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Certificate of compliance

Applicant:

SMA Solar Technology AG
Sonnenallee 1, 34266 Niestetal
Germany

Product:

Grid-tied photovoltaic (PV) inverter & Grid-tied bi-directional battery converter

Model:

Grid connected photovoltaic inverter:

SC 4000 UP, **SC 4200 UP,** **SC 4400 UP,** **SC 4600 UP,**
SC 2500-EV-10

Grid-tied bi-directional battery converter:

SCS 1900-10, **SCS 2900-10**

Use in accordance with regulations:

Automatic disconnection device with three-phase mains surveillance in accordance with EN 50549-2:2019 for photovoltaic systems with a three-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter.

Connection rule:

EN 50549-2:2019:

Requirements for generating plants to be connected in parallel with distribution networks - Part 2:
Connection to a MV distribution network - Generating plants up to and including Type B

Regulations:

Commission Regulation (EU) 2016/631 of April 2016

Establishing a network code on requirements for grid connection of generators

Standards / directives for testing:

FGW TG3, Rev. 25: 2018-09-01
CEI 0-16:2019-04
IEC 62116:2014

The power generating units, stated in the certificate, were tested and certified according to the technical guidelines referenced to the grid connection regulation. The electrical characteristics fulfil the requirements of the grid connection regulation:

- 4.4 Normal operating range
- 4.5 Immunity to disturbances
- 4.6 Active response to frequency deviation
- 4.7 Power response to voltage changes
- 4.8 EMC and power quality
- 4.9 Interface protection
- 4.10 Connection and starting to generate electrical power
- 4.11 Ceasing and reduction of active power on set point

This certificate proofs the conformity of a generating unit. However, some requirements, such as FSM or reactive power capacity, are applicable on the generating plant level, which assessment is out of the scope of this certificate. As a consequence, it is possible that the conformity assessment of a generating unit does not cover all aspects of the above mentioned standardization documents, typically when a requirement is rather evaluated on a plant level.

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

Report number: 15TH0407_EN50549-2_0

Certification scheme: NSOP-0032-DEU-ZE-V01

Certificate number: U20-1009

Date of issue:

2020-11-14

Certification body

Thomas Lammel



Deutsche
Akreditierungsstelle
D-ZE-12024-01-00

Certification body of Bureau Veritas Consumer Products Services Germany GmbH accredited according to DIN EN ISO/IEC 17065

A partial representation of the certificate requires the written approval of Bureau Veritas Consumer Products Services Germany GmbH

Type Approval and declaration of compliance with the requirements of EN 50549-2				
Unit / Type	SUNNY CENTRAL UP			
	SC 4000 UP		SC 4200 UP	
Firmware version	07.01.03.R			
Temperature dependence [°C]	25	50	25	50
MPP DC voltage range [V].....	880 - 1325	880 - 1100	921 - 1325	921 - 1100
Input DC voltage range [V]	849 - 1500		891 - 1500	
Input DC current [A].....	max. 4750			
Nominal output AC voltage [V].....	600, 3~ + PE, 50Hz		630, 3~ + PE, 50Hz	
AC voltage range [V].....	480 ~ 720		504 ~ 756	
Nominal output AC current [A].....	3850	3273	3850	3273
Nominal active output power [kW]	4000	3400	4200	3570
Max. apparent / active output power [kVA / kW].....	4000	3400	4200	3570
Unit / Type	SUNNY CENTRAL UP			
	SC 4400 UP		SC 4600 UP	
Firmware version	07.01.03.R			
Temperature dependence [°C]	25	50	25	50
MPP DC voltage range [V].....	962 - 1325	962 - 1100	1003 - 1325	1003 - 1100
Input DC voltage range [V]	934 - 1500		976 - 1500	
Input DC current [A].....	max. 4750			
Nominal output AC voltage [V].....	660, 3~ + PE, 50Hz		690, 3~ + PE, 50Hz	
AC voltage range [V].....	528 ~ 759		552 ~ 759	
Nominal output AC current [A].....	3850	3273	3850	3273
Nominal active output power [kW]	4400	3740	4600	3910
Max. apparent / active output power [kVA / kW].....	4400	3740	4600	3910

Unit / Type.....	SUNNY CENTRAL STORAGE					
	SCS 1900-10		SCS 2900-10			
Firmware version	07.01.03.R					
Temperature dependence [°C].....	25	50	25	50		
DC operating voltage range [V].....	477 - 1100					
Input DC current [A]	max. 4060					
Nominal output AC voltage [V].....	337, 3~ + PE, 50Hz		520, 3~ + PE, 50Hz			
AC voltage range [V].....	270 ~ 404		416 ~ 624			
Nominal output AC current [A]	3255	2960	3265	2968		
Nominal active output power [kW].....	1900	1727	2940	2673		
Max. apparent / active output power [kVA / kW]	1900	1727	2940	2673		
Unit / Type.....	SUNNY CENTRAL					
	SC 2500-EV-10					
Firmware version	07.01.03.R					
Temperature dependence [°C].....	35	50				
MPP DC voltage range [V].....	850 - 1425		850 - 1200			
Input DC voltage range [V].....	778 - 1500					
Input DC current [A]	max. 3200					
Nominal output AC voltage [V].....	550, 3~ + PE, 50Hz					
AC voltage range [V].....	440 ~ 660					
Nominal output AC current [A]	2624		2362			
Nominal active output power [kW].....	2500		2250			
Max. apparent / active output power [kVA / kW]	2500		2250			

Description of the structure of the power generation unit:

The DC input is connected to wiring terminals. The input provides fuses for every DC input which are monitored by a fuse monitoring system and an overvoltage protection build of varistors to PE. The input current is measured via a current sensor. Afterwards there is the DC switch. EMC filtering is done via x-capacitors, y-capacitors and inductances. After the EMC filter, the Control Board checks the DC input voltage and current, before it is going to the IGBT modules which are also monitored by the control board with the gate driver control unit. A B6 inverter makes the PWM signal. The PWM signal is smoothed by a LC filter into a sine wave. The AC current is measured by current sensors and the DC current directly after the PV-fuses. The unit does not provide galvanic separation from input to output (transformerless inverter).

Parameter Table



Parameter list of PGU series SC(S)

1. Information regarding the power generating unit

Type designation (clear identification of the type)	Rated power [kW] @ cos φ = 1; @ 25°C	Rated active current [A] @ 25°C
SC 2200	2200	3300
SC 2475	2475	3300
SC 2500-EV	2500	2624
SC 2750-EV	2750	2646
SC 3000-EV	3000	2646
SC 4000 UP	4000	3850
SC 4200 UP	4200	3850
SC 4400 UP	4400	3850
SC 4600 UP	4600	3850
SCS 1900	1900	3255
SCS 2200	2200	3300
SCS 2475	2475	3292
SCS 2900	2900	3265
SCS 3450 UP	3450	3320
SCS 3450 UP-XT	4000	3850
SCS 3600 UP	3620	3320
SCS 3600 UP-XT	4200	3850
SCS 3800 UP	3800	3320
SCS 3800 UP-XT	4400	3850
SCS 3950 UP	3960	3320
SCS 3950 UP-XT	4600	3850
SC 2660 UP	2660	
SC 2800 UP	2800	
SC 2930 UP	2930	
SC 3060 UP	3060	
SCS 2300 UP-XT	2300	
SCS 2400 UP-XT	2400	
SCS 2530 UP-XT	2530	
SCS 2630 UP-XT	2630	



2. Relevant parameters for the electrical behaviour

General parameter settings (rated values or reference values): parameters marked in green depend on the inverter type. Type depending parameters refer to device SC4600 UP.

Parameter set for the default values:		"VDE-AR-N 4110"				
No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	WRtg	Rated (max.) active power	kW	0	5000	4600
	VArRtg	Rated (max.) apparent power	kVA	0	5000	4600
	VolRtg	Rated voltage	V			690
	AmpRtg	Rated (max.) current	A			3850
	HzRtg	Rated frequency	Hz			50
	VArRtg	Rated (max.) reactive power overexcited	kVAr	0	5000	2760
	VArRtg	Rated (max.) reactive power overexcited	kVAr	0	5000	2760
<i>Operating power limited by grid operator</i>						
	WGra	Active power ramp in case of grid operator specification (increase and decrease)	p.u./s	0	100	0,2
	GriMng.WMod	The source for the specification of the external active power control is configured in the parameter GriMng.WMod				WCtlCom
	GriMng.WMod -> WCtlAnIn	Analogue specification of active power (4.0...20.0mA)		N/A		
	GriMng.WMod -> WCtlCom	Specification of active power via BUS system		N/A		
	GriMng.WMod -> WCtlMan	Manual specification of active power via user interface		N/A		
	GriMng.WMod -> WCtlMan -> WSptMan	The parameter WSptMan defines the amount of active power to be fed in and can be changed during feed-in operation. The parameter WSptMan must not be greater than the parameter WRtg	kW	-5000	+5000	2000
<i>Active Power Setpoints</i>						
	WSptMax	Active power, maximum setpoint	kW	-5000	+5000	4600
	WSptMaxMan	Active power, manual maximum setpoint	kW	-5000	+5000	4600



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	WSptMaxFlb	Active power, maximum setpoint for fallback operation	kW	-5000	+5000	4600
	GriMng.WMaxMod	Grid system services: maximum setpoint active power	-	WMaxCtlCom WMaxCtlMan		WMaxCtlMan
	WSptMaxMinFilMod	Filter for maximum/minimum active power setpoint, activation	-	ENABLE	DISABLE	DISABLE
	WSptMaxMinFilTm	Maximum/Minimum active power setpoint filter time constant	s	0,000	100,000	0,500
	WSptMaxMinGraMod	Gradient for maximum/minimum active power setpoint, activation		ENABLE	DISABLE	ENABLE
	WSptMaxMinGra	Positive/Negative gradient for maximum/minimum active power setpoint	p.u./s	0,0000	100,0000	0,2000
	WSptMin	Active power, minimum setpoint	kW	-5000	+5000	0
	WSptMinMan	Active power, manual minimum setpoint	kW	-5000	+5000	0
	WSptMinFlb	Active power, minimum setpoint for fallback operation	kW	-5000	+5000	0
	GriMng.WMinMod	Grid system services: minimum setpoint active power		WMinCtlCom WMinCtlMan		WMinCtlMan

Active power feed-in as a function of grid frequency

	WCtlHzLoHi	P(f) function				
	WCtlHzLoHiMod	Frequency characteristic VDE 4110 / 4120	-	Disabled	Enabled	Enabled
	WCtlHzLoHi.HzOv1	Start frequency P(f) (Start of frequency regulation - power reduction)	Hz	0	70	50,2
	WCtlHzLoHi.HzStopMax	End frequency P(f) (End of frequency regulation - power reduction)	Hz	0	70	50,15
	WCtlHzLoHi.HzOvGra1	Active power gradient with P(f) - power reduction	%Pnom/Hz	-1000	0	-40
	WCtlHzLoHi.HzUn1	Start frequency P(f) (Start of frequency regulation - power increase)	Hz	0	70	49,8
	WCtlHzLoHi.HzStopMin	End frequency P(f) (End of frequency regulation - power increase)	Hz	0	70	49,85
	WCtlHzLoHi.HzUnGra1	Active power gradient with P(f) - power increase	%Pnom/Hz	-1000	0	-40



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	WCtlHzLoHi.OvGraW RefMod	P(f) in case of overfrequency: Active power reference for the gradient	-	WNOM WACTUAL WSNPTMAX		WNOM
	WCtlHzLoHi.UnGraW RefMod	P(f) in case of underfrequency: Active power reference for the gradient	-	WNOM WACTUAL WSNPTMAX		WNOM
	WCtlHzLoHi.DrgIndOv Ena	P(f) in case of overfrequency: behavior when frequency is decreasing	-	ENABLE	DISABLE	DISABLE
	WCtlHzLoHi.DrgIndUn Ena	P(f) in case of underfrequency: behavior when frequency is increasing	-	ENABLE	DISABLE	DISABLE
	WCtlHzLoHi.WGra	Frequency-dependent active power control in case of over-/underfrequency: gradient for the active power setpoint when returning to dead band	%Pnom/ Minute	0	600000	9
<i>Active power feed-in depending on grid voltage</i>						
WCtlVol	P(U) function					
WCtlVol.Ena	AC Voltage-dependent active power control, activation		-	ENABLE	DISABLE	DISABLE
WCtlVol.CrvNumPt	AC Voltage-dependent active power control: Number of used curve points			1	4	2
WCtlVol.Vol1	AC Voltage-dependent active power control: Voltage at reference point 1		pu	0	2	1,1
WCtlVol.Vol2	AC Voltage-dependent active power control: Voltage at reference point 2		pu	0	2	1,2
WCtlVol.Vol3	AC Voltage-dependent active power control: Voltage at reference point 3		pu	0	2	2
WCtlVol.Vol4	AC Voltage-dependent active power control: Voltage at reference point 4		pu	0	2	2
WCtlVol.W1	AC Voltage-dependent active power control, Active power at reference point 1		%	0	200	100



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	WCtlVol.W2	AC Voltage-dependent active power control, Active power at reference point 2	%	0	200	0
	WCtlVol.W3	AC Voltage-dependent active power control, Active power at reference point 3	%	0	200	0
	WCtlVol.W4	AC Voltage-dependent active power control, Active power at reference point 4	%	0	200	0
	WCtlVol.RefMod	Selection of the active power to be used as a reference for the active power reduction <ul style="list-style-type: none"> • WNom - Reduction is based on the nominal active power of the inverter (WRtg) • W actual - Reduction is based on the instantaneous active power at the time of shortfall of the voltage threshold • WSnptMax - Reduction is based on the difference between the maximum charging and discharging power (for battery operation) 				
	WCtlVol.WGraEna	Activation of a gradient, by which the active power is changed at the most in case of a voltage variation		ENABLE	DISABLE	DISABLE
	WCtlVol.WGraPos	Gradient for the ramp after a voltage reduction	%/s	0	1000	100
	WCtlVol.WGraNeg	Gradient for the ramp after a voltage increase	%/s	0	1000	100
<i>Active power gradient following disconnection from the grid</i>						
	WGraReconMod	If enabled, the inverter restarts using the gradient which is defined in parameter WGraRecon		ENABLE	DISABLE	ENABLE
	WGraRecon	Active power gradient after fault (P per min) related to reference values	p.u./s	0	1	0,001333
<i>Reconnection time following disconnection from the grid</i>						
	GriErrTm	Time until reconnection after fault	s	0	3600	30
<i>Reactive power provision</i>						



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	GriMng.VArMod	Mode of external reactive power control is configured in this parameter		PFCtlMan PFCtl-Com PFCtlAnIn VArCtlMan VArCtlCom AutoCom VArCtlAnIn Off		VArCtlMan
	GriMng.InvVArMod	The Mode for specifications set directly on the inverter for reactive power control is configured in this parameter		VArCtlVol (Q(U)) VArCtlVolPi PFCtlW (cosphi(P)) VArCtlW (Q(P)) Off		Off
		The inverter control adds up both reactive power setpoints and feeds the sum of the reactive power into the utility grid.				
	GriMng.VArMod -> PFCtlMan	Cos phi specifications, manual Entry of displacement power factor via fixed specification defined in parameter PFsptMan		-1,0000	1,0000	1,0000
	GriMng.VArMod -> PFCtlCom	Cos phi specifications, external Specifications of the electric utility company for the displacement power factor transmitted via Further information see Modbus protocol description				N/A
	GriMng.VArMod -> PFCtlAnIn	PFCtlAnIn - 4.0 mA to 20.0 mA input, ripple control signals via the analog inputs of the inverter				N/A
	GriMng.VarMod -> VArCtlMan	VArCtlMan - Entry of reactive power via fixed specification defined in parameter VArSptMan				N/A
	GriMng.VarMod -> VArCtlCom	VArCtlCom - Specifications of the electric utility company for the reactive power values transmitted via Modbus protocol.				N/A
	GriMng.VarMod -> AutoCom	AutoCom - Specifications of the electric utility company that are transmitted via Modbus protocol. The inverter recognizes automatically from the data				N/A



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
		format whether a reactive power value or a displacement power factor is being used.				
	GriMng.VarMod -> VArCtlAnIn,	VArCtlAnIn - 4.0 mA to 20.0 mA input, ripple control signals via the analog inputs of the inverter				N/A
	GriMng.VarMod -> Off	Off - The inverter does not provide reactive power.				N/A
	GriMng.InvVArMod -> VArCtlVol	Q(U) function				
	VArCtlVol.LoVolRef1HiVolRef1	Voltage quotient at which reactive power feed-in is zero	pu	0,000	2,000	1,000
	VArCtlVol.HiVolRef2	Threshold of the voltage quotient at increased grid voltage reference point 2	pu	0,000	2,000	1,055
	VArCtlVol.HiVolRef3	Threshold of the voltage quotient at increased grid voltage reference point 3	pu	0,000	2,000	2,000
	VArCtlVol.HiGra1	Gradient of reactive power adjustment of the given voltage band at increased grid voltage Gradient 1 – from reference point 1	pu/pu	0,00	100,00	0,00
	VArCtlVol.HiGra2	Gradient of reactive power adjustment of the given voltage band at increased grid voltage Gradient 2 – from reference point 2	pu/pu	0,00	100,00	15,00
	VArCtlVol.HiGra3	Gradient of reactive power adjustment of the given voltage band at increased grid voltage Gradient 3 – from reference point 3	pu/pu	0,00	100,00	0,00
	VArCtlVol.LoVolRef2	Threshold of the voltage quotient at reduced grid voltage reference point 2	pu	0,000	2,000	0,945
	VArCtlVol.LoVolRef3	Threshold of the voltage quotient at reduced grid voltage reference point 3	pu	0,000	2,000	0,000



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	VArCtlVol.LoGra1	Gradient of reactive power adjustment of the given voltage band at decreased grid voltage Gradient 1 – from reference point 1	pu/pu	0,00	100,00	0,00
	VArCtlVol.LoGra2	Gradient of reactive power adjustment of the given voltage band at decreased grid voltage Gradient 2 – from reference point 2	pu/pu	0,00	100,00	15,00
	VArCtlVol.LoGra3	Gradient of reactive power adjustment of the given voltage band at decreased grid voltage Gradient 3 – from reference point 3	pu/pu	0,00	100,00	0,00
	VArCtlVol.VArSptFilTm	Filter constant by which the measured values of the grid voltage are filtered	s	0,00	1000,00	0,50
	VolNomSptMan	Voltage setpoint at 0 QMom/SNenn	pu	0,8500	1,1500	1,0000
	GriMng.InvVArMod -> PFCtlW	Cos phi(P) function				
	PFCtlW.VolMod	Activation of the voltage band in which reactive power control should be effective	-	0	1	0
	PFCtlW.VolDsaPF	Reference point of the displacement power factor for activating the voltage band	pu	-1,00	+1,00	1,00
	PFCtlW.VolEnaVol	Activation voltage	pu	0,000	2,000	1,050
	PFCtlW.VolDsaVol	Deactivation voltage	pu	0,000	2,000	1,000
	PFCtlW.VolEnaTm	Waiting time for which the activation voltage must be present before reactive power control is activated	ms	0	1000000	1000
	PFCtlW.VolDsaTm	Waiting time for which the deactivation voltage must be present before reactive power control is deactivated	ms	0	1000000	1000
	PFCtlW.WRef1	First reference point of the active power on the characteristic curve	pu	0,00	1,00	0,00



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	PFCtlW.PFRef1	First reference point of the displacement power factor on the characteristic curve	pu	-1,00	+1,00	-0,90
	PFCtlW.WRef2	Second reference point of the active power on the characteristic curve	pu	0,00	1,00	1,00
	PFCtlW.PFRef2	Second reference point of the displacement power factor on the characteristic curve	pu	-1,00	+1,00	0,90
	PFCtlW.WRef3	Third reference point of the active power on the characteristic curve	pu	0,00	1,00	1,00
	PFCtlW.PFRef3	Third reference point of the displacement power factor on the characteristic curve	pu	-1,00	+1,00	1,00
	PFCtlW.WRef4	Fourth reference point of the active power on the characteristic curve	pu	0,00	1,00	1,00
	PFCtlW.PFRef4	Fourth reference point of the displacement power factor on the characteristic curve	pu	-1,00	+1,00	1,00
	PFCtlW.WRef5	Fifth reference point of the active power on the characteristic curve	pu	0,00	1,00	1,00
	PFCtlW.PFRef5	Fifth reference point of the displacement power factor on the characteristic curve	pu	-1,00	+1,00	1,00
	GriMng.InvVArMod -> VArCtlW	Q(P) function				
	VArCtlW.CrvNumPt	Active power-dependent reactive power control: Number of used curve points		0	8	4
	VArCtlW.W1	Active power-dependent reactive power control: Active power at reference point n	%	-100	100	50
	VArCtlW.W2	Active power-dependent reactive power control: Active power at reference point n	%	-100	100	60
	VArCtlW.W3	Active power-dependent reactive power control: Active power at reference point n	%	-100	100	90



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	VArCtlW.W4	Active power-dependent reactive power control: Active power at reference point n	%	-100	100	100
	VArCtlW.W5	Active power-dependent reactive power control: Active power at reference point n	%	-100	100	100
	VArCtlW.W6	Active power-dependent reactive power control: Active power at reference point n	%	-100	100	100
	VArCtlW.W7	Active power-dependent reactive power control: Active power at reference point n	%	-100	100	100
	VArCtlW.W8	Active power-dependent reactive power control: Active power at reference point n	%	-100	100	100
	VArCtlW.VAr1	Active power-dependent reactive power control: Reactive power at reference point n	%	-100	100	0
	VArCtlW.VAr2	Active power-dependent reactive power control: Reactive power at reference point n	%	-100	100	-5
	VArCtlW.VAr3	Active power-dependent reactive power control: Reactive power at reference point n	%	-100	100	-33
	VArCtlW.VAr4	Active power-dependent reactive power control: Reactive power at reference point n	%	-100	100	-33
	VArCtlW.VAr5	Active power-dependent reactive power control: Reactive power at reference point n	%	-100	100	-33
	VArCtlW.VAr6	Active power-dependent reactive power control: Reactive power at reference point n	%	-100	100	-33
	VArCtlW.VAr7	Active power-dependent reactive power control: Reactive power at reference point n	%	-100	100	-33



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	VArCtlW.VAr8	Active power-dependent reactive power control: Reactive power at reference point n	%	-100	100	-33
	VArCtlW.VArRefMod	Active power-dependent reactive power control: Reactive power reference		WNOM	VARNOM	VARNOM
	VArCtlW.VArFilEna	Active power-dependent reactive power control: Filter for reactive power setpoint, activation		ENABLE	DISABLE	ENABLE
	VArCtlW.VArGraEna	Active power-dependent reactive power control: Gradient for reactive power setpoint, activation		ENABLE	DISABLE	DISABLE
	VArCtlW.VArDynEna	Active power-dependent reactive power control: Dynamic behavior in the FRT case for reactive power setpoint, activation		ENABLE	DISABLE	DISABLE
	VArCtlW.VArFilTm	Active power-dependent reactive power control: Reactive power filter time constant (3*tau)	s	0,01	1000	10
	VArCtlW.VArGraPos	Active power-dependent reactive power control: Positive gradient for reactive power setpoint	%/s	1	10000	100
	VArCtlW.VArGraNeg	Active power-dependent reactive power control: Negative gradient for reactive power setpoint	%/s	1	10000	100
	VarLimVol	voltage-dependent reactive power limitation (4110: 10.2.2.3)				
	GriMng.VArLimVolMod	Grid system services: Voltage dependent reactive power limitation		OFF	CRV	OFF
	VArLimVolCrv.Vol1	Voltage dependent reactive power limitation: Voltage at reference point n	pu	0	2	0,94
	VArLimVolCrv.Vol2	Voltage dependent reactive power limitation: Voltage at reference point n	pu	0	2	0,96
	VArLimVolCrv.Vol3	Voltage dependent reactive power limitation: Voltage at reference point n	pu	0	2	1,04



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	VArLimVolCrv.Vol4	Voltage dependent reactive power limitation: Voltage at reference point n	pu	0	2	1,06
	VArLimVolCrv.VAr1	Voltage dependent reactive power limitation: Reactive power at reference point n	%	-100	100	33
	VArLimVolCrv.VAr2	Voltage dependent reactive power limitation: Reactive power at reference point n	%	-100	100	0
	VArLimVolCrv.VAr3	Voltage dependent reactive power limitation: Reactive power at reference point n	%	-100	100	0
	VArLimVolCrv.VAr4	Voltage dependent reactive power limitation: Reactive power at reference point n	%	-100	100	-33
	VArLimVolCrv.VArRef Mod	Voltage dependent reactive power limitation: Reactive power reference		WNOM	VARNOM	VARNOM
	VArLimVolCrv.VArFilE na	Voltage dependent reactive power limitation: Filter for reactive power setpoint, activation		ENABLE	DISABLE	ENABLE
	VArLimVolCrv.VArGra Ena	Voltage dependent reactive power limitation: Gradient for reactive power setpoint, activation		ENABLE	DISABLE	DISABLE
	VArLimVolCrv.VArDyn Ena	Voltage dependent reactive power limitation: Dynamic behavior in the FRT case for reactive power setpoint, activation		ENABLE	DISABLE	DISABLE
	VArLimVolCrv.VArFilT m	Voltage dependent reactive power limitation: Reactive power filter time constant (3*tau)	s	0,01	1000	10
	VArLimVolCrv.VArGra Pos	Voltage dependent reactive power limitation: Positive gradient for reactive power setpoint	%/s	1	10000	1200
	VArLimVolCrv.VArGra Neg	Voltage dependent reactive power limitation: Negative gradient for reactive power setpoint	%/s	1	10000	1200
	VArGraMod	If activated, the inverter approaches the setpoints with a slow increase of the reactive power		ENABLE	DISABLE	ENABLE



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	VArGra	The configured reactive power is increased by the configured amount per second	pu/s	0,000	100,000	0,100 pu/s
	VArFilMod	Filter for reactive power setpoint, activation	-	ENABLE	DISABLE	DISABLE
	VArFilTm	Reactive power setpoint filter time constant	s	0,0	100,0	0,5
	VArCtlVol.VArSptFilTm	AC voltage-dependent reactive power control: filter time constant	s	0,0	1000,0	0,5
	PFCtlW.VArSptFilTm	Setting time cosφ(P) characteristic	s	0,0	1000,0	0,5
	...					
<i>Synchronisation conditions after system perturbations</i>						
	HzCtl.OpMaxNomRec on	Monitoring of grid frequency: upper switch-on limit after grid error	Hz	40	70	50,1
	HzCtl.OpMinNomRec on	Monitoring of grid frequency: lower switch-on limit after grid error	Hz	40	70	49,9
	VCtl.OpMaxNomRec on	Monitoring of grid voltage: upper switch-on limit after grid error	PU	0	2	1,1
	VCtl.OpMinNomRecon	Monitoring of grid voltage: lower switch-on limit after grid error	PU	0	2	0,95
<i>PGU disconnection from the grid</i>						
	VCtl.Hi1Lim	Monitoring the grid voltage: upper switch-off limit 1	PU	0	2	1,2
	VCtl.Hi2Lim	Monitoring the grid voltage: upper switch-off limit 2	PU	0	2	1,25
	VCtl.Hi3Lim	Monitoring the grid voltage: upper switch-off limit 3	PU	0	2	2
	VCtl.Hi4Lim	Monitoring the grid voltage: upper switch-off limit 4	PU	0	2	2
	VCtl.Hi5Lim	Monitoring the grid voltage: upper switch-off limit 5	PU	0	2	2
	VCtl.Hi1LimTm	Monitoring the grid voltage: waiting time upper switch-off limit 1	MS	0	1000000	3000
	VCtl.Hi2LimTm	Monitoring the grid voltage: waiting time upper switch-off limit 2	MS	0	1000000	100



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	VCtl.Hi3LimTm	Monitoring the grid voltage: waiting time upper switch-off limit 3	MS	0	1000000	10000
	VCtl.Hi4LimTm	Monitoring the grid voltage: waiting time upper switch-off limit 4	MS	0	1000000	10000
	VCtl.Hi5LimTm	Monitoring the grid voltage: waiting time upper switch-off limit 5	MS	0	1000000	10000
	VCtl.Lo1Lim	Monitoring the grid voltage: lower switch-off limit 1	PU	0	2	0,8
	VCtl.Lo2Lim	Monitoring the grid voltage: lower switch-off limit 2	PU	0	2	0,3
	VCtl.Lo3Lim	Monitoring the grid voltage: lower switch-off limit 3	PU	0	2	0
	VCtl.Lo4Lim	Monitoring the grid voltage: lower switch-off limit 4	PU	0	2	0
	VCtl.Lo5Lim	Monitoring the grid voltage: lower switch-off limit 5	PU	0	2	0
	VCtl.Lo1LimTm	Monitoring the grid voltage: upper switch-off limit 2	MS	0	1000000	2400
	VCtl.Lo2LimTm	Monitoring the grid voltage: waiting time lower switch-off limit 2	MS	0	1000000	800
	VCtl.Lo3LimTm	Monitoring the grid voltage: waiting time lower switch-off limit 3	MS	0	1000000	10000
	VCtl.Lo4LimTm	Monitoring the grid voltage: waiting time lower switch-off limit 4	MS	0	1000000	10000
	VCtl.Lo5LimTm	Monitoring the grid voltage: waiting time lower switch-off limit 5	MS	0	1000000	10000
	HzCtl.Hi1Lim	Monitoring the power frequency: upper switch-off limit 1	HZ	40	70	51,5
	HzCtl.Hi2Lim	Monitoring the power frequency: upper switch-off limit 2	HZ	40	70	52,5
	HzCtl.Hi3Lim	Monitoring the power frequency: upper switch-off limit 3	HZ	40	70	55
	HzCtl.Hi4Lim	Monitoring the power frequency: upper switch-off limit 4	HZ	40	70	55



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	HzCtl.Hi5Lim	Monitoring the power frequency: upper switch-off limit 5	HZ	40	70	55
	HzCtl.Hi6Lim	Monitoring the power frequency: upper switch-off limit 6	HZ	40	70	55
	HzCtl.Hi1LimTm	Monitoring the power frequency: waiting time upper switch-off limit 1	MS	0	1000000	5000
	HzCtl.Hi2LimTm	Monitoring the power frequency: waiting time upper switch-off limit 2	MS	0	1000000	100
	HzCtl.Hi3LimTm	Monitoring the power frequency: waiting time upper switch-off limit 3	MS	0	1000000	10000
	HzCtl.Hi4LimTm	Monitoring the power frequency: waiting time upper switch-off limit 4	MS	0	1000000	10000
	HzCtl.Hi5LimTm	Monitoring the power frequency: waiting time upper switch-off limit 5	MS	0	1000000	10000
	HzCtl.Hi6LimTm	Monitoring the power frequency: waiting time upper switch-off limit 6	MS	0	1000000	10000
	HzCtl.Lo1Lim	Monitoring the power frequency: lower switch-off limit 1	HZ	40	70	47,5
	HzCtl.Lo2Lim	Monitoring the power frequency: lower switch-off limit 2	HZ	40	70	45
	HzCtl.Lo3Lim	Monitoring the power frequency: lower switch-off limit 3	HZ	40	70	45
	HzCtl.Lo4Lim	Monitoring the power frequency: lower switch-off limit 4	HZ	40	70	45
	HzCtl.Lo5Lim	Monitoring the power frequency: lower switch-off limit 5	HZ	40	70	45
	HzCtl.Lo6Lim	Monitoring the power frequency: lower switch-off limit 6	HZ	40	70	45
	HzCtl.Lo1LimTm	Monitoring the power frequency: waiting time lower switch-off limit 1	MS	0	10000000	100



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	HzCtl.Lo2LimTm	Monitoring the power frequency: waiting time lower switch-off limit 2	MS	0	10000000	10000
	HzCtl.Lo3LimTm	Monitoring the power frequency: waiting time lower switch-off limit 3	MS	0	10000000	10000
	HzCtl.Lo4LimTm	Monitoring the power frequency: waiting time lower switch-off limit 4	MS	0	10000000	10000
	HzCtl.Lo5LimTm	Monitoring the power frequency: waiting time lower switch-off limit 5	MS	0	10000000	10000
	HzCtl.Lo6LimTm	Monitoring the power frequency: waiting time lower switch-off limit 6	MS	0	10000000	10000
<i>Connection conditions</i>						
	VCtl.OpMaxNom	Monitoring the grid voltage: upper switch-on limit	PU	0	2	1,1
	VCtl.OpMinNom	Monitoring the grid voltage: lower switch-on limit	PU	0	2	0,9
	HzCtl.OpMaxNom	Monitoring the power frequency: upper switch-on limit	HZ	40	70	50,2
	HzCtl.OpMinNom	Monitoring the power frequency: lower switch-on limit	HZ	40	70	47,5
	ProErr	External release signal				
<i>Response during grid faults</i>						
	FrtMod	Behavior:	Disable Full Partial Active Current Constant Momentary Cessation			Full
	Frt.LoDb	LVRT: lower threshold	pu	0	1	0,9
	Frt.HiDb	HVRT: upper threshold	pu	1	1,5	1,1
	Frt.WaitTmHi	HVRT: power-down time	s	0,02	20	0,5
	Frt.LoVolRef1	LVRT: reference voltage 1	pu	0	1	1
	Frt.LoVolRef2	LVRT: reference voltage 2	pu	0	1	0
	Frt.LoVolRef3	LVRT: reference voltage 3	pu	0	1	0
	Frt.LoGra1	LVRT: gradient from reference voltage 1	$(\Delta I_q/I_n)/(V/V_n)$	0	10	2
	Frt.LoGra2	LVRT: gradient from reference voltage 2	$(\Delta I_q/I_n)/(V/V_n)$	0	10	2
	Frt.LoGra3	LVRT: gradient from reference voltage 3	$(\Delta I_q/I_n)/(V/V_n)$	0	10	2



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	Frt.HiVolRef1	HVRT: reference voltage 1	pu	1	2	1
	Frt.HiVolRef2	HVRT: reference voltage 2	pu	1	2	2
	Frt.HiVolRef3	HVRT: reference voltage 3	pu	1	2	2
	Frt.HiGra1	HVRT: gradient from reference voltage 1	(dq/I_n)/(V/V_n)	0	10	2
	Frt.HiGra2	HVRT: gradient from reference voltage 2	(dq/I_n)/(V/V_n)	0	10	2
	Frt.HiGra3	HVRT: gradient from reference voltage 3	(dq/I_n)/(V/V_n)	0	10	2
	Frt.AmpDGra	FRT: maximum active current gradient during and after fault ride through	pu/s			2
	Frt.VoDFilTm	FRT: time constant of the voltage adjustment (positive sequence)	s	0	600	60
	Frt.AmpQFilTm	FRT: time constant of the reactive current adjustment (positive sequence)	s	0	600	60
	Frt.AmpDGra	FRT: maximum active current gradient during and after fault ride through	pu/s	0	100	2
	Frt.VoFilMod	Definition of the reference value during grid support: The voltage refers to the nominal voltage: VOLRTG The voltage refers to a filtered value of the measured voltage: PT1	-	PT1	VOLRTG	PT1
	Frt.WaitTmLo	LVRT: power-down time	s	0,02	20	0,5
	Frt.HystEna	FRT: hysteresis, activation		enable	disable	disable
	Frt.LoDbHyst	LVRT: lower threshold with hysteresis activated	pu	0	1	0,92
	Frt.HiDbHyst	HVRT: upper threshold with hysteresis activated	pu	1	1,5	1,08
	Frt.ExpryEna	FRT: expiry function, activation		enable	disable	disable
	Frt.LoDbExpry	LVRT: lower threshold for FRT-expiry function	pu	0	1	0,9
	Frt.HiDbExpry	HVRT: upper threshold for FRT-expiry function	pu	1	1,5	1,1
	Frt.ExpryTm	FRT: time in FRT after which the threshold for FRT is expanded	s	0	10000	60



No.	Name	Description	Unit	Setting range		Default value (acc. to parameter set)
				Min.	Max.	
	Frt.ExpryEndTm	FRT: duration of the expanded threshold for FRT	s	0	10000	1
	FrtStep.HiDb	HVRT-Step: upper threshold	pu	1	1,5	1,05
	FrtStep.LoDb	LVRT-Step: lower threshold	pu	0	1	0,95
	FrtStep.ExpryTm	FRT-Step: time after which the FRT curve is deactivated	s	0	10000	5
	FrtStep.Ena	FRT-Step: activation		enable	disable	disable
	FrtStep.VolFilTm	FRT-Step: filter time constant of the voltage adjustment	s	0	600	1
<i>Behavior in Case of Communication Disturbances</i>						
	Pleas refer to the Operating Manual, chapter „Inverter Behavior in Case of Communication Disturbances“ and/or search for parameter names starting with „GriMng.ComFlt*“					