



CERTIFICATE

Applicant: **VOLTRONIC POWER TECHNOLOGY (SHENZHEN) CORP.**

1-5F, Building 5 & 1F Building 7 & 1F Building 9, Run-DongSheng Industrial Park, No.467, Section Xixiang, National Highway 107, LongZhu Community, Xixiang, Bao An District, Shenzhen, China

Product: **Hybrid Inverter with integrated automatic disconnection device between a generator and the public low-voltage grid**

Model:	INFINISOLAR WP 30KW
Rating:	30 kW

Intended use:

Hybrid (PV with DC coupled Electricity Storage) Inverter with an automatic disconnection device with three phase mains surveillance in accordance with Engineering Recommendation G99-1 for photovoltaic systems with a three phase parallel coupling via an inverter to the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter.

Applied standards and guidelines:

SOP-9-1_15 GCC Certification Program, 09/21

Based on:

Engineering Recommendation G99 Issue 1 – Amendment 9; 03 October 2022

Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019

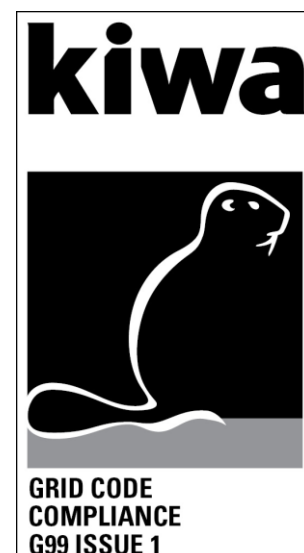
The safety concept of an aforementioned representative product corresponds at the time of issue of this certificate to the valid safety specifications for the specified use in accordance with regulations.

Report No: HC23100903001-EG-UK-001
Test laboratory: LYNS-TCI TECHNOLOGY GUANG-DONG CO., LTD., A2LA accredited, certificate #5200.02

Certificate No: 24-166-00

Date of issue: 2024-05-07

Raphael Rader
Certification Engineer

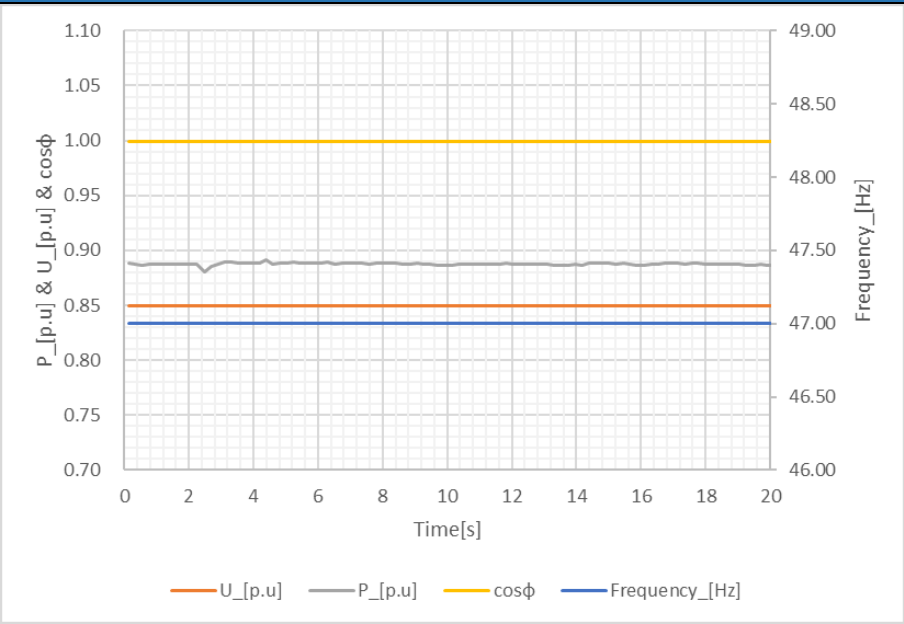


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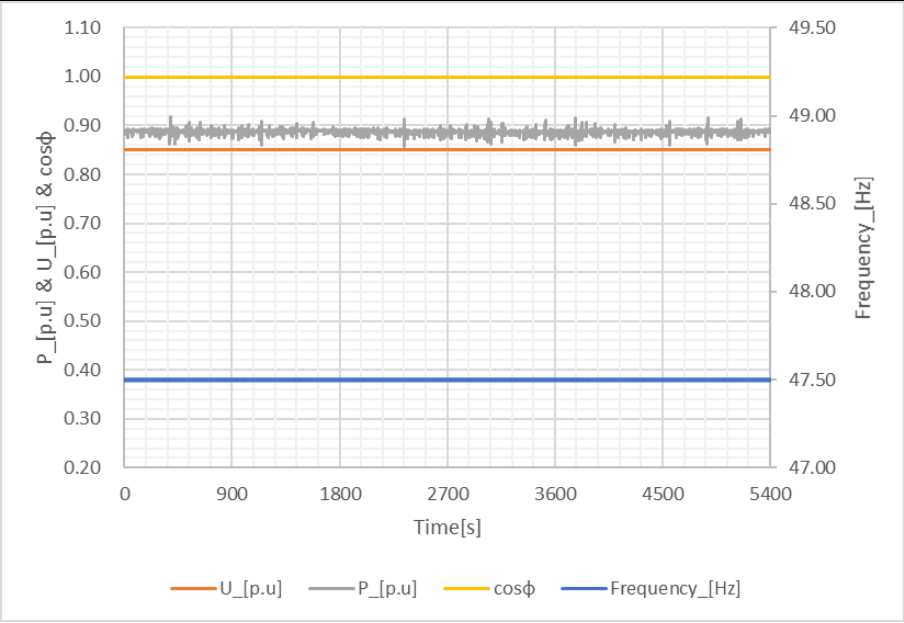
Operating Range:

Test 1
Voltage = 85% of nominal
(195.5 V), Frequency = 47 Hz,
Power Factor = 1,
Period of test 20 s



Pass, no disconnection occurs

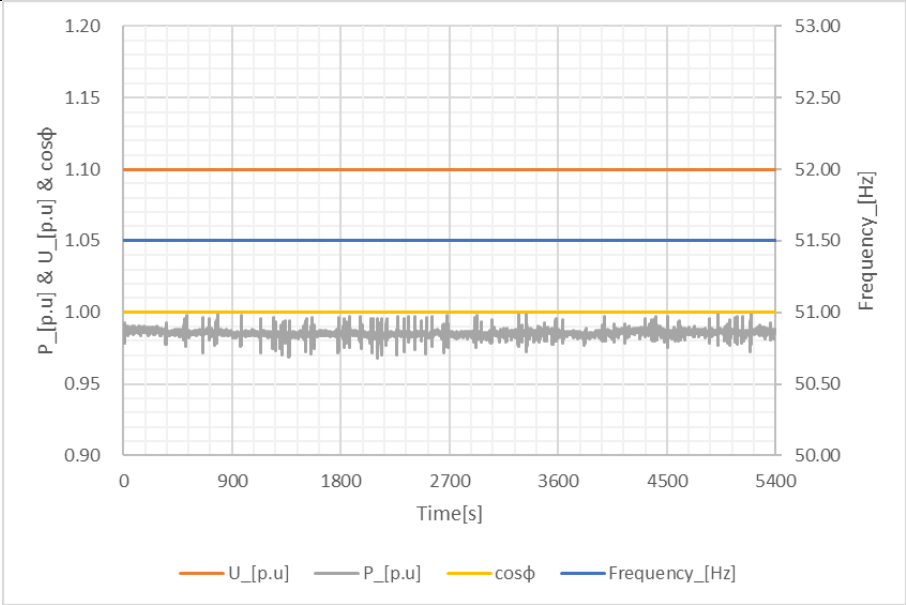
Test 2
Voltage = 85% of nominal
(195.5 V), Frequency = 47.5 Hz,
Power Factor = 1,
Period of test 90 minutes



Pass, no disconnection occurs

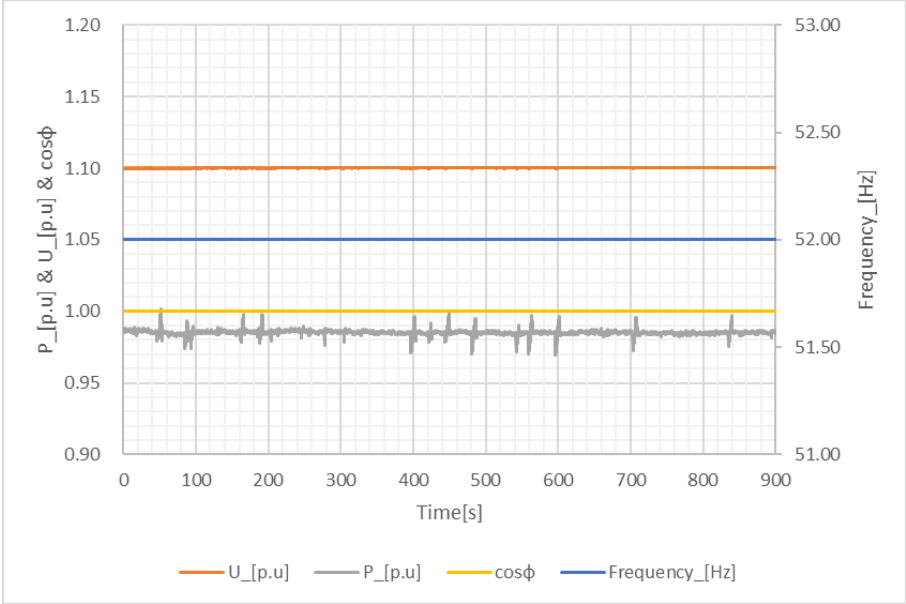


Test 3
Voltage = 110% of nominal (253 V), Frequency = 51.5 Hz,
Power Factor = 1,
Period of test 90 minutes



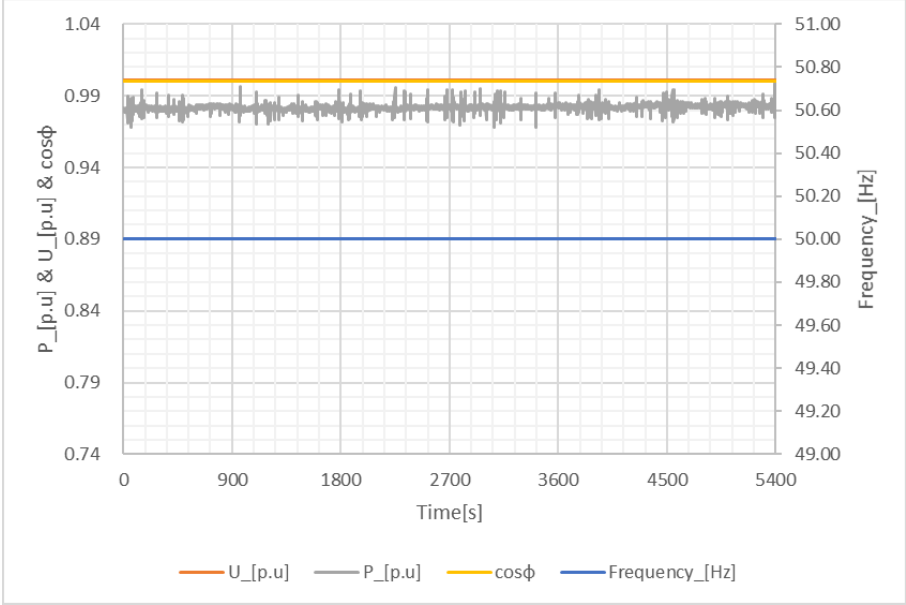
Pass, no disconnection occurs

Test 4
Voltage = 110% of nominal (253 V), Frequency = 52.0 Hz,
Power Factor = 1,
Period of test 15 minutes



Pass, no disconnection occurs

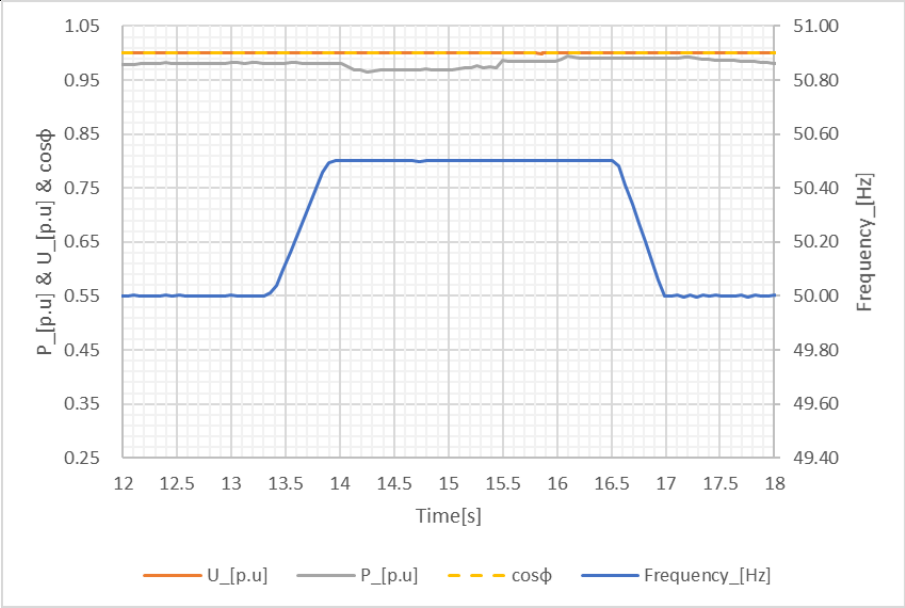
Test 5
Voltage = 100% of nominal (230 V), Frequency = 50.0 Hz,
Power Factor = 1,
Period of test = 90 minutes



Pass, no disconnection occurs



Test 6 RoCoF withstand
Confirm that the Power Gener-
ating Module is capable of
staying connected to the Distri-
bution Network and operate at
rates of change of frequency up
to 1 Hzs-1 as measured over a
period of 500 ms. Note that this
is not expected to be demon-
strated on site.



Pass, no disconnection occurs



Power Quality – Harmonics								
Generating Unit tested to BS EN 61000-3-12								
Generating Unit rating per phase (rpp)				10.000		kVA	Harmonics % =Measured Value (Amps) x 23/rating per phase (kVA)	
Harmonic	At 45-55% of Registered Capacity						Limit in BS EN 61000-3-12	
	Measured Value (A)			Measured Value (%)			1 phase	3 phase
	L1	L2	L3	L1	L2	L3		
2	0.035	0.123	0.096	0.081	0.283	0.221	8%	8%
3	0.244	0.244	0.238	0.561	0.561	0.547	21,6%	Not stated
4	0.013	0.010	0.013	0.030	0.023	0.030	4%	4%
5	0.261	0.233	0.253	0.600	0.536	0.582	10,7%	10,7%
6	0.010	0.016	0.015	0.023	0.037	0.035	2,67%	2,67%
7	0.255	0.252	0.252	0.587	0.580	0.580	7,2%	7,2%
8	0.009	0.022	0.017	0.021	0.051	0.039	2%	2%
9	0.246	0.257	0.257	0.566	0.591	0.591	3,8%	Not stated
10	0.009	0.023	0.020	0.021	0.053	0.046	1,6%	1,6%
11	0.169	0.185	0.186	0.389	0.426	0.428	3,1%	3,1%
12	0.009	0.019	0.013	0.021	0.044	0.030	1,33%	1,33%
13	0.159	0.145	0.142	0.366	0.334	0.327	2%	2%
THD	-	-	-	1.495	1.540	1.523	23%	13%
PWHD	-	-	-	3.397	3.686	3.549	23%	22%
Harmonic	At 100% of Registered Capacity						Limit in BS EN 61000-3-12	
	Measured Value (A)			Measured Value (%)			1 phase	3 phase
	L1	L2	L3	L1	L2	L3		
2	0.110	0.187	0.143	0.253	0.430	0.329	8%	8%
3	0.391	0.416	0.430	0.899	0.957	0.989	21,6%	Not stated
4	0.030	0.023	0.029	0.069	0.053	0.067	4%	4%
5	0.105	0.114	0.101	0.242	0.262	0.232	10,7%	10,7%
6	0.033	0.013	0.026	0.076	0.030	0.060	2,67%	2,67%
7	0.047	0.046	0.075	0.108	0.106	0.173	7,2%	7,2%
8	0.025	0.018	0.025	0.058	0.041	0.058	2%	2%
9	0.095	0.119	0.125	0.219	0.274	0.288	3,8%	Not stated
10	0.018	0.023	0.019	0.041	0.053	0.044	1,6%	1,6%
11	0.173	0.194	0.170	0.398	0.446	0.391	3,1%	3,1%
12	0.013	0.016	0.016	0.030	0.037	0.037	1,33%	1,33%
13	0.239	0.239	0.255	0.550	0.550	0.587	2%	2%
THD	-	-	-	1.706	1.917	1.888	23%	13%
PWHD	-	-	-	5.354	6.275	6.142	23%	22%



Power Quality – Voltage Fluctuations and Flicker								
Test start date	2023-12-20			Test End date			2023-12-20	
Test Location	Lyns-tci Technology Guangdong Co., Ltd. Room 1201, Unit 2, Building 18, No. 7, Science and Technology Boulevard, Houjie Town, Dongguan City, Guangdong, 523960, China							
	Starting			Stopping			Running	
	dmax	dc	d(t)	dmax	dc	d(t)	Pst	Plt 2 hours
Measured Values	7.799	5.292	2960	5.892	3.759	1900	0.177	0.156
Normalised to standard impedance	7.799	5.292	2960	5.892	3.759	1900	0.177	0.156
Normalised to required maximum impedance	4.000	2.714	---	3.022	1.928	---	0.093	0.082
Limit set under BS EN 61000-3-11	4%	3,3%	3,3%*	4%	3,3%	3,3%*	1,0	0,65
*500ms is the maximum allowed time above 3,3%.								
Test Impedance	R	0.24	Ω	X	0.15	Ω		
Standard Impedance	R	0.24 * 0.4 ^	Ω	X	0.15 * 0.25 ^	Ω		
Maximum Impedance	R	0.12	Ω	X	0.08	Ω		
* Applies to three phase and split single phase Power Generating Modules.								
^ Applies to single phase Power Generating Module and Power Generating Modules using two phases on a three phase system.								



Power Quality – DC injection			
Test power level	10%	55%	100%
Recorded DC value in Amps	0.1878	0.2091	0.2210
As % of rated AC current	0.144	0.160	0.169
Limit (%)	0.25	0.25	0.25

Power Factor			
Voltage	0,94 pu (216.2 V)	1,0 pu (230 V)	1,1 pu (253 V)
Measured Value	0.999	0.999	0.999
Power Factor Limit	>0,95		



Protection – Frequency Tests						
Function	Setting		Trip test		No trip test	
	Frequency	Time delay	Frequency	Time delay	Frequency time	Confirm no trip
U/F stage 1	47.5 Hz	20 s	47.50Hz	20.007 s	47.7Hz 30s	No trip
U/F stage 2	47 Hz	0.5 s	47.00 Hz	0.514 s	47.2 Hz 19,5s	No trip
					46.8 Hz 0,45 s	No trip
O/F	52 Hz	0.5 s	52.00 Hz	0.510 s	51.8 Hz 120 s	No trip
					52.2Hz 0,45s	No trip

Protection – Voltage Tests.							
Function		Setting		Trip test		No trip test	
		Voltage	Time delay	Voltage	Time delay	Voltage time	Confirm no trip
U/V	L1-N	0.8 pu (184V)	2.5s	183.60 V	2.516 s	188 V 5 s	No trip
	L2-N			183.50 V	2.515s		No trip
	L3-N			185.30V	2.534s		No trip
						180V 2.45 s	No trip
O/V stage 1	L1-N	1.14 pu (262,2V)	1.0s	262.60 V	1.044 s	258.2 V 5.0 s	No trip
	L2-N			262.30 V	1.036 s		No trip
	L3-N			263.10 V	1.039 s		No trip
O/V stage 2	L1-N	1.19 pu (273,7V)	0.5s	273.90 V	0.518 s	269.7 V 0.95 s	No trip
	L2-N			273.70 V	0.543 s		No trip
	L3-N			274.60 V	0.530 s		No trip
						277.7 V 0.45 s	No trip



Protection – Loss of Mains Test according BS EN 62116 for Inverters.						
Test Power and imbalance	33% -5% Q	66% -5% Q	100% -5% P	33% +5% Q	66% +5% Q	100% -5% P
Trip time (s)	0.177	0.177	0.177	0.177	0.177	0.177
Trip time limit [s]	0.5					
Protection – Frequency change, Vector Shift Stability test.						
	Start frequency		Change	Confirm no trip		
Positive vector shift	49.5Hz		+50 degrees	No Trip		
Negative vector shift	50.5Hz		- 50 degrees	No Trip		
Protection – Frequency Change, RoCoF Stability Test						
Ramp range	Test frequency ramp		Test duration	Confirm no Trip		
49,0 Hz to 51,0 Hz	+0.95 Hzs ⁻¹		2.1 s	No trip		
51,0 Hz to 49,0 Hz	-0.95 Hzs ⁻¹		2.1 s	No trip		
Protection – Limited Frequency Sensitive Mode – Over frequency Test						
Active Power response to rising frequency/time plots are attached						N
Test sequence at registered capacity >80%	Measured Active Power output [W]	Frequency [Hz]	Primary power source (if applicable)		Active Power Gradient	
Step a) 50,00Hz ± 0,01Hz	29993	50.00	31500 W		—	
Step b) 50,45Hz ± 0,05Hz	29661	50.45			—	
Step c) 50,70Hz ± 0,10Hz	27968	50.70			—	
Step d) 51,15Hz ± 0,05Hz	25316	51.15			—	
Step e) 51,70Hz ± 0,10Hz	27970	50.70			—	
Step f) 50,45Hz ± 0,05Hz	29648	50.45			—	
Step g) 50,00Hz ± 0,01Hz	29977	50.00			≤10,0%P _n /min	
Test sequence at registered capacity 40% - 60%	Measured Active Power output [W]	Frequency [Hz]	Primary power source (if applicable)		Active Power Gradient	
Step a) 50,00Hz ± 0,01Hz	15008	50.00	15750 W		—	
Step b) 50,45Hz ± 0,05Hz	14668	50.45			—	
Step c) 50,70Hz ± 0,10Hz	13098	50.70			—	
Step d) 51,15Hz ± 0,05Hz	10510	51.15			—	
Step e) 50,70Hz ± 0,01Hz	13082	50.70			—	
Step f) 50,45 Hz ± 0,05Hz	14662	50.45			≤10,0%P _n /min	
Step g) 50,00 Hz ± 0,01Hz	14978	50.00			≤10,0%P _n /min	



Protection – Reconnection Timer					
Time delay setting	Measured delay	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of Table 10.1.			
20 s	20 s	At 1.16 pu (266.2V)	At 0.78pu (180.0V)	At 47.4 Hz	At 52.1 Hz
Confirmation that the Power Generating Module does not re-connect.		No reconnection	No reconnection	No reconnection	No reconnection
Fault Level Contribution					
For Inverter Output					
Time after fault		Volts		Amps	
20ms		L1: 33.5 L2: 43.4 L3: 35.8		L1: 49.01 L2: 48.43 L3: 51.02	
100ms		L1: 28.3 L2: 28.1 L3: 27.7		L1: 49.29 L2: 45.68 L3: 39.73	
250ms		L1: 23.9 L2: 22.5 L3: 22.5		L1: 0.03 L2: 0.06 L3: 0.12	
500ms		L1: 26.9 L2: 27.0 L3: 26.9		L1: 0.07 L2: 0.06 L3: 0.06	
Time to trip		0.234		In seconds	
As SSEGs (small-scale embedded generators) for PV are inverter-connected the max. short circuit current is the max. AC current.					

Self-Monitoring Solid state switching	
It has been verified that in the event of the solid state switching device failing to disconnect the Power Park Module, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 s.	NA*
*there are no solid state switching devices in the unit, mechanical relays are provided	

Wiring functional Tests	
Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning)	NA



Logic interface (input port)

Confirm that an input port is provided and can be used to shut down the module.	YES
Provide high level description of logic interface, e.g. details in 11.1.3.1 such as AC or DC signal (the additional comments box below can be used)	YES

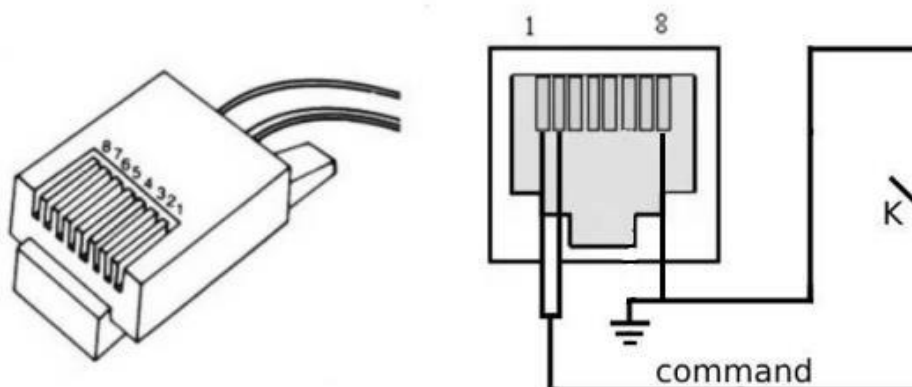
Cyber security

Confirm that the Power Generating Module has been designed to comply with cyber security requirements, as detailed in 9.1.7.	YES
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Additional Comments

High level description of logic interface:

The PGU equipped with a logic interface for ceasing active power output within 5 s following an instruction being received. The following is a possible configuration (if another configuration is required, this can be agreed with the manufacturer):



where RRCR = Radio Ripple Control Receiver.

The signal from the Power Generating Module that is being switched can be either AC (maximum value 240 V) or DC (maximum value 110 V), Remote control of AC output opening and closing through it. Pin1 and Pin2 are command control output pins that can be used to control the close and open of AC output relay's Pin8 as the ground circuit of the system.

Command	Function	Relay State	Active Power	Power drop rate	COS(ϕ)
^S005LON0	Turn off	Open	0%	<5 seconds	1
^S005LON1	Turn off	Close	100%	/	1