

Certificate of Conformity

No. ESY 124661 0021 Rev. 00

Holder of Certificate: **Zhejiang Inventronics New Energy Technology Co., Ltd.**

West Section 2nd Floor, South Building
Building 1, No.88, Huancheng South Road
Tonglu Economic Development Zone
Tonglu County
311500 Hangzhou City, Zhejiang Province
PEOPLE'S REPUBLIC OF CHINA

Product: **Converter
(Hybrid Inverter)**

Model(s): **HHB-05K000CRLV**


Parameters: See page 2

Applicable standards: VDE-AR-N 4105:2018
DIN VDE V 0124-100 (VDE V 0124-100):2020

This Certificate of Conformity confirms the compliance with the above listed standards on a voluntary basis. It refers only to the sample submitted to TÜV SÜD Product Service GmbH and does not certify the quality or safety of the serial products. It was issued according to TÜV SÜD Product Service certification program Photovoltaics and Grid Integration. For details see: www.tuvsud.com/ps-cert

Test report no.: 64290233214401

Date, 2024-04-18



(Billy Qiu)

Certificate of Conformity

No. ESY 124661 0021 Rev. 00

Parameters:

Model	HHB-05K000CRLV
PV terminal parameters	
Maximum PV voltage [V_{DC}]	580
Rated voltage [V_{DC}]	300
MPPT voltage range [V_{DC}]	125 - 550
MPPT voltage range (full load) [V_{DC}]	360 - 550
Maximum input current [A_{DC}]	13/13
Isc PV [A_{DC}]	14/14
MPPT tracker number	2
Maximum input power [W]	6000
Battery input/output parameters	
Battery type	Li-ion
Battery rated voltage [V_{DC}]	48
Battery voltage range [V_{DC}]	40 - 58
Maximum charge power [W]	4200
Maximum discharge power [W]	4600
Maximum charge current [A_{DC}]	70
Maximum discharge current [A_{DC}]	100
Grid input terminal parameters	
Rated input voltage [V_{AC}]	1P+N+PE, 230
Rated input frequency [Hz]	50
Maximum continuous input current [A_{AC}]	20.9
Maximum continuous input active power [W]	4600
Maximum continuous input apparent power [VA]	4600
Grid output terminal parameters	
Rated output voltage [V_{AC}]	1P+N+PE, 230
Rated output frequency [Hz]	50
Rated output current [A_{AC}]	20
Maximum continuous output current [A_{AC}]	20.9
Rated output active power [W]	4600
Maximum output active power [W]	4600
Maximum output apparent power [VA]	4600
Maximum output active power $P_{E_{max}}$ [W]	4562
Maximum output apparent power $S_{E_{max}}$ [VA]	4570
Power factor range	0.95 under-excited to 0.95 over-excited

Certificate of Conformity

No. ESY 124661 0021 Rev. 00

E.4 Unit certificate

Unit Certificate		
Manufacturer	Zhejiang Inventronics New Energy Technology Co., Ltd.	
Power generation unit type	[Hybrid Inverter]: HHB-05K000CRLV	
Assessment values	max. active power $P_{E_{max}}$	4562 W (HHB-05K000CRLV)
	max. apparent power $S_{E_{max}}$	4570 VA (HHB-05K000CRLV)
	Rated voltage	230 V _{AC} (HHB-05K000CRLV)
	Rated current (AC) I_r	20.0 A _{AC} (HHB-05K000CRLV)
	Initial short-circuit AC current I''_k	14.0 A _{AC} (HHB-05K000CRLV)
Network connection rule	VDE-AR-N 4105:2018-11 “Generators connected to the low-voltage distribution network” Technical minimum requirements for connection and parallel operation of power generation systems connected to the low-voltage network	
Test requirement	DIN VDE V 0124-100 (VDE V 0124-100):2020-06 “Network integration of power generation systems – Low voltage” Test requirements for power generation units intended for connection to and parallel operation on the low-voltage network	
Test report	64.290.23.32144.01 from 2024-01-10	
The above designated power generation unit meets the requirements of VDE-AR-N 4105:2018-11		

Certificate of Conformity

No. ESY 124661 0021 Rev. 00

E.5 Test report "Network interactions" for power generation units with an input current > 75 A

Extract of the test report for power generation units "Determination of electrical properties"		
System manufacturer:	<u>Zhejiang Inventronics New Energy Technology Co., Ltd.</u> <u>West Section 2nd Floor, South Building</u> <u>Building 1, No.88, Huancheng South Road</u> <u>Tonglu Economic Development Zone</u> <u>Tonglu County</u> <u>311500 Hangzhou City, Zhejiang Province</u> <u>PEOPLE'S REPUBLIC OF CHINA</u>	
Manufacturer indications:	Type of system	Hybrid Inverter
	Max. active power P_{Emax}	4562 W (HHB-05K000CRLV)
	Rated voltage	230 V _{AC} (HHB-05K000CRLV)
Measurement period:	<u>From 2020-03-01 to 2020-04-10, 2021-03-15 to 2021-04-29, 2022-</u> <u>03-14 to 2022-03-24</u>	

Rapid voltage changes	
Model	<u>HHB-05K000CRLV</u>
Connection without provisions (regarding the primary energy carrier)	$K_i=0.08$
Most adverse case when switching between generator levels	$K_i=0.41$
Connection at nominal conditions (of the primary energy carrier)	$K_i=0.16$
Disconnection at rated power	$K_i=0.69$
Worst value of all switching operations	$K_{imax}=0.69$

Voltage fluctuations and flicker						
Simulated network frequency (Hz)	50Hz	Short circuit power S_k (VA)	187k			
Plt (Maximum measured Pst)	0.08	EZE nominal power (Pn)	4.6 kVA			
Maximum flicker coefficient $C_{\phi k}$	3.25	--	--			
Pst	#1	#2	#3	#4	#5	#6
L1-N	0.07	0.07	0.07	0.07	0.07	0.07
Pst	#7	#8	#9	#10	#11	#12
L1-N	0.07	0.07	0.07	0.07	0.08	0.08

Certificate of Conformity

No. ESY 124661 0021 Rev. 00

Harmonics (>16 A and ≤75 A) (HHB-05K000CRLV)												
Active power P/Pn[%]	0	10	20	30	40	50	60	70	80	90	100	Limit
Ordinal number	Ih/Iref [%]											[%]
0	0.02%	0.01%	0.02%	0.03%	0.02%	0.05%	0.06%	0.06%	0.05%	0.03%	0.01%	0.5
1	2.31%	10.54%	20.24%	29.86%	39.83%	50.08%	60.32%	69.55%	79.78%	89.90%	99.02%	--
2	0.03%	0.04%	0.04%	0.04%	0.04%	0.04%	0.03%	0.03%	0.03%	0.03%	0.04%	8.0
3	1.04%	0.87%	1.46%	1.89%	2.15%	2.31%	2.47%	2.62%	2.77%	2.95%	3.12%	5.0
4	0.07%	0.08%	0.09%	0.09%	0.09%	0.09%	0.09%	0.09%	0.09%	0.09%	0.09%	4.0
5	0.78%	0.75%	0.43%	0.74%	0.88%	0.95%	1.00%	1.06%	1.13%	1.21%	1.26%	10.7
6	0.03%	0.08%	0.03%	0.04%	0.04%	0.04%	0.04%	0.03%	0.03%	0.03%	0.03%	2.7
7	0.30%	0.24%	0.11%	0.40%	0.61%	0.69%	0.70%	0.67%	0.63%	0.62%	0.64%	7.2
8	0.17%	0.17%	0.18%	0.16%	0.15%	0.14%	0.13%	0.14%	0.14%	0.14%	0.14%	2.0
9	0.24%	0.22%	0.28%	0.13%	0.37%	0.46%	0.53%	0.61%	0.65%	0.67%	0.64%	3.8
10	0.31%	0.31%	0.37%	0.41%	0.43%	0.45%	0.45%	0.45%	0.45%	0.45%	0.46%	1.6
11	0.13%	0.15%	0.12%	0.14%	0.10%	0.28%	0.37%	0.30%	0.22%	0.32%	0.48%	3.1
12	0.19%	0.17%	0.20%	0.22%	0.23%	0.22%	0.21%	0.19%	0.20%	0.18%	0.18%	1.3
13	0.06%	0.05%	0.06%	0.04%	0.15%	0.22%	0.14%	0.21%	0.32%	0.39%	0.38%	2.0
14	0.15%	0.15%	0.18%	0.20%	0.22%	0.25%	0.25%	0.27%	0.28%	0.28%	0.31%	--
15	0.05%	0.03%	0.05%	0.05%	0.09%	0.12%	0.19%	0.21%	0.16%	0.17%	0.22%	--
16	0.12%	0.12%	0.14%	0.15%	0.16%	0.17%	0.17%	0.18%	0.19%	0.19%	0.21%	--
17	0.02%	0.04%	0.07%	0.07%	0.05%	0.15%	0.16%	0.17%	0.22%	0.21%	0.19%	--
18	0.06%	0.04%	0.06%	0.06%	0.07%	0.05%	0.05%	0.05%	0.05%	0.04%	0.05%	--
19	0.03%	0.02%	0.02%	0.08%	0.02%	0.06%	0.15%	0.17%	0.16%	0.21%	0.22%	--
20	0.06%	0.07%	0.09%	0.09%	0.10%	0.11%	0.10%	0.11%	0.12%	0.12%	0.12%	--
21	0.04%	0.03%	0.03%	0.06%	0.03%	0.05%	0.07%	0.14%	0.17%	0.17%	0.19%	--
22	0.05%	0.06%	0.07%	0.07%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.10%	--
23	0.02%	0.03%	0.02%	0.03%	0.03%	0.04%	0.08%	0.07%	0.12%	0.15%	0.15%	--
24	0.03%	0.03%	0.03%	0.03%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	--
25	0.03%	0.02%	0.03%	0.03%	0.03%	0.03%	0.06%	0.09%	0.07%	0.11%	0.13%	--
26	0.04%	0.04%	0.04%	0.05%	0.06%	0.06%	0.07%	0.07%	0.07%	0.07%	0.07%	--
27	0.03%	0.02%	0.03%	0.02%	0.04%	0.02%	0.05%	0.07%	0.10%	0.08%	0.11%	--
28	0.04%	0.04%	0.04%	0.04%	0.05%	0.05%	0.05%	0.05%	0.06%	0.06%	0.06%	--
29	0.03%	0.02%	0.02%	0.02%	0.04%	0.02%	0.03%	0.06%	0.07%	0.09%	0.10%	--
30	0.02%	0.03%	0.02%	0.02%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.02%	--
31	0.04%	0.02%	0.02%	0.02%	0.03%	0.02%	0.02%	0.05%	0.07%	0.08%	0.10%	--
32	0.03%	0.02%	0.03%	0.04%	0.04%	0.04%	0.04%	0.05%	0.05%	0.05%	0.05%	--
33	0.04%	0.02%	0.02%	0.02%	0.03%	0.03%	0.02%	0.04%	0.06%	0.07%	0.08%	--
34	0.03%	0.06%	0.03%	0.04%	0.04%	0.04%	0.03%	0.04%	0.04%	0.05%	0.07%	--
35	0.03%	0.02%	0.02%	0.02%	0.02%	0.03%	0.02%	0.04%	0.04%	0.06%	0.07%	--
36	0.05%	0.03%	0.05%	0.04%	0.03%	0.03%	0.04%	0.05%	0.08%	0.11%	0.14%	--
37	0.04%	0.02%	0.03%	0.03%	0.03%	0.04%	0.03%	0.05%	0.06%	0.06%	0.07%	--
38	0.02%	0.09%	0.08%	0.07%	0.07%	0.09%	0.12%	0.18%	0.25%	0.30%	0.35%	--
39	0.04%	0.02%	0.02%	0.02%	0.02%	0.03%	0.03%	0.04%	0.05%	0.06%	0.06%	--
40	0.24%	0.21%	0.27%	0.31%	0.34%	0.40%	0.46%	0.55%	0.66%	0.71%	0.73%	--
THD	1.46%	1.31%	1.67%	2.18%	2.53%	2.76%	2.95%	3.13%	3.31%	3.53%	3.72%	13
PWHD	1.90%	1.77%	2.15%	2.44%	2.64%	3.07%	3.59%	4.29%	5.08%	5.54%	5.90%	22
Remark: Iref=20.0 A												

Certificate of Conformity

No. ESY 124661 0021 Rev. 00

E.6 Certificate of the network and system protection

Certificate of NS protection		
Manufacturer	Zhejiang Inventronics New Energy Technology Co., Ltd.	
Type of NS protection	Integrated NS protection	
Central NS protection	<input type="checkbox"/>	
Integrated NS protection	<input checked="" type="checkbox"/>	Assigned to power generation unit of type: <u>HHB-05K000CRLV</u> .
Network connection rule	VDE-AR-N 4105:2018-11 “Generators connected to the low-voltage distribution network” Technical minimum requirements for connection and parallel operation of power generation systems connected to the low-voltage network	
Test requirement	DIN VDE V 0124-100 (VDE V 0124-100):2020-06 “Network integration of power generation systems – Low voltage” Test requirements for power generation units intended for connection to and parallel operation on the low-voltage network	
Test report	<u>64.290.23.32144.01</u> from <u>2024-01-10</u>	
The network and system protection designated above meets the requirements of VDE-AR-N 4105:2018-11.		

Certificate of Conformity

No. ESY 124661 0021 Rev. 00

E.7 Requirement for the test report for the NS protection

Extract from test report for NS protection			
“Determination of electrical properties”			
NS protection test report			
Type of NS system:	Integrated NS protection		Other Manufacturer indications
Software version:	A02		
Manufacturer:	Zhejiang Inventronics New Energy Technology Co., Ltd. West Section 2nd Floor, South Building Building 1, No.88, Huancheng South Road Tonglu Economic Development Zone Tonglu County 311500 Hangzhou City, Zhejiang Province PEOPLE'S REPUBLIC OF CHINA		
Measuring period:	From 2020-03-01 to 2020-04-10, 2021-03-15 to 2021-04-29, 2022-03-14 to 2022-03-24		
		Inverter	
Protection function	Setting value	Tripping value	Tripping time NS protection*
Rise-in-voltage protection $U >>$	$1.25 * U_n$	L1-N/L2-N/L3-N: --; L1-N: 288.8 V; L2-N: --; L3-N: --;	L1-N/L2-N/L3-N: --; L1-N: 132.2 ms; L2-N: --; L3-N: --;
Rise-in-voltage protection $U >$	$1.10 * U_n$	$1.10 * U_n$	ms**
Voltage drop protection $U <$	$0.8 * U_n$	L1-N/L2-N/L3-N: --; L1-N: 183.1 V; L2-N: --; L3-N: --;	L1-N/L2-N/L3-N: --; L1-N: 3.098 s; L2-N: --; L3-N: --;
Voltage drop protection $U <<$	$0.45 * U_n$	L1-N/L2-N/L3-N: --; L1-N: 103.7 V; L2-N: --; L3-N: --;	L1-N/L2-N/L3-N: --; L1-N: 313.9 ms; L2-N: --; L3-N: --;
Frequency decrease protection $f <$	47.5 Hz	47.49 Hz	136.7 ms
Frequency increase protection $f >$	51.5 Hz	51.51 Hz	134.6 ms

Certificate of Conformity

No. ESY 124661 0021 Rev. 00

<p>*: The tripping time includes the period from the limit value violation U/f until the tripping signal to the interface switch.</p> <p>When planning the power generation system, the response time of the interface switch shall be added to the maximum time value obtained as indicated above.</p> <p>The disconnection time (sum of tripping time of the NS protection plus response time of the interface switch) shall not exceed 200 ms.</p> <p>**: Verification disconnection time of moving 10-min-average value.</p> <p>Disconnecting time as below:</p> <p>475.30 s (L1-N from 600s@U_n to 112%U_n)</p> <p>Continuous operation (L1-N from 600s@U_n to 108%U_n)</p> <p>308.70 s (L1-N&L2-N&L3-N from 600s@106%U_n to 114%U_n)</p>	
<input checked="" type="checkbox"/> as integrated NS protection	
Assigned to power generation unit type	HHB-05K000CRLV
Integrated interface switch type	Series-connected relays for all phase conductors each Relay type: HongFa, Model: HF161F-W/12-HT (477)
Response time of interface switch for integrated NS protection	Release time: Max. 10 ms
Verification of the entire functional chain "integrated NS protection – interface switch" has resulted in successful disconnection.	<input checked="" type="checkbox"/>