TEST REPORT
DIN V VDE V 0126-1-1:2013.08
Automatic disconnecting device

Report Reference No.....:	191012014GZU-003
Date of issue.....:	21 Nov., 2019
Total number of pages.....	29 pages
Testing Laboratory.....:	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Address .....:	Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China
Testing location/ address .....:	Same as above
Tested by (name + signature) .....:	Tommy Zhong Technical Manager
Approved by (+ signature).....:	Jason Fu Technical Team Leader
Applicant's name.....:	Hitachi Hi-Rel Power Electronics Pvt. Ltd.
Address.....:	SM 3 & 4, Sanand – II GIDC, Industrial Estate, Boll Village, Sanand – 382 110, Gujarat, India.
Test specification:	
Standard .....:	DIN V VDE V 0126-1-1:2013.08 (VFR 2013 and VFR 2014)
Test procedure.....:	Type test for France
Non-standard test method……..:	N/A
Test Report Form No.....:	VDE0126-1-1b
Test Report Form(s) Originator .....:	Intertek
Master TRF.....:	Dated 2013-09

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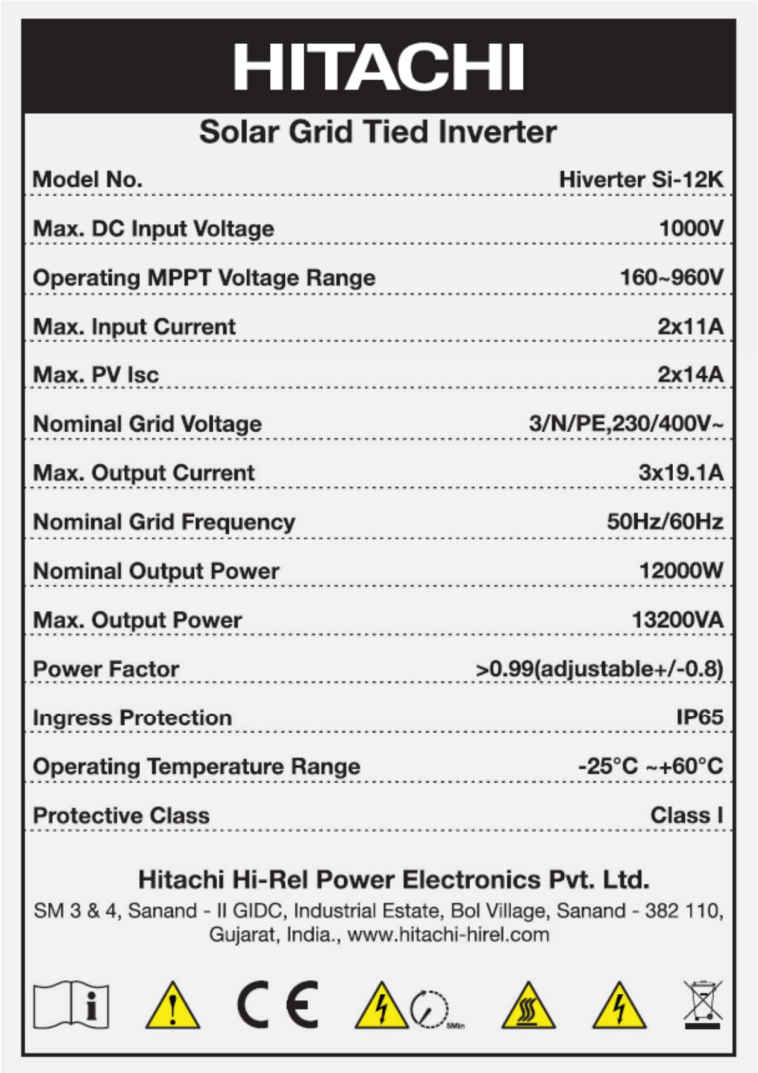
Test item description ..... :	Solar Grid Tied Inverter
Trade Mark .....:	HITACHI
Manufacturer.....:	Same as Applicant
Model/Type reference.....:	Hiverter Si-4.4K, Hiverter Si-5.5K, Hiverter Si-6.6K, Hiverter Si-8.8K, Hiverter Si-11K, Hiverter Si-12K

Ratings.....:	For model: Hiverter Si-4.4K DC input: Max. PV Voltage: 1000Vdc; DC MPPT Voltage Range: 160-960Vdc; Max input current:2X11A; Max. PV Isc: 2X14A AC output: Nominal Output Voltage: 3W/N/PE 230Vac/400Vac; Nominal Frequency: 50Hz; Max. Output Current: 3*6.4A; Nominal Output Power: 4000W; Max. Apparent Power: 4.4kVA; Power Factor: 0.8 Leading – 0.8 Lagging Ambient Temperature: -25℃ - +60℃ IP65, Class I For model: Hiverter Si-5.5K DC input: Max. PV Voltage: 1000Vdc; DC MPPT Voltage Range: 160-960Vdc; Max input current:2X11A ; Max. PV Isc: 2X14A AC output: Nominal Output Voltage: 3W/N/PE 230Vac/400Vac; Nominal Frequency: 50Hz; Max. Output Current: 3*8.0A; Nominal Output Power: 5000W; Max. Apparent Power: 5.5kVA; Power Factor: 0.8 Leading – 0.8 Lagging Ambient Temperature: -25℃ - +60℃ IP65, Class I For model: Hiverter Si-6.6K DC input: Max. PV Voltage: 1000Vdc; DC MPPT Voltage Range: 160-960Vdc; Max input current:2X11A ; Max. PV Isc: 2X14A AC output: Nominal Output Voltage: 3W/N/PE 230Vac/400Vac; Nominal Frequency: 50Hz; Max. Output Current: 3*9.6A; Nominal Output Power: 6000W; Max. Apparent Power: 6.6kVA; Power Factor: 0.8 Leading – 0.8 Lagging Ambient Temperature: -25℃ - +60℃ IP65, Class I For model: Hiverter Si-8.8K DC input: Max. PV Voltage: 1000Vdc; DC MPPT Voltage Range: 160-960Vdc; Max input current:2X11A; Max. PV Isc: 2X14A AC output: Nominal Output Voltage: 3W/N/PE 230Vac/400Vac; Nominal Frequency: 50Hz; Max. Output Current: 3*12.8A; Nominal Output Power: 8000W; Max. Apparent Power: 8.8kVA; Power Factor: 0.8 Leading – 0.8 Lagging Ambient Temperature: -25℃ - +60℃ IP65, Class I For model: Hiverter Si-11K DC input: Max. PV Voltage: 1000Vdc; DC MPPT Voltage Range: 160-960Vdc; Max input current:2X11A; Max. PV Isc: 2X14A AC output: Nominal Output Voltage: 3W/N/PE 230Vac/400Vac; Nominal

	Frequency: 50Hz; Max. Output Current: 3*15.9A; Nominal Output Power: 10000W; Max. Apparent Power: 11.0kVA; Power Factor: 0.8 Leading – 0.8 Lagging Ambient Temperature: -25℃ - +60℃ IP65, Class I For model: Hiverter Si-12K DC input: Max. PV Voltage: 1000Vdc; DC MPPT Voltage Range: 160-960Vdc; Max input current:2X11A; Max. PV Isc: 2X14A AC output: Nominal Output Voltage: 3W/N/PE 230Vac/400Vac; Nominal Frequency: 50Hz; Max. Output Current: 3*19.1A; Nominal Output Power: 12000W; Max. Apparent Power: 13.2kVA; Power Factor: 0.8 Leading – 0.8 Lagging Ambient Temperature: -25℃ - +60℃ IP65, Class I
Software version.....:	V1.00

Summary of testing:	
Tests performed (name of test and test clause): All applicable test items.	**Testing location:** Intertek Testing Services Shenzhen Ltd. Guangzhou Branch

Copy of marking plate(representative):



HITACHI

Solar Grid Tied Inverter

Model No.	Hiverter Si-12K
Max. DC Input Voltage	1000V
Operating MPPT Voltage Range	160~960V
Max. Input Current	2x11A
Max. PV Isc	2x14A
Nominal Grid Voltage	3/N/PE,230/400V~
Max. Output Current	3x19.1A
Nominal Grid Frequency	50Hz/60Hz
Nominal Output Power	12000W
Max. Output Power	13200VA
Power Factor	>0.99(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25°C ~+60°C
Protective Class	Class I

Hitachi Hi-Rel Power Electronics Pvt. Ltd.
SM 3 & 4, Sanand - II GIDC, Industrial Estate, Bol Village, Sanand - 382 110, Gujarat, India., www.hitachi-hirel.com

Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation
3. The other model labels are identical with label above, except the model name and rating.

Test item particulars.....:	
Temperature range.....:	-25°C ~ 60 °C
Overvoltage category.....:	☐ OVC I ☒ OVC II (for PV input) ☒ OVC III (for main) ☐ OVC IV
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 ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Testing..... :	
Date of receipt of test item..... :	12 Oct., 2019
Date (s) of performance of tests..... :	12 Oct., 2019 – 21 Nov., 2019

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

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

Clause numbers in parentheses derive from VDE-AR-N 4105:2011-08.

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

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The test report only allows to be revised only within the report defined retention period unless standard or regulation was withdrawn or invalid.

This report is based on the report 170418017GZU-003, dated 27 Jul., 2017, Revision 1: 15 Mar., 2019 and changes the applicant, trade mark, product name and model name to apply for a new certificate.

The model Hiverter Si-4.4K, Hiverter Si-5.5K, Hiverter Si-6.6K, Hiverter Si-8.8K, Hiverter Si-11K, Hiverter Si-12K in this report are same as the model SOFAR 4.4KTL-X, SOFAR 5.5KTL-X, SOFAR 6.6KTL-X, SOFAR 8.8KTL-X, SOFAR 11KTL-X, SOFAR 12KTL-X respectively in the report 170418017GZU-003, except the product name, model name and the trade Mark.

General product information:

Product covered by this report is grid-connected PV inverter for indoor or outdoor installation. The connection to the DC input and AC output are through terminal. The structure of the unit complied with the IP 65 requirement.
The inverters intended to operate at ambient temperature -25℃ - +60℃, which will be specified in the user manual, however, the inverters will output full power when operated at 45℃, if operated at high than 45℃ temperature, the output power would be derate.

All models have identical mechanical and electrical construction except some parameter of the software architecture in order to control the max output power. The detailed difference as following:

Model	Hiverter Si-8.8K, Hiverter Si-11K, Hiverter Si-12K		Hiverter Si-4.4K, Hiverter Si-5.5K, Hiverter Si-6.6K	
Componets	Specification	Numbers	Specification	Numbers
Inverter Chock	NPS226060*2+NPF226060*1 2.0Φ*2P*42Ts L=0.73mH	3	NPS226060*2 2.2Φ*1P*67Ts L=1.24mH	3
Bus capacitor	75µF/600V	4	75µF/600V	2

Other than special notice, the model Hiverter Si-12K is as the representative test models in this report

Factory information:
Factory: Dongguan SOFAR SOLAR Co., Ltd.
Address: 1F-6F, Building E, No.1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City.

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
4	**REQUIREMENTS**		P
4.0	**General**		P
	These requirements apply to integrated or separate (independent) disconnecting devices unless otherwise noted. The disconnection device has to cut off the power generating system on the ac side from the grid by two switches in series when: — the voltage and/or the frequency of the grid is deviating, — direct current (DC) is fed into the Grid. — unintentional islanding operation occurs, — intentional islanding operation using grid backup systems (emergency supplies).		P
4.1	**Functional safety**		P
	The safety must be assured under all operating conditions complying with the defined functions 4.3 to 4.6 and – if applicable – 4.8 of the disconnection device. The disconnection device can be an independent unit or an integrated part of the power generating unit and must switch off in case of a fault and indicate the fault status	Considered, see annex. The single fault safe system was reviewed. The theoretical investigation was verified by error simulation.	P
4.1.1	**Single fault tolerance**		P
	The disconnection device must comply with the single fault tolerance requirements of VDE-AR-N 4105:2011-08, A.6	Considered, functional explanation and table 6.1 below.	P
4.1.2	**Interface Switch**		P
	The interface switch must, in case it is integrated into a PV-inverter, comply with the requirements of DIN EN 62109-2(VDE 0126-14-2):2012-04, 4.4.4.15.2 and in all other cases with the requirements according to VDE-AR-N 4105:2011-08, 6.4.	Disconnection takes place redundant through two relays and the IGBT-full bridge in series. The relays and the IGBT-full bridge are able to switch the full current.	P
(6.4.1)	**General**		P
	For the connection of the power generation system to the network operator's low-voltage network or to the remaining customer system, it is necessary to use an interface switch. It consists of two electric switching devices connected in series and shall thus be constructed redundantly. The interface switch is controlled by the NS protection and activates automatically if at least one protective function responds. The breaking devices of the interface switch shall be designed to be short-circuit proof and shall be releasable without delay and with due regard to the protective devices required by clause 6.5. The breaking		P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	capacity of the two breaking devices of the interface switch shall be dimensioned at least in accordance with the responding range of the upstream safety fuse or the maximum short-circuit current contribution of the power generation system. Switches with at least breaking capacity shall be use for both breaking devices of the interface switch. In addition to that, all-pole disconnection shall be ensured.		
(6.4.2)	**Central interface switch**		N/A
	The two break devices of the central interface switch shall be executed as galvanic break devices. The two break devices of the interface switch shall be installed directly at the central meter panel in the circuit distributor of the power generation system.		N/A
(6.4.3)	**Integrated interface switch**		P
	Construction of the interface switch shall be carried out taking into consideration the single-fault tolerance. An interface switch ensures a single-fault tolerant all-phase galvanic breaking. For power generation systems with inverters, the interface switch shall be provided on the inverter's network side. A short circuit in the inverter shall not impair the switching function of the interface switch.		P
4.2	**Connection conditions**		P
	The connection, the reconnection after a grid-fault and the reconnection after short interruption shall be carried out according to VDE-AR-N 4105:2011-08, 8.3.1		P
(8.3.1)	**General**		P
	A power generation system shall be connected to the network operator's network only if a suitable device determines that both the mains voltage and the mains frequency are within the tolerance range of 85 % Un to 110 % Un or 47.5 Hz to 50.05 Hz, respectively, for a period of at least 60 seconds. If decoupling protection devices are tripped because of a short interruption, then the power generation system is permitted to already reconnect as soon as the mains voltage and mains frequency have uninterruptedly remained within the tolerance ranges given above for a period of 5 seconds. Short time interruptions are characterised by the NS protection settings of the mains frequency and/ or network voltage being exceeded or undershot for a maximum period of 3 seconds. The power generation system being reconnected to the network operator's network at the tripping of the decoupling protection device, the active power of controllable power generation systems supplied to the network operator's network shall not exceed the	Tested with a variable AC-Power supply at the output. Inverter disconnects within the limits, see table 6.2 below.	P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	gradient of 10 % of the active power per minute.		
4.3	**Monitoring the voltage**		P
4.3.1	**voltage drop U<**		P
	The disconnection because of a voltage drop shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
4.3.2	**rise-in-voltage U>>**		P
	The disconnection because of a rise-in-voltage shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
4.3.3	**slow rise-in-voltage U>**		P
	The disconnection because of a slow rise-in-voltage (10-minute-average) shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
4.4	**Monitoring the frequency**		P
	The disconnection because of a frequency decrease or a frequency increase shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.2	See appended table below.	P
(6.5.1)	**General**		P
	The purpose of the NS protection is to disconnect the power generation system from the net in the event of inadmissible voltage and frequency values. This is intended to prevent an unintentional feed-in of the power generation system into a power-supply unit separated from the remaining distribution network as well as the feed-in of faults within this network. The system operator shall himself take precautions to prevent damages to his systems and installations as might be caused by switching actions, voltage fluctuations and automatic reclosings in the network connected upstream or other process in the network of the network operator. The following functions of the decoupling protection shall be implemented: - Voltage drop protection *U* <; - Rise-in-voltage protection *U* >; - Rise-in-voltage protection *U* >>; - Frequency decrease protection *f* <; - Frequency increase protection *f* >; - Islanding detection. The setting values of the protective functions and the last five dated failure reports shall be readable at the NS protection. Interruptions of supply with durations of 3 s or longer shall not lead to loss of any of the failure reports. Read-out shall be possible at the central NS protection irrespective of the operational state of the		P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	power generation system and without any additional aids. For integrated NS protection read-out may be carried out using a data interface.		
(6.5.2)	**Protective functions**		P
	The protective functions of the NS protection shall be designed so that the disconnection time (the sum of the proper times of NS protection and interface switch plus a delay for the protection relay, which may or may not be adjustable) does not exceed 200 ms.		P
4.5	**Monitoring the dc current**		P
	A feed in of d.c current into the low-voltage grid due to defective equipment must lead to a switch off within 0.2 seconds. For this purpose the fault itself or a measurement of the dc component of the current exceeding 1 A can be used as disconnection criteria.	See appended table below.	P
4.6	**Detection of islanding operation**		P
	The disconnection because of a detection of unintended islanding operation shall be carried out according to VDE-AR-N 4105:2011-08, 6.5.1 and 6.5.3	See appended table below.	P
(6.5.3)	**Islanding detection**		P
	The islanding detection is implemented in the central NS protection or in the integrated NS protection of the power generation unit. If an islanding detection system acting on the integrated interface switch is integrated in all power generation units of a power generation system, then it is permitted to omit the islanding detection in the central NS protection regardless of the system power. Detection of an isolated network and disconnection of the power generation system by means of the interface switch shall be completed within 5 seconds.	See appended table below.	P
4.7	**Markings**		P
	A generating system equipped with an automatic disconnecting device shall be marked with the information “VDE 0126-1-1” which is visible from the outside. This can be done by — the marking plate or — showing it on a display of the disconnection device or — a separate marking		P
4.8	**Requirements for disconnection devices integrated into PV-inverters**		P
	The requirements of the DIN EN 62109-2 (VDE 0126-14-2):2012-04, 4.8 regarding the residual current detection and the insulation detection of the PV-generator shall be complied with.		P

DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
5	**General Requirements**		P
	Limits according to DIN EN 61000-6-3 (VDE 0839-6-3) regarding radio interferences must be complied with. For disturbance-free operation disturbance limits according to DIN EN 61000-6-2 (VDE 0839-6-2) shall be complied with.		P
6	**TYPE TESTING**		**P**
6.0	**General**		P
	The following tests are valid for integrated and separated disconnecting devices unless otherwise noted. A separate disconnection device must be tested together with a suitable supply. It has to be ensured that the turn-off signal is caused by the disconnection device and not by the supply.	See following test report	P
6.1	**Functional safety**		P
	The testing of the single fault tolerance and the error detection with following disconnection according to 4.1 is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.2.		P
6.2	**Connection conditions**		P
	The testing of the connection and the reconnection is carried out according to DIN VDE V 0124-100 (VDE V 0124):2012-07, 5.5.1 and 5.5.2.		P
6.3	**Monitoring the voltage**		P
	The testing of the voltage monitoring is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.3.		P
6.4	**Monitoring the frequency**		P
	The testing of the frequency monitoring is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.4.		P
6.5	**Monitoring the dc current**		P
	The testing of the disconnection due to feed in of direct current is carried out either by a) or b): a) The measuring device at the switching point (e.g. current transformer or resistance) is fed with direct current of 1 A. The cut-off must be carried out within 0.2 seconds. b) By means of a fault simulation it is measured if a defective system operation with a d.c. fault current of more than 1 A leads to cut-off within 0.2 seconds.		P
6.6	**Detection of islanding operation**		P

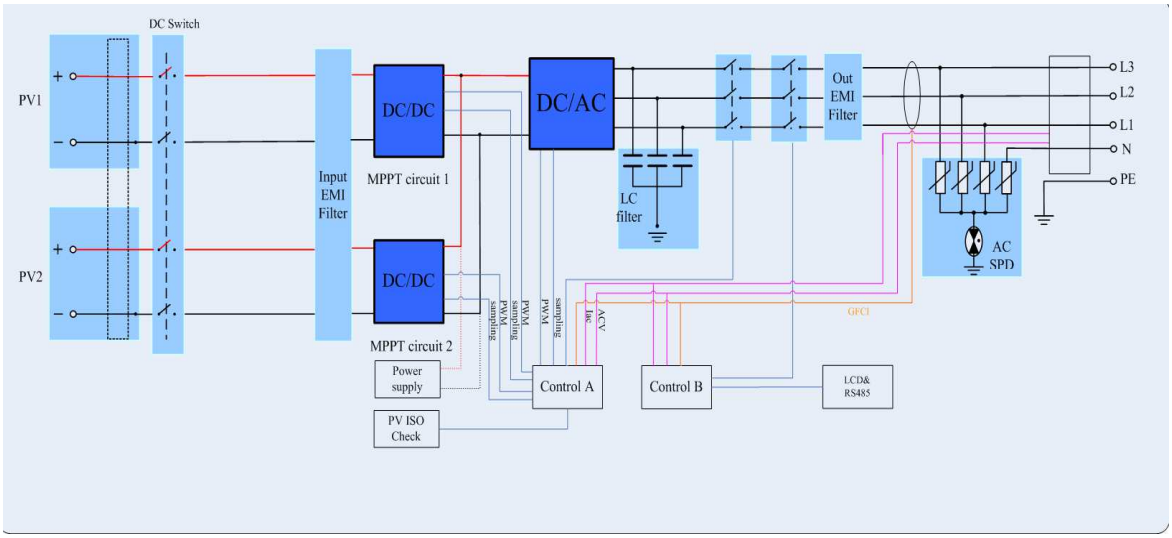
DIN V VDE V 0126-1-1:2013.08			
Clause	Requirement - Test	Result - Remark	Verdict
	The testing of the disconnection due to unintended islanding operation is carried out according to DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.6.		P
7	**Routine Test**		**P**
	The manufacturer has to carry out routine tests regarding all safety relevant functions before delivering an automatic disconnection device.		P
8	**Construction Specification**		**P**
	Initial tests and re-examination in addition to the routine tests may be omitted. If the disconnection device is a separate unit it must not be used in a TN-C power system. In this case a TN-C-S power system must be created.		P

6.1 (5.4.5.1 & 5.4.5.2)	TABLE: General requirements	P

Design of functional safety:

The internal control is redundant built. It consists of Microcontroller main CPU (Control A) and slave CPU (Control B).
The main CPU control the relays by switching signals; measures the PV voltage, current and voltage, measures grid voltage, frequency, AC current with injected DC and the array insulation resistance to ground. In addition it tests the current sensors and the RCMU circuit before each start up.
The CPU (Control B) is measures the grid voltage and residual current measuring, also can switch off the relays independently, and communicate with CPU (Control A) each other.
The current is measured by a current sensor. The AC current signal and the injected DC current signal are sent to the main CPU. The main CPU tests and calibrates before each start up all current sensors.

The unit provides two relays in series in all output conductors. When single fault applied to one relay, alarm an error code in display panel, another redundant relay provides basic insulation maintained between the PV array and the mains. All the relays are tested before each start up.



Supplementary information:

Two series relays would be automatically checked before the inverter starts operation

String	1	U_{DC} = Un	600Vdc	Uac = Un	230Vac	P = (W)	12K

Component No.	Fault	Observation
EC2	SC	PCE Shutdown, C43, C44 damaged. No hazard.
R131	SC	LCD displays 'ID27' for three times and than displays 'ID69'. Recoverable. No hazard, no damaged.
C3	SC	LCD displays 'ID02'.Recoverable. No hazard, no damaged.
R27	SC	LCD displays 'ID24' for three times and than displays 'ID67'. Recoverable. No hazard, no damaged.
R26	OC	LCD displays 'ID02'. Recoverable. No hazard, no damaged.
R39	SC	LCD displays 'ID24' for three times and than displays 'ID67'. Recoverable. No hazard, no damaged.
R246	SC	LCD displays 'ID27'. Recoverable. No hazard, no damaged.
Q25 pin1-2	SC	LCD displays 'ID52'. Recoverable. No hazard, no damaged.
C20	SC	PCE Shutdown, D1, D3 No damaged. No hazard.

RL1 Pin3-4	SC	The EUT cannot start, LCD displays “ID55’. Recoverable. No hazard, no damaged.
RL3 Pin3-4	SC	The EUT cannot start, LCD displays “ID55’. Recoverable. No hazard, no damaged.
RL5 Pin3-4	SC	The EUT cannot start, LCD displays “ID55’. Recoverable. No hazard, no damaged.
C394	SC	PCE Shutdown, LCD displays ‘ID53’. Recoverable. No hazard, no damaged.
CC209	SC	PCE Shutdown, Q9 damaged. No hazard.
CC243	SC	PCE Shutdown, LCD displays ‘ID53’. Recoverable. No hazard, no damaged.
Qc40 D-S	SC	PCE Shutdown, LCD displays ‘ID14’. Recoverable. No hazard, no damaged.
RL6	SC	PCE Shutdown, LCD displays ‘ID55’. Recoverable. No hazard, no damaged.
RL4	SC	PCE Shutdown, LCD displays ‘ID55’. Recoverable. No hazard, no damaged.
RL2	SC	PCE Shutdown, LCD displays ‘ID55’. Recoverable. No hazard, no damaged.
R162	SC	PCE Shutdown, LCD displays ‘ID24’. Recoverable. No hazard, no damaged.

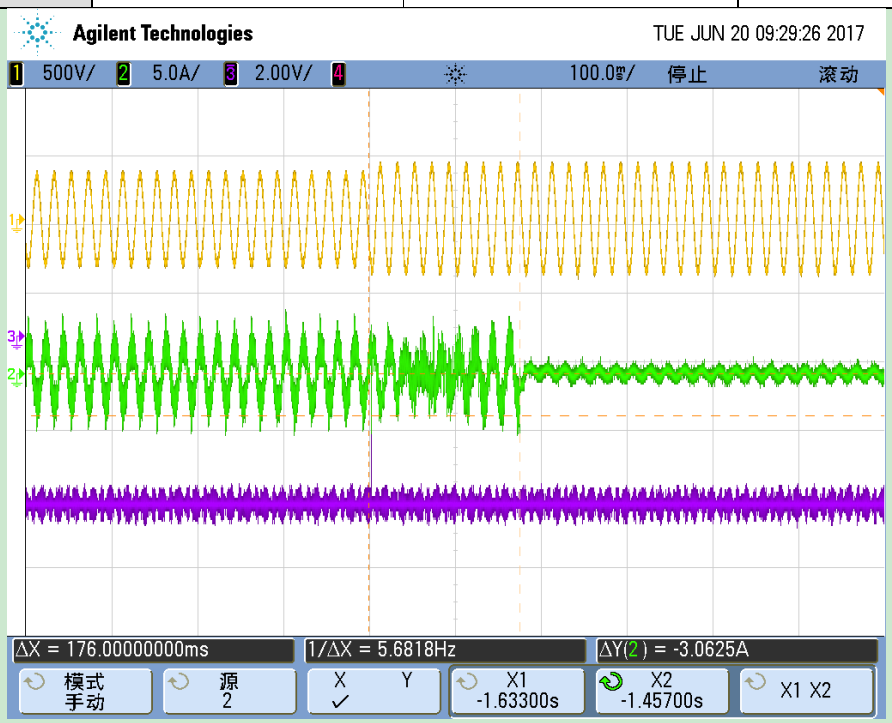
Supplementary information:
SC: Short-circuited; OC: Open-circuited; O/L: Overloaded.

During the test:
Fire do not propagates beyond the EUT; Equipment do not emit molten metal;
Enclosures do not deform to cause non-compliance with the standard.
Pass the dielectric test.

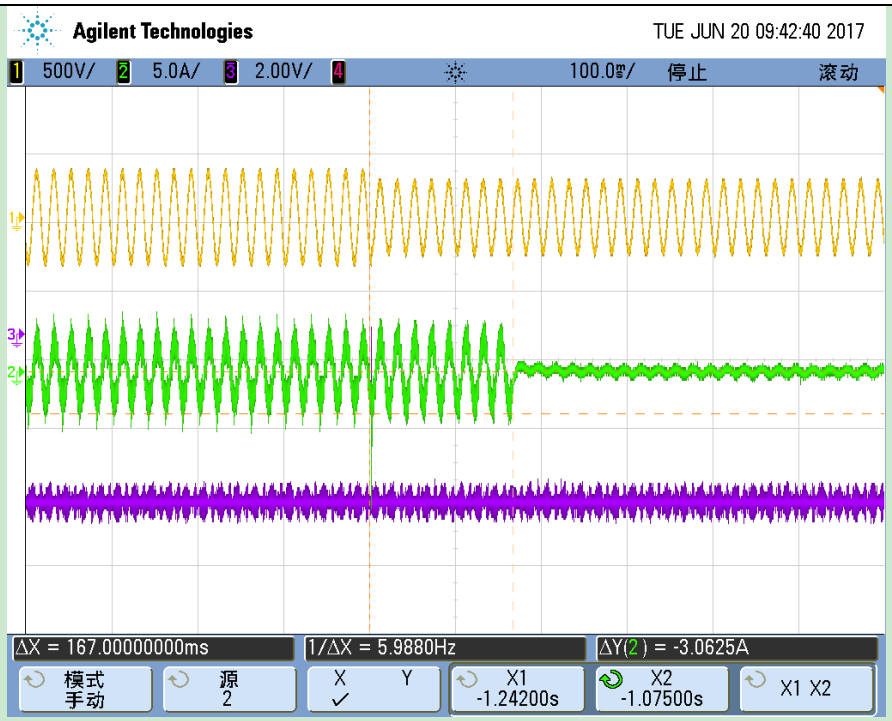
6.2 (5.5.1)	**Connection conditions**		**P**
For Hiverter Si-12K			
DC input:	AC output:		Rated Output Power
600Vdc	230Vac; 50Hz		12000W
Measure Item	Reconnection?		Reconnection Time (>180s)
f_{ist} = 47,45Hz	☐ Yes	☒ No	Cannot reconnection
f_{ist} ≥ 47,55Hz	☒ Yes	☐ No	182.0s
f_{ist} = 50,1Hz	☐ Yes	☒ No	Cannot reconnection
f_{ist} ≤ 50,0Hz	☒ Yes	☐ No	182.0s
U_{ist} < 85% U_n	☐ Yes	☒ No	Cannot reconnection
U_{ist} ≥ 85% U_n	☒ Yes	☐ No	184.0s
U_{ist} > 110% U_n	☐ Yes	☒ No	Cannot reconnection
U_{ist} ≤ 110% U_n	☒ Yes	☐ No	180.0s

6.2 (5.5.2)	**Short-time Interruption**		**P**
For Hiverter Si-12K			
	Reconnection time		
	1	2	3
After 2s of 77% Un	182.0s	182.0s	182.0s
After 4s of 77% Un	182.0s	182.0s	182.0s

6.3 (5.4.5.3)	Monitoring the voltage (Results of Voltage monitoring)		P
For Hiverter Si-12K			
Rated Voltage (Un)	230Vac	Rated Frequency	50Hz
	1	2	3
115% Un (R phase)	163.0ms	166.0ms	165.0ms
115% Un (S phase)	148.0ms	154.0ms	175.0ms
115% Un (T phase)	166.0ms	169.0ms	158.0ms
115% Un (RST phase)	145.0ms	156.0ms	176.0ms
80% Un (R phase)	156.0ms	153.0ms	157.0ms
80% Un (S phase)	161.0ms	160.0ms	154.0ms
80% Un (T phase)	149.0ms	150.0ms	169.0ms
80% Un (RST phase)	165.0ms	167.0ms	154.0ms



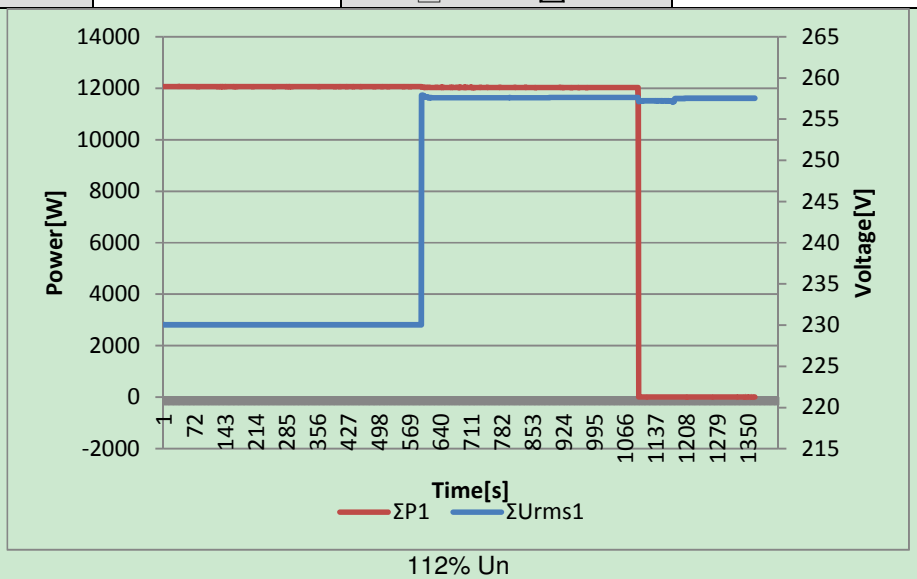
115% Un



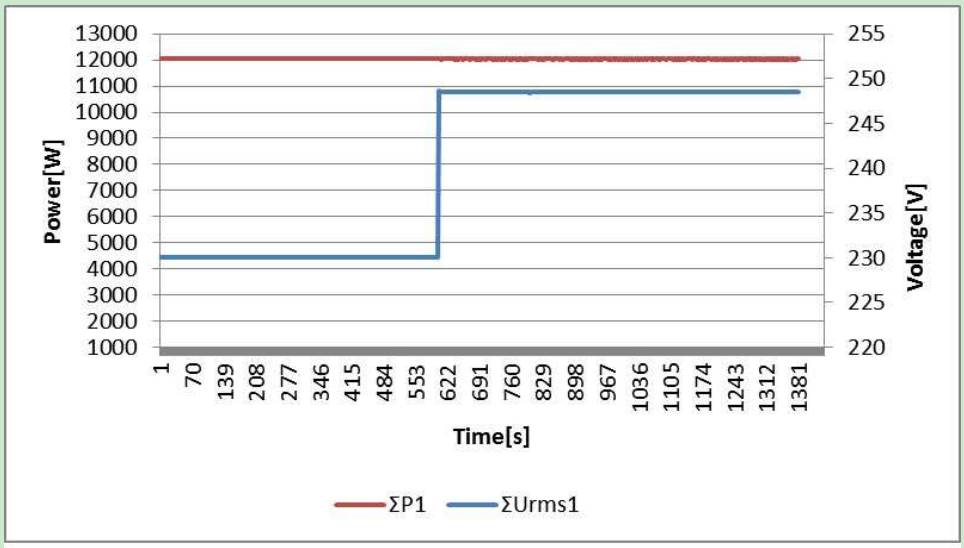
80% Un

Colour Yellow represent Voltage of output, Green represent current of output, Purple represent trip signal

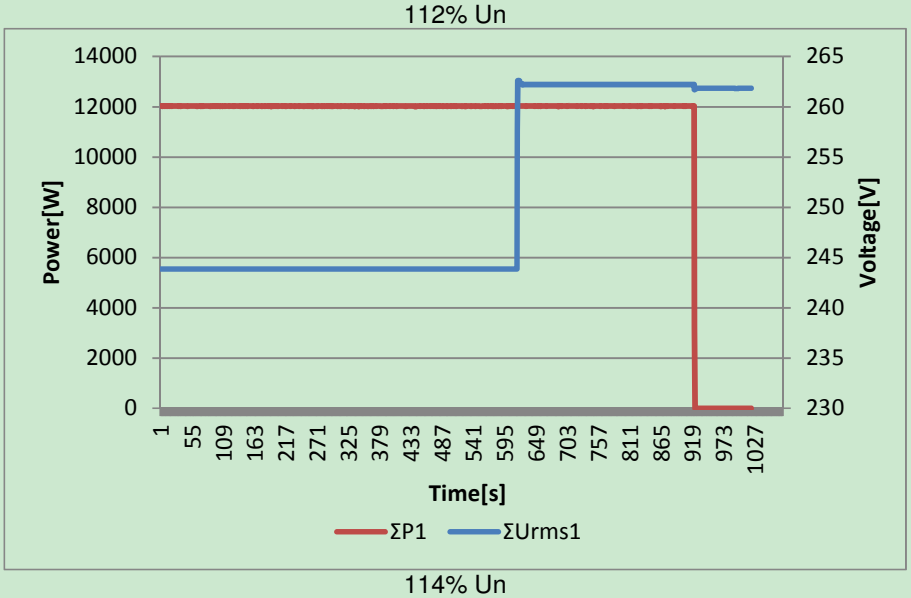
6.3 (5.4.5.3)	Monitoring the voltage (Results of the Protection of the Increase in Voltage as 10-min moving average)		P
	Output Voltage （V）	Switch	
		On/Off state Finally	Time until Switch off (s)
100% Un	230.0	☒On ☐Off	Work normally
112% Un	257.6	☐On ☒Off	492s
100% Un	230.0	☒On ☐Off	Work normally
108% Un	248.4	☒On ☐Off	Work normally
106% Un	243.8	☒On ☐Off	Work normally
114% Un	262.2	☐On ☒Off	298s



112% Un

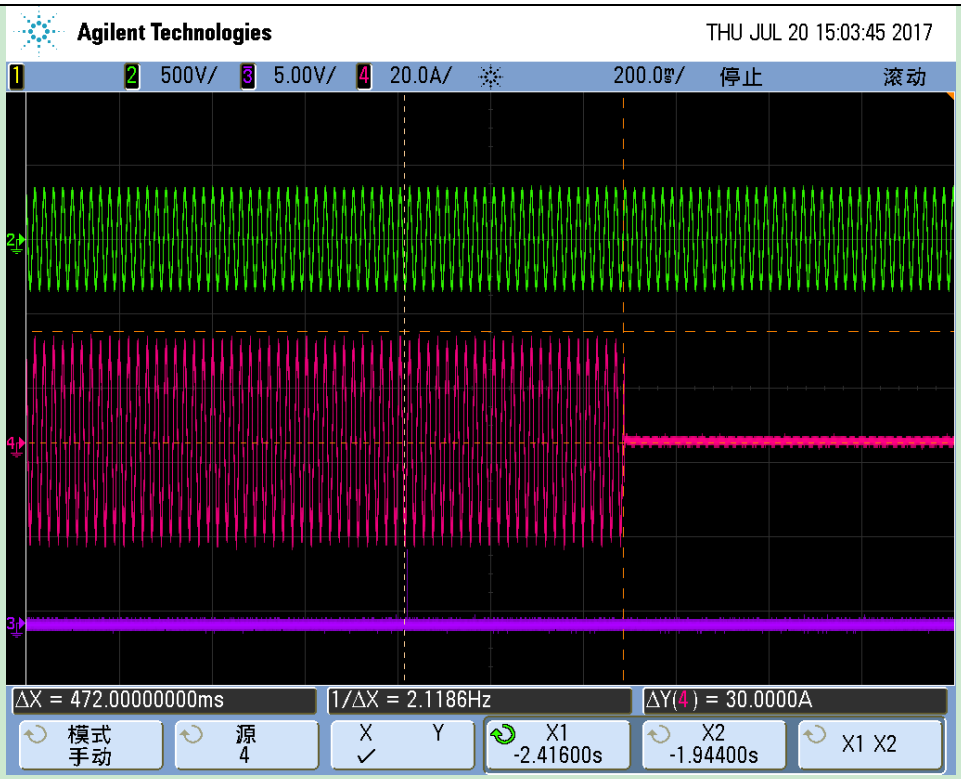


112% Un

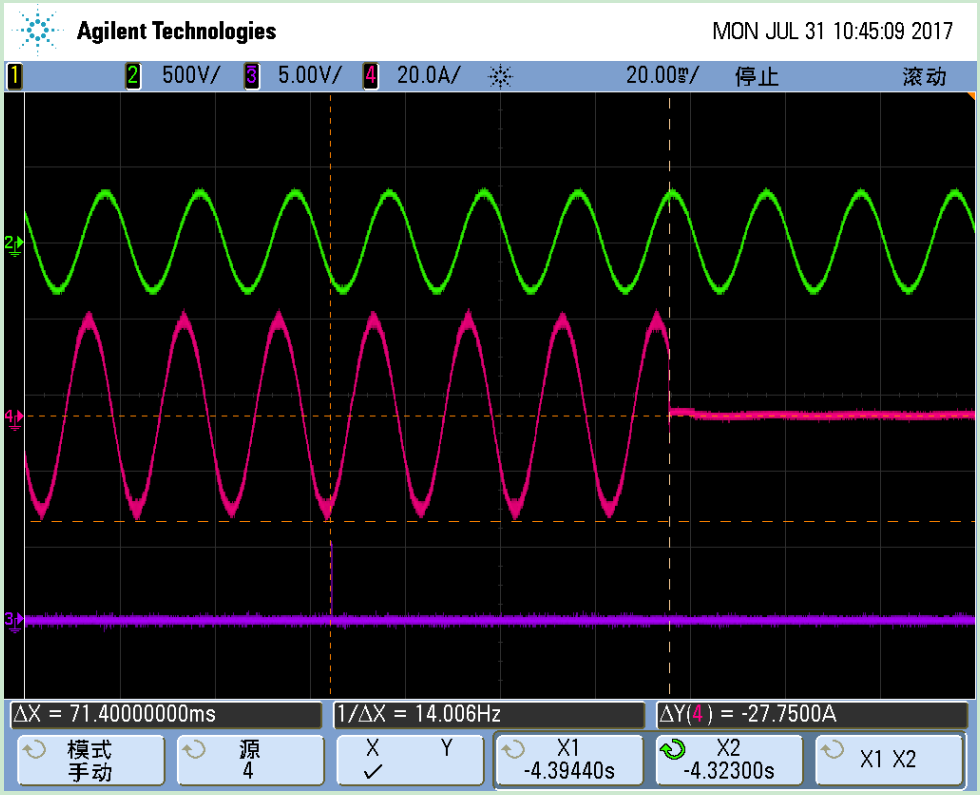


114% Un

6.4 (5.4.5.4)	**Monitoring the frequency(VFR 2013)**					**P**
	1		2		3	
	f (Hz)	Trip time (ms)	f (Hz)	Trip time (ms)	f (Hz)	Trip time (ms)
Frequency decrease	47.50	163.0	47.50	165.0	47.50	166.0
Frequency increase	50.41	71.4	50.41	70.2	50.41	71.0
6.4 (5.4.5.4)	**Monitoring the frequency(VFR 2014)**					**P**
	1		2		3	
	f (Hz)	Trip time (ms)	f (Hz)	Trip time (ms)	f (Hz)	Trip time (ms)
Frequency decrease	47.50	163.0	47.50	165.0	47.50	166.0
Frequency increase	50.61	59.0	50.61	67.6	50.61	69.2



Frequency decrease



Frequency increase

6.5	TABLE: Monitoring the dc current	P
P = 0.25 P_N= (W)	3000W	
Feed-in current = 1.0 A d.c., Cut-off current = (ms)	146ms	
P = 0.5 P_N= (W)	6000W	
Feed-in current = 1.0 A d.c., Cut-off current = (ms)	155ms	
P = 1.0 P_N= (W)	12000W	
Feed-in current = 1.0 A d.c., Cut-off current = (ms)	137ms	

25%P

50%P

100%P

Yellow represent trip of signal, Purple represent current of output

6.6 (5.4.6)	TABLE: Detection of islanding operation				P
Test conditions:	Frequency: 50+/-0,2Hz U_N=230+/-3Vac RLC consumes inverter real power within +/-3% Distortion factor of chokes <3% Quality Q>2				
P = 1.0 P_N = (W)	12230W	P = 0.5 P_N = (W)	6310W	P = 0.25 P_N = (W)	3395W
Q_L = 12920 Var	Cut-off time (s)	Q_L = 7080 Var	Cut-off time (s)	Q_L = 3800 Var	Cut-off time (s)
95%	0.943	95%	1.079	95%	0.791
96%	1.040	96%	0.944	96%	0.993
97%	0.979	97%	0.982	97%	0.958
98%	1.049	98%	0.985	98%	1.036
99%	1.056	99%	1.146	99%	0.990
100%	1.067	100%	0.935	100%	0.113
101%	1.131	101%	0.933	101%	0.109
102%	1.081	102%	1.029	102%	0.111
103%	1.058	103%	1.007	103%	0.108
104%	0.971	104%	0.239	104%	0.098
105%	0.958	105%	0.192	105%	0.089

100%P,101% Q_L

50%P,99% Q_L

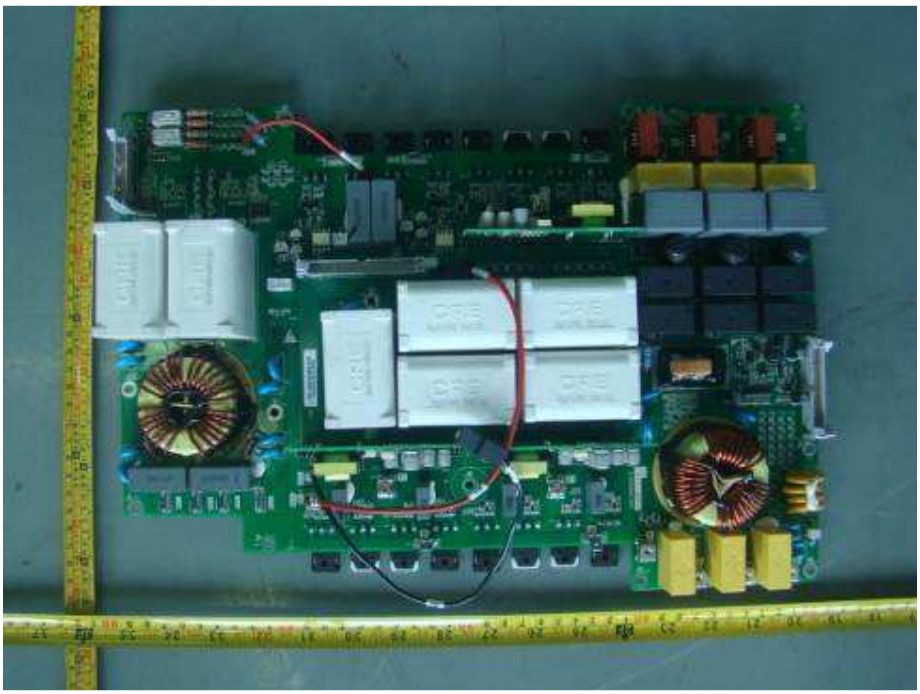
CH13 : 100.00V/div
Position : -0.09 div
Display Group
AcqMode : Normal
20kS/s 1s/div
光标
类型
垂直
通道
CH9
光标1
1.076div
光标2
2.112div
光标跳转
项目设定
X1 -3.93395s
X2 -2.89795s
ΔX 1.03600s
Y1:CH9 0.025A
Y2:CH9 0.016A
ΔY -0.009A
RMS :CH9 463.806mA
RMS :CH10 481.284mA
RMS :CH11 286.838mA
RMS :CH12 161.941V
RMS :CH13 162.404V
RMS :CH14 161.352V
Stopped
2017/05/11 14:53:07.21218088
Auto
2017/05/11 14:53:57

25%P, 98% Q_L

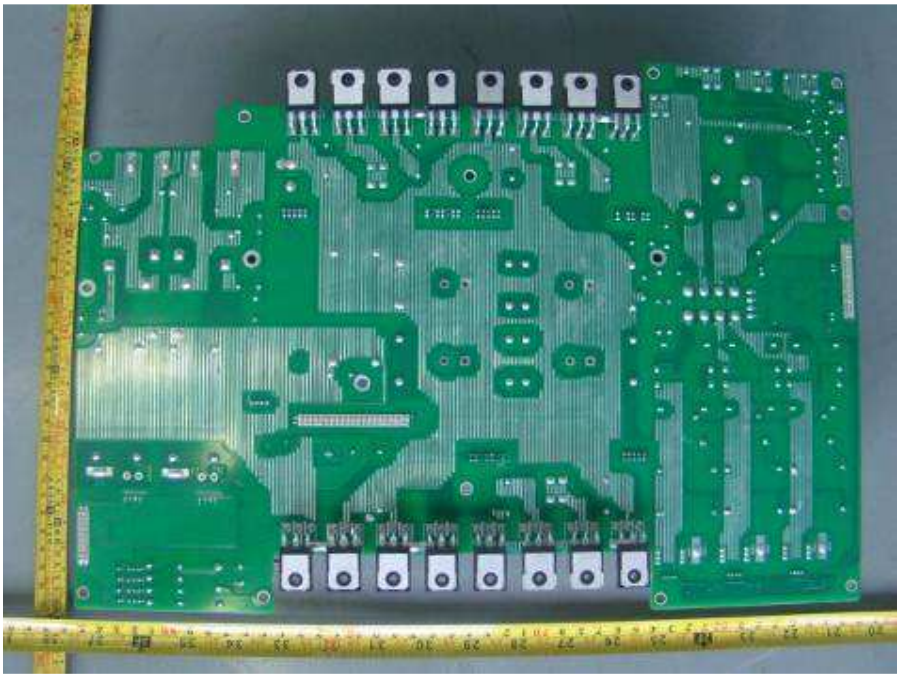
Appendix photos

Overview

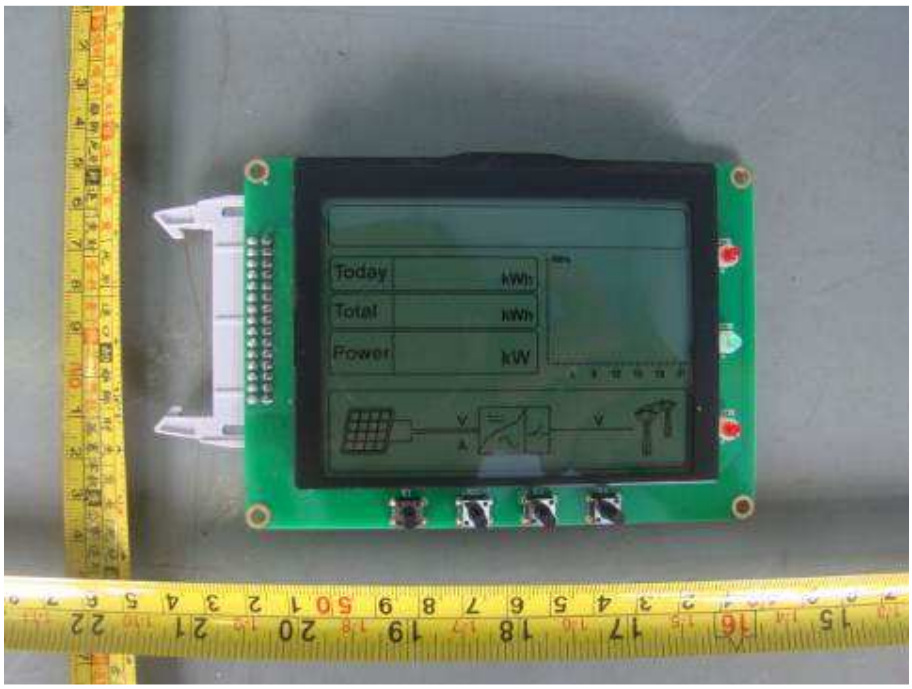
Heatsink view



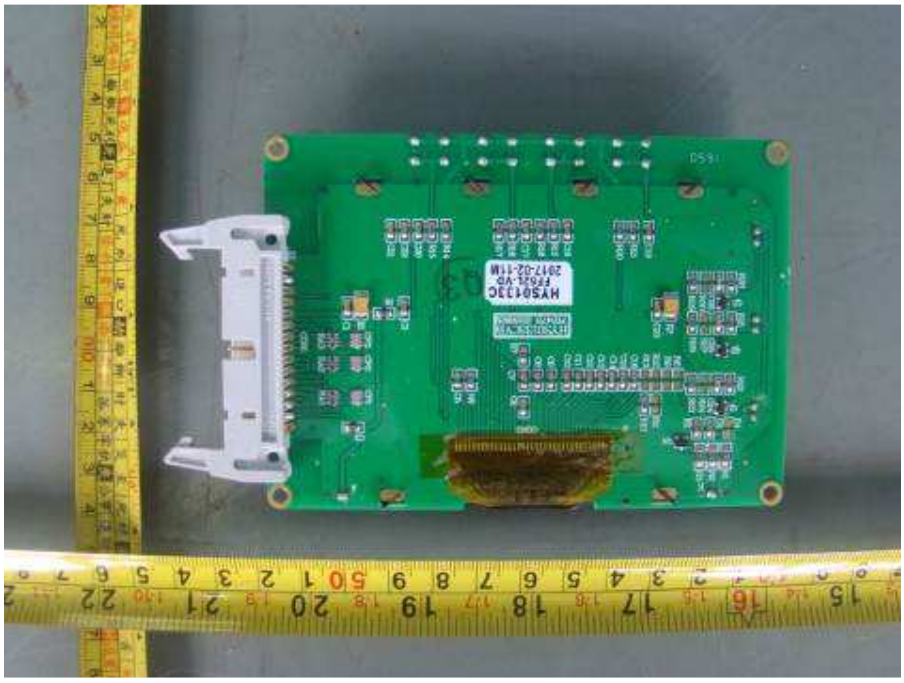
Main board view



Main board view

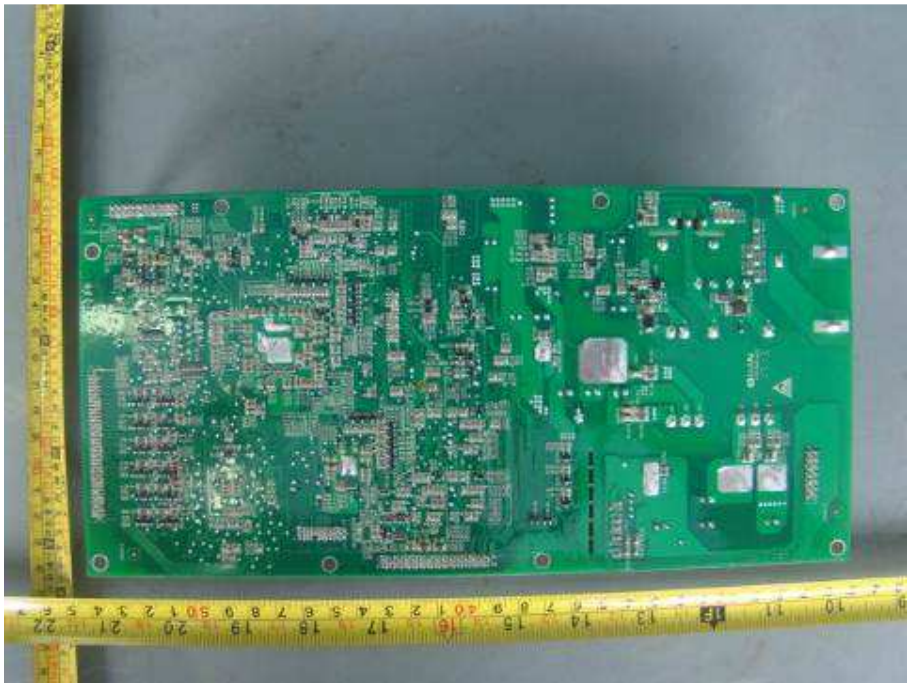


LCD board

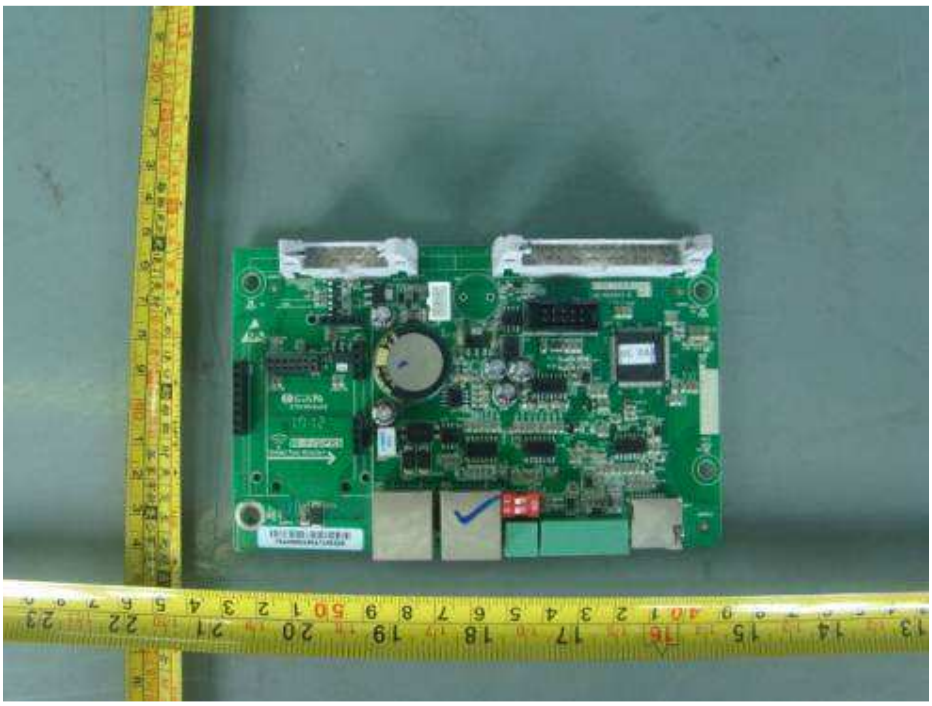


LCD board

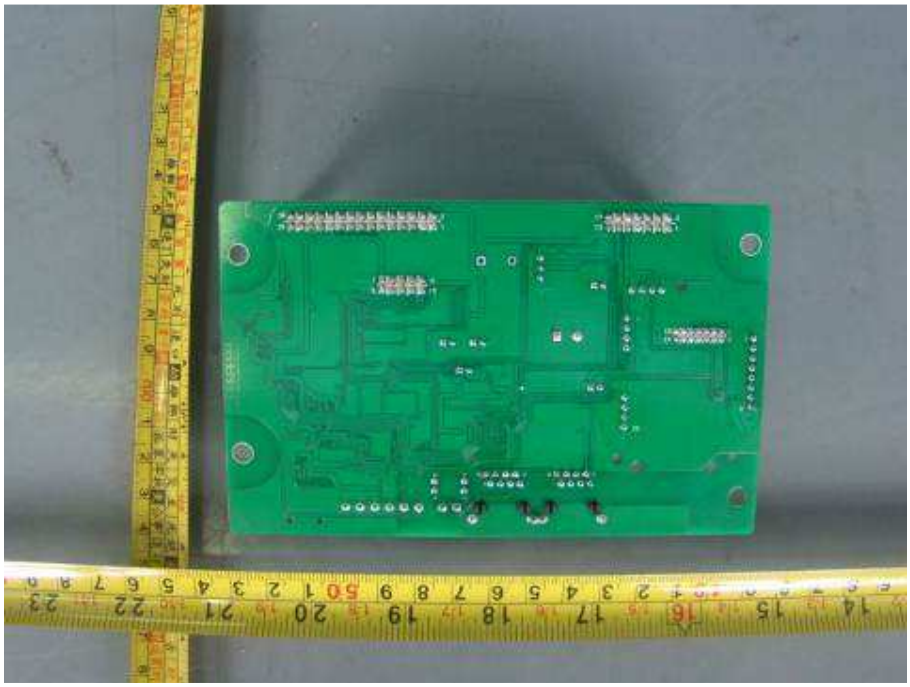
Control board



Control board

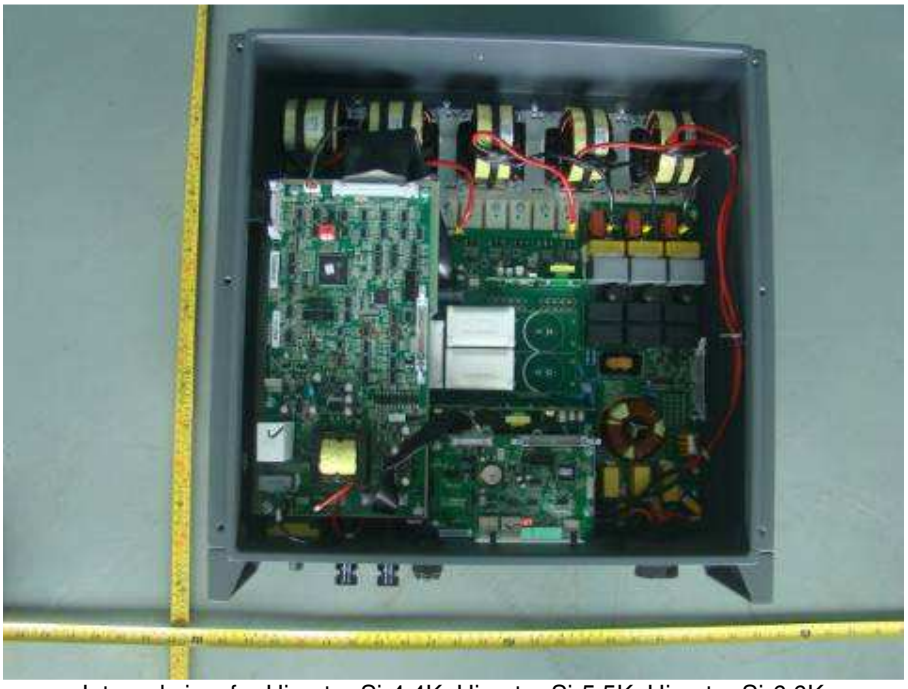


Communication board



Communication board

Internal view for Hiverter Si-8.8K, Hiverter Si-11K, Hiverter Si-12K



Internal view for Hiverter Si-4.4K, Hiverter Si-5.5K, Hiverter Si-6.6K

Input/output terminal view

----------End of report----------