PROTOTYPE DECLARATION / Prototypenbescheinigung

Product prototype certificate number No:2619/0246-PTCER

For the company: / *Für das Unternehmen*

Sungrow Power Supply Co., LTD.
No. 1699, Xiyou Road
New&High Technology Industrial Developlment Zone
Hefei City, Anhui Province, P.R. China

Has provided to E&E Product Certification Body of SGS the technical documentation indicated in both articles no. 12 of standards /
Hat der E & E-Produktzertifizierungsstelle von SGS die technischen Dokumente für beide Artikel-Nr. 12 des Standards überliefert:

- **VDE-AR-N 4110: 2018.** Technical requirements for the connection and operation of customer installations to the medium voltage network (TAR medium voltage) /
  VDE-AR-N 4110: 2018. Technische Voraussetzungen für den Anschluss und Betrieb von Kundenanlagen an das Mittelspannungsnetz (TAR-Mittelspannung).
- **VDE-AR-N 4120:2018.** Technical requirements for the connection and operation of customer installations to the high voltage network (TAR high voltage).
  VDE-AR-N 4120: 2018.. Technische Voraussetzungen für den Anschluss und Betrieb von Kundeninstallationen an das Hochspannungsnetz (TAR-Hochspannung).

For the product / *Für das Produkt:* **Type 2 PV Grid-Connected Inverter / *Typ 2 PV-Wechselrichter***

Models / *Modelle:*		**SG250HX**
Technical Data / *Technische Daten:*		
DC	Max. PV input voltaje / *Max. PV-Eingangsspannung:*	1500 V
	MPP Voltage Range / *MPP-Spannungsbereich:*	600 – 1500 V
	Nº of MPP inputs / *Anzahl MPP-Eingänge:*	12
	Max. PV input current / *Max. PV-Eingangsstrom:*	26 A x 12
AC	AC output power/ *AC-Ausgangsleistung:*	250 kVA
	Max. AC output current / *Max. AC-Ausgangsstrom:*	180.5 A
	Nominal Grid Voltage / *Nominale Netzspannung:*	3 / N / PE, 800 V
	AC voltage range / *Wechselspannungsbereich:*	680 – 880 V
	Nominal Grid Frequency / *Nominale Netzfrequenz:*	50 / 60 Hz

We confirm that the above mentioned PV inverters are considered as Prototypes in accordance with the VDE-AR-N 4110, the VDE-AR-N 4120 and the standard FGW TR 8 / *Hiermit bestätigen wir, dass es sich bei der genannten EZE nach VDE-AR-N 4110, VDE-AR-N 4120 und FGW TR 8 um einen Prototyp handelt*

- **FGW TR8. Certification of the Electrical Characteristics of Power Generating Units, Systems and Storage Systems as well as for their Components to the Grid. Revision 9.**
  FGW TR8. Zertifizierung der elektrischen Eigenschaften von Erzeugungseinheiten und -anlagen, Speicher sowie für deren Komponenten am Stromnetz. Revision 9.

Test reports and certificates will be issued when the testing process is finished and evaluated with positive result.
Testberichte und Zertifikate werden nach Abschluss des Testprozesses ausgestellt und mit positivem Ergebnis bewertet.

Madrid, 1st of August 2019

SGS Tecnos, S.A.

Daniel Arranz
Certification Manager /
Zertifizierungsmanager

Annex 1 / *Anhang 1*

This certificate confirms that the mentioned generation unit is a prototype according to FGW TR 8. For this purpose, the PGU is described below and the main technical developments or innovations are presented: /
Diese Bescheinigung bestätigt, dass es sich bei der genannten Erzeugungseinheit nach FGW TR 8 um einen Prototypen handelt. Dazu wird im Folgenden die EZE beschrieben und die wesentlichen technischen Weiterentwicklungen oder Neuerungen dargestellt:

Description of the generating unit / *Beschreibung der Erzeugungseinheit:*

The photovoltaic generation unit (PV-PGU) enables the supply of direct current generated by means of photovoltaic modules from solar radiation into the public alternating current grid using power electronics. /
Die Photovoltaikerzeugungseinheit (PV-EZE) ermöglicht die Einspeisung von Gleichstrom erzeugt mittels Photovoltaikmodulen aus solarer Einstrahlung in das öffentliche Wechselstromnetz unter Verwendung von Leistungselektronik.

Treatment according to FGW TR 8, 2.3.2.2 / Behandlung nach FGW TR 8, 2.3.2.2:

The mentioned PGU is a non-wind generation unit. The plant certificate must be issued two years after the commissioning of the first PGU at the latest. /
Bei der genannten EZE handelt es sich um eine Nicht-Wind-Erzeugungseinheit. Spätestens zwei Jahre nach der Inbetriebnahme der ersten EZE muss das Anlagenzertifikat erstellt werden.

The PGU is operated in an PGS (generation plant), which consists of an PGU with PGU certificate and prototypes (case 2). Manufacturer's data must be compiled and provided for certification of the plant. The final plant certificate is issued when the PGU certificate is available for the generation unit in question./
Die EZE wird in einer EZA (Erzeugungsanlage) betrieben, welche aus EZE mit EZE-Zertifikat und Prototypen besteht (Fall 2). Herstellerangaben müssen erstellt und für die Zertifizierung der Anlage zur Verfügung gestellt werden. Das endgültige Anlagenzertifikat wird erstellt, wenn das EZE-Zertifikat für die genannte Erzeugungseinheit vorliegt.

Annex 2 / *Anhang 2*

This certificate confirms that the mentioned generation unit is a prototype according to FGW TR 8. For this purpose, the PGU is described below and the main technical developments or innovations are presented: /
Diese Bescheinigung bestätigt, dass die genannte Erzeugungseinheit (EZE) in der Lage ist, die Anforderungen an die elektrischen Eigenschaften der Erzeugungseinheit nach VDE-AR-N 4110 und VDE-AR-N 4120 zu erfüllen. Dazu wird im Folgenden die Übereinstimmung der elektrischen Eigenschaften der EZE mit den Anforderungen nach VDE-ARN 4110 und VDE 4120 nachgewiesen:

VDE-AR-N 4110 & VDE-AR-N 4120	**Comment and reference / *Kommentar und Bewertung***
12 Regulation for prototypes / *Prototypen-Regelung*	
A prototype is the first power generating unit of a type presenting substantial technological developments or innovations and all other power generating units of this type put into operation within two years after the commissioning of the first power generating unit of this type. / *Ein Prototyp ist die erste Erzeugungseinheit eines Typs, der wesentliche technische Weiterentwicklungen oder Neuerungen aufweist, und alle weiteren Erzeugungseinheiten dieses Typs, die innerhalb von zwei Jahren nach der Inbetriebsetzung der ersten Erzeugungseinheit dieses Typs in Betrieb gesetzt werden.* NOTE 1 This definition corresponds to the term's definition given in SDLWindV. There is no relation to the term "pilot wind turbine" (de: Pilotwindenergieanlage) used in the EEG. / *ANMERKUNG 1 Diese Definition entspricht der Begriffsdefinition nach SDLWindV. Es besteht kein Zusammenhang zum Begriff „Pilotwindenergieanlage" im EEG [6].* Technological developments and innovations are generally considered to be substantial where components or software versions are changed so that the electrical behaviour of the power generating unit at the network changes significantly and a unit certification of this new type is required. / *Wesentliche technische Weiterentwicklungen und Neuerungen liegen in der Regel vor, wenn Komponenten oder Softwareversionen so geändert werden,dass sich das elektrische Verhalten der Erzeugungseinheit am Netz signifikant ändert und eine Einheitenzertifizierung dieses neuen Typs erforderlich wird.*	Checked / *Berücksichtigt:* - See annex 1 / siehe Anhang 1
For the prototype of a power generating unit the requirements of this VDE application guide apply. For these prototypes, a prototype confirmation, in which the certification body confirms a substantial technological development or innovation based on a manufacturer declaration, is sufficient, instead of the unit certificate, for a period of two years after commissioning of the first power generating unit prototype in Germany. The certification body shall also check and set out reproducibly in the prototype confirmation, whether the prototype is generally capable of meeting the requirements of this VDE application guide for the electrical properties of the power generating unit. This is based on an electrical properties data sheet prepared by the manufacturer of the power generating unit. / *Für einen Prototypen einer Erzeugungseinheit gelten die Anforderungen dieser VDE-Anwendungsregel. Innerhalb von zwei Jahren nach der Inbetriebsetzung der ersten Prototypen-Erzeugungseinheit in Deutschland ist für diese Prototypen anstelle des Einheitenzertiflkats eine Prototypenbestätigung ausreichend, in der die Zertifizierungsstelle das Vorhandensein einer wesentlichen technischen Weiterentwicklung oder Neuerung auf Basis einer Herstellererklärung bestätigt. Weiterhin ist durch die Zertifizierungsstelle zu prüfen und in der Prototypenbestätigung nachvollziehbar auszuweisen, ob der Prototyp grundsätzlich in der Lage ist. die Anforderungen dieser VDE-Anwendungsregel an die elektrischen Eigenschaften der Erzeugungseinheit zu erfüllen. Dies erfolgt auf Basis eines vom Hersteller der Erzeugungseinheit erstellten Datenblattes der elektrischen Eigenschaften.* For prototypes commissioned before 2019-04-27, the above-mentioned period starts 2019-04-27. / *Für Prototypen die vor dem 27.04.2019 in Betrieb gesetzt werden, beginnt die oben genannte Frist am 27.04.2019.*	Checked / *Berücksichtigt*

VDE-AR-N 4110 & VDE-AR-N 4120	Comment and reference / *Kommentar und Bewertung*
In order to allow the certification body to carry out the required plausibility test, the data sheet of the power generating unit shall contain at least the following information:/ *Damit die geforderte Plausibilitätsprüfung durch die Zertifizierungsstelle erfolgen kann, muss das Datenblatt der Erzeugungseinheit mindestens folgende Angaben enthalten:*	Checked / *Berücksichtigt* After documentation provided by the manufacturer (see annex 3 and Annex 4). / *Daten vom Hersteller stehen zur Verfügung (siehe Anhang 3 und Anhang 4).*
1. Electrical data (nominal and rated quantities) / E*lektrische Daten (Nenn- und Bemessungsgrößen);*	Compliant / *Erfüllt:* - See annex 3 / *siehe Anhang 3*
2. Schematic overview circuit diagram of the power generating unit with all relevant componentsschematisches / *Übersichtsbilcl der Erzeugungseinheit mit allen wesentlichen Komponenten.*	Compliant / *Erfüllt:* - See annex 4 / *siehe Anhang 4*
3. Operating ranges of the power generating unit / *Betriebsbereiche der Erzeugungseinheit:* • Limits in quasi-static operation / *Grenzen im quasistationären Betrieb.* • Reactive power adjustment range / Blindleistungsstellbereich. • FRT limit curve (U/t diagram) / *FRT-Grenzkurve(U/t-Diagramm).*	Compliant / *Erfüllt:* - See annex 4 / *siehe Anhang 4*
4. Protection functions with setting ranges / *Schutzfunktionen mit Einstellberemhen:* • Decoupling protection / Entkupplungschutz. • Self-protection / Eigenschutz.	Compliant / *Erfüllt:* - See annex 4 / *siehe Anhang 4*
5. Active power control / *Wirkleistungsregelung:* • Power/frequency behaviour / *Leistungs-Freqbenz-Verhalten.* • Active power gradient / *Wirkleistungsgradient.*	Compliant / *Erfüllt:* - See annex 4 / *siehe Anhang 4*
6. Reactive power control / Blindleistungsregelung.	Compliant / *Erfüllt:* - See annex 4 / *siehe Anhang 4*
7. Dynamic reactive current feed-in / *Dynamische Blindstromeinspeisung:* • Basic functionality / *GrundsätzlicheFunktionsweise.*	Compliant / *Erfüllt:* - See annex 4 / *siehe Anhang 4*
8. Declaration of the manufacturer stating that the power generating unit has been designed so that the requirements of this application guide for the power generating unit can be complied with / *Erklärung des Herstellers, dass die Erzeugungseinheit so konstruiert wurde, dass die Anforderungen dieser Anwendungsregel an die Erzeugungseinheit erfüllt werden können.*	Compliant / *Erfüllt:* - See annex 4 / *siehe Anhang 4*
At the latest after expiry of the above-mentioned period, a unit certificate is required. / *Spätestens nach Ablauf der oben genannten Frist ist ein Einheitenzertifikat erforderlich.* *NOTE 2 If the unit certificate is available prior to expiry of the two-year term after commissioning the first power generating unit of this type, it can still be a prototype. / ANMERKUNG 2 Sofern das Einheitenzertifikat vor Ablauf der Frist von zwei Jahren nach der Inbelnebsetzung der ersten Erzeugungseinheilt.*	Compliant / *Erfüllt*

Annex 3 / *Anhang 3*

Datasheet of the generating unit / *Datenblatt der Erzeugungseinheit:*

1. Electrical data

SG250HX

Type designation	SG250HX
Input (DC)	
Max. PV input voltage	1500 V
Min. PV input voltage / Startup input voltage	600 V / 600 V
Nominal PV input voltage	1160 V
MPP voltage range	600 V - 1500 V
MPP voltage range for nominal power	860 V - 1300 V
No. of independent MPP inputs	12
Max. number of input connectors per MPPT	2
Max. PV input current	26 A * 12
Max. current for input connector	30 A
Max. DC short-circuit current	50 A * 12
Output (AC)	
AC output power	250 kVA @ 30 °C / 225 kVA @40 °C / 200 kVA @ 50 °C
Max. AC output current	180.5 A
Nominal AC voltage	3 / PE, 800 V
AC voltage range	680 - 880V
Nominal grid frequency / Grid frequency range	50 Hz / 45 - 55 Hz, 60 Hz / 55 - 65 Hz
THD	< 3 % (at nominal power)
DC current injection	< 0.5 % In
Power factor at nominal power / Adjustable power factor	> 0.99 / 0.8 leading - 0.8 lagging
Feed-in phases / connection phases	3 / 3
Efficiency	
Max. efficiency	99.0 %
European efficiency	98.8 %
Protection	
DC reverse connection protection	Yes
AC short circuit protection	Yes
Leakage current protection	Yes
Grid monitoring	Yes
Ground fault monitoring	Yes
DC switch	Yes
AC switch	No
PV String current monitoring	Yes
Q at night function	Yes
PID protection	Anti-PID or PID recovery
Overvoltage protection	DC Type II / AC Type II
General Data	
Dimensions (W*H*D)	1051 * 660 * 363 mm
Weight	95kg
Isolation method	Transformerless
Ingress protection rating	IP66
Night power consumption	< 2 W
Operating ambient temperature range	-30 to 60 °C
Allowable relative humidity range (non-condensing)	0 - 100 %
Cooling method	Smart forced air cooling
Max. operating altitude	4000 m (> 3000 m derating)
Display	LED, Bluetooth+APP
Communication	RS485 / PLC
DC connection type	Amphenol UTX (Max. 6 mm²)
AC connection type	OT terminal (Max. 300 mm²)
Compliance	IEC 62109, IEC 61727, IEC 62116, IEC 60068, IEC 61683, VDE-AR-N 4110:2018, VDE-AR-N 4120:2018, IEC 61000-6-3, EN 50549, UNE 206007-1:2013, P.O.12.3, UTE C15-712-1:2013
Grid Support	Q at night function, LVRT, HVRT, active & reactive power control and power ramp rate control

*: Only compatible with Sungrow logger and iSolarCloud

Annex 4 / *Anhang 4*

Technical data of the generating unit / *Technische Daten der Erzeugungseinheit:*

SUNGROW

2. Schematic overview of SG250HX

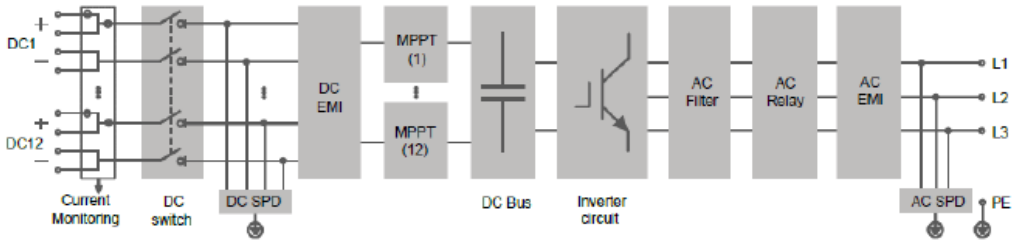

Figure 1 Schematic overview of SG250HX

3. Selection for VDE-AR-N 4110 and VDE-AR-N 4120

When first start PV inverter SG250HX, there will be an initial setting for country and corresponding gird type connected according to Figure 2 below.

After enter into 'Germany' for Germany setting, then choose the gird type as:

Low voltage for VDE-AR-N 4105

Medium voltage for VDE-AR-N 4110

High voltage for VDE-AR-N 4120

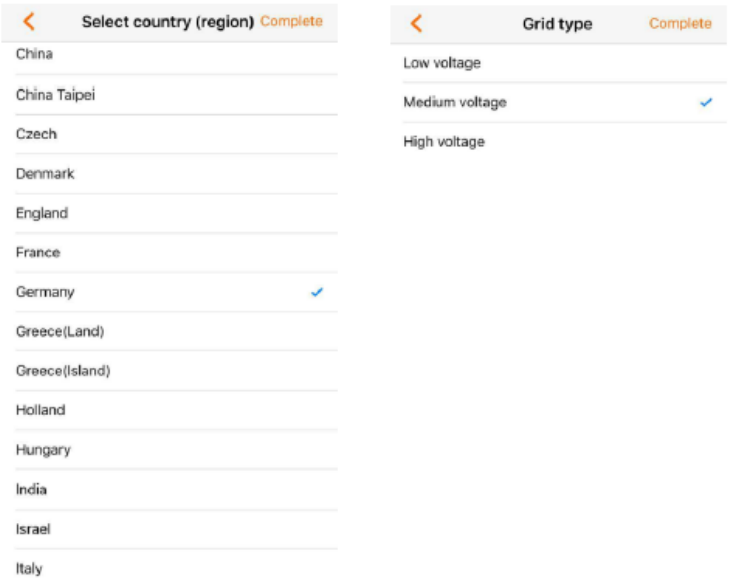

Figure 2 Country and grid type setting for SG250HX

4. Operational areas of SG250HX

a) Limits during quasi-stationary operation

For both VDE-AR-N 4110 and 4120, in the entire frequency range from 47.5 Hz to 51.5 Hz and voltages in the range of 85% Un to 115% Un at the SG250HX PV inverter AC connection terminal, while voltage gradient <5% Uc / min and a frequency gradient of <0.5% fn / min, for quasi-stationary operation, SG250HX PV inverter is able to in parallel operation with grid according to the minimum duration time Figure 3 below.

When voltage changes at the inverter AC terminal in the amount of $\Delta U \leq 10\%$ Uc with voltage gradients of $\geq$ 5% Uc / min within the voltage band from 90% Uc to 110% Uc occur, inverter has no reduction for active and reactive power and keep connected to the grid.

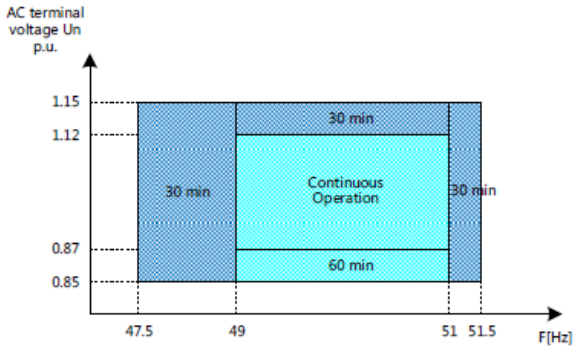

Figure 3 Quasi-stationary operation range for SG250HX

b) Reactive power capability

For both VDE-AR-N 4110 and 4120, the reactive power capability of SG250HX PV inverter is according to Figure 4 below.

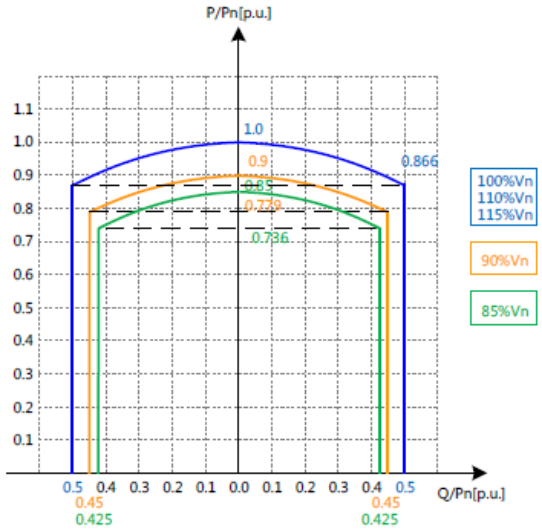

Figure 4 Voltage-dependent PQ diagram for SG250HX

c) FRT-limit curve (U(t)-diagram)

For both VDE-AR-N 4110 and 4120, the FRT limit curve of SG250HX PV inverter is according to Figure 5 below.

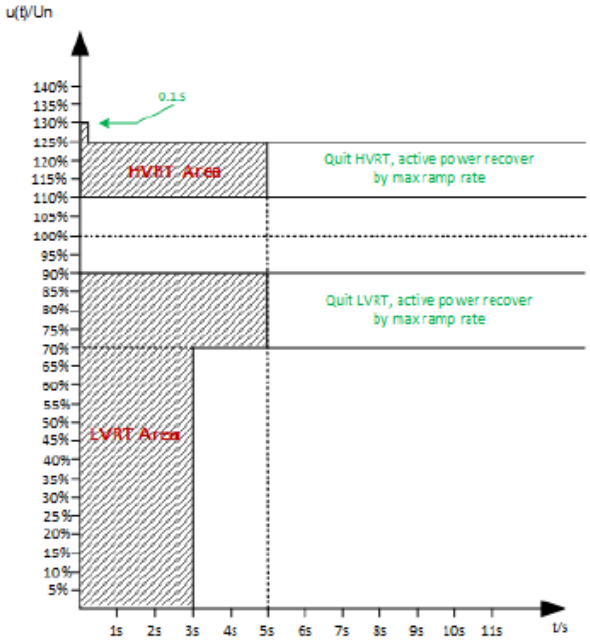

Figure 5 FRT limit curve for SG250HX

Note: For the reason of limited dynamic grid support requirement, SG250HX provide ZP(Zero Power) mode as well, when select this mode, SG250HX will supply no active and reactive power during LVRT for the voltage drop ≤70%Un , but for voltage range from 70%~90%Un, even choose ZP mode, inverter will enter into normal LVRT period with reactive power supplied by K factor.

5. Protection functions:

a) Grid prtection

The default grid protection of SG250HX for VDE-AR-N 4110:2018 is according to Table 1 below:

Function	Protection value	Trip time
U>	Default: 1.25 Un Range: 1.0-1.4Un	Default: 0.1s Range: 0-14400s
U>>	Default: 1.25 Un Range: 1.0-1.4Un	Default: 0.1s Range: 0-14400s
U<	Default: 0.80 Un Range: 0.1-1.0Un	Default: 1.0 s Range: 0-14400s
U<<	Default: 0.45 Un Range: 0.1-1.0Un	Default: 0.3s Range: 0-14400s
f>>	Default: 52.5 Hz Range: 50.11-55.0Hz	Default: 0.1s Range: 0-14400s
f>	Default: 51.5 Hz Range: 50.11-55.0Hz	Default: 5 s Range: 0-14400s
f<	Default: 47.5 Hz Range: 45.0-49.88Hz	Default: 0.1s Range: 0-14400s

Table 1 SG250HX default protection setting for VDE-AR-N 4110:2018

The default grid protection of SG250HX for VDE-AR-N 4120:2018 is according to Table 2 below:

Function	Protection value	Trip time
U>>	Default: 1.25 Un Range: 1.0-1.4Un	Default: 0.1s Range: 0-14400s
U>	Default: 1.25 Un Range: 1.0-1.4Un	Default: 0.1s Range: 0-14400s
U<	Default: 0.80 Un Range: 0.1-1.0Un	2.4 s Range: 0-14400s
U<<	Default: 0.30 Un Range: 0.1-1.0Un	800 ms Range: 0-14400s
f>>	Default: 52.5 Hz Range: 50.11-55.0Hz	≤ 0.1s Range: 0-14400s
f>	Default: 51.5 Hz Range: 50.11-55.0Hz	≤ 5 s Range: 0-14400s
f<	Default: 47.5 Hz Range: 45.0-49.88Hz	Default: 0.1s Range: 0-14400s

Table 2 SG250HX default protection setting for VDE-AR-N 4120:2018

Function	Protection value	Trip time
Step for Voltage protection	0.1V	0.01s
Step for Frequency protection	0.01Hz	0.01s

Table 3 SG250HX setting step for voltage/frequency protection

The protection functions is independence from other set point, once the set points is fixed, it' s cannot be possible to change the protection set point by remote power plant controller.

After the inverter trip for protection, when the voltage recovers to at least 95%Un and frequency is between 49.9~50.1Hz, SG250HX has the setting of the delay time of recovery for both VDE-AR-N 4110 and 4120, the setting range is from 0 to 30 mins, default setting is 10 mins. And for VDE-AR-N 4120 only, inverter will wait PPC(power plant controller)' s release signal for reconnection first when PPC detect the PV plant grid connection point voltage is over 95%Un.

Notes: SG250HX didn' t provide testing terminal for protection test without disconnect the wires, such test terminal would be supplied at the system level on the LV side of MV transformer.

b)Intrinsic ("self") protection

For both VDE-AR-N 4110 and 4120, SG250HX is integrated with intrinsic hardware protection only for over voltage, the protection is for hardware protection and is not settable. The protection default setting is 1.4Un for 1ms.

6. Active power control

a) Frequency control (P(f)-diagram)

For both VDE-AR-N 4110 and 4120, P(f)-diagram is default according to Figure 6 below.

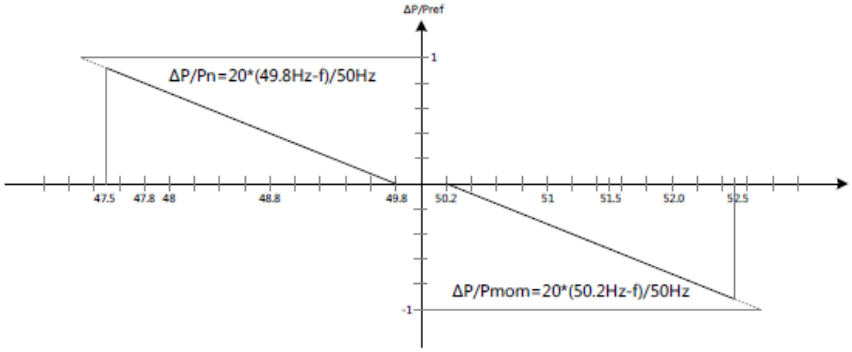

Figure 6 SG250HX P(f)-diagram

Note: Here Pmom is the active power freeze at that moment when the frequency to 50.2Hz. Pn is normial active power. The default gradient for over-frequency and under-frequency is 40%Pref/Hz (slope=5%), while it can be adjustable from 16.67%Pref/Hz(s=12%) to 100%Pref/Hz(s=2%).
When doing for TR3 test, due to the requirement by FGW TR3, inverter take higher priority for active power rising during frequency drop from 49.8Hz to 47.5Hz temporary than dispatching command by grid operator set point only for test purpose, but the final inverter will take higher priority for dispatching command set point.

b) Related gradients, dynamics and functions

For both VDE-AR-N 4110 and 4120, the following active power control applied to SG250HX.
Normal active power gradients: 0.33%Pn/s~0.66%Pn/s (default is 0.66%Pn/s) for stationary connection and reconnection after grid fault trip.
P(f)-diagram: When frequency over 50.2Hz and dropping below 49.8Hz, the active power gradients is 100%Pn/s. When frequency returned to rated value(50Hz±0.2Hz), for the first 10mins, the active power gradients is less than 10%Pn/min, after 10mins quit from abnormal frequency, the active power gradients will back to normal active power gradients: 0.33%Pn/s~0.66%Pn/s.
Dynamic functions: When SG250HX enter into FTR, the active power reduced to zero to ensure reactive power, after the FTR end according to Figure 4 limit or 5s whichever is the earlier, the active power will recover by max ramp rate within 1s.

c) Set point

For both VDE-AR-N 4110 and 4120, the active power control set point applied to SG250HX is according to Table 4 Underfrequency increment and Table 5 Overfrequency derating.

Function	Default Set point	Set range
Frequency-power response(Underfrequency increment)	ON	ON/OFF
F1 (0.01Hz step)	49.80Hz	45.00-49.98Hz
P1 (0.1%Pn step)	0.0% (refer to Pn)	0.0-100.0%

F2	49.80Hz	45.00-49.98Hz
P2	0.0% (refer to Pn)	0-100.0%
F3	47.50Hz	45.00-49.98Hz
P3	92.0% (refer to Pn)	0.0-100.0%
Underfrequency up restore point	49.95Hz	45.00-50.00HZ
Underfrequency up curve	A curve	A curve /B curve/ C curve
Active power drop rate in underfrequency up	6000%/min	1-6000%/min
Time to wait for restoration after underfrequency up	300s	1-1200s
Active power restoration rate after underfrequency up	9%/min	1-6000%/min

Table 4 Active power set point for SG250HX (Underfrequency increment)

Function	Default Set point	Set range
Frequency-power response(Overfrequency derating)	ON	ON/OFF
F1 (0.01Hz step)	50.20Hz	50.02-55.00Hz
P1 (0.1%Pn step)	100.0% (refer to Pmom)	0-100.0%
F2	52.50Hz	50.02-55.00Hz
P2	8.0% (refer to Pmom)	0-100.0%
F3	52.50Hz	50.02 -55.00Hz
P3	0.0% (refer to Pmom)	0-100.0%
Overfrequency derating recovery point	50.20Hz	50.00-55.00Hz
Overfrequency drop curve	A curve	A curve /B curve/ C curve
Active power drop rate in overfrequency drop	6000%/min	1-6000%/min
Time to wait for restoration after overfrequency drop	0.1s	1-1200s
Active power restoration rate after overfrequency drop	9%/min	1-6000%/min

Table 5 Active power set point for SG250HX(Overfrequency derating)

7. Reactive power control

a) Related gradients, dynamics and functions

For both VDE-AR-N 4110 and 4120, SG250HX reactive power control is following according to Figure 7 below.

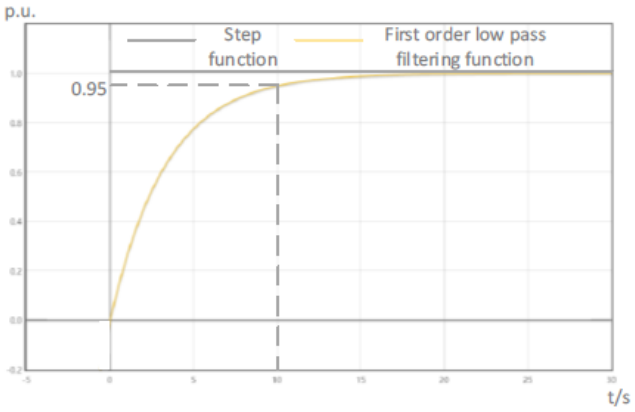

Figure 7 SG250HX reactive power control feature

The reactive power is supplied by equation (1):

Q = Qset * [1-e^(3t/3Tau)] (1)

Here the time constant 3Tau is settable as the time for 95% target value.

For VDE-AR-N 4110, the 3Tau setting range is from 1~60s, the default setting is 10s.

For VDE-AR-N 4120, the 3Tau setting range is from 1~60s, the default setting is 5s.

As VDE-AR-N 4120 requires for 90% target value time while VDE-AR-N 4110 requires for 95% target value time, so the time constant setting for VDE 4120 from 1~5s will multiplied 1.3times internal PV inverter processing to make sure 90% target value time by the equation is same as the setting time.

b) Set point

For VDE-AR-N 4110 and 4120, the reactive power control set point applied to SG250HX is according to Table 6.

Function	Default Set point	Set range
Q-Var switch	OFF	Pf/Qt/Off/QP/QU (1)
Pf (when select Pf) (0.001)	1.000	-1 ~ -0.8 , +0.8~ +1
Reactive response(when select Qt)	ON	ON/OFF
Reactive response time(when select Qt)	0.2s	0.1-600s
Reactive power limit(when select Qt) (0.1%)	100.0%	0~100% (refer to Qmax)
Reactive response(when select Q(P))	ON	ON/OFF

Reactive response time(when select Q(P))	10s for VDE 4110 0.2s for VDE 4120	1~600s
Curve (when select Q(P))	B curve for VDE 4110 A curve for VDE 4120	A/B/C curve
PA (when select Q(P))	50%	10%-100%
PB (when select Q(P))	60% for VDE 4110 50% for VDE 4120	20%-100%
PC (when select Q(P))	90.0% for VDE 4110 100.0% for VDE 4120	20%-100%
K_A (when select Q(P))	0.000 for VDE 4110 1.000 for VDE 4120	-0.600~+0.600 for curve B 0.900-1.000 for curve A/C
K_B (when select Q(P))	0.050 for VDE 4110 1.000 for VDE 4120	-0.600~+0.600 for curve B 0.900-1.000 for curve A/C
K_C (when select Q(P))	0.330 for VDE 4110 0.900 for VDE 4120	-0.600~+0.600 for curve B 0.900-1.000 for curve A/C
Uin(when select Q(P))	105.0%	100%-110%
Uout(when select Q(P))	100.0%	90%-100%
Pout(when select Q(P))	10.0%	1%-20%
No Condition In(when select Q(P))	ON	ON/OFF
Q(U)		
Reactive response(when select Q(U))	ON	ON/OFF
Reactive response time(when select Q(U))	10s for VDE 4110 5s for VDE 4120	1~600s
Curve (when select Q(U))	A	A/B/C curve
Hysteresis(when select Q(U))	0.0%	0-5%
U1(when select Q(U))	94.0%	80%-100%
K_Q1(when select Q(U))	-33.0%	-60%~0
U2(when select Q(U))	96.0%	80%-100%
K_Q2(when select Q(U))	0.0%	-60%~+60%
U3(when select Q(U))	104.0%	100%~120%
K_Q3(when select Q(U))	0.0%	-60%~+60%
U4(when select Q(U))	106.0%	100%~120%
K_Q4(when select Q(U))	33.0%	0%~+60%
Pin(when select Q(U))	20.0%	20.0%~100%
Pout(when select Q(U))	9.0%	1%~20%
No Condition In(when select Q(U))	ON	ON/OFF

Table 6 Reactive power set point for SG250HX

(1) Pf The reactive power can be regulated by the parameter PF (Power Factor).

Qt The reactive power can be regulated by the parameter Reactive power limit (in %).

Off The PF is limited to +1.000, and the "Q-Var limits" is limited to 0.0%.

Q(P) The PF changes with the output power of the inverter.

Q(U) The reactive power changes with the grid voltage.

8. Dynamic reactive current control

a) Basic functions

The reactive current supply during FRT is calculated by both positive sequence and negative sequence component. The additional reactive current Δi_B of SG250HX is proportional to the voltage deviation Δu ($\Delta i_B = k^* \Delta u$), where k is the amplification factor. It is defined by the straight line below in Figure 8.

The k factor is settable between 0 to 10 with the step of 0.1, the default SG250HX k factor for VDE-AR-N 4110 is 2, and for VDE-AR-N 4120 is 5.

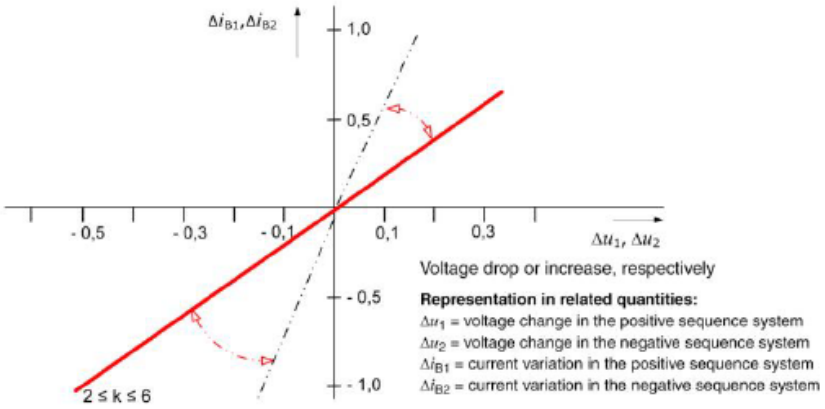

Figure 8 k factor of voltage support in the event of a network fault