

Vorläufige Prototypenbestätigung / Preliminary prototype confirmation

Nr. / No.:

968/GI 1729.00/23

Netzintegration von Erzeugungseinheiten und -anlagen

Grid integration of power generating units and systems

Antragsteller /
Applicant

Ginlong Technologies Co., Ltd.
No. 57 Jintong Road, Binhai, (seafront) industrial park,
Xiangshan, Ningbo, Zhejiang, 315712,
P. R. China

Zertifizierstelle /
Certification Body

TÜV Rheinland Industrie Service GmbH
Am Grauen Stein
51105 Köln, Deutschland / Germany

Produkttyp /
Product type

Wechselrichter / Energieerzeugungseinheit (EZE) Typ 2
Inverter / Power Generating Unit (PGU) Type 2

Modell /
Model

Solis-50K-LV-5G-PRO, Solis-60K-LV-5G-PRO, Solis-75K-LV-5G-PRO, Solis-80K-
5G-PRO, Solis-100K-5G-PRO, Solis-110K-5G-PRO, Solis-125K-5G-PRO

Beschreibung /
Description

Die EZE kann innerhalb ihrer Betriebsbereiche Leistung und Blindleistung bereitstellen / beziehen. Darüber hinaus bietet sie eine dynamische Blindstromeinspeisung bei Netzfehlern mit eingebauter Schutzfunktion. / *The PGU can supply/receive power and reactive power within its operating ranges. It also provides dynamic reactive current feed-in during grid fault with equipped protective function.*

Normen /
Standards

VDE-AR-N 4110:2018-11,
FGW TR 8 / TG8, Rev.9 (2019-02-01)

Erklärung /
Declaration

Die TÜV Rheinland Industrie Service GmbH bestätigt, dass es sich bei der genannten Energieerzeugungseinheit (EZE) Typ-2 nach VDE-AR-N 4110, sowie gemäß FGW TR 8, um einen Prototypen handelt, der in der Lage ist die technischen Anforderungen der Normen zu erfüllen. Es wird davon ausgegangen, dass die Anforderungen der FGW TR 8 im Rahmen einer Zertifizierung erfüllt werden. / *TÜV Rheinland Industrie Service GmbH confirms that the mentioned Power Generating Unit (PGU Type-2) is a prototype according to VDE-AR-N 4110, as well as according to FGW TR 8, which is able to meet the technical requirements of the standards. It is assumed that the requirements of FGW TR 8 are fulfilled within the scope of a certification.*

Inbetriebnahme der ersten EZE /
Commissioning of the first PGU

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Datum / Date

2023-04-19

Gültig bis / Valid until

2025-04-19

Die Details zur Gültigkeit im Kapitel 1.3 sind entsprechend zu beachten. /
The details on validity in chapter 1.3 must be observed accordingly.

Diese Prototypenbestätigung darf nicht auszugsweise verwendet werden.

This prototype confirmation may not be used in extracts.

Köln, 2023-04-19

TÜV Rheinland Industrie Service GmbH
Am Grauen Stein, D-51105 Köln


Dipl.-Ing. Marco Klose
Specialist Certifier


M. Sc. Armin Kerperin
Assessor

1. Aufgabenstellung / Task

Im Rahmen dieser Prototypenbestätigung wird auf Grundlage herstellerspezifischer Dokumente überprüft, ob die genannte Energieerzeugungseinheit (EZE) die Anforderungen gemäß [N1] bis [N2] erfüllen kann.

As part of this prototype confirmation, it is checked on the basis of manufacturer-specific documents whether the named power generating unit (EZE Type-2) can meet the requirements according to [N1] to [N2].

1.1. Normen und Technische Richtlinien / Standards and technical guidelines

[N1] Technical Guideline for the connection of customer systems to the medium-voltage network and their operation (TAR medium voltage / VDE-AR-N 4110: 2018-11)

[N2] Technical guideline for generating units and systems part 8 revision 09 of the Fördergesellschaft Windenergie und andere Erneuerbare Energien e.V. (FGW TG8 Rev. 9)

1.2. Für die Bestätigung verwendete Dokumente / Documents supplied for confirmation

Für die Bewertung der EZE wurden u. a. Informationen aus den folgenden herstellerspezifischen Dokumenten entnommen.

For the evaluation of the PGU, e.g. Information taken from the following manufacturer-specific documents.

[D1] Ginlong Technologies Co., Ltd.
Application for Certification
Datum / Date: 2023-03-10

[D2] Ginlong Technologies Co., Ltd.
Installation and Operation Manual
Version 1.1

[D3] Ginlong Technologies Co., Ltd.
Declaration of VDE-AR-N 4110
Datum / Date: 2023-04-11

1.3. Gültigkeit der Prototypenbestätigung / Validity of prototype confirmation

Die Gültigkeit der ausgestellten Prototypenbestätigung beschränkt sich gemäß VDE-AR-N 4110 auf zwei Jahre nach Inbetriebsetzung des ersten Prototypen. Da zurzeit noch keine EZE von diesem Typ in Betrieb genommen worden ist, handelt es sich um eine vorläufige Prototypenbestätigung. Diese Prototypenbestätigung ist nach Inbetriebnahme des ersten Prototypen entsprechend zu revidieren und die Gültigkeit ist auf zwei Jahre nach Inbetriebsetzung der ersten EZE dieses Prototypen zu beschränken.

The validity of the prototype confirmation issued is limited to two years after commissioning of the first prototype in accordance with VDE-AR-N 4110. Since no PGU of this type has currently been commissioned, this is a provisional prototype confirmation. This prototype confirmation must be revised accordingly after commissioning of the first prototype and the validity must be limited to two years after commissioning of the first PGU of this prototype.

2. Prototypenregelung nach FGW TR 8 / Prototype regulation according to FGW TG 8

In diesem Abschnitt wird überprüft, ob es sich bei der EZE gemäß FGW TR 8 [N2] um einen Prototyp handelt. Nach [N2] ist ein Prototyp das erste Betriebsmittel eines Typs, welches wesentliche technische Weiterentwicklungen oder Neuerungen aufweist, sowie alle weiteren Betriebsmittel dieses Typs, die innerhalb von zwei Jahren nach Inbetriebsetzung des ersten Betriebsmittels dieses Typs in Betrieb gesetzt wurden. Die Regelung und Fristen von Betriebsmittelprototypen in einer EZE können den Netzanschlussregeln (NAR) entnommen werden.

In this section, it is checked whether the mentioned PGU is a prototype according to FGW TG 8 [N2]. According to [N2], the definition of the prototype is the first item of equipment of this type that has significant technical developments or innovations, as well as all other items of equipment of this type that were put into operation within two years after the first item of equipment of this type was in service. The rules and deadlines for equipment prototypes of PGU can be found in the grid connection guideline (NAR).

Gemäß [N1] gilt: Für Erzeugungsanlagen (EZA) mit EZE gleichen Prototyps müssen das Anlagenzertifikat und die Konformitätserklärung binnen eines Jahres, nachdem für den ersten Prototyp ein Einheitenzertifikat vorliegt, nachgereicht werden. Für Komponenten innerhalb der Erzeugungsanlage, für die ein Komponentenzertifikat erforderlich ist, kann die Prototypenregelung entsprechend angewendet werden.

According to [N1], the following applies: for power generating systems (PGS) with PGU of the same prototype, the plant certificate and the declaration of conformity must be submitted within one year after a unit certificate is available for the first prototype. The prototype regulation can be applied accordingly for components within the generating plant for which a component certificate is required.

Bewertung / Assessment:

FGW TR8 / TG8 (Revision 9)	Bewertung/Assessment
2.11 Betriebsmittel Prototypen / Prototype	
Herstellereklärung zur teilweisen oder vollständigen Konformität zu einer oder mehreren NAR. / <i>Manufacturer's declaration of partial or full conformity to one or more NAR.</i>	☒ Berücksichtigt / Included (Anhang 1 / Annex 1)
Herstellereklärung, dass es sich um eine wesentliche technische Weiterentwicklung bzw. Neuerung handelt. / <i>Manufacturer's declaration that it is a major technical development or innovation.</i>	☒ Berücksichtigt / Included (Anhang 1 / Annex 1)
Aufzeigen von Unterschieden zu ggf. vorhandenen und bereits zertifizierten Betriebsmitteln. / <i>Identification of differences to any existing and already certified equipment.</i>	☒ Berücksichtigt / Included (Anhang 1 / Annex 1)
Herstellereklärung, dass weitere technische Daten den Anforderungen der jeweiligen NAR entsprechen. / <i>Manufacturer's declaration that further technical data meet the requirements of the respective NAR.</i>	☒ Berücksichtigt / Included (Anhang 1 / Annex 1)

3. Prototypenregelung gemäß VDE-AR-N 4110/ Prototype regulation according to VDE-AR-N4110

Nach [N2] muss die Zertifizierungsstelle in der Prototypenbestätigung nachvollziehbar ausweisen, dass der Prototyp grundsätzlich in der Lage ist, die Anforderungen der jeweiligen NAR an die elektrischen Eigenschaften und Funktionen der Betriebsmittel zu erfüllen.

According to [N2], the certification body must clearly state in the prototype confirmation that the prototype is basically able to meet the requirements of the respective NAR for the electrical properties and functions of the equipment.

Die Vorgaben der NAR an den Prüfumfang für die Prototypenbestätigung sind zu berücksichtigen (sofern vorhanden). Im Folgenden wird dazu die Übereinstimmung der elektrischen Eigenschaften des EZE- mit den Anforderungen nach [N1] überprüft.

The specifications of the NAR for the scope of testing for the prototype confirmation must be taken into account (if available). In the following, the compliance of the electrical properties of the PGU with the requirements of [N1] is checked.

Bewertung / Assessment:

Art der Betriebsmittel Type	EZE / PGU		Komponenten / Components		
	PV	Speicher / Storage System	EZA-Regler / PGU Controller	Kompensations-einrichtung / Compensation equipment	Schutzeinrichtungen / Protective devices
	☒	☐	☐	☐	☐
Anmerkung Annotation	Die folgenden Punkte 1), 2) und 4) sind anzuwenden. <i>The following items 1), 2) and 4) are applied.</i>		Die folgenden Punkte 1), 2), 3) und 4) sind anzuwenden. <i>The following items 1), 2), 3) and 4) are applied.</i>		
Anforderungen an Prototypen gemäß VDE-AR-N 4110 Requirements for Prototypes according to VDE-AR-N 4110					
Nr.	Anforderungen / Requirements				Bewertung / Evaluation
1)	Der Prototyp weist wesentliche technische Weiterentwicklungen oder Neuerungen auf. / <i>The prototype shows significant technical developments or innovations.</i>				☒ Zutreffend/ Applied
2)	Der Prototyp ist grundsätzlich in der Lage die Anforderungen dieser VDE-Richtlinie an die elektrischen Eigenschaften zu erfüllen. / <i>The prototype is basically able to meet the requirements of this VDE guideline for the electrical properties.</i>				☒ Zutreffend/ Applied
3)	Für Komponenten innerhalb der Erzeugungsanlage, für die ein Komponentenzertifikat erforderlich ist, kann die Prototypenregelung entsprechend angewandt werden. <i>For components within the power generating plant, for which a component certificate is required, the prototype regulation can be applied in analogy.</i>				☐ Zutreffend/ Applied
4)	Anforderungen an die Angaben der Datenblätter und darauf basierende Plausibilitätsprüfung (PP) / <i>Requirements for the information in the data sheets and the plausibility check (PP) based on them</i>				

a) Herstellererklärung, dass die Erzeugungseinheit so konstruiert wurde, dass die Anforderungen der VDE erfüllt werden können. / <i>Manufacturer's declaration that the generating unit was constructed in such a way that the requirements of the VDE can be met.</i>	☒ Enthalten/ <i>Included</i>
PP: ☒ Erfüllt (Anhang 1) / <i>Fulfilled (Annex 1)</i> ☐ Entfällt / <i>Not applicable</i>	
b) Schematisches Übersichtsbild der Erzeugungseinheit mit allen wesentlichen Komponenten / <i>Schematic overview of the generating unit with all essential components</i>	☒ Enthalten/ <i>Included</i>
PP: ☒ Erfüllt (Anhang 1) / <i>Fulfilled (Annex 1)</i> ☐ Entfällt / <i>Not applicable</i>	
c) Elektrische Daten (Nenn- und Bemessungsgrößen) / <i>Electrical data (nominal and rated values)</i>	☒ Enthalten/ <i>Included</i>
PP: ☒ Erfüllt (Anhang 1) / <i>Fulfilled (Annex 1)</i> ☐ Entfällt (keine Anforderungen an EZA-Regler) / <i>Not applicable for PGU controllers</i>	
d) Schutzfunktionen mit Einstellbereichen / <i>Protection functions with setting ranges</i> Entkopplungsschutz / <i>Decoupling protection</i> Eigenschutz / <i>Self-protection</i>	☒ Enthalten/ <i>Included</i>
PP: ☒ Erfüllt (Anhang 1) / <i>Fulfilled (Annex 1)</i> ☐ Entfällt (keine Anforderungen an EZA-Regler) / <i>Not applicable for PGU controllers</i>	
e) Betriebsbereich der Erzeugungseinheit: / <i>Operating range of the generating unit</i> Grenzen im quasistationären Betrieb / <i>Limits in quasi-steady state operation</i> Blindleistungsstellbereich / <i>Reactive power adjustment range</i> FRT-Grenzkurve (U/t-Diagramm) / <i>FRT limit curve (U/t diagram)</i>	☒ Enthalten/ <i>Included</i>
PP: ☒ Erfüllt (Anhang 1) / <i>Fulfilled (Annex 1)</i> ☐ Entfällt (keine Anforderungen an EZA-Regler) / <i>Not applicable for PGU controllers</i>	
f) Wirkleistungsregelung: / <i>Active power control</i> Leistungs-Frequenz-Verhalten; / <i>Power frequency regulation</i> Wirkleistungsgradient / <i>Active power ramping</i>	☒ Enthalten/ <i>Included</i>
PP: ☒ fulfilled: the active power can be regulated by following methods (Annex-6): - Power/frequency behavior $P = f(f, P_{ref})$ - Power/Voltage behavior $P = f(v)$ - Active power ramping ☐ Entfällt / <i>Not applicable</i>	
g) Blindleistungsregelung / <i>Reactive power control regulated by</i> - Fixed Q - Fixed $\cos \varphi$ - Voltage-dependent reactive power $Q(U)$ - Active power Dependent reactive power $Q(P)$	☒ Enthalten/ <i>Included</i> ☐ Entfällt für EZA-Regler / <i>Not applicable</i>
PP: ☒ Erfüllt (Anhang 1) / <i>Fulfilled (Annex 1)</i> : ☐ Entfällt (keine Anforderung an EZA-Regler) / <i>Not applicable</i>	
h) Spannungsstützung bei Netzfehlern durch Blindstromspeisung bei dynamischer Netzstützung / <i>Dynamic reactive current feed-in functionality</i>	☒ Enthalten/ <i>Included</i>
PP: ☒ Erfüllt (Anhang 1) / <i>Fulfilled (Annex 1)</i> ☐ Entfällt / <i>Not applicable</i>	

Votum des Fachauditors / Conclusion

Die TÜV Rheinland Industrie Service GmbH bestätigt, dass es sich bei der genannten EZE nach [N1], sowie gemäß [N2], um einen Prototypen handelt, der in der Lage ist die technischen Anforderungen der Normen zu erfüllen. Es wird davon ausgegangen, dass die Anforderungen von [N3] im Rahmen einer Zertifizierung erfüllt werden.

TÜV Rheinland Industrie Service GmbH confirms that the mentioned PGU according to [N1], as well as according to [N2], is a prototype that is able to meet the technical requirements of the standards. It is assumed that the requirements of [N2] are met within the framework of a certification.

Die Bewertung ergab keine Beanstandungen.
The evaluation did not result in any objections.

Anhang / Annex
Anhang 1 / Annex 1:
Manufacturer's Declaration



Declaration of VDE-AR-N 4110

Ginlong technologies Co., Ltd.

Solis 50-125K Series

Version: V3.0

Signature: PanRui

Date: 11.04.2023

Declaration of VDE-AR-N 4110

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1. Company Information

License Holder: Ginlong technologies Co., Ltd.

Address: No.57 Jintong Road, Binhai, (seafront) industrial Park, Xiangshan, Ningbo, Zhejiang
315712, P.R. China

Product Type: Solis-50K-LV-5G-PRO, Solis-60K-LV-5G-PRO, Solis-75K-LV-5G-PRO,
Solis-80K-5G-PRO, Solis-100K-5G-PRO, Solis-110K-5G-PRO, Solis-125K-5G-PRO

2. Product Datasheet: See following page.

Declaration of VDE-AR-N 4110

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Product Model:	Solis-50K-LV-5G-PRO	Solis-60K-LV-5G-PRO	Solis-75K-LV-5G-PRO	Solis-80K-5G-PRO	Solis-100K-5G-PRO	Solis-110K-5G-PRO	Solis-125K-5G-PRO
d.c.Max.Input Voltage:	1100 Vd.c						
d.c.Input Voltage Range:	160-1000 Vd.c						
d.c.Max.Input Current:	4*36A+4*32A	4*36A+4*32A	10*36A	3*36A+3*32A	4*36A+4*32A	4*36A+4*32A	10*36A
d.c.Shorted Input Current:	8*50A	8*50A	10*50A	6*50 A	8*50A	8*50A	10*50A
a.c.Rated Output Voltage:	3/(N)/PE, 220V	3/(N)/PE, 220V	3/(N)/PE, 220V	3/N/PE, 230/400V	3/N/PE, 230/400V	3/N/PE, 230/400V	3/N/PE, 230/400V
a.c.Rated Output Frequency:	50/60 Hz						
a.c.Max.Output Current:	144.3A	173.2A	196.8A	133.7A	167.1A	183.8A	198.5A
a.c.Rated Output Power:	50kW	60kW	75kW	80kW	100kW	110kW	125kW
Max.Apparent Power:	55kVA	66kVA	75kVA	88kVA	110kVA	121kVA	137.5kVA
Adjustable Power Factor Range:	0.8(lagging)~0.8(leading)						
Enclosure:	IP66						
Temperature Range:	-30°C ~ +60°C						
Voltage measure accuracy	± 1% Un						
Frequency measure accuracy	± 0.05Hz						
Firmware:	A1						
Hardware:	V2						
Protective Class:	I						

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3. Rating Label:

					
Model: Solis-50K-LV-5G-PRO		Model: Solis-60K-LV-5G-PRO		Model: Solis-75K-LV-5G-PRO	
Max.input voltage d.c.	1100V	Max.input voltage d.c.	1100V	Max.input voltage d.c.	1100V
Mppt voltage range d.c.	160-1000V	Mppt voltage range d.c.	160-1000V	Mppt voltage range d.c.	160-1000V
Max.input current d.c.	4X36+4X32A	Max.input current d.c.	4X36+4X32A	Max.input current d.c.	10X36A
Isc PV(absolute maximum) d.c.	8X50A	Isc PV(absolute maximum) d.c.	8X50A	Isc PV(absolute maximum) d.c.	10X50A
Rated grid voltage a.c.	3/(N)/PE, 220V	Rated grid voltage a.c.	3/(N)/PE, 220V	Rated grid voltage a.c.	3/(N)/PE, 220V
Rated grid frequency	50/60Hz	Rated grid frequency	50/60Hz	Rated grid frequency	60Hz
Rated output power	50000W	Rated output power	60000W	Rated output power	75000W
Max.AC output active power	55000W	Max.AC output active power	66000W	Max.AC output active power	75000W
Max.AC output apparent power	55000VA	Max.AC output apparent power	66000VA	Max.AC output apparent power	75000VA
Max.continuous output current a.c.	144.3A	Max.continuous output current a.c.	173.2A	Max.continuous output current a.c.	196.8A
Adjustable cos(φ)	-0.8...1...+0.8	Adjustable cos(φ)	-0.8...1...+0.8	Adjustable cos(φ)	-0.8...1...+0.8
Operating temperature range	-30...+60°C	Operating temperature range	-30...+60°C	Operating temperature range	-30...+60°C
Ingress protection	IP66	Ingress protection	IP66	Ingress protection	IP66
Protective class	I	Protective class	I	Protective class	I
Overvoltage category	II(PV) III(MAINS)	Overvoltage category	II(PV) III(MAINS)	Overvoltage category	II(PV) III(MAINS)
Inverter topology	Non-isolated	Inverter topology	Non-isolated	Inverter topology	Non-isolated
 S/N: 120130199180009		 S/N: 121130199180009		 S/N: 123130199580109	
  		  		  	
Name: Ginlong Technologies Co.,Ltd. Address:No.57 Jintong Road,Binhai Industrial Park, Xiangshan,Ningbo,Zhejiang,315712,P.R.China www.solisinverters.com Made in China		Name: Ginlong Technologies Co.,Ltd. Address:No.57 Jintong Road,Binhai Industrial Park, Xiangshan,Ningbo,Zhejiang,315712,P.R.China www.solisinverters.com Made in China		Name: Ginlong Technologies Co.,Ltd. Address:No.57 Jintong Road,Binhai Industrial Park, Xiangshan,Ningbo,Zhejiang,315712,P.R.China www.solisinverters.com Made in China	

Declaration of VDE-AR-N 4110

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 Model: Solis-80K-5G-PRO		 Model: Solis-100K-5G-PRO		 Model: Solis-110K-5G-PRO		 Model: Solis-125K-5G-PRO	
Max.input voltage d.c.	1100V	Max.input voltage d.c.	1100V	Max.input voltage d.c.	1100V	Max.input voltage d.c.	1100V
Mppt voltage range d.c.	160-1000 V	Mppt voltage range d.c.	160-1000 V	Mppt voltage range d.c.	160-1000 V	Mppt voltage range d.c.	160-1000 V
Max.input current d.c.	3×36A+3×32A	Max.input current d.c.	4×36A+4×32A	Max.input current d.c.	4×36A+4×32A	Max.input current d.c.	10×36A
Isc PV(absolute maximum) d.c.	6X50A	Isc PV(absolute maximum) d.c.	8X50A	Isc PV(absolute maximum) d.c.	8X50A	Isc PV(absolute maximum) d.c.	10X50A
Rated grid voltage a.c.	3/N/PE,220/380V 3/N/PE,230/400V	Rated grid voltage a.c.	3/N/PE,220/380V 3/N/PE,230/400V	Rated grid voltage a.c.	3/N/PE,220/380V 3/N/PE,230/400V	Rated grid voltage a.c.	3/N/PE,230/400V
Rated grid frequency	50/60Hz	Rated grid frequency	50/60Hz	Rated grid frequency	50/60Hz	Rated grid frequency	50/60Hz
Rated output power	80000W	Rated output power	100000W	Rated output power	110000W	Rated output power	125000W
Max.AC output active power	88000W	Max.AC output active power	110000W	Max.AC output active power	121000W	Max.AC output active power	137500W
Max.AC output apparent power	88000VA	Max.AC output apparent power	110000VA	Max.AC output apparent power	121000VA	Max.AC output apparent power	137500VA
Max.continuous output current a.c.	133.7A	Max.continuous output current a.c.	167.1 A	Max.continuous output current a.c.	183.8A	Max.continuous output current a.c.	198.5A
Adjustable cos(φ)	-0.8...1...+0.8	Adjustable cos(φ)	-0.8...1...+0.8	Adjustable cos(φ)	-0.8...1...+0.8	Adjustable cos(φ)	-0.8...1...+0.8
Operating temperature range	-30...+60℃	Operating temperature range	-30...+60℃	Operating temperature range	-30...+60℃	Operating temperature range	-30...+60℃
Ingress protection	IP66	Ingress protection	IP66	Ingress protection	IP66	Ingress protection	IP66
Protective class	I	Protective class	I	Protective class	I	Protective class	I
Overvoltage category	II(PV) III(MAINS)	Overvoltage category	II(PV) III(MAINS)	Overvoltage category	II(PV) III(MAINS)	Overvoltage category	II(PV) III(MAINS)
Inverter topology	Non-isolated	Inverter topology	Non-isolated	Inverter topology	Non-isolated	Inverter topology	Non-isolated
 S/N: 120030199180007		 S/N: 120030199180005		 S/N: 120030199180006		 S/N: 120030199180096	
    		    		    		    	
Name: Ginlong Technologies Co.,Ltd. Address:No.57 Jintong Road,Binhai Industrial Park, Xiangshan,Ningbo,Zhejiang,315712,P.R.China www.solisinverters.com Made in China		Name: Ginlong Technologies Co.,Ltd. Address:No.57 Jintong Road,Binhai Industrial Park, Xiangshan,Ningbo,Zhejiang,315712,P.R.China www.solisinverters.com Made in China		Name: Ginlong Technologies Co.,Ltd. Address:No.57 Jintong Road,Binhai Industrial Park, Xiangshan,Ningbo,Zhejiang,315712,P.R.China www.solisinverters.com Made in China		Name: Ginlong Technologies Co.,Ltd. Address:No.57 Jintong Road,Binhai Industrial Park, Xiangshan,Ningbo,Zhejiang,315712,P.R.China www.solisinverters.com Made in China	

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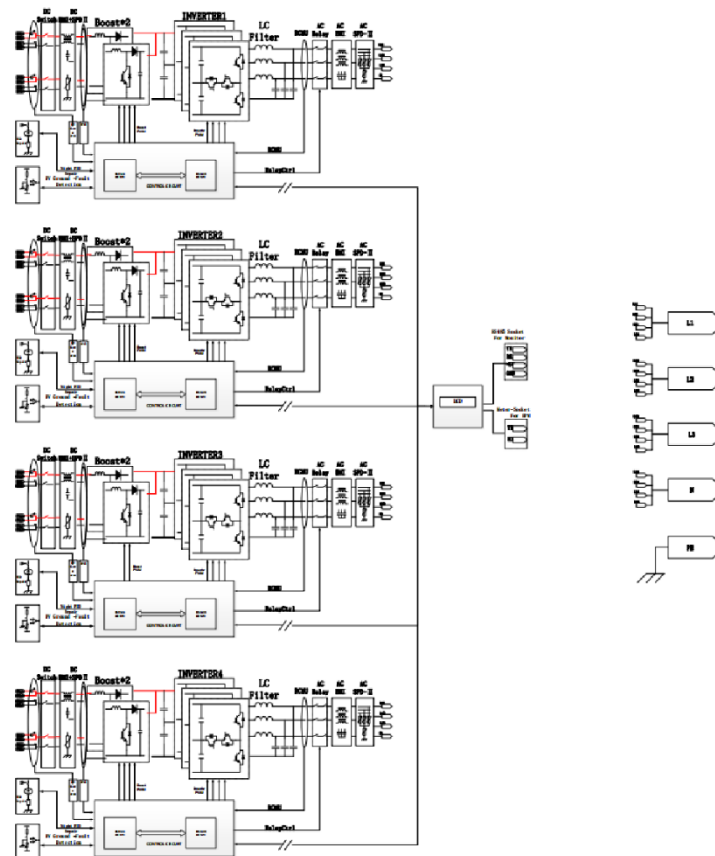


4. Product description:

The PCE under test (EUT) is Grid-connected PV Inverter which utilizes the advanced power electronics conversion components IGBT to convert the variable DC power generated from the photovoltaic (PV) arrays to the stable utility AC power which can be fed into the commercial electrical grid.

The PCE series under test is three-phase grid-connected PV inverter for solar power generation with the rating of 50-125kW. All models are identical in hardware and software except for MPPT numbers, electrical ratings and model name.

The block diagrams of products are as below, amount of input terminals may have difference:



Solis-50K-LV-5G-PRO, Solis-60K-LV-5G-PRO, Solis-75K-LV-5G-PRO,
 Solis-80K-5G-PRO, Solis-100K-5G-PRO, Solis-110K-5G-PRO, Solis-125K-5G-PRO

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Model difference table

Model/Difference term	Solis-80K-5G-PRO	Solis-100K-5G-PRO Solis-110K-5G-PRO Solis-50K-5G-LV-PRO Solis-60K-5G-LV-PRO	Solis-125K-5G-PRO Solis-75K-5G-LV-PRO
MPPT number / Max. input strings number	6/12	8/16	10/20
Rated grid output current	133.7	144.3 A / 158.8 A 131.2A/157.5A	180.4 A/196.8A
Mother board model	MW2070-Vx/ IVMW2750-Vx number: 3	MW2070-Vx/ IVMW2750-Vx number: 4	MW2070-Vx/ IVMW2750-Vx number: 4
DSP board model	DL1635-V4 number: 3	DL1635-V4 number: 4	DL1635-V4 number: 4
MPPT board model	IVSW6330A IVSW6330B IVSW6330C	IVSW6330A IVSW6330B IVSW6330C IVSW6330D	IVSW6330A IVSW6330B IVSW6330C IVSW6330D
LCD board model	IVLW6330		
Combiner board model	IVEW2750		
Communication board model	IVTC6330		
DSP communication board model	IVTW6330		
Dc power inductance	L-5G-3P-32A-DC1 number: 3 L-5G-3P-32A-DC2 number: 3	L-5G-3P-32A-DC1 number: 4 L-5G-3P-32A-DC2 number: 4	L-5G-3P-32A-DC1 number: 4 L-5G-3P-32A-DC2 number: 4
Ac power inductance	L-4X-3P25K-AC number: 3	L-4X-3P25K-AC number: 4	L-4X-3P25K-AC number: 4
Heat sink	number: 3	number: 4	number: 4
Fan	number: 6	number: 8	number: 8

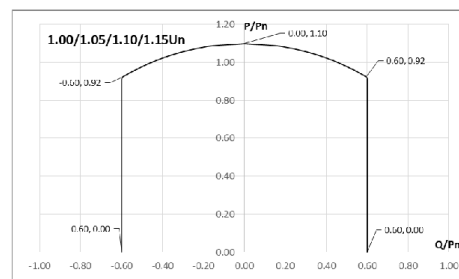
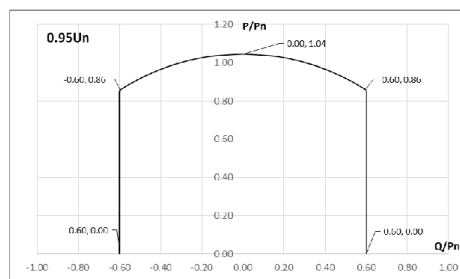
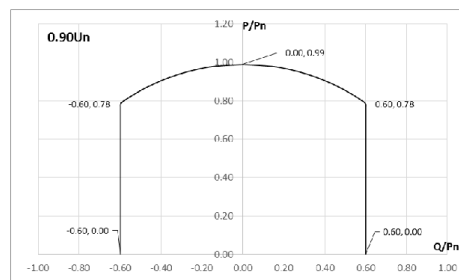
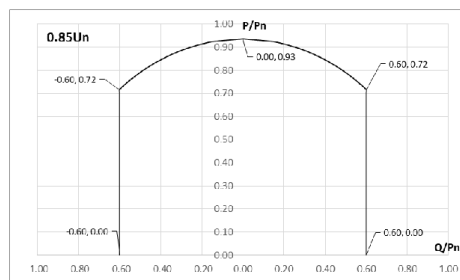
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5. PQ diagram:

Solis-50K-LV-5G-PRO								
P [p.u.]	Direction	Qmax [p.u.]						
		85 % U _N	90 % U _N	95 % U _N	100 % U _N	105 % U _N	110 % U _N	115 % U _N
0	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.1	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.2	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.3	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.4	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.5	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.6	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.7	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.8	Underexcited	-0.48	-0.58	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.48	0.58	0.6	0.6	0.6	0.6	0.6
0.9	Underexcited	-0.24	-0.41	-0.53	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.24	0.41	0.53	0.6	0.6	0.6	0.6
1.0	Underexcited	--	--	-0.3	-0.46	-0.46	-0.46	-0.46
	Overexcited	--	--	0.3	0.46	0.46	0.46	0.46
1.1	Underexcited	--	--	--	0	0	0	0
	Overexcited	--	--	--	0	0	0	0

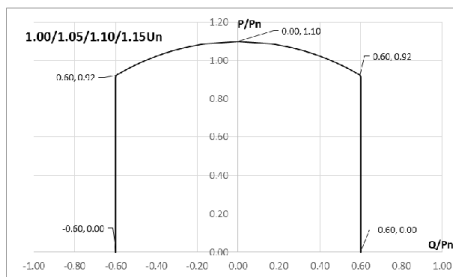
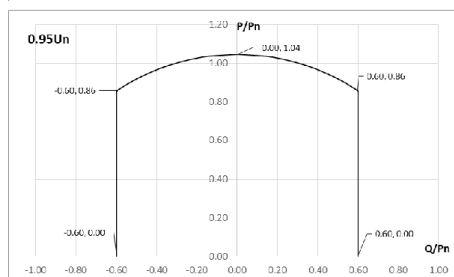
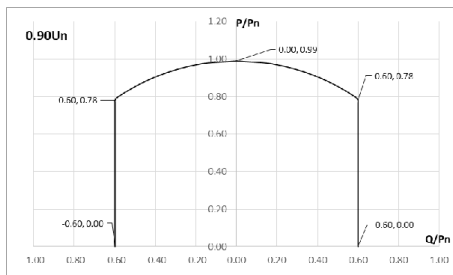
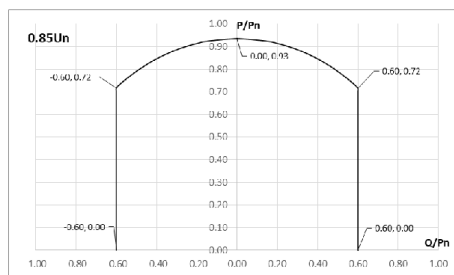


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Solis-60K-LV-5G-PRO								
P [p.u.]	Direction	Qmax [p.u.]						
		85 % U _N	90 % U _N	95 % U _N	100 % U _N	105 % U _N	110 % U _N	115 % U _N
0	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.1	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.2	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.3	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.4	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.5	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.6	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.7	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.8	Underexcited	-0.48	-0.58	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.48	0.58	0.6	0.6	0.6	0.6	0.6
0.9	Underexcited	-0.25	-0.41	-0.53	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.25	0.41	0.53	0.6	0.6	0.6	0.6
1.0	Underexcited	--	--	-0.3	-0.46	-0.46	-0.46	-0.46
	Overexcited	--	--	0.3	0.46	0.46	0.46	0.46
1.1	Underexcited	--	--	--	0	0	0	0
	Overexcited	--	--	--	0	0	0	0

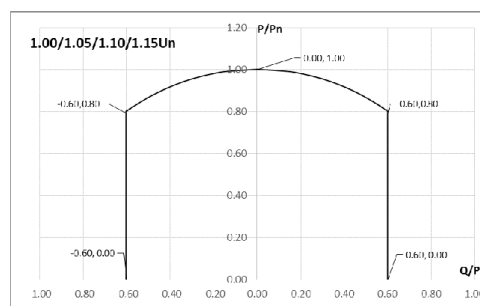
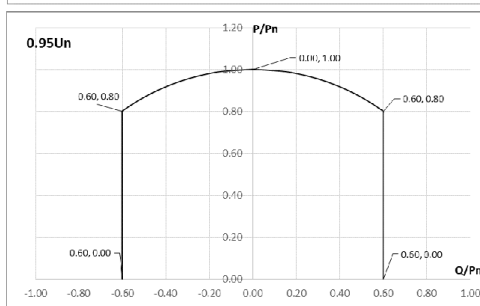
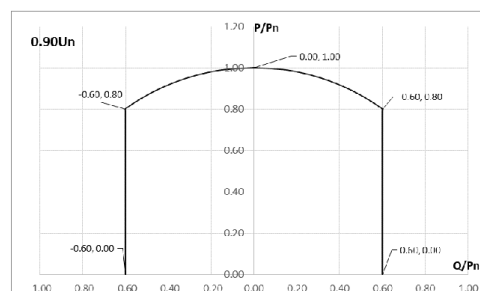
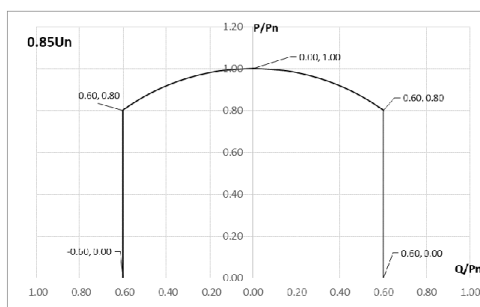


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Solis-75K-LV-5G-PRO								
P [p.u.]	Direction	Qmax [p.u.]						
		85 % U _N	90 % U _N	95 % U _N	100 % U _N	105 % U _N	110 % U _N	115 % U _N
0	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.1	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.2	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.3	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.4	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.5	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.6	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.7	Underexcited	-0.48	-0.57	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.48	0.57	0.6	0.6	0.6	0.6	0.6
0.8	Underexcited	-0.29	-0.41	-0.51	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.29	0.41	0.51	0.6	0.6	0.6	0.6
0.9	Underexcited	--	--	-0.3	-0.44	-0.44	-0.44	-0.44
	Overexcited	--	--	0.3	0.44	0.44	0.44	0.44
1.0	Underexcited	--	--	--	0	0	0	0
	Overexcited	--	--	--	0	0	0	0
1.1	Underexcited	--	--	--	--	--	--	--
	Overexcited	--	--	--	--	--	--	--

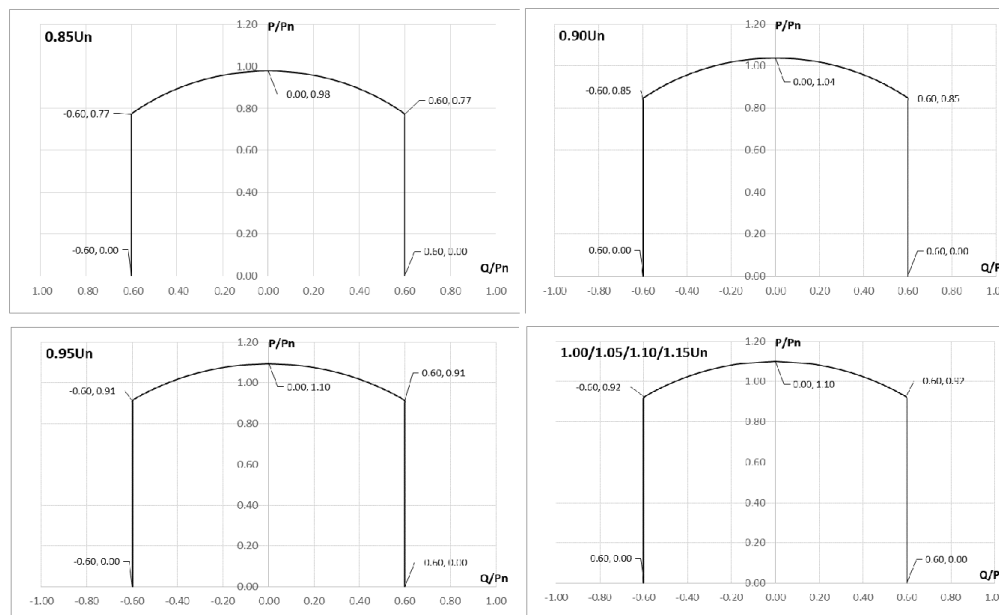


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Solis-80K-5G-PRO								
P [p.u.]	Direction	Q _{max} [p.u.]						
		85 % U _N	90 % U _N	95 % U _N	100 % U _N	105 % U _N	110 % U _N	115 % U _N
0	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.1	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.2	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.3	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.4	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.5	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.6	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.7	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.8	Underexcited	-0.56	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.56	0.6	0.6	0.6	0.6	0.6	0.6
0.9	Underexcited	-0.38	-0.51	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.38	0.51	0.6	0.6	0.6	0.6	0.6
1.0	Underexcited	--	-0.27	-0.45	-0.46	-0.46	-0.46	-0.46
	Overexcited	--	0.27	0.45	0.46	0.46	0.46	0.46
1.1	Underexcited	--	--	--	0	0	0	0
	Overexcited	--	--	--	0	0	0	0

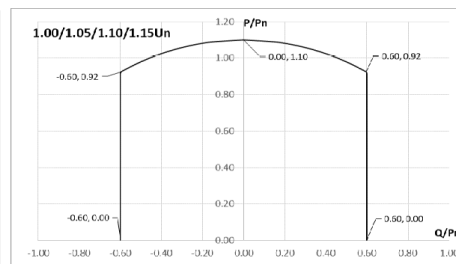
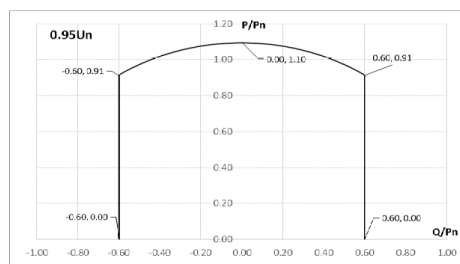
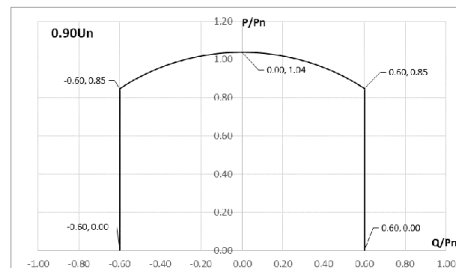
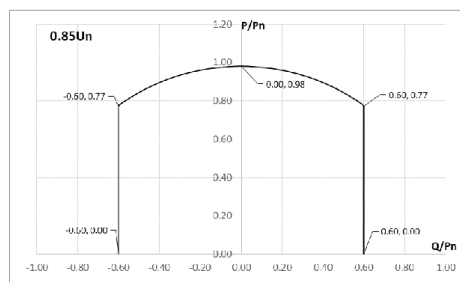


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Solis-100K-5G-PRO								
P [p.u.]	Direction	Qmax [p.u.]						
		85 % U _N	90 % U _N	95 % U _N	100 % U _N	105 % U _N	110 % U _N	115 % U _N
0	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.1	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.2	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.3	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.4	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.5	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.6	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.7	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.8	Underexcited	-0.56	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.56	0.6	0.6	0.6	0.6	0.6	0.6
0.9	Underexcited	-0.38	-0.51	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.38	0.51	0.6	0.6	0.6	0.6	0.6
1.0	Underexcited	--	-0.27	-0.44	-0.46	-0.46	-0.46	-0.46
	Overexcited	--	0.27	0.44	0.46	0.46	0.46	0.46
1.1	Underexcited	--	--	--	0	0	0	0
	Overexcited	--	--	--	0	0	0	0

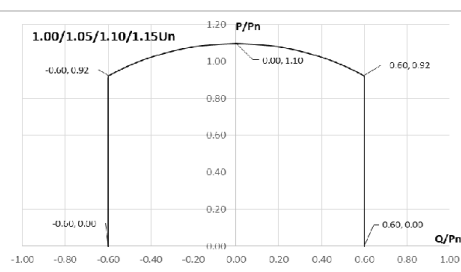
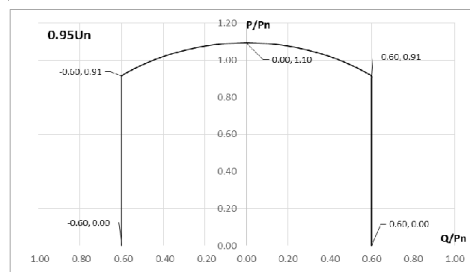
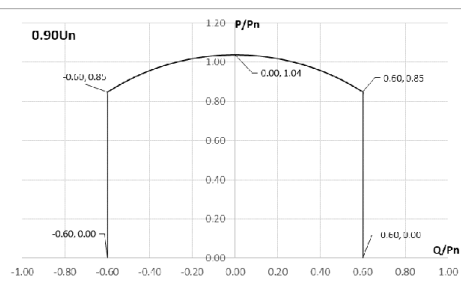
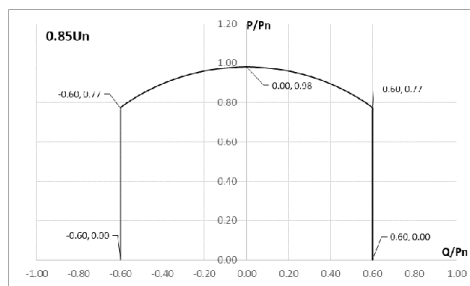


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Solis-110K-5G-PRO								
P [p.u.]	Direction	Qmax [p.u.]						
		85 % U _N	90 % U _N	95 % U _N	100 % U _N	105 % U _N	110 % U _N	115 % U _N
0	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.1	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.2	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.3	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.4	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.5	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.6	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.7	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.8	Underexcited	-0.56	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.56	0.6	0.6	0.6	0.6	0.6	0.6
0.9	Underexcited	-0.38	-0.51	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.38	0.51	0.6	0.6	0.6	0.6	0.6
1.0	Underexcited	--	-0.27	-0.44	-0.46	-0.46	-0.46	-0.46
	Overexcited	--	0.27	0.44	0.46	0.46	0.46	0.46
1.1	Underexcited	--	--	--	0	0	0	0
	Overexcited	--	--	--	0	0	0	0

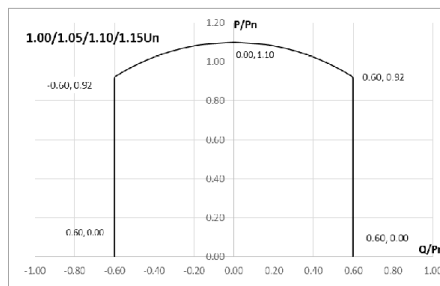
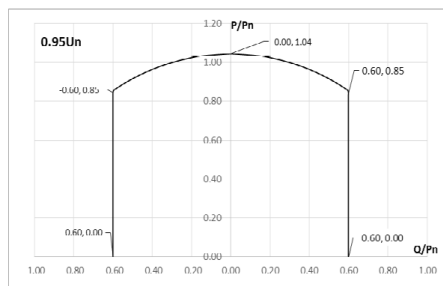
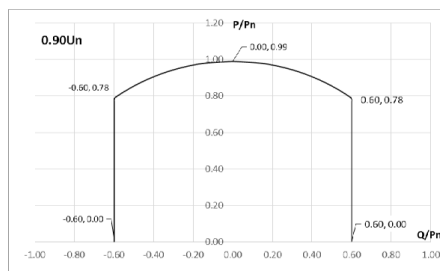
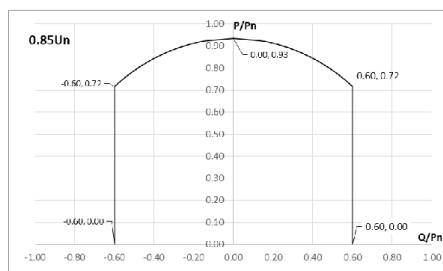


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 GINLONG

Solis-125K-5G-PRO								
P [p.u.]	Direction	Qmax [p.u.]						
		85 % U _N	90 % U _N	95 % U _N	100 % U _N	105 % U _N	110 % U _N	115 % U _N
0	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.1	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.2	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.3	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.4	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.5	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.6	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.7	Underexcited	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.6	0.6	0.6	0.6	0.6	0.6	0.6
0.8	Underexcited	-0.48	-0.58	-0.6	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.48	0.58	0.6	0.6	0.6	0.6	0.6
0.9	Underexcited	-0.24	-0.41	-0.53	-0.6	-0.6	-0.6	-0.6
	Overexcited	0.24	0.41	0.53	0.6	0.6	0.6	0.6
1.0	Underexcited	--	--	-0.3	-0.46	-0.46	-0.46	-0.46
	Overexcited	--	--	0.3	0.46	0.46	0.46	0.46
1.1	Underexcited	--	--	--	0	0	0	0
	Overexcited	--	--	--	0	0	0	0



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6. Methods for reactive power control

The reactive power is always prioritised over active power.

The P-Q relation in normal operation always follow the equation:

$$S = \min(U \cdot I, \min(S_{\max}, U \cdot I_{\max}))$$

$$P = \sqrt{S^2 - Q^2}$$

a. Reactive power-voltage character curve Q(U)

Reactive power-voltage character curve Q(U):			
Parameter	Setting range	Setting step	Default value
Reactive power node (Q1-Q4)	Q1: 0...0.6Pn Q2: -0.6Pn...0.6Pn Q3: -0.6Pn...0.6Pn Q4: -0.6Pn...0	0.01Pn	Q1: 0.6Pn Q2: 0 Q3: 0 Q4: -0.6Pn
Voltage node (Voltage1-Voltage4)	Voltage1: 0.93Un...1.00Un Voltage2: 0.95Un...1.00Un Voltage3: 1.00Un...1.05Un Voltage4: 1.00Un...1.07Un	0.01Un	Voltage1: 0.96Un Voltage2: 1.00Un Voltage3: 1.00Un Voltage4: 1.04Un
Settling time 3Tau	6s...60s	1s	10s

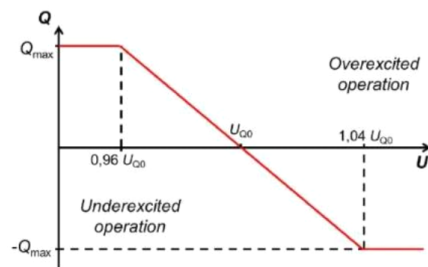


Fig. 4-166: Q(U) characteristic for use in the test

b. Character curve Q(P)

Character curve Q(P)			
Parameter	Setting range	Setting step	Default value
Reactive Power Node (Q1-Q5)	Q1: -0.6Pn...0.6Pn Q2: -0.6Pn...0.6Pn Q3: -0.6Pn...0.6Pn Q4: -0.6Pn...0.6Pn Q5: -0.6Pn...0.6Pn	0.01Pn	Q1: 0 Q2: 0 Q3: -0.05Pn Q4: -0.33Pn Q5: -0.33Pn
Active Power Node (P1-P5)	P1: 0...1.0Pn P2: 0...1.0Pn P3: 0...1.0Pn P4: 0...1.0Pn P5: 0...1.0Pn	0.01Pn	P1: 0 P2: 0.5Pn P3: 0.6Pn P4: 0.9Pn P5: 1.0Pn

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Settling time 3τ	6s...60s	1s	10s
--------------------------	----------	----	-----

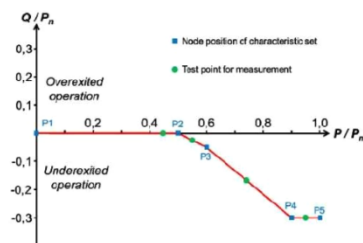


Fig. 4-177: Q(P) characteristic for test

c. Fixed Q

Fixed Q			
Parameter	Setting range	Setting step	Default value
Reactive power Q <i>React. Power</i>	$-0.6P_n \dots 0.6P_n$	$0.01P_n$	$Q=0$
Reactive power Q in com loss condition	--	--	last set-point received
Settling time 3τ	6s...60s	1s	10s

If communication with plant controller or network operator interrupted over 1min, the reactive power maintain the last set-point received.

d. Fixed $\cos\phi$

Fixed $\cos\phi$			
Parameter	Setting range	Setting step	Default value
Displacement factor <i>Power Factor</i>	$0.80_{ue} \dots 0.80_{oe}$	0.005	1.00
Displacement factor in com loss condition	--	--	last set-point received
Settling time 3τ	6s...60s	1s	10s

If communication with plant controller or network operator interrupted over 1min, the reactive power maintain the last set-point received.

Reactive power strategy:

The reactive power is prioritized over active power. Active power can be reduced in favor of reactive power provision.

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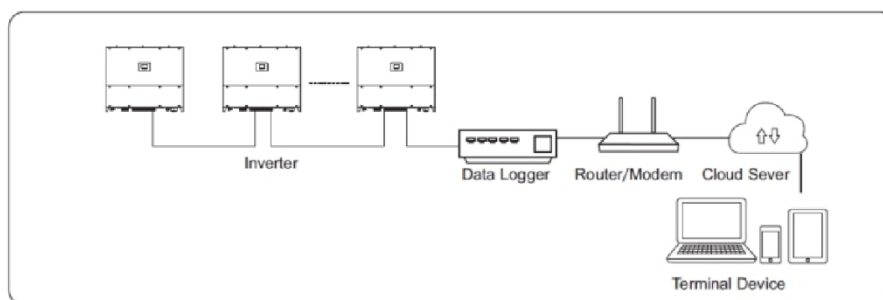


7. Network security management

Network security management			
Parameter	Setting range	Setting step	Default value
Active power	0...1.0Pn	0.01Pn	1.0Pn
Power Gradient	0.33%Pn/s...0.66%Pn/s	0.01%Pn/s	0.5%Pn/s

Interface: RS485

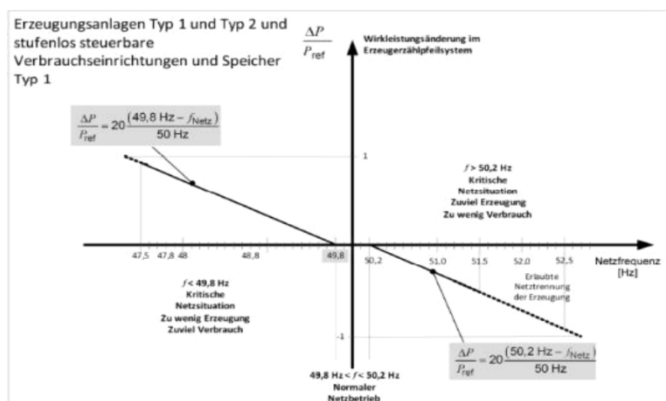
There is single interface for network security management integrated in each unit and only one command from network or third party can be responded a time.



8. Active power output dependent on grid frequency

RoCoF complied with:

- ± 2.0Hz/s for a moving average window 0.5s or
- ± 1.5Hz/s for a moving average window 1s or
- ± 1.25Hz/s for a moving average window 2s P(f) curve:



Over frequency curve start point: 50.2Hz – 50.5Hz adjustable Over frequency curve droop: 2% - 12% adjustable.

Under frequency curve start point: 49.5Hz – 49.8Hz adjustable Under frequency curve droop: 2% - 12% adjustable

While frequency step or shift exceeded the dead-band of P(f) curve, the unit output decrease or increase according to the droop of curve. There is no power change when frequency located within the dead-band

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(50±200mHz default). In the case of frequency above 51.5Hz the unit is able to remain connected to grid for another 5s without any power increase.

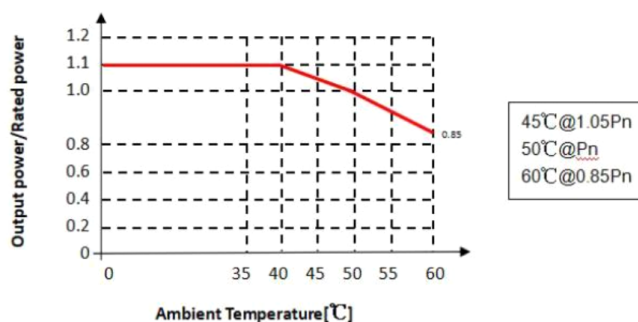
Even if the mains frequency has regained the tolerance band of 50,0 Hz ± 200 mHz after the frequency deviation, a critical network condition shall still be assumed. The transition from "critical network condition" to "normal operation" is time-limited by a maximum change of the set-point active power, starting from P_{mom} . This set-point active power change (except for the supply of control energy) shall be limited to a maximum gradient of 10 % P_b inst/min. Only when the mains frequency has been within the tolerance band of 50,0 Hz ± 200 mHz for an uninterrupted period of 10 min, the normal network operation is considered to be restored and this requirement is no longer valid.

The following requirements complied:

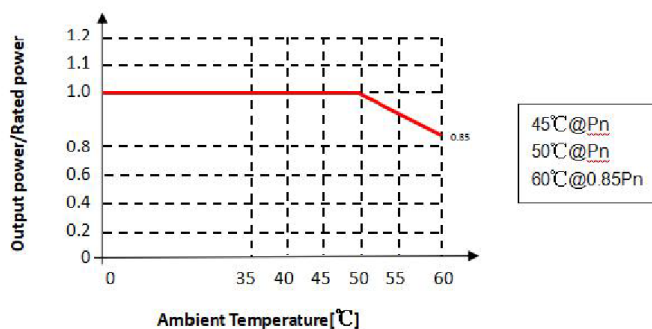
- 1) Initial time delay $T_v < 2$ s
- 2) Accuracy of frequency measurement < 10 mHz
- 3) Accuracy of fast frequency measurement < 50 mHz
- 4) Sample time < 200 ms

9. Active power dependent on ambient temperature

Following Power-temp curve applies on Solis-80K-5G-PRO, Solis-100K-5G-PRO, Solis-110K-5G-PRO, Solis-125K-5G-PRO, Solis-50K-LV-5G-PRO, Solis-60K-LV-5G-PRO:



Following Power-temp curve applies on Solis-75K-LV-5G-PRO:



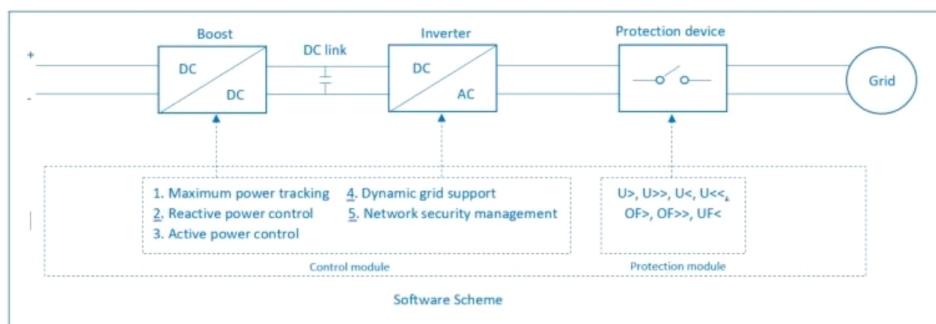
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10. Interface protection function

Interface protection settings:			
Parameter	Setting range	Setting step	Default value
OV1 protection value <i>OV-G-V1</i>	1.00Un...1.30Un	0.001Un	1.10Un
OV1 protection time <i>OVGV1-T</i>	0.02s...180s	0.02s	100ms
OV2 protection value <i>OV-G-V2</i>	1.00Un...1.30Un	0.001Un	1.25Un
OV2 protection time <i>OVGV2-T</i>	20ms...100ms	0.02s	100ms
UV1 protection value <i>UN-G-V1</i>	0.10Un...1.00Un	0.001Un	0.80Un
UV1 protection time <i>UNGV1-T</i>	0.02s...2.4s	0.02s	1.0s
UV2 protection value <i>UN-G-V2</i>	0.10Un...1.00Un	0.001Un	0.45Un
UV2 protection time <i>UNGV2-T</i>	20ms...800ms	0.02s	300ms
OF1 protection value <i>OV-G-F1</i>	50.0Hz...55.0Hz	0.01Hz	51.5Hz
OF1 protection time <i>OVGF1T</i>	0.02s...5s	0.02s	100ms
OF2 protection value <i>OV-G-F2</i>	50.0Hz...55.0Hz	0.01Hz	52.5Hz
OF2 protection time <i>OVGF2T</i>	20ms...100ms	0.02s	100ms
UF1 protection value <i>UN-G-F1</i>	45.0Hz...50.0Hz	0.01Hz	47.5Hz
UF1 protection time <i>UNGF1T</i>	20ms...100ms	0.02s	100ms



All the settings values are readable through PC or directly on display.

The self-check function of protection device is integrated in unit and could be started by PC without any wiring change. When self-check function started, the program would change the voltage sampling value to trip the protection settings. It's detected by unit if the protection relay works normally.

The integrated protection functions are implemented in separate software modules and they operate independent from control functions as the software block diagram below:

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The auxiliary power supply of protection device be supply from dc side, as a network independent auxiliary power can supply to the protection device over 5s. The protection device would be tripped immediately as long as the auxiliary power supply failed.

11. Connection and reconnection conditions

It shall be set out in the unit certificate that the requirements for connection and reconnection of the power generating unit given in 10.4 can be complied with. Based on a manufacturer declaration or on measurements carried out on the power generating unit or on the control unit relevant for analysis of the connection conditions, it shall be verified that connection is possible for $47,5 \text{ Hz} \pm 0,1 \text{ Hz}$ and $50,2 \text{ Hz} \pm 0,1 \text{ Hz}$ as well as at $90 \% U_n \pm 2 \% U_n$ and $110 \% U_n \pm 2 \% U_n$. The verification of connection can be carried out at simulated mains frequency and mains voltage.

After a power generating unit was disconnected from the network by opening the coupler circuit-breaker(galvanic isolation) at the power generating unit due to the tripping of decoupling protection equipment(overfrequency, underfrequency, voltage reduction, voltage rise), automatic connection or reconnection of the power generating units is permitted only if the voltage at the network connection point is at least $95 \% U_c$ and if the frequency is between $49,9 \text{ Hz}$ and $50,1 \text{ Hz}$.

The gradient of power recovery could be set between $1\%P_n/\text{min}$ – $100\%P_n/\text{min}$.

Automatic reconnection of the power generating units may only be made after the mains voltage and frequency have been stable within the aforementioned voltage and frequency limits for a settable period of time. This time period shall be adjustable from undelayed operation up to 10 min. Unless otherwise specified by the network operator, a default value of 5 min shall be set.

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12. Interface Switch Information

Mfg.	Type	Parameter
Santon	XBE+3410-2-D	1000V d.c, 16A, -40~85°C
Santon	XBE3410-2-D	1000V d.c, 16A, -40~85°C
Beijing People's Electric Plant Co.,Ltd	GHX5-32P	1100V dc, 32A, -40~70°C
Shanghai Liangxin Electrical Co.,Ltd	NDG3V-32	1100V dc, 32A, -40~80°C
Zhejiang Benyi Electrical Co.,Ttd.	BYSS. 1-50/T	1100V dc, 50A, -40~85°C
Shanghai Liangxin Electrical Co.,Ltd	NDG3V-50	1100V dc, 50A, -40~85°C
Beijing People's Electric Plant Co.,Ltd	GHX6-55P	1100V dc, 45A, -40~70°C

the interface switch complied with:

- Three-pole galvanic separation.
- The switch is designed as specified by the manufacturer. The switching capacity of the coupling switch may sustain the max. output current of inverter
- The coupling switch is designed to be triggered without delay.
- The sum of time elements of the protection and switching equipment does not exceed 100 ms.

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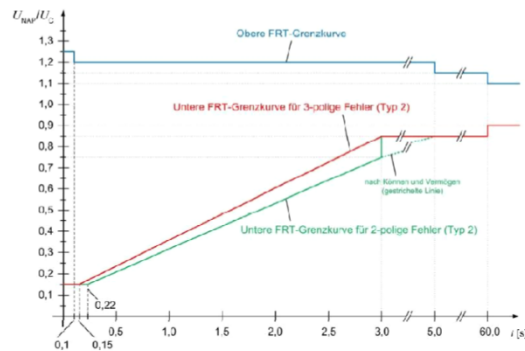


13. Dynamic Grid Support

The occurrence of the following two events is defined as the onset of the fault whichever comes first:

- occurrence of an abrupt voltage change (tolerance band of at least 5 %); or
- voltages $> 1,1 U_n$ or $< 0,9 U_n$.

The inverter is able to keep connecting on the grid in case grid voltage change within the limit curve below, even the step change of voltage exceeded 15% U_n .



Legende

U_{RUV} Effektivwert der aktuellen Spannung am Netzeinschlusspunkt

During the voltage fault, the inverter may:

- cease feeding any current to grid or
- feed the reactive current of both positive and negative sequence components according to the ΔU - ΔI relationship below:

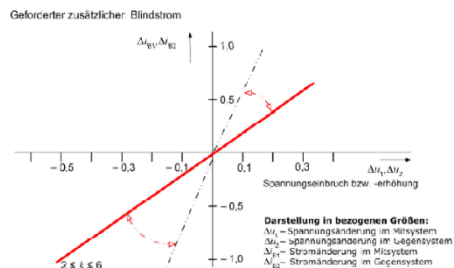


Bild 16 – Prinzip der Spannungsstützung bei Netzfehlern

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Response the reactive current fulfill:

a) Anschwingzeit: $T_{an_90\%} \leq 30 \text{ ms}$;

b) Einschwingzeit: $T_{ein_Δx} \leq 60 \text{ ms}$.

Dynamic network support			
Parameter	Setting range	Setting step	Default value
Operation Mode	Full support / Zero current	--	Full support/ 0.7Un
K factor <i>VRT_K1, VRT_K2</i>	2 ...6	0.5	2
Entry threshold <i>StaticVL, StaticVH</i>	Upper bond: 1.0...1.2Un <i>StaticVH</i> Lower bond: 0.8...1.0Un <i>StaticVL</i>	0.01Un	Upper bond: 1.1Un <i>StaticVH</i> Lower bond: 0.89Un <i>StaticVL</i>

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14. Configuration summary

Interface protection settings:			
Parameter	Setting range	Setting step	Default value
OV1 protection value <i>OV-G-V1</i>	1.00Un...1.30Un	0.001Un	1.10Un
OV1 protection time <i>OVGV1-T</i>	0.02s...180s	0.02s	100ms
OV2 protection value <i>OV-G-V2</i>	1.00Un...1.30Un	0.001Un	1.25Un
OV2 protection time <i>OVGV2-T</i>	20ms...100ms	0.02s	100ms
UV1 protection value <i>UN-G-V1</i>	0.10Un...1.00Un	0.001Un	0.80Un
UV1 protection time <i>UNGV1-T</i>	0.02s...2.4s	0.02s	1.0s
UV2 protection value <i>UN-G-V2</i>	0.10Un...1.00Un	0.001Un	0.45Un
UV2 protection time <i>UNGV2-T</i>	20ms...800ms	0.02s	300ms
OF1 protection value <i>OV-G-F1</i>	50.0Hz...55.0Hz	0.01Hz	51.5Hz
OF1 protection time <i>OVGF1T</i>	0.02s...5s	0.02s	100ms
OF2 protection value <i>OV-G-F2</i>	50.0Hz...55.0Hz	0.01Hz	52.5Hz
OF2 protection time <i>OVGF2T</i>	20ms...100ms	0.02s	100ms
UF1 protection value <i>UN-G-F1</i>	45.0Hz...50.0Hz	0.01Hz	47.5Hz
UF1 protection time <i>UNGF1T</i>	20ms...100ms	0.02s	100ms
Self-protection settings:			
Parameter	Setting range	Setting step	Default value
OV protection value	--	--	1.40Un
OV protection time	--	--	50ms
Connection condition settings:			
Parameter	Setting range	Setting step	Default value
Voltage range <i>Start-VH, Start-VL</i>	--	--	90%Un...110%Un
Frequency range <i>Start-FH, Start-FL</i>	--	--	47.5Hz...50.2Hz
Delay time <i>Startup-T</i>	0...30 mins	1s	10 mins
Power Gradient <i>Ramp-up-EN</i>	0.33%Pn/s...0.66%Pn/s	0.01%Pn/s	0.5%Pn/s
Reconnection condition settings:			
Parameter	Setting range	Setting step	Default value
Voltage range <i>Restore-VH, Restore-VL</i>	--	--	≥95%Un
Frequency range <i>Restore-FH, Restore-FL</i>	--	--	49.9Hz...50.1Hz
Delay time <i>Restore-T</i>	0...30 mins	1s	10 mins
Power Gradient <i>Reconnect-EN</i>	0.33%Pn/s...0.66%Pn/s	0.01%Pn/s	0.5%Pn/s

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Reactive power-voltage character curve Q(U):			
Parameter	Setting range	Setting step	Default value
Reactive power node (Q1-Q4)	Q1: 0...0.6Pn Q2: -0.6Pn...0.6Pn Q3: -0.6Pn...0.6Pn Q4: -0.6Pn...0	0.01Pn	Q1: 0.6Pn Q2: 0 Q3: 0 Q4: -0.6Pn
Voltage node (Voltage1-Voltage4)	Voltage1: 0.93Un...1.00Un Voltage2: 0.95Un...1.00Un Voltage3: 1.00Un...1.05Un Voltage4: 1.00Un...1.07Un	0.01Un	Voltage1: 0.96Un Voltage2: 1.00Un Voltage3: 1.00Un Voltage4: 1.04Un
Settling time 3Tau	6s...60s	1s	10s
Character curve Q(P)			
Parameter	Setting range	Setting step	Default value
Reactive Power Node (Q1-Q5)	Q1: -0.6Pn...0.6Pn Q2: -0.6Pn...0.6Pn Q3: -0.6Pn...0.6Pn Q4: -0.6Pn...0.6Pn Q5: -0.6Pn...0.6Pn	0.01Pn	Q1: 0 Q2: 0 Q3: -0.05Pn Q4: -0.33Pn Q5: -0.33Pn
Active Power Node (P1-P5)	P1: 0...1.0Pn P2: 0...1.0Pn P3: 0...1.0Pn P4: 0...1.0Pn P5: 0...1.0Pn	0.1Pn	P1: 0 P2: 0.5Pn P3: 0.6Pn P4: 0.9Pn P5: 1.0Pn
Settling time 3Tau	6s...60s	1s	10s
Fixed Q			
Parameter	Setting range	Setting step	Default value
Reactive power Q React. Power	-0.6Pn...0.6Pn	0.01Pn	Q=0
Reactive power Q in com loss condition	--	--	last set-point received
Settling time 3Tau	6s...60s	1s	10s
Fixed cosφ			
Parameter	Setting range	Setting step	Default value
Displacement factor Power Factor	0.80ue...0.80oe	0.005	1.00
Displacement factor in com loss condition	--	--	last set-point received
Settling time 3Tau	6s...60s	1s	10s
Network security management			
Parameter	Setting range	Setting step	Default value
Active power	0...1.0Pn	0.01Pn	1.0Pn
Power Gradient	0.33%Pn/s...0.66%Pn/s	0.01%Pn/s	0.5%Pn/s
Active power output dependent on grid frequency			
Parameter	Setting range	Setting step	Default value
OF threshold OV-F-Start	50.2Hz...50.5Hz	0.01Hz	50.2Hz

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OF droop <i>Gradient</i>	2%...12%	1%	5%
UF threshold <i>FDStart</i>	49.5Hz...49.8Hz	0.01Hz	49.8Hz
UF droop <i>FDdroop</i>	2%...12%	1%	5%
Dynamic network support			
Parameter	Setting range	Setting step	Default value
Operation Mode	Full support / Zero current	--	Full support/ 0.7Un
K factor <i>VRT_K1, VRT_K2</i>	2 ...6	0.5	2
Entry threshold <i>StaticVL, StaticVH</i>	Upper bond: 1.0...1.2Un <i>StaticVH</i> Lower bond: 0.8...1.0Un <i>StaticVL</i>	0.01Un	Upper bond: 1.1Un <i>StaticVH</i> Lower bond: 0.89Un <i>StaticVL</i>

15. Short-circuited current of PGU

Type of power generating Unit	Information	Symbol	Value [p.u.]
PGU with full-scale converters	RMS value of the source current for three-phase fault	I_{skPF}	1.00
	RMS value of the source current for two-phase fault	$I_{(1)sk2PF}$	1.00
	RMS value of the source current for single-phase fault	$I_{(1)sk1PF}$	1.00
	Negative-sequence short-circuit impedance for integer k-factors	$Z_{(2)PF}$	0.50

The PGU have been designed so that the requirements of VDE-AR-N 4110 and VDE-AR-N 4120 for the power generating unit can be complied with.

The prototype is an essential technical advancement or innovation.

This series product is new generation developed by new topology and firmware.

The product on certificate no: 968/GI 1569.01/22 is previous generation, do not link to new generation.

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