a.c. Output Nominal Voltage:	3/N/PE~ 400 V
a.c. Nominal Operating Frequency:	50 Hz
a.c. Output Max. Current:	48 A
a.c. Output Rated Active Power:	30 kW
a.c. Output Max. Active Power:	30 kW
a.c. Output Max. Apparent Power:	33 kVA
Power Factor(adj.):	0,8(lagging)…0,8(leading)
Operating Temperature Range:	-25°C…+60°C
Protective Class:	I
Ingress Protection:	IP65

Tested according to:

VDE-AR-N 4105:2011
DIN VDE V 0124-100 (VDE V 0124-100):2012
DIN VDE 0126-1-1 (VDE V 0126-1-1):2013

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstraße 65 · 80339 München · Germany

TÜV®

G.2   Certificate of conformity for power generation units
F.3 Requirements for the test report for power generation units
G.3   Certificate of conformity of the network and system protection
F.4 Requirements for the test report for the NS protection
Dated <2015-08-10>

Client:

Huawei Technologies Co., Ltd
Bantian, Administration Building Headquarters of Huawei Technologies Co., Ltd., Longgang District, 518129 Shenzhen, PEOPLE'S REPUBLIC OF CHINA

Manufacturing place:

Huawei Technologies Co., Ltd
Bantian, Administration Building Headquarters of Huawei Technologies Co., Ltd., Longgang District, 518129 Shenzhen, PEOPLE'S REPUBLIC OF CHINA

Test subject:

Product: SOLAR INVERTER
Type: SUN2000-33KTL

Test specification:

VDE-AR-N 4105:2011
DIN VDE V 0124-100(VDE V 0124-100):2012
DIN VDE 0126-1-1 (VDE V 0126-1-1):2013

Purpose of examination:

- Update technical report according to annex G2/F3 and G3/F4 in VDE-AR-N 4105 based on former version 70.409.15.062.01-00
- TÜV SÜD certification mark specifications(type D certificate)

Test result:

The test results show that the presented product is in compliance with the specified requirements.

TPS_GCN_F_09.20E – Rev. 1   2012-10-29

Project No: <70.409.15.062.01>
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TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

3-13, No.151 Heng Tong Road, 200070, Shanghai, P.R. China

Choose certainty.
Add value.

1 Description of the test subject

1.1 Function

This device is transformer-less grid-connected PV inverters which converts direct current optimized by photovoltaic DC conditioner to alternating current, and it is intended to be connected in parallel with the low-voltage mains to supply common load.
It is intended for professional incorporation into PV system, and they are assessed on a component test basis.
Hardware version: V200R001C00
Firmware version: V200R001

License conditions---

1. When installing the equipment, all requirements of the mentioned standards must be fulfilled.

2. In order to protect the installation against electrical and fire hazard, all branch circuits in an installation, switchgear, cables etc., must be short-circuit and over-current protected according to the national/international regulations.

3. When install PV generation system, double/reinforced insulation cable required with mechanical protection.
PV input cables: Cu, PV+&PV-, 4,0 mm² - 6 mm²@ Max. 60°C ambient temperature and Min. rated voltage@1000VDC
AC output cables: Cu, L1/L2/L3/N+PE, 4 x (16 mm^2 - 25 mm^2) + 16mm^2@ Max. 60°C ambient temperature and Min. rated voltage@400VAC
This type of PV inverters should be used together with suitable circuit breaker, or equivalent gL/gG fuse, whose operating time is less than 5 seconds, and installation method according to B2 in IEC 60364-5-52(ed.3) Annex D: cable in conduit cable trunking system, number of loaded circuit only one. H07RN-F (cord designation 60245 IEC 66) maybe used for ambient temperature of up to 40°C or less, rough cable should be used for ambient temperature between 40°C and 60°C. If any higher temperature environment used, it shall increase the conductor current carrying capacity and recalculation.

4. Maximum inverter backfeed current form grid to the array is 0A based on test/circuit topology analysis and manufacturer's declaration. And due to design, only two strings can be connected to each MPP input of inverter, no backfeed current can from others strings when short-circuit occurs in one string, so no PV string fuse required to be installed at the end installation.

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5. Serial – RS485 are used for telecommunication interface ports with circuitry intended for connection to a Network Environment 0 per manufacturer's instruction manual, according to IEC TR 62102(ed.2).

RS 485 circuit is classed to be as SELV, Only PELV or SELV voltages may be connected at RS 485 terminals.

6. The inverter is intended to be used with appropriate PV-generator, switchgear, SPDs, combiner feeder box, distribution board, electrical protection components and other device to form complete end systems. Compliance with safety regulations depends upon installing and configuring inverter correctly, including using the specified emergency stop device adjacent to solar inverter. The unit must be installed only by professional assemblers who are familiar with requirements for safety and EMC. The assembler is responsible for ensuring that the end product or system complies with all the relevant laws in the country where it is to be used. Refer to instruction manual.

7. Additional equipment connected to the inverter must comply with the respective IEC, EN or ISO standards (e.g. IEC 60950/EN 60950 series for data processing equipment, IEC 61439/EN 61439 series for switchgear).

8. To allow maintenance of PV inverter, means of isolating the PV inverter from the DC side and the AC side shall be provided at the end-use application.

9. For safety reasons, install the emergency stop devices at station adjacent to solar inverter in the end-system. Pressing the stop function on the control panel of the inverter does generate an emergency stop and separate the inverter from dangerous potential.

10. An additional RCD, type B according to IEC/TR 60755(ed.2), which is located between the inverter and the mains, shall be provided for fault protection by automatic disconnection of supply in the end-use application with the agreement of local network operator.

11. Island operation can be detected independently for individual unit. For multiple units operation, the automatic disconnection device should receive break commands via an interface from another protection device with equivalent island network detection. A break command must trigger a break within 0.2 s. The protection device issuing the break signal and the interface must also fulfill the functional safety requirements.

12. According to VDE-AR-N 4105:2011, for maximum apparent power of more than 30kVA generating unit or power system, an external suitable certified central NS protection device must be installed at the central meter panel.

13. In addition to the central NS protection, this type of inverter is integrated with the following protection functions, the following safety parameters are factory set and fixed as per VDE-AR-N 4105:2011 and DIN VDE 0126-1-1 (VDE V 0126-1-1):2013.

Default protection settings

Parameters	Normative requirements		Internal threshold setting	
	Maximum clearance time	Trip limit	Maximum clearance time (factory setting)	Factory setting trip value(default setting)
Over voltage – stage 1 10 minutes mean value corresponding to EN 50160	200ms	400/230V~ +10%...15%	200ms	440/253 V, adjustable
Over voltage – stage 2	200ms	Phase to neutral : 264,5V~	200ms	264,5V
	200ms	Phase to Phase: 460V~	200ms	460V
Under voltage	200ms	Phase to neutral : 184V~	200ms	184V
	200ms	Phase to Phase: 320V~	200ms	320V
Over frequency	200ms	51,5Hz	200ms	51,5Hz
Under frequency	200ms	47,5Hz	200ms	47,5Hz
Reconnection voltage range after a network outage and response to abnormal conditions	-	85 % Un to 110 % Un(340/195,5V-440/253V)	-	85 % Un to 110 % Un(340/195,5V-440/253V)
Reconnection frequency range after a network outage and response to abnormal conditions	-	47,5 Hz to 50,05 Hz	-	47,5 Hz to 50,05 Hz
Automatic reconnection after a network outage and response to abnormal conditions ≥ 3s	≥60s	-	≥60s	-
Automatic reconnection after a network outage and response to short-term interruption < 3s	>5s	-	>20s	-
DC injection current	200ms	1A	200ms	1A
PV array Insulation resistance measurement before start-	-	Vmax/30mA	-	100kΩ

ing operation				
Islanding detection	Max. 5s	Loss of mains	Max. 5s	Loss of mains
Continuous residual current	300ms	300mA	300ms	300mA
Sudden changes in residual current:	300ms	30mA	300ms	30mA
	150ms	60mA;	150ms	60mA;
	40ms	150mA;	40ms	150mA;

The tolerance between setting value and trip value of the voltage shall be at maximum ± 1 % and the admissible tolerance for the frequency at maximum ± 0,1 %.

Alteration of the above settings or full setting range of the interface protection may cause a breach of the type-certificate marking.

Unauthorised access to factory safety parameters setting and software should be prohibited. A reset to the factory safety parameters requires retesting and verification in conjunction with the end-use system.

1.2   Consideration of the foreseeable misuse

☐ Not applicable
☒ Covered through the applied standard
☐ Covered by the following comment
☐ Covered by attached risk analysis

1.3   Technical Data

Model	:	SUN2000-33KTL
PV input	:	d.c. Max. Input Voltage: 1000 Vd.c. d.c. MPP Range: 250-850 Vd.c. d.c. Max. Input Current: 23 A/23 A/23 A Isc PV: 34,5 A /34,5 A/34,5 A
AC output	:	a.c. Output Nominal Voltage: 3/N/PE~ 400 V a.c. Nominal Operating Frequency: 50 Hz a.c. Output Max. Current: 48 A a.c. Output Rated Power: 30 kVA a.c. Output Max. Active Power: 30 kW a.c. Output Max. Apparent Power: 33 kVA

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Shanghai, P.R. China

Protection Class	: I
Ingress protection	: IP65
Construction	: pluggable equipment type B
Supply connection	: Fixed equipment
Weight	: 50kg

2 Order

2.1 Date of Purchase Order, Customer's Reference

2015.03.11, 7482041525/1000

2.2 Receipt of Test Sample, Location

2015.03.11,
Nanjing CQC - Trusted Testing Technology Co., Ltd.
No.99,Wenlan Road, Xianlin University Zone, Xianlin Street, Qixia District, NanJing, China

2.3 Date of Testing

2015-03-11 – 2015-04-20

2.4 Location of Testing

Nanjing CQC - Trusted Testing Technology Co., Ltd.

No.99,Wenlan Road, Xianlin University Zone, Xianlin Street, Qixia District, NanJing, China

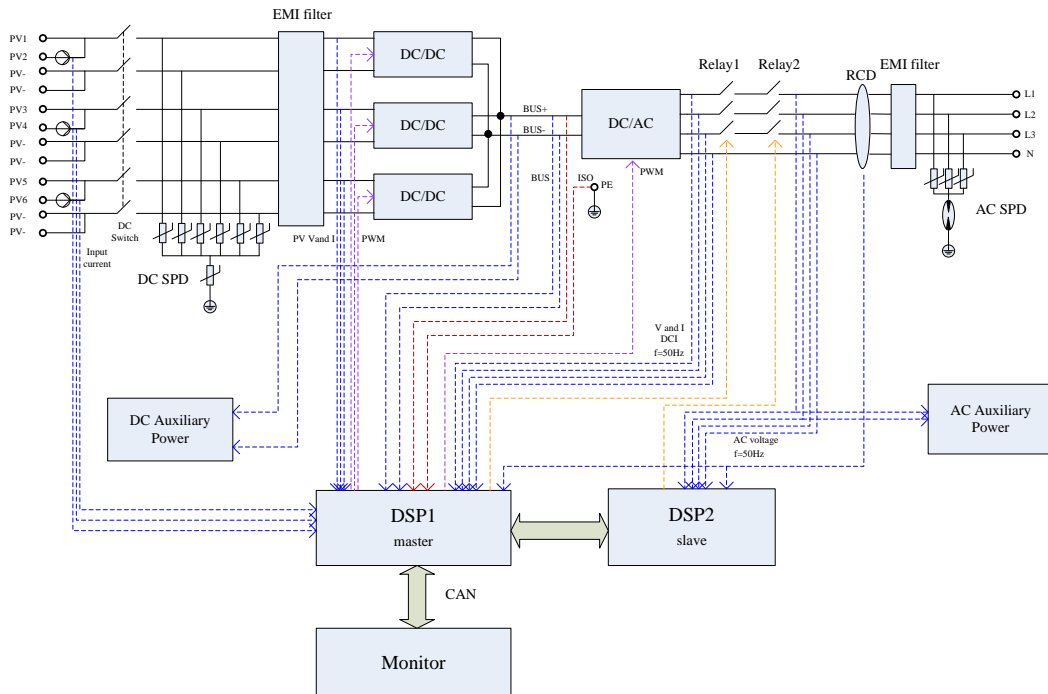### 2.5 Points of Non-compliance or Exceptions of the Test Procedure

None

3 Test Results

3.1 Positive Test Results (as attachment of type D certificate)

G.2 Certificate of conformity for power generation units

Certificate of conformity Power generation unit	No. 70.409.15.062.01-00
Manufacturer	Huawei Technologies Co., Ltd.
	Bantian, Administration Building Headquarters of Huawei

Type power generation unit	SOLAR INVERTER	
Model	SUN2000-33KTL	
Assessment values	Max. active power P_{Emax}	29,966 kW
	Max. apparent power S_{Emax}	33,112 kVA
	Rated voltage	3/N/PE~ 400V
Network connection rules	**VDE-AR-N 4105 "Power generation systems connected to the low-voltage network"** Technical minimum requirements for connection and parallel operation of power generation systems connected to the low-voltage network	
Firmware version	V200R001	
Period of measurement	From 2015-03-11 to 2015-04-20	

Technologies Co., Ltd., Longgang District, 518129 Shenzhen, PEOPLE'S REPUBLIC OF CHINA

The above mentioned power generation unit meets the requirements of VDE-AR-N 4105.

Description of the structure and schematic set-up of the generating unit. (including single fault check)

The generating unit integrated EMC filter on both PV and AC side converts direct current optimized by photovoltaic DC conditioner to alternating current and it is intended to be connected in parallel with the low-voltage mains to supply common load. The generating unit has no electrical isolation between DC input and AC output. The output is switched off by the failsafe inverter bridge and two relays in series. This allows a safe separation from generating unit to the network, also in case of failure. Refer to below illustration.

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F.3 Requirements for the test report for power generation units (VDE-AR-N 4105)

Extract from test report for unit certificate "Determination of electrical properties"		No. 70.409.15.062.01-00	
Type of system	Grid-connected inverter for PV system	Manufacturer's data	
Generation unit manufacturer	Huawei Technologies Co., Ltd. Address: Bantian, Administration Building Headquarters of Huawei Technologies Co., Ltd., Longgang District, 518129 Shenzhen, PEOPLE'S REPUBLIC OF CHINA	Type of system:	Grid-connected inverter for PV system
		Active power (nominal power at reference conditions):	30kW
		Rated voltage:	3/N/PE~ 400V
Period of measurement:	From 2015-03-11 to 2015-04-20		

Active power P_{Emax}	29,966 kW (Assessment values)

Reactive power reference (@0,91Un)										
Active power P/P_{Emax} [%]	10	20	30	40	50	60	70	80	90	100
Max. possible $\cos\varphi_{under\text{-}excited}$	0,775	0,790	0,793	0,794	0,796	0,795	0,796	0,797	0,897*	1,000*
Max. possible $\cos\varphi_{over\text{-}excited}$	0,808	0,805	0,802	0,801	0,800	0,799	0,800	0,799	0,899*	1,000*

"*": The max. current is limited by software to 48 A, the apparent power and active power are limited accordingly when test at fixed grid voltage(0,91Un).
$S_{limited}=P_{limited}=48A\times209,3\times3\approx30000W/VA$

Due to apparent power is limited to S_{Emax}, the active power is reduced accordingly when adjust cos φ. It is therefore not achieved to default cos φ at points 90% and 100% P/P_{Emax}. The max. possible cos φ is recorded accordingly.

Reactive power reference (@Un)										
Active power P/P_{Emax} [%]	10	20	30	40	50	60	70	80	90	100
Max. possible $\cos\varphi_{under\text{-}excited}$	0,774	0,790	0,793	0,795	0,796	0,796	0,796	0,796	0,815*	0,898*

Max. possible $\cos\varphi_{over-excited}$	0,813	0,805	0,803	0,802	0,801	0,799	0,799	0,799	0,815*	0,899*

"*": Due to apparent power is limited to S_{Emax}, the active power is reduced accordingly when adjust cos φ. It is therefore not achieved to default cos φ at points 90% and 100% P/P_{Emax}. The max. possible cos φ is recorded accordingly.

Reactive power reference (@1,09Un)

Active power P/P_{Emax} [%]	10	20	30	40	50	60	70	80	90	100
Max. possible $\cos\varphi_{under-excited}$	0,767	0,790	0,791	0,794	0,795	0,796	0,796	0,796	0,815*	0,898*
Max. possible $\cos\varphi_{over-excited}$	0,816	0,808	0,804	0,802	0,801	0,801	0,799	0,800	0,915*	0,899*

"*": Due to apparent power is limited to S_{Emax}, the active power is reduced accordingly when adjust cos φ. It is therefore not achieved to default cos φ at points 90% and 100% P/P_{Emax}. The max. possible cos φ is recorded accordingly.

Remark:

Starting with an active power output of more than 20 % of the max. active power with the above displacement factors cos φ required. Test value at 10% of the Max. active power is a reference only.

Compliance of required displacement factor cosφ

Default in system control	$0,900_{ov}$	$0,920_{ov}$	$0,940_{ov}$	$0,960_{ov}$	$0,980_{ov}$	1,000	$0,980_{un}$	$0,960_{un}$	$0,940_{un}$	$0,920_{un}$	$0,900_{un}$
Measured value at PGU terminals	0,899	0,918	0,941	0,961	0,979	1,000	0,978	0,958	0,937	0,919	0,898

Reactive power transfer function – Standard-cosφ-(P)-characteristic

Active power P/P_n [%]	10	20	30	40	50	60	70	80	90	100
cosφ	0,991	0,998	0,999	0,999	0,999	0,978	0,958	0,938	0,918	0,898

Conform to Standard- cosφ-(P)-characteristic

Remark:

Starting with a power of 0,2 P_{Emax}, the characteristic curve shall be adhered to according to VDE AR-N 4105: 2011.

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Switching actions		
Making operation without default (of primary energy carrier)	k_i	0,140
Worst case at switch over of generator sections*	k_i	-
Making operation at reference conditions (of primary energy carrier)	k_i	1,103
Breaking operation at nominal power	k_i	1,085
Worst-case value of all switching operations	k_{imax}	1,103

Remark: "*" Not applicable for PV system

Flicker	Angle of network impedance ψ_k:	32°[1]	50°	70°	85°
	Coefficient of system flicker c_ψ:	4,94	-	-	-

Remark: [1] $R_A = 0,24\ \Omega$; $X_A = j\ 0,15\ \Omega$ at 50 Hz network impedance used for most unfavorable condition which is approximately 32° flicker angle.

Harmonics											
Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100
Ordinal number	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
2	-	0,049	0,067	0,020	0,088	0,101	0,127	0,120	0,088	0,096	0,148
3	-	0,044	0,035	0,013	0,043	0,051	0,071	0,069	0,050	0,061	0,098
4	-	0,044	0,044	0,013	0,052	0,056	0,073	0,066	0,066	0,072	0,093
5	-	0,301	0,293	0,099	0,316	0,330	0,346	0,367	0,375	0,385	0,401
6	-	0,005	0,006	0,002	0,008	0,008	0,010	0,009	0,010	0,012	0,016
7	-	0,050	0,021	0,017	0,058	0,071	0,089	0,089	0,097	0,111	0,189
8	-	0,012	0,011	0,004	0,013	0,018	0,018	0,018	0,020	0,023	0,029
9	-	0,015	0,022	0,007	0,019	0,022	0,025	0,026	0,016	0,019	0,030
10	-	0,012	0,013	0,004	0,017	0,019	0,027	0,024	0,028	0,029	0,034
11	-	0,188	0,070	0,056	0,295	0,350	0,472	0,437	0,453	0,489	0,629
12	-	0,005	0,005	0,002	0,007	0,007	0,008	0,008	0,008	0,010	0,014
13	-	0,186	0,120	0,056	0,223	0,296	0,403	0,372	0,395	0,410	0,526
14	-	0,006	0,007	0,002	0,011	0,012	0,013	0,014	0,012	0,012	0,021
15	-	0,011	0,027	0,009	0,009	0,011	0,025	0,025	0,017	0,019	0,035
16	-	0,010	0,011	0,003	0,015	0,012	0,019	0,019	0,019	0,019	0,025
17	-	0,076	0,169	0,051	0,148	0,244	0,353	0,331	0,375	0,417	0,497
18	-	0,006	0,008	0,002	0,008	0,008	0,012	0,011	0,009	0,011	0,017
19	-	0,052	0,150	0,045	0,131	0,204	0,296	0,277	0,304	0,351	0,377
20	-	0,007	0,008	0,003	0,010	0,012	0,018	0,015	0,013	0,015	0,024
21	-	0,023	0,029	0,023	0,032	0,039	0,046	0,050	0,050	0,055	0,060
22	-	0,008	0,011	0,003	0,011	0,011	0,017	0,014	0,014	0,015	0,019
23	-	0,077	0,079	0,024	0,078	0,132	0,200	0,208	0,242	0,298	0,269
24	-	0,006	0,008	0,002	0,007	0,008	0,011	0,010	0,009	0,010	0,013
25	-	0,069	0,051	0,021	0,075	0,103	0,152	0,165	0,178	0,218	0,182
26	-	0,006	0,007	0,002	0,006	0,010	0,015	0,012	0,009	0,009	0,011
27	-	0,013	0,013	0,004	0,019	0,020	0,031	0,027	0,027	0,024	0,037
28	-	0,006	0,007	0,002	0,006	0,009	0,010	0,010	0,008	0,008	0,008
29	-	0,035	0,022	0,011	0,072	0,081	0,132	0,139	0,130	0,146	0,110
30	-	0,005	0,005	0,001	0,005	0,007	0,008	0,006	0,006	0,006	0,007
31	-	0,024	0,024	0,007	0,051	0,051	0,092	0,103	0,104	0,106	0,091
32	-	0,005	0,004	0,002	0,005	0,008	0,010	0,006	0,007	0,006	0,007
33	-	0,007	0,015	0,004	0,011	0,014	0,015	0,016	0,014	0,013	0,015
34	-	0,005	0,005	0,002	0,005	0,006	0,008	0,007	0,007	0,007	0,008
35	-	0,028	0,036	0,011	0,041	0,041	0,047	0,069	0,076	0,079	0,072
36	-	0,004	0,005	0,002	0,005	0,005	0,006	0,006	0,006	0,006	0,007
37	-	0,026	0,035	0,011	0,037	0,046	0,041	0,064	0,084	0,087	0,086
38	-	0,005	0,005	0,001	0,005	0,005	0,007	0,006	0,006	0,007	0,008
39	-	0,012	0,014	0,004	0,008	0,010	0,011	0,011	0,009	0,009	0,013
40	-	0,005	0,005	0,002	0,005	0,005	0,006	0,006	0,005	0,006	0,008

Subharmonics											
Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100
Frequency [Hz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
75	-	0,145	0,245	0,342	0,441	0,533	0,710	0,945	1,033	1,041	1,273
125	-	0,038	0,050	0,067	0,084	0,101	0,135	0,185	0,211	0,265	0,358
175	-	0,022	0,030	0,040	0,050	0,060	0,080	0,107	0,122	0,156	0,214
225	-	0,021	0,027	0,037	0,046	0,054	0,070	0,089	0,101	0,130	0,179
275	-	0,018	0,026	0,034	0,041	0,047	0,058	0,072	0,080	0,078	0,095
325	-	0,015	0,021	0,030	0,040	0,045	0,053	0,064	0,070	0,068	0,080
375	-	0,016	0,023	0,031	0,041	0,045	0,054	0,065	0,071	0,071	0,085
425	-	0,016	0,018	0,021	0,026	0,029	0,036	0,045	0,052	0,054	0,064
475	-	0,015	0,017	0,020	0,026	0,029	0,035	0,042	0,048	0,051	0,062
525	-	0,018	0,018	0,029	0,052	0,060	0,071	0,082	0,084	0,084	0,099
575	-	0,018	0,018	0,029	0,054	0,060	0,072	0,086	0,088	0,085	0,095
625	-	0,020	0,018	0,026	0,053	0,064	0,077	0,091	0,091	0,086	0,098
675	-	0,020	0,018	0,027	0,054	0,064	0,078	0,094	0,096	0,090	0,100
725	-	0,018	0,018	0,021	0,026	0,028	0,034	0,043	0,049	0,049	0,055
775	-	0,016	0,018	0,020	0,024	0,027	0,033	0,043	0,049	0,050	0,056
825	-	0,018	0,029	0,024	0,050	0,070	0,092	0,117	0,122	0,117	0,130
875	-	0,020	0,030	0,025	0,053	0,074	0,097	0,121	0,123	0,118	0,134
925	-	0,018	0,032	0,027	0,046	0,067	0,093	0,120	0,125	0,120	0,134
975	-	0,020	0,033	0,028	0,047	0,070	0,097	0,123	0,127	0,124	0,144
1025	-	0,018	0,020	0,022	0,024	0,029	0,037	0,044	0,047	0,055	0,066
1075	-	0,019	0,020	0,023	0,024	0,027	0,035	0,042	0,044	0,050	0,058
1125	-	0,021	0,028	0,042	0,042	0,055	0,085	0,116	0,124	0,124	0,143
1175	-	0,020	0,029	0,042	0,042	0,055	0,084	0,114	0,124	0,120	0,136
1225	-	0,020	0,023	0,040	0,042	0,042	0,065	0,096	0,105	0,105	0,121
1275	-	0,021	0,023	0,042	0,041	0,042	0,063	0,093	0,106	0,105	0,122
1325	-	0,018	0,021	0,023	0,027	0,029	0,029	0,032	0,038	0,041	0,050
1375	-	0,017	0,020	0,027	0,021	0,022	0,026	0,033	0,035	0,035	0,043
1425	-	0,019	0,021	0,030	0,043	0,038	0,044	0,060	0,074	0,078	0,093
1475	-	0,024	0,025	0,037	0,037	0,027	0,041	0,064	0,070	0,073	0,086
1525	-	0,016	0,020	0,026	0,036	0,030	0,031	0,044	0,058	0,066	0,072
1575	-	0,026	0,028	0,027	0,032	0,025	0,028	0,046	0,055	0,061	0,076
1625	-	0,015	0,016	0,017	0,031	0,033	0,028	0,022	0,026	0,031	0,032
1675	-	0,021	0,021	0,028	0,018	0,019	0,025	0,034	0,027	0,024	0,031
1725	-	0,016	0,016	0,025	0,029	0,026	0,023	0,028	0,040	0,051	0,054
1775	-	0,026	0,027	0,023	0,022	0,029	0,021	0,032	0,037	0,042	0,057
1825	-	0,018	0,032	0,033	0,038	0,023	0,028	0,027	0,035	0,041	0,047
1875	-	0,024	0,023	0,019	0,017	0,036	0,022	0,030	0,038	0,039	0,050
1925	-	0,013	0,035	0,018	0,022	0,014	0,034	0,023	0,018	0,030	0,034
1975	-	0,028	0,015	0,017	0,017	0,021	0,016	0,034	0,037	0,019	0,022

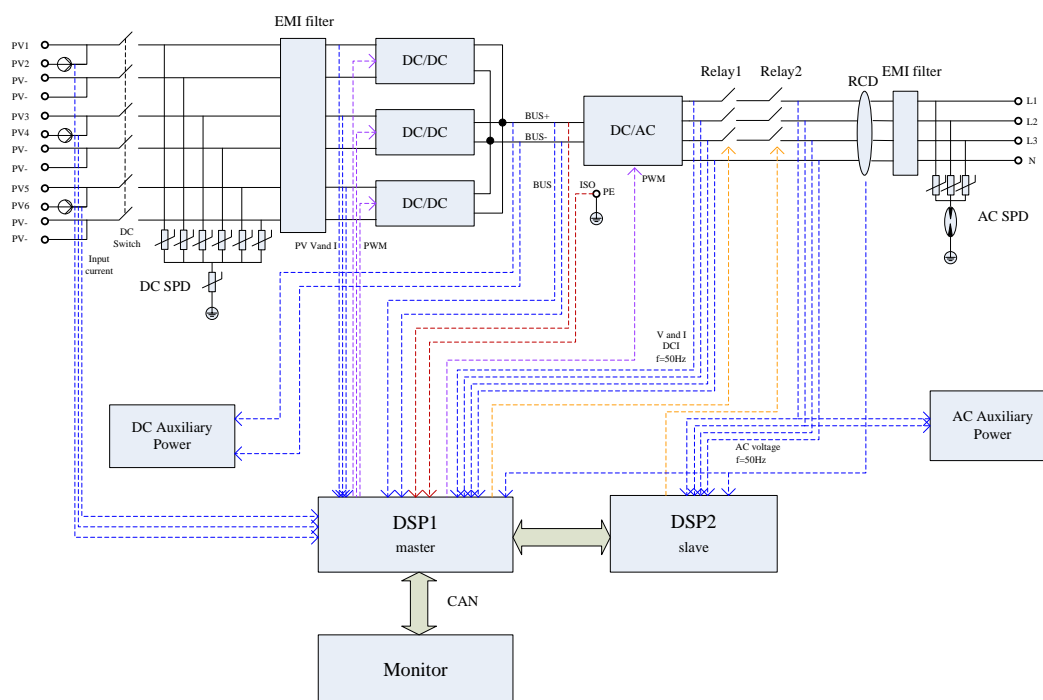| Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100
Frequency [kHz]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]	I [%]
2.1	-	0,054	0,056	0,043	0,052	0,070	0,062	0,071	0,099	0,123	0,139
2.3	-	0,043	0,040	0,040	0,045	0,057	0,051	0,049	0,067	0,084	0,096
2.5	-	0,044	0,041	0,040	0,040	0,042	0,044	0,059	0,078	0,094	0,102
2.7	-	0,045	0,047	0,044	0,050	0,047	0,052	0,069	0,074	0,087	0,128
2.9	-	0,043	0,045	0,050	0,055	0,056	0,056	0,051	0,052	0,082	0,111
3.1	-	0,044	0,046	0,059	0,064	0,065	0,071	0,084	0,080	0,083	0,096
3.3	-	0,042	0,047	0,056	0,088	0,099	0,096	0,095	0,085	0,072	0,070
3.5	-	0,041	0,042	0,057	0,077	0,092	0,097	0,127	0,138	0,131	0,134
3.7	-	0,039	0,042	0,047	0,067	0,086	0,098	0,108	0,113	0,100	0,082
3.9	-	0,038	0,040	0,040	0,051	0,067	0,082	0,093	0,109	0,113	0,113
4.1	-	0,039	0,039	0,039	0,044	0,046	0,053	0,060	0,068	0,075	0,079
4.3	-	0,037	0,037	0,037	0,040	0,040	0,045	0,049	0,057	0,066	0,076
4.5	-	0,037	0,037	0,038	0,041	0,041	0,044	0,048	0,052	0,057	0,064
4.7	-	0,037	0,037	0,038	0,039	0,038	0,039	0,041	0,043	0,044	0,047
4.9	-	0,036	0,036	0,037	0,038	0,036	0,037	0,038	0,039	0,040	0,042
5.1	-	0,037	0,037	0,038	0,039	0,038	0,039	0,040	0,041	0,043	0,048
5.3	-	0,036	0,036	0,037	0,037	0,036	0,037	0,037	0,038	0,038	0,038
5.5	-	0,036	0,036	0,037	0,036	0,036	0,036	0,036	0,037	0,038	0,041
5.7	-	0,036	0,036	0,036	0,036	0,036	0,037	0,036	0,037	0,037	0,037
5.9	-	0,036	0,037	0,036	0,036	0,036	0,036	0,036	0,037	0,037	0,037
6.1	-	0,036	0,037	0,036	0,036	0,036	0,037	0,037	0,038	0,040	0,042
6.3	-	0,037	0,038	0,038	0,045	0,050	0,056	0,065	0,085	0,115	0,137
6.5	-	0,037	0,038	0,038	0,040	0,041	0,043	0,044	0,046	0,049	0,051
6.7	-	0,036	0,037	0,043	0,065	0,075	0,084	0,071	0,056	0,061	0,073
6.9	-	0,036	0,036	0,035	0,036	0,036	0,036	0,036	0,036	0,036	0,036
7.1	-	0,036	0,036	0,036	0,035	0,036	0,036	0,036	0,036	0,036	0,036
7.3	-	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,038
7.5	-	0,037	0,036	0,035	0,036	0,036	0,036	0,036	0,036	0,036	0,036
7.7	-	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,036
7.9	-	0,036	0,036	0,036	0,036	0,035	0,036	0,035	0,036	0,035	0,035
8.1	-	0,036	0,036	0,036	0,036	0,035	0,035	0,035	0,036	0,035	0,035
8.3	-	0,036	0,036	0,037	0,036	0,035	0,036	0,035	0,036	0,036	0,037
8.5	-	0,036	0,036	0,037	0,036	0,035	0,036	0,036	0,035	0,036	0,035
8.7	-	0,036	0,036	0,037	0,036	0,035	0,035	0,036	0,036	0,037	0,042
8.9	-	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,035	0,035

Remark:

The harmonic values are maximum values from all phases.

G.3 Certificate of conformity of the network and system protection

Certificate of conformity NS protection	No. 70.409.15.062.01-00		
Manufacturer	Huawei Technologies Co., Ltd. Bantian, Administration Building Headquarters of Huawei Technologies Co., Ltd., Longgang District, 518129 Shenzhen, PEOPLE'S REPUBLIC OF CHINA		
Type of NS protection			
Central NS protection	☐		
Integrated NS protection	☑	Assigned to power generation unit type	SUN2000-33KTL
Network connection rules	**VDE-AR-N 4105 "Power generation systems connected to the low-voltage network"** Technical minimum requirements for connection and parallel operation of power generation systems connected to the low-voltage network		
Firmware version	V200R001		
Type of integrated interface switch	Relaies: HE1aN-P-DC12V-Y5		
Period of measurement	From 2015-03-11 to 2015-04-20		

The network and system protection mentioned above meets the requirements of VDE-AR-N 4105.

Protection function	Setting value	Tripping value [c]	Break time [a]
Voltage drop protection $U <$	$0{,}8^{*}\ U_n$	318,3/183,1 V	≤ 192,8 ms
Rise-in-voltage protection $U >$	$1{,}1^{*}\ U_n$	$1{,}1^{*}\ U_n$	≤ 200,0 ms
Rise-in-voltage protection $U >>$	$1{,}15^{*}\ U_n$	458,4/265,0 V	≤ 193,6 ms
Frequency decrease protection $f <$	47,5 Hz	47,49 Hz	≤ 184,8 ms
Frequency increase protection $f >$	51,5 Hz	51,50 Hz	≤ 184,2 ms

Remark:
"a": The break time (sum of tripping time plus proper time of interface switch) shall not exceed 200 ms. Max. break times are recorded.
"b": Verification disconnecting time of moving 10min-average value.
Disconnecting time as below:
1. 494s(from 600s@U_n to 112%U_n)
2. Continuous operation(from 600s@U_n to 108%U_n)
3. 297s(from 600s@106%U_n to 114%U_n)
"c": The maximum deviation from the required values are recorded, within the admissible tolerance between setting value and trip value of the voltage at maximum ± 1 % and for the frequency at maximum ± 0,1 %.

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Description of the structure and schematic set-up of the generating unit. (including single fault check)

The generating unit integrated EMC filter on both PV and AC side converts direct current optimized by photovoltaic DC conditioner to alternating current and it is intended to be connected in parallel with the low-voltage mains to supply common load. The generating unit has no electrical isolation between DC input and AC output. The output is switched off by the failsafe inverter bridge and two relays in series. This allows a safe separation from generating unit to the network, also in case of failure. Refer to below illustration.

F.4 Requirement for the test report for the NS protection (VDE-AR-N 4105)

Extract from test report for NS protection "Determination of electrical properties"	No. 70.409.15.062.01-00

☐ **NS protection as central NS protection**	

Type of NS system	**Other Manufacturer's data**
Software version:	
Manufacturer:	

Measuring period: From XXXX-XX-XX to XXXX-XX-XX

Protection function	**Control value**	**Release value**	**Tripping time NS protection [a]**
Voltage drop protection $U <$	$0{,}8 \, {}^* \, U_n$	U_n	ms
Rise-in-voltage protection $U >$	$1{,}1 \, {}^* \, U_n$	U_n	ms
Rise-in-voltage protection $U >>$	$1{,}15 \, {}^* \, U_n$	U_n	ms
Frequency decrease protection $f <$	47,5 Hz	Hz	ms
Frequency increase protection $f >$	51,5 Hz	Hz	ms

Remark:

"a": The tripping time comprises the period before limit violation U/f until tripping signal to interface switch.

During planning of power generation system the proper time of interface switch shall be added to the highest value of time determined above. The break time (sum of tripping time NS protection plus proper time of interface switch) shall not exceed 200 ms.

■ **NS protection as integrated NS protection**	

Note: $S_{Emax} > 30kVA$, an external suitable certified central NS protection device must be installed at the central meter panel, in addition to the central NS protection, PGU is integrated with grid protection functions as below.

Type of NS system	Central NS protection required, but PGU is integrated with grid protection functions	**Other Manufacturer's data**	
Software version:	V200R001	Assigned to PGU type	SUN2000-33KTL
Manufacturer:	Huawei Technologies Co., Ltd. Address: Bantian, Administration Building Headquarters of Huawei Technologies Co., Ltd., Longgang District, 518129 Shenzhen, PEOPLE'S REPUBLIC OF CHINA	Integrated interface switch Type of Switching equipment 1	Relay
		Type of Switching equipment 2	Relay

Measuring period: From 2015-03-11 to 2015-04-20

Protection function	**Setting value**	**Tripping value [c]**	**Break time [a]**
Voltage drop protection $U <$	$0{,}8 \, {}^* \, U_n$	318,3/183,1 V	≤ 192,8 ms

Rise-in-voltage protection $U >$	$1,1^* U_n$	$1,1^* U_n$	≤ 200,0 ms
Rise-in-voltage protection $U >>$	$1,15^* U_n$	458,4/265,0 V	≤ 193,6 ms
Frequency decrease protection $f <$	47,5 Hz	47,49 Hz	≤ 184,8 ms
Frequency increase protection $f >$	51,5 Hz	51,50 Hz	≤ 184,2 ms
Proper time of interface switch	N/A (maximum break time recorded above)		

Remark:
"a": The break time (sum of tripping time plus proper time of interface switch) shall not exceed 200 ms. Max. break times are recorded.
"b": Verification disconnecting time of moving 10min-average value.
Disconnecting time as below:
4.   494s(from 600s@U_n to 112%U_n)
5.   Continuous operation(from 600s@U_n to 108%U_n)
6.   297s(from 600s@106%U_n to 114%U_n)
"c": The maximum deviation from the required values are recorded, within the admissible tolerance between setting value and trip value of the voltage at maximum ± 1 % and for the frequency at maximum ± 0,1 %.

4   Remark

The user manual has been examined according to the minimum requirements described in the product standard. The manufacturer is responsible for the accuracy of further particulars as well as of the composition and layout.

4.1   Remarks to Factory *(N/A)*

The assembly of the product has to comply with the documentation (CDF). Before the implementation of safety relevant modifications to the product into the ongoing production the product must be retested for acceptance. The results must be implemented to the documentation and if necessary the certificate must be updated.

5   Documentation

- Photograph
- Circuit diagrams
- PCB layout drawing
- Instruction manual

6   Summary

The test specifications are met

Engineer: _____   Technical Report checked: _____