

CERTIFICATE OF COMPLIANCE

Certificate Number 20180329-E210376-C
Report Reference E210376-2013-06-14
Issue Date 2018-03-29

Issued to: SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal GERMANY

**This is to certify that
representative samples of**

STATIC INVERTERS, CONVERTERS AND
ACCESSORIES FOR USE IN INDEPENDENT POWER
SYSTEMS

SMA Solar Technology AG Models:
STP20000TL-US-10

Have been investigated by UL in accordance with the
Standard(s) indicated on this Certificate.

Standard(s) for Safety:

UL 1741, Standard for Safety for Inverters, Converters,
Controllers and Interconnection System Equipment for Use
With Distributed Energy Resources, UL 1741, Second
Edition, dated January 28, 2010, with revisions through
February 15, 2018. Including the requirements in UL 1741
Supplement SA, sections as noted in the Technical
considerations.

IEEE 1547, IEEE Standard for Interconnecting Distributed
Resources with Electric Power Systems.

IEEE 1547.1, IEEE Standard for Conformance Test
Procedures for Equipment Interconnecting Distributed
Resources with Electric Power Systems.

CSA C22.2 No. 107.1-01, General Use Power Supplies.

Additional Information:

See the UL Online Certifications Directory at
www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's
Certification and Follow-Up Service.



Bruce Mahrenholz, Director North American Certification Program

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The UL Recognized Component Mark generally consists of the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark: , may be used in conjunction with the required Recognized Marks. The Recognized Component Mark is required when specified in the UL Directory preceding the recognitions or under "Markings" for the individual recognitions.

Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL LLC.

Look for the UL Certification Mark on the product.

This is to certify that representative samples of the Permanently-connected, Grid Support Utility Interactive inverter products as specified on this certificate were tested according to the current UL requirements.

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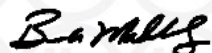
CSA C22.2 No. 107.1-01, General Use Power Supplies.

This description covers the SMA Solar Technology AG Model: STP20000TL-US-10 inverters.

The Certificate is valid for the HP-Version V2.05.01.R.

USL - Evaluated to the requirements of the Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741,

CNL - Additionally evaluated to CAN/CSA C22.2 No. 107.1-1, "General Use Power Supplies." September 2001, Reaffirmed 2011



Bruce Mahrenholz, Director North American Certification Program

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Report Reference E210376-2013-06-14
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Products covered by this certificate provide functionality in compliance with UL 1741 Supplement A (SA) when used in a UL Listed end product which has been evaluated by UL for its intended purpose.

Compliance testing was conducted on samples of the products according to the test methods in UL 1741 with compliant results, and product ratings were reviewed for fulfillment of the requirements in the following SRDs:

See also **Appendix A:** Grid Support Utility Interactive Inverter Worksheet

(+)

Grid Support Function	Source Requirement Document(s)	Test Standard(s) and Section(s)	NRTL Certified Date
TRANSIENT OVERVOLTAGE (TrOV-2)	HECO APPENDIX 1: Transient Overvoltage Self-Certification Instructions	N/A (+)	N/A
LOW/HIGH VOLTAGE RIDE-THROUGH	SRD 14H V1.1: Part II.C. Table 4	UL 1741 SA 9	2018-March-09
LOW/HIGH FREQUENCY RIDE-THROUGH	SRD 14H V1.1: Part II.D.1 Table 5	UL 1741 SA 10	2018-March-09
RAMP RATES	SRD 14H V1.1: Part II.G.1	UL 1741 SA 11.2	2018-March-09
RECONNECT BY "SOFT START"	SRD 14H V1.1: Part II.G.2	UL 1741 SA 11.4	2018-March-09
SPECIFIED POWER FACTOR	SRD 14H V1.1: Part II.A.1	UL 1741 SA 12	2018-March-09
DYNAMIC VOLT/VAR OPERATIONS	SRD 14H V1.1: Part II.A.2 Table 2, Figure 2	UL 1741 SA 13	2018-March-09
FREQUENCY-WATT	SRD 14H V1.1: Part II.F Table 7	UL 1741 SA 14	2018-March-09
VOLT-WATT	SRD 14H V1.1: Part II.B Table 3, Figure 3	UL 1741 SA 15	2018-March-09
Anti-Islanding	N/A	UL 1741 SA8	2018-March-09

(+) - Self Certification

B. Mahrenholz

Bruce Mahrenholz, Director North American Certification Program

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Complete all fields highlighted in red.

GENERAL		
VALUE	INFORMATION	NOTES
Manufacturer	SMA America, LCC	
Model #	STP20000TL-US-10	List Applicable Model(s)
Firmware version	02.84.01.R or higher	Provide applicable firmware
Certification / Self-Certification	Certified	Choose 1
NRTL Name		
Certificate #		
SA Certification Date		
Responsible Engineer		
Report #		

MANUFACTURER's STATED ACCURACY						
VALUE	UNITS	RANGE	RATING			DESCRIPTION
Model	unitless	-	STP20000TL-US-10	-	-	Provide MSA for each model represented
Voltage, RMS	Volts	50 % < V ≤ 120 %	2%	-	-	
Current, RMS	Amps	100 %	1%	-	-	
Frequency	Hz	50 to 66 Hz	0.05 Hz	-	-	
Active Power	Watts	20 % < P ≤ 100 %	5%	-	-	
Reactive Power	VAR	20 % < Q ≤ 100 %	5%	-	-	
Power Factor	Displacement	20 % < P ≤ 100 %	0.01	-	-	
Time	s	100 ms to 600 s	0.001 s	-	-	

INVERTER DC (INPUT) SIDE				
VALUE	RATING		UNITS	DESCRIPTION
	Min	Max		
V _{DC} - rating	150	1000	Volts	DC voltage rating

$V_{MPPT-RANGE}$	380	800	Volts	Maximum power point track range
$I_{DC,max}$	53		Amps	Max input short-circuit current per MPPT

INVERTER AC (OUTPUT) SIDE					
VALUE	RATING			UNITS	DESCRIPTION
$V_{AC-NOMINAL(Phase-neutral)}$	277	-	-	Volts	Nominal Voltage Phase-neutral (if neutral available)
$V_{AC-NOMINAL(Phase-phase)}$	480	-	-	Volts	Nominal Voltage Phase-phase
Number of Phases	3		-	Number	Number of electrical phases
P_{OUT}	20000			VA	Rated Power Output
$I_{NOMINAL-OUTPUT}$	24.10			Amps	Nominal current per phase
$I_{MAXIMUM-OUTPUT (at Vlow)}$	24.10			Amps	Maximum output current at lowest operating voltage

FIXED POWER FACTOR		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
>15 kW	Underexcited, Inductive, Absorbing	-80	100					%	-85% to 100%	Y	Capacitive (var injection) power factor to Reactive (var absorption) power factor range. RULE 14H Default PF = -0.95 (Absorbing) for self certification purposes.
	Overexcited, Capacitive, Injecting	100	80					%	100% to 85%	Y	
<=15 kW	Underexcited, Inductive, Absorbing	NA	NA					%	-90% to 100%	-	Capacitive (var injection) power factor to Reactive (var absorption) power factor range. RULE 14H Default PF = -0.95 (Absorbing) for self certification purposes.
	Overexcited, Capacitive, Injecting	NA	NA					%	100% to 90%	-	

Appendix A: Grid Support Utility Interactive Worksheet

VOLTAGE RIDE-THROUGH		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
OV2	$I_{RMS_MAX@VRT(V = 120\%)}$	20.05						Amps	-	-	Maximum RMS current when voltage goes above to 120% before trip
	$t_{TRIP(V > 120\%)}$	0.05	59.00					Sec.	0.16	Y	Trip time
OV1	$I_{RMS_MAX@VRT(V = 110\%)}$	21.87						Amps	-	-	Maximum RMS current when voltage is between 110% and 120% before trip
	$t_{RIDE-THROUGH(110\% < V \leq 120\%)}$	0.10	30					Sec.	0.92	Y	Ride through time
	$t_{TRIP(110\% < V \leq 120\%)}$	0.10	60.0					Sec.	1	Y	Trip time
Nominal	$I_{RMS_MAX@V(V = 109\%)}$	22.07						Amps	-	-	Maximum RMS current when voltage is 109%
	$I_{RMS@V(V = 100\%)}$	24.06						Amps	-	-	RMS current when voltage is 100%
	$I_{RMS_MIN@V(V = 90\%)}$	24.10						Amps	-	-	Minimum RMS current when voltage is 90%
UV1	$I_{RMS_MIN@VRT(V = 75\%)}$	24.10						Amps	-	-	Minimum RMS current when voltage is between 70% and 88% before trip
	$t_{RIDE-THROUGH(70\% \leq V < 88\%)}$	0.1	30					Sec.	20	Y	Ride through time
	$t_{TRIP(70\% \leq V < 88\%)}$	0.1	60.0					Sec.	21	Y	Trip time
UV2	$I_{RMS_MIN@VRT(V = 70\%)}$	24.10						Amps	-	-	Minimum RMS current when voltage is between 50% and 70% before trip
	$t_{RIDE-THROUGH(50\% \leq V < 70\%)}$	0.10	30					Sec.	10-20	Y	Ride through time
	$t_{TRIP(50\% \leq V < 70\%)}$	0.10	60.0					Sec.	11-21	Y	Trip time
UV3	$I_{RMS_MIN@VRT(V = 50\%)}$	24.10						Amps	-	-	Minimum RMS current when voltage is below 50% before trip
	$t_{RIDE-THROUGH(V < 50\%)}$	0.10	30					Sec.	-	-	Ride through time
	$t_{TRIP(V < 50\%)}$	0.10	60.0					Sec.	2	Y	Trip time

FREQUENCY RIDE-THROUGH		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
OF2	$I_{RMS_MAX@FRT(f = 64Hz)}$	24.10						Amps	-	-	Maximum RMS current when the frequency is above 64 Hz before trip
	$t_{TRIP(f > 64 Hz)}$	0.10	1000.00					Sec.	0.16	Y	Trip time
OF1	$I_{RMS_MAX@FRT(63 Hz < f \leq 64Hz)}$	24.10						Amps	-	-	Maximum RMS current when the frequency is between 63 and 64 Hz before trip
	$t_{RIDE-THROUGH(63 Hz < f \leq 64 Hz)}$	0.10	999					Sec.	20	Y	Ride Through Time
	$t_{TRIP(63 Hz < f \leq 64 Hz)}$	0.1	1000.0					Sec.	21	Y	Trip time
Nominal	$I_{RMS_MAX@f = 63 Hz}$	24.10						Amps	-	-	Maximum RMS current when the frequency is 63 Hz
	$I_{RMS@f = 60 Hz}$	24.10						Amps	-	-	RMS current when the frequency is 60 Hz
	$I_{RMS_MIN@f = 57 Hz}$	24.10						Amps	-	-	Minimum RMS current when the frequency is 57 Hz
UF1	$I_{RMS_MIN@FRT(56 Hz \leq f < 57 Hz)}$	24.10						Amps	-	-	Minimum RMS current when the frequency is between 56 and 57 Hz before trip
	$t_{RIDE-THROUGH(56 Hz \leq f < 57 Hz)}$	0.10	999					Sec.	20	Y	Ride Through Time
	$t_{TRIP(56 Hz \leq f < 57 Hz)}$	0.1	1000.0					Sec.	21	Y	Trip time
UF2	$I_{RMS_MIN@FRT(f < 56 Hz)}$	24.10						Amps	-	-	Minimum RMS current when the frequency is below 56 Hz before trip
	$t_{TRIP(f < 56 Hz)}$	0.1	1000					Sec.	0.16	Y	Trip time

Appendix A: Grid Support Utility Interactive Worksheet

VOLT-VAR, Q(V)	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
V1, UV _{Volt-Var_MIN}	70	100					% V _{NOMINAL}	94	Y	Lowest voltage where Volt-VAR starts at undervoltage
% Q1, VAr _{s@UV_Volt-Var_MIN}	-100	100					% Q (Var Injection)	44	Y	VAr _s at lowest undervoltage Volt-VAR point (-53% for aggregate generating facility >15 kW, -44% for aggregate generating facility <= 15 kW)
V2, UV _{Volt-Var_MAX}	70	100					% V _{NOMINAL}	97	Y	Highest voltage where Volt-VAR finish at undervoltage
% Q2, VAr _{s@UV_Volt-Var_MAX}	-100	100					% Q (0 Var)	0	Y	VAr _s at highest undervoltage Volt-VAR point
V3, OV _{Volt-Var_MIN}	100	120					% V _{NOMINAL}	103	Y	Lowest voltage where Volt-VAR starts at overvoltage
% Q3, VAr _{s@OV_Volt-Var_MIN}	-100	100					% Q (0 Var)	0	Y	VAr _s at lowest overvoltage Volt-VAR point
V4, OV _{Volt-Var_MAX}	100	120					% V _{NOMINAL}	106	Y	Highest voltage where Volt-VAR finish at overvoltage
% Q4, VAr _{s@OV_Volt-Var_MAX}	-100	100					% Q (Var Absorption)	-44	Y	VVAr _s at highest overvoltage Volt-VAR point (53% for aggregate generating faility >15 kW, 44% for aggregate generating facility <= 15 kW)
Response Time	0	1000					Sec.	10	Y	Response time (if non-adjustable range, place default value in MIN)
Power Priority	reactive						Unitless	Reactive	Y	Power Priority

POWER RAMP RATE	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
Connect/Reconnect RAMP _{RATE}	0.16	166					% P _{RATED} /sec.	100	Y	Percentage of nominal generated power per second "Ramp Rate"
Soft Start RAMP _{RATE}	0.016	166					% P _{RATED} /sec.	0.33	Y	Percentage of nominal generated power per second "Ramp Rate"

VOLT-WATT	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
Power Rate	0	100					% P _{PRATED} /V	-25	Y	Percentage of power reduction per volt "Volt-Watt rate"
Start voltage	100	120					% V _{nom}	106	Y	Power reduction starting voltage
Stop voltage	100	120					% V _{nom}	110	Y	Power reduction endpoint voltage
Response Time	0	1000					Sec.	10	Y	Response tiem (If non-adjustable range, place default value in MIN)
Power Reference	P _{pre}						unitless	P _{rated} or P _{pre-disturbance}	Y	Active power output

FREQUENCY-WATT	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
FW _{RATE}	28.6	130					%P _{rated} /Hz	~42	Y	Minimum percentage of power reduction per hertz "frequency-watt rate" (based on KOF = 0.04)
Freq adjustment range at Start frequency	60.01	62					Hz	60.04	Y	Power reduction Starting Frequency (Based on dbOF = 0.036 Hz)
Response Time	3	3					Sec.	0,5 - 3	Y	Response tiem (if non-adjustable range, place default value in MIN)
Power Reference	P _{pre}						unitless	P _{rated} or P _{pre-disturbance}	Y	Active power output

METHODS FOR APPLYING SETPOINTS

1. Verify installed firmware version 02.84.01.R or higher
 - a. If necessary, download and install latest firmware version for Sunny Tripower TL-US (STPxx000TL-US-10) from SMA website
2. Set inverter operating parameters to comply with HECO Rule 14H GSUI requirements by manual parameter adjustments as described in SMA Technical Note US SA 101-0115-001 rev. 02 (US SA 101-0115-001r02_TN_HECO_Rule_14H_settings_STPTLUS_CORE1)

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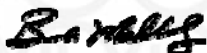
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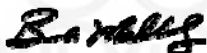
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The Certificate is valid for the HP-Version V2.05.01.R.

USL - Evaluated to the requirements of the Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741,

CNL - Additionally evaluated to CAN/CSA C22.2 No. 107.1-1, "General Use Power Supplies." September 2001, Reaffirmed 2011



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CERTIFICATE OF COMPLIANCE

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Report Reference E210376-2013-06-14
Issue Date 2018-03-29

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Grid Support Function	Source Requirement Document(s)	Test Standard(s) and Section(s)	NRTL Certified Date
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LOW/HIGH FREQUENCY RIDE-THROUGH	SRD 14H V1.1: Part II.D.1 Table 5	UL 1741 SA 10	2018-March-09
RAMP RATES	SRD 14H V1.1: Part II.G.1	UL 1741 SA 11.2	2018-March-09
RECONNECT BY "SOFT START"	SRD 14H V1.1: Part II.G.2	UL 1741 SA 11.4	2018-March-09
SPECIFIED POWER FACTOR	SRD 14H V1.1: Part II.A.1	UL 1741 SA 12	2018-March-09
DYNAMIC VOLT/VAR OPERATIONS	SRD 14H V1.1: Part II.A.2 Table 2, Figure 2	UL 1741 SA 13	2018-March-09
FREQUENCY-WATT	SRD 14H V1.1: Part II.F Table 7	UL 1741 SA 14	2018-March-09
VOLT-WATT	SRD 14H V1.1: Part II.B Table 3, Figure 3	UL 1741 SA 15	2018-March-09
Anti-Islanding	N/A	UL 1741 SA8	2018-March-09

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Complete all fields highlighted in red.

GENERAL		
VALUE	INFORMATION	NOTES
Manufacturer	SMA America, LCC	
Model #	STP24000TL-US-10	List Applicable Model(s)
Firmware version	02.84.01.R or higher	Provide applicable firmware
Certification / Self-Certification	Certified	Choose 1
NRTL Name		
Certificate #		
SA Certification Date		
Responsible Engineer		
Report #		

MANUFACTURER's STATED ACCURACY						
VALUE	UNITS	RANGE	RATING		DESCRIPTION	
Model	unitless	-	STP24000TL-US-10	-	-	Provide MSA for each model represented
Voltage, RMS	Volts	50 % < V ≤ 120 %	2%	-	-	
Current, RMS	Amps	100 %	1%	-	-	
Frequency	Hz	50 to 66 Hz	0.05 Hz	-	-	
Active Power	Watts	20 % < P ≤ 100 %	5%	-	-	
Reactive Power	VAR	20 % < Q ≤ 100 %	5%	-	-	
Power Factor	Displacement	20 % < P ≤ 100 %	0.01	-	-	
Time	s	100 ms to 600 s	0.001 s	-	-	

INVERTER DC (INPUT) SIDE			
VALUE	RATING	UNITS	DESCRIPTION

VALUE	Min	Max	UNITS	DESCRIPTION
V_{DC} - rating	150	1000	Volts	DC voltage rating
$V_{MPPT-RANGE}$	450	800	Volts	Maximum power point track range
I_{DC} max	53		Amps	Max input short-circuit current per MPPT

INVERTER AC (OUTPUT) SIDE					
VALUE	RATING			UNITS	DESCRIPTION
$V_{AC-NOMINAL(Phase-neutral)}$	277	-	-	Volts	Nominal Voltage Phase-neutral (if neutral available)
$V_{AC-NOMINAL(Phase-phase)}$	480	-	-	Volts	Nominal Voltage Phase-phase
Number of Phases	3		-	Number	Number of electrical phases
P_{OUT}	24000			VA	Rated Power Output
$I_{NOMINAL-OUTPUT}$	29.00			Amps	Nominal current per phase
$I_{MAXIMUM-OUTPUT}$ (at Vlow)	29.00			Amps	Maximum output current at lowest operating voltage

FIXED POWER FACTOR		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
>15 kW	Underexcited, Inductive, Absorbing	-80	100					%	-85% to 100%	Y	Capacitive (var injection) power factor to Reactive (var absorption) power factor range. RULE 14H Default PF = -0.95 (Absorbing) for self certification purposes.
	Overexcited, Capacitive, Injecting	100	80					%	100% to 85%	Y	
<=15 kW	Underexcited, Inductive, Absorbing	NA	NA					%	-90% to 100%	-	Capacitive (var injection) power factor to Reactive (var absorption) power factor range. RULE 14H Default PF = -0.95 (Absorbing) for self certification purposes.
	Overexcited, Capacitive, Injecting	NA	NA					%	100% to 90%	-	

Appendix A: Grid Support Utility Interactive Worksheet

VOLTAGE RIDE-THROUGH		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
OV2	$I_{RMS_MAX@VRT(V = 120\%)}$	24.06						Amps	-	-	Maximum RMS current when voltage goes above to 120% before trip
	$t_{TRIP(V > 120\%)}$	0.05	59.00					Sec.	0.16	Y	Trip time
OV1	$I_{RMS_MAX@VRT(V = 110\%)}$	26.24						Amps	-	-	Maximum RMS current when voltage is between 110% and 120% before trip
	$t_{RIDE-THROUGH(110\% < V \leq 120\%)}$	0.10	30					Sec.	0.92	Y	Ride through time
	$t_{TRIP(110\% < V \leq 120\%)}$	0.10	60.0					Sec.	1	Y	Trip time
Nominal	$I_{RMS_MAX@V(V = 109\%)}$	26.48						Amps	-	-	Maximum RMS current when voltage is 109%
	$I_{RMS@V(V = 100\%)}$	28.87						Amps	-	-	RMS current when voltage is 100%
	$I_{RMS_MIN@V(V = 90\%)}$	29.00						Amps	-	-	Minimum RMS current when voltage is 90%
UV1	$I_{RMS_MIN@VRT(V = 75\%)}$	29.00						Amps	-	-	Minimum RMS current when voltage is between 70% and 88% before trip
	$t_{RIDE-THROUGH(70\% \leq V < 88\%)}$	0.1	60					Sec.	20	Y	Ride through time
	$t_{TRIP(70\% \leq V < 88\%)}$	0.1	60.0					Sec.	21	Y	Trip time
UV2	$I_{RMS_MIN@VRT(V = 70\%)}$	29.00						Amps	-	-	Minimum RMS current when voltage is between 50% and 70% before trip
	$t_{RIDE-THROUGH(50\% \leq V < 70\%)}$	0.10	30					Sec.	10-20	Y	Ride through time
	$t_{TRIP(50\% \leq V < 70\%)}$	0.10	60.0					Sec.	11-21	Y	Trip time
UV3	$I_{RMS_MIN@VRT(V = 50\%)}$	29.00						Amps	-	-	Minimum RMS current when voltage is below 50% before trip
	$t_{RIDE-THROUGH(V < 50\%)}$	0.10	30					Sec.	-	-	Ride through time
	$t_{TRIP(V < 50\%)}$	0.10	60.0					Sec.	2	Y	Trip time

FREQUENCY RIDE-THROUGH		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
OF2	$I_{RMS_MAX@FRT(f = 64Hz)}$	29.00						Amps	-	-	Maximum RMS current when the frequency is above 64 Hz before trip
	$t_{TRIP(f > 64 Hz)}$	0.10	1000.00					Sec.	0.16	Y	Trip time
OF1	$I_{RMS_MAX@FRT(63 Hz < f \leq 64Hz)}$	29.00						Amps	-	-	Maximum RMS current when the frequency is between 63 and 64 Hz before trip
	$t_{RIDE-THROUGH(63 Hz < f \leq 64 Hz)}$	0.10	999					Sec.	20	Y	Ride Through Time
	$t_{TRIP(63 Hz < f \leq 64 Hz)}$	0.1	1000.0					Sec.	21	Y	Trip time
Nominal	$I_{RMS_MAX@f = 63 Hz}$	29.00						Amps	-	-	Maximum RMS current when the frequency is 63 Hz
	$I_{RMS@f = 60 Hz}$	29.00						Amps	-	-	RMS current when the frequency is 60 Hz
	$I_{RMS_MIN@f = 57 Hz}$	29.00						Amps	-	-	Minimum RMS current when the frequency is 57 Hz
UF1	$I_{RMS_MIN@FRT(56 Hz \leq f < 57 Hz)}$	29.00						Amps	-	-	Minimum RMS current when the frequency is between 56 and 57 Hz before trip
	$t_{RIDE-THROUGH(56 Hz \leq f < 57 Hz)}$	0.10	999					Sec.	20	Y	Ride Through Time
	$t_{TRIP(56 Hz \leq f < 57 Hz)}$	0.1	1000.0					Sec.	21	Y	Trip time
UF2	$I_{RMS_MIN@FRT(f < 56 Hz)}$	29.00						Amps	-	-	Minimum RMS current when the frequency is below 56 Hz before trip
	$t_{TRIP(f < 56 Hz)}$	0.1	1000					Sec.	0.16	Y	Trip time

Appendix A: Grid Support Utility Interactive Worksheet

VOLT-VAR, Q(V)	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
V1, UV _{Volt-Var_MIN}	70	100					% V _{NOMINAL}	94	Y	Lowest voltage where Volt-VAR starts at undervoltage
% Q1, VAr _{s@UV_Volt-Var_MIN}	-100	100					% Q (Var Injection)	44	Y	VAr _s at lowest undervoltage Volt-VAR point (-53% for aggregate generating facility >15 kW, -44% for aggregate generating facility <= 15 kW)
V2, UV _{Volt-Var_MAX}	70	100					% V _{NOMINAL}	97	Y	Highest voltage where Volt-VAR finish at undervoltage
% Q2, VAr _{s@UV_Volt-Var_MAX}	-100	100					% Q (0 Var)	0	Y	VAr _s at highest undervoltage Volt-VAR point
V3, OV _{Volt-Var_MIN}	100	120					% V _{NOMINAL}	103	Y	Lowest voltage where Volt-VAR starts at overvoltage
% Q3, VAr _{s@OV_Volt-Var_MIN}	-100	100					% Q (0 Var)	0	Y	VAr _s at lowest overvoltage Volt-VAR point
V4, OV _{Volt-Var_MAX}	100	120					% V _{NOMINAL}	106	Y	Highest voltage where Volt-VAR finish at overvoltage
% Q4, VAr _{s@OV_Volt-Var_MAX}	-100	100					% Q (Var Absorption)	-44	Y	VVAr _s at highest overvoltage Volt-VAR point (53% for aggregate generating faility >15 kW, 44% for aggregate generating facility <= 15 kW)
Response Time	0	1000					Sec.	10	Y	Response time (if non-adjustable range, place default value in MIN)
Power Priority	reactive						Unitless	Reactive	Y	Power Priority

POWER RAMP RATE	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
Connect/Reconnect RAMP _{RATE}	0.16	166					% P _{RATED} /sec.	100	Y	Percentage of nominal generated power per second "Ramp Rate"
Soft Start RAMP _{RATE}	0.016	166					% P _{RATED} /sec.	0.33	Y	Percentage of nominal generated power per second "Ramp Rate"

VOLT-WATT	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
Power Rate	0	100					% P _{PRATED} /V	-25	Y	Percentage of power reduction per volt "Volt-Watt rate"
Start voltage	100	120					% V _{nom}	106	Y	Power reduction starting voltage
Stop voltage	100	120					% V _{nom}	110	Y	Power reduction endpoint voltage
Response Time	0	1000					Sec.	10	Y	Response tiem (If non-adjustable range, place default value in MIN)
Power Reference	P _{pre}						unitless	P _{rated} or P _{pre-disturbance}	Y	Active power output

FREQUENCY-WATT	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
FW _{RATE}	28.6	130					%P _{rated} /Hz	~42	Y	Minimum percentage of power reduction per hertz "frequency-watt rate" (based on KOF = 0.04)
Freq adjustment range at Start frequency	60.01	62					Hz	60.04	Y	Power reduction Starting Frequency (Based on dbOF = 0.036 Hz)
Response Time	3	3					Sec.	0,5 - 3	Y	Response tiem (if non-adjustable range, place default value in MIN)
Power Reference	P _{pre}						unitless	P _{rated} or P _{pre-disturbance}	Y	Active power output

METHODS FOR APPLYING SETPOINTS

1. Verify installed firmware version 02.84.01.R or higher
 - a. If necessary, download and install latest firmware version for Sunny Tripower TL-US (STPxx000TL-US-10) from SMA website
2. Set inverter operating parameters to comply with HECO Rule 14H GSUI requirements by manual parameter adjustments as described in SMA Technical Note US SA 101-0115-001 rev. 02 (US SA 101-0115-001r02_TN_HECO_Rule_14H_settings_STPTLUS_CORE1)

CERTIFICATE OF COMPLIANCE

Certificate Number 20180329-E210376-E
Report Reference E210376-2016-01-06
Issue Date 2018-03-29

Issued to: SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal GERMANY

**This is to certify that
representative samples of**

STATIC INVERTERS, CONVERTERS AND
ACCESSORIES FOR USE IN INDEPENDENT POWER
SYSTEMS

SMA Solar Technology AG Models:
STP30000TL-US-10

Have been investigated by UL in accordance with the
Standard(s) indicated on this Certificate.

Standard(s) for Safety:

UL 1741, Standard for Safety for Inverters, Converters,
Controllers and Interconnection System Equipment for Use
With Distributed Energy Resources, UL 1741, Second
Edition, dated January 28, 2010, with revisions through
February 15, 2018. Including the requirements in UL 1741
Supplement SA, sections as noted in the Technical
considerations.

IEEE 1547, IEEE Standard for Interconnecting Distributed
Resources with Electric Power Systems.

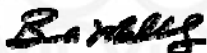
IEEE 1547.1, IEEE Standard for Conformance Test
Procedures for Equipment Interconnecting Distributed
Resources with Electric Power Systems.

CSA C22.2 No. 107.1-01, General Use Power Supplies.

Additional Information:

See the UL Online Certifications Directory at
www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's
Certification and Follow-Up Service.



Bruce Mahrenholz, Director North American Certification Program

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CERTIFICATE OF COMPLIANCE

Certificate Number 20180329-E210376-E
Report Reference E210376-2016-01-06
Issue Date 2018-03-29

The UL Recognized Component Mark generally consists of the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark: , may be used in conjunction with the required Recognized Marks. The Recognized Component Mark is required when specified in the UL Directory preceding the recognitions or under "Markings" for the individual recognitions.

Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL LLC.

Look for the UL Certification Mark on the product.

This is to certify that representative samples of the Permanently-connected, Grid Support Utility Interactive inverter products as specified on this certificate were tested according to the current UL requirements.

Standards for Safety:

UL 1741, Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741, Second Edition, dated January 28, 2010, with revisions through February 15, 2018. Including the requirements in UL 1741 Supplement SA, sections as noted in the Technical considerations.

IEEE 1547, IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems.

IEEE 1547.1, IEEE Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.

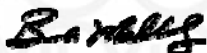
CSA C22.2 No. 107.1-01, General Use Power Supplies.

This description covers the SMA Solar Technology AG Model: STP30000TL-US-10 inverters.

The Certificate is valid for the HP-Version V2.05.01.R.

USL - Evaluated to the requirements of the Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741,

CNL - Additionally evaluated to CAN/CSA C22.2 No. 107.1-1, "General Use Power Supplies." September 2001, Reaffirmed 2011



Bruce Mahrenholz, Director North American Certification Program

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CERTIFICATE OF COMPLIANCE

Certificate Number 20180329-E210376-E
Report Reference E210376-2016-01-06
Issue Date 2018-03-29

Products covered by this certificate provide functionality in compliance with UL 1741 Supplement A (SA) when used in a UL Listed end product which has been evaluated by UL for its intended purpose.

Compliance testing was conducted on samples of the products according to the test methods in UL 1741 with compliant results, and product ratings were reviewed for fulfillment of the requirements in the following SRDs:

See also **Appendix A:** Grid Support Utility Interactive Inverter Worksheet

(+)

Grid Support Function	Source Requirement Document(s)	Test Standard(s) and Section(s)	NRTL Certified Date
TRANSIENT OVERVOLTAGE (TrOV-2)	HECO APPENDIX 1: Transient Overvoltage Self-Certification Instructions	N/A (+)	N/A
LOW/HIGH VOLTAGE RIDE-THROUGH	SRD 14H V1.1: Part II.C. Table 4	UL 1741 SA 9	2018-March-09
LOW/HIGH FREQUENCY RIDE-THROUGH	SRD 14H V1.1: Part II.D.1 Table 5	UL 1741 SA 10	2018-March-09
RAMP RATES	SRD 14H V1.1: Part II.G.1	UL 1741 SA 11.2	2018-March-09
RECONNECT BY "SOFT START"	SRD 14H V1.1: Part II.G.2	UL 1741 SA 11.4	2018-March-09
SPECIFIED POWER FACTOR	SRD 14H V1.1: Part II.A.1	UL 1741 SA 12	2018-March-09
DYNAMIC VOLT/VAR OPERATIONS	SRD 14H V1.1: Part II.A.2 Table 2, Figure 2	UL 1741 SA 13	2018-March-09
FREQUENCY-WATT	SRD 14H V1.1: Part II.F Table 7	UL 1741 SA 14	2018-March-09
VOLT-WATT	SRD 14H V1.1: Part II.B Table 3, Figure 3	UL 1741 SA 15	2018-March-09
Anti-Islanding	N/A	UL 1741 SA8	2018-March-09

(+) - Self Certification



Bruce Mahrenholz, Director North American Certification Program
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Complete all fields highlighted in red.

GENERAL		
VALUE	INFORMATION	NOTES
Manufacturer	SMA America, LCC	
Model #	STP30000TL-US-10	List Applicable Model(s)
Firmware version	02.84.01.R or higher	Provide applicable firmware
Certification / Self-Certification	Certified	Choose 1
NRTL Name		
Certificate #		
SA Certification Date		
Responsible Engineer		
Report #		

MANUFACTURER'S STATED ACCURACY						
VALUE	UNITS	RANGE	RATING			DESCRIPTION
Model	unitless	-	STP30000TL-US-10	SPR-30000m-3	-	Provide MSA for each model represented
Voltage, RMS	Volts	50 % < V ≤ 120 %	2%	2%	-	
Current, RMS	Amps	100 %	1%	1%	-	
Frequency	Hz	50 to 66 Hz	0.05 Hz	0.05 Hz	-	
Active Power	Watts	20 % < P ≤ 100 %	5%	5%	-	
Reactive Power	VAR	20 % < Q ≤ 100 %	5%	5%	-	
Power Factor	Displacement	20 % < P ≤ 100 %	0.01	0.01	-	
Time	s	100 ms to 600 s	0.001 s	0.001 s	-	

INVERTER DC (INPUT) SIDE					
VALUE	RATING		UNITS	DESCRIPTION	
	Min	Max			
$V_{DC\text{-rating}}$	150	1000	Volts	DC voltage rating	
$V_{MPPT\text{-RANGE}}$	500	800	Volts	Maximum power point track range	
$I_{DC\text{ max}}$	53		Amps	Max input short-circuit current per MPPT	

INVERTER AC (OUTPUT) SIDE					
VALUE	RATING		UNITS		DESCRIPTION
$V_{AC\text{-NOMINAL(Phase-neutral)}}$	277	-	-	Volts	Nominal Voltage Phase-neutral (if neutral available)
$V_{AC\text{-NOMINAL(Phase-phase)}}$	480	-	-	Volts	Nominal Voltage Phase-phase
Number of Phases	3		-	Number	Number of electrical phases
P_{OUT}	30000			VA	Rated Power Output
$I_{NOMINAL\text{-OUTPUT}}$	36.20			Amps	Nominal current per phase
$I_{MAXIMUM\text{-OUTPUT (at Vlow)}}$	36.20			Amps	Maximum output current at lowest operating voltage

FIXED POWER FACTOR		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
>15 kW	Underexcited, Inductive, Absorbing	-80	100					%	-85% to 100%	Y	Capacitive (var injection) power factor to Reactive (var absorption) power factor range. RULE 14H Default PF = -0.95 (Absorbing) for self certification purposes.
	Overexcited, Capacitive, Injecting	100	80					%	100% to 85%	Y	
<=15 kW	Underexcited, Inductive, Absorbing	NA	NA					%	-90% to 100%	-	Capacitive (var injection) power factor to Reactive (var absorption) power factor range. RULE 14H Default PF = -0.95 (Absorbing) for self certification purposes.
	Overexcited, Capacitive, Injecting	NA	NA					%	100% to 90%	-	

VOLTAGE RIDE-THROUGH		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
OV2	$I_{RMS_MAX@VRT(V = 120\%)}$	30.07						Amps	-	-	Maximum RMS current when voltage goes above to 120% before trip
	$t_{TRIP}(V > 120\%)$	0.1	59.00					Sec.	0.16	Y	Trip time
OV1	$I_{RMS_MAX@VRT(V = 110\%)}$	32.80						Amps	-	-	Maximum RMS current when voltage is between 110% and 120% before trip
	$t_{RIDE-THROUGH}(110\% < V \leq 120\%)$	0.10	30					Sec.	0.92	Y	Ride through time
	$t_{TRIP}(110\% < V \leq 120\%)$	0.10	60.0					Sec.	1	Y	Trip time
Nominal	$I_{RMS_MAX@V(V = 109\%)}$	33.10						Amps	-	-	Maximum RMS current when voltage is 109%
	$I_{RMS@V(V = 100\%)}$	36.08						Amps	-	-	RMS current when voltage is 100%
	$I_{RMS_MIN@V(V = 90\%)}$	36.20						Amps	-	-	Minimum RMS current when voltage is 90%
UV1	$I_{RMS_MIN@VRT(V = 75\%)}$	36.20						Amps	-	-	Minimum RMS current when voltage is between 70% and 88% before trip
	$t_{RIDE-THROUGH}(70\% \leq V < 88\%)$	0.1	30					Sec.	20	Y	Ride through time
	$t_{TRIP}(70\% \leq V < 88\%)$	0.1	60.0					Sec.	21	Y	Trip time
UV2	$I_{RMS_MIN@VRT(V = 70\%)}$	36.20						Amps	-	-	Minimum RMS current when voltage is between 50% and 70% before trip
	$t_{RIDE-THROUGH}(50\% \leq V < 70\%)$	0.10	30					Sec.	10-20	Y	Ride through time
	$t_{TRIP}(50\% \leq V < 70\%)$	0.10	60.0					Sec.	11-21	Y	Trip time
UV3	$I_{RMS_MIN@VRT(V = 50\%)}$	36.20						Amps	-	-	Minimum RMS current when voltage is below 50% before trip
	$t_{RIDE-THROUGH}(V < 50\%)$	0.10	30					Sec.	-	-	Ride through time
	$t_{TRIP}(V < 50\%)$	0.10	60.0					Sec.	2	Y	Trip time

FREQUENCY RIDE-THROUGH		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
OF2	$I_{RMS_MAX@FRT(f = 64Hz)}$	36.20						Amps	-	-	Maximum RMS current when the frequency is above 64 Hz before trip
	$t_{TRIP}(f > 64 Hz)$	0.10	1000.00					Sec.	0.16	Y	Trip time
OF1	$I_{RMS_MAX@FRT(63 Hz < f \leq 64 Hz)}$	36.20						Amps	-	-	Maximum RMS current when the frequency is between 63 and 64 Hz before trip
	$t_{RIDE-THROUGH}(63 Hz < f \leq 64 Hz)$	0.10	999					Sec.	20	Y	Ride Through Time
	$t_{TRIP}(63 Hz < f \leq 64 Hz)$	0.1	1000.0					Sec.	21	Y	Trip time
Nominal	$I_{RMS_MAX@f = 63 Hz}$	36.20						Amps	-	-	Maximum RMS current when the frequency is 63 Hz
	$I_{RMS@f = 60 Hz}$	36.20						Amps	-	-	RMS current when the frequency is 60 Hz
	$I_{RMS_MIN@f = 57 Hz}$	36.20						Amps	-	-	Minimum RMS current when the frequency is 57 Hz
UF1	$I_{RMS_MIN@FRT(56 Hz \leq f < 57 Hz)}$	36.20						Amps	-	-	Minimum RMS current when the frequency is between 56 and 57 Hz before trip
	$t_{RIDE-THROUGH}(56 Hz \leq f < 57 Hz)$	0.10	999					Sec.	20	Y	Ride Through Time
	$t_{TRIP}(56 Hz \leq f < 57 Hz)$	0.1	1000.0					Sec.	21	Y	Trip time
UF2	$I_{RMS_MIN@FRT(f < 56 Hz)}$	36.20						Amps	-	-	Minimum RMS current when the frequency is below 56 Hz before trip
	$t_{TRIP}(f < 56 Hz)$	0.1	1000					Sec.	0.16	Y	Trip time

Appendix A: Grid Support Utility Interactive Worksheet

VOLT-VAR, Q(V)	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
V1, UV _{Volt-Var_MIN}	70	100					% V _{NOMINAL}	94	Y	Lowest voltage where Volt-VAr starts at undervoltage
% Q1, VAr _{s@UV_Volt-Var_MIN}	-100	100					% Q (Var Injection)	44	Y	VAr _s at lowest undervoltage Volt-VAR point (-53% for aggregate generating facility >15 kW, -44% for aggregate generating facility <= 15 kW)
V2, UV _{Volt-Var_MAX}	70	100					% V _{NOMINAL}	97	Y	Highest voltage where Volt-VAr finish at undervoltage
% Q2, VAr _{s@UV_Volt-Var_MAX}	-100	100					% Q (0 VAr)	0	Y	VAr _s at highest undervoltage Volt-VAR point
V3, OV _{Volt-Var_MIN}	100	120					% V _{NOMINAL}	103	Y	Lowest voltage where Volt-VAR starts at overvoltage
% Q3, VAr _{s@OV_Volt-Var_MIN}	-100	100					% Q (0 VAr)	0	Y	VAr _s at lowest overvoltage Volt-VAR point
V4, OV _{Volt-Var_MAX}	100	120					% V _{NOMINAL}	106	Y	Highest voltage where Volt-VAR finish at overvoltage
% Q4, VAr _{s@OV_Volt-Var_MAX}	-100	100					% Q (Var Absorption)	-44	Y	VVAr _s at highest overvoltage Volt-VAR point (53% for aggregate generating facility >15 kW, 44% for aggregate generating facility <= 15 kW)
Response Time	0	1000					Sec.	10	Y	Response time (if non-adjustable range, place default value in MIN)
Power Priority	reactive						Unitless	Reactive	Y	Power Priority

POWER RAMP RATE	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
Connect/Reconnect RAMP _{RATE}	0.16	166					% P _{RATED} /sec.	100	Y	Percentage of nominal generated power per second "Ramp Rate"
Soft Start RAMP _{RATE}	0.016	166					% P _{RATED} /sec.	0.33	Y	Percentage of nominal generated power per second "Ramp Rate"

VOLT-WATT	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
Power Rate	0	100					% P _{RATED} /V	-25	Y	Percentage of power reduction per volt "Volt-Watt rate"
Start voltage	100	120					% V _{nom}	106	Y	Power reduction starting voltage
Stop voltage	100	120					% V _{nom}	110	Y	Power reduction endpoint voltage
Response Time	0	1000					Sec.	10	Y	Response time (If non-adjustable range, place default value in MIN)
Power Reference	P _{pre}						unitless	P _{rated} or P _{pre-disturbance}	Y	Active power output

FREQUENCY-WATT	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
FW _{RATE}	28.6	130					%P _{rated} /Hz	~42	Y	Minimum percentage of power reduction per hertz "frequency-watt rate" (based on KOF = 0.04)
Freq adjustment range at Start frequency	60.01	62					Hz	60.04	Y	Power reduction Starting Frequency (Based on dbOF = 0.036 Hz)
Response Time	3	3					Sec.	0.5 - 3	Y	Response time (if non-adjustable range, place default value in MIN)
Power Reference	P _{pre}						unitless	P _{rated} or P _{pre-disturbance}	Y	Active power output

METHODS FOR APPLYING SETPOINTS

1. Verify installed firmware version 02.84.01.R or higher
 - a. If necessary, download and install latest firmware version for Sunny Tripower TL-US (STPxx000TL-US-10) from SMA website
2. Set inverter operating parameters to comply with HECO Rule 14H GSUI requirements by manual parameter adjustments as described in SMA Technical Note US SA 101-0115-001 rev. 02 (US SA 101-0115-001r02_TN_HECO_Rule_14H_settings_STPTLUS_CORE1)

CERTIFICATE OF COMPLIANCE

Certificate Number 20180329-E210376-A
Report Reference E210376-2013-06-14
Issue Date 2018-03-29

Issued to: SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal GERMANY

**This is to certify that
representative samples of**

STATIC INVERTERS, CONVERTERS AND
ACCESSORIES FOR USE IN INDEPENDENT POWER
SYSTEMS

SMA Solar Technology AG Models:
STP12000TL-US-10

Have been investigated by UL in accordance with the
Standard(s) indicated on this Certificate.

Standard(s) for Safety:

UL 1741, Standard for Safety for Inverters, Converters,
Controllers and Interconnection System Equipment for Use
With Distributed Energy Resources, UL 1741, Second
Edition, dated January 28, 2010, with revisions through
February 15, 2018. Including the requirements in UL 1741
Supplement SA, sections as noted in the Technical
considerations.

IEEE 1547, IEEE Standard for Interconnecting Distributed
Resources with Electric Power Systems.

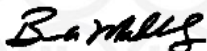
IEEE 1547.1, IEEE Standard for Conformance Test
Procedures for Equipment Interconnecting Distributed
Resources with Electric Power Systems.

CSA C22.2 No. 107.1-01, General Use Power Supplies.

Additional Information:

See the UL Online Certifications Directory at
www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's
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Bruce Mahrenholz, Director North American Certification Program

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CERTIFICATE OF COMPLIANCE

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The UL Recognized Component Mark generally consists of the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark: , may be used in conjunction with the required Recognized Marks. The Recognized Component Mark is required when specified in the UL Directory preceding the recognitions or under "Markings" for the individual recognitions.

Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL LLC.

Look for the UL Certification Mark on the product.

This is to certify that representative samples of the Permanently-connected, Grid Support Utility Interactive inverter products as specified on this certificate were tested according to the current UL requirements.

Standards for Safety:

UL 1741, Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741, Second Edition, dated January 28, 2010, with revisions through February 15, 2018. Including the requirements in UL 1741 Supplement SA, sections as noted in the Technical considerations.

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IEEE 1547.1, IEEE Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.

CSA C22.2 No. 107.1-01, General Use Power Supplies.

This description covers the SMA Solar Technology AG Model: STP12000TL-US-10 inverters.

The Certificate is valid for the HP-Version V2.05.01.R.

USL - Evaluated to the requirements of the Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741,

CNL - Additionally evaluated to CAN/CSA C22.2 No. 107.1-1, "General Use Power Supplies." September 2001, Reaffirmed 2011



Bruce Mahrenholz, Director North American Certification Program

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CERTIFICATE OF COMPLIANCE

Certificate Number 20180329-E210376-A
Report Reference E210376-2013-06-14
Issue Date 2018-03-29

Products covered by this certificate provide functionality in compliance with UL 1741 Supplement A (SA) when used in a UL Listed end product which has been evaluated by UL for its intended purpose.

Compliance testing was conducted on samples of the products according to the test methods in UL 1741 with compliant results, and product ratings were reviewed for fulfillment of the requirements in the following SRDs:

See also **Appendix A:** Grid Support Utility Interactive Inverter Worksheet

(+)

Grid Support Function	Source Requirement Document(s)	Test Standard(s) and Section(s)	NRTL Certified Date
TRANSIENT OVERVOLTAGE (TrOV-2)	HECO APPENDIX 1: Transient Overvoltage Self-Certification Instructions	N/A (+)	N/A
LOW/HIGH VOLTAGE RIDE-THROUGH	SRD 14H V1.1: Part II.C. Table 4	UL 1741 SA 9	2018-March-09
LOW/HIGH FREQUENCY RIDE-THROUGH	SRD 14H V1.1: Part II.D.1 Table 5	UL 1741 SA 10	2018-March-09
RAMP RATES	SRD 14H V1.1: Part II.G.1	UL 1741 SA 11.2	2018-March-09
RECONNECT BY "SOFT START"	SRD 14H V1.1: Part II.G.2	UL 1741 SA 11.4	2018-March-09
SPECIFIED POWER FACTOR	SRD 14H V1.1: Part II.A.1	UL 1741 SA 12	2018-March-09
DYNAMIC VOLT/VAR OPERATIONS	SRD 14H V1.1: Part II.A.2 Table 2, Figure 2	UL 1741 SA 13	2018-March-09
FREQUENCY-WATT	SRD 14H V1.1: Part II.F Table 7	UL 1741 SA 14	2018-March-09
VOLT-WATT	SRD 14H V1.1: Part II.B Table 3, Figure 3	UL 1741 SA 15	2018-March-09
Anti-Islanding	N/A	UL 1741 SA8	2018-March-09

(+) - Self Certification

B. Mahlen

Bruce Mahrenholz, Director North American Certification Program

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Complete all fields highlighted in red.

GENERAL		
VALUE	INFORMATION	NOTES
Manufacturer	SMA America, LCC	
Model #	STP12000TL-US-10	List Applicable Model(s)
Firmware version	02.84.01.R or higher	Provide applicable firmware
Certification / Self-Certification	Certified	Choose 1
NRTL Name		
Certificate #		
SA Certification Date		
Responsible Engineer		
Report #		

MANUFACTURER's STATED ACCURACY						
VALUE	UNITS	RANGE	RATING			DESCRIPTION
Model	unitless	-	STP12000TL-US-10	-	-	Provide MSA for each model represented
Voltage, RMS	Volts	50 % < V ≤ 120 %	2%	-	-	
Current, RMS	Amps	100 %	1%	-	-	
Frequency	Hz	50 to 66 Hz	0.05 Hz	-	-	
Active Power	Watts	20 % < P ≤ 100 %	5%	-	-	
Reactive Power	VAR	20 % < Q ≤ 100 %	5%	-	-	
Power Factor	Displacement	20 % < P ≤ 100 %	0.01	-	-	
Time	s	100 ms to 600 s	0.001 s	-	-	

INVERTER DC (INPUT) SIDE

VALUE	RATING		UNITS	DESCRIPTION
	Min	Max		
V _{DC} -rating	150	1000	Volts	DC voltage rating
V _{MPPT-RANGE}	300	800	Volts	Maximum power point track range
I _{DC max}	50		Amps	Max input short-circuit current per MPPT

INVERTER AC (OUTPUT) SIDE					
VALUE	RATING			UNITS	DESCRIPTION
V _{AC-NOMINAL(Phase-neutral)}	277	-	-	Volts	Nominal Voltage Phase-neutral (if neutral available)
V _{AC-NOMINAL(Phase-phase)}	480	-	-	Volts	Nominal Voltage Phase-phase
Number of Phases	3		-	Number	Number of electrical phases
P _{OUT}	12000			VA	Rated Power Output
I _{NOMINAL-OUTPUT}	14.50			Amps	Nominal current per phase
I _{MAXIMUM-OUTPUT (at Vlow)}	14.50			Amps	Maximum output current at lowest operating voltage

FIXED POWER FACTOR		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
>15 kW	Underexcited, Inductive, Absorbing	NA	NA					%	-85% to 100%	-	Capacitive (var injection) power factor to Reactive (var absorption) power factor range. RULE 14H Default PF = -0.95 (Absorbing) for self certification purposes.
	Overexcited, Capacitive, Injecting	NA	NA					%	100% to 85%	-	
<=15 kW	Underexcited, Inductive, Absorbing	-80	100					%	-90% to 100%	y	Capacitive (var injection) power factor to Reactive (var absorption) power factor range. RULE 14H Default PF = -0.95 (Absorbing) for self certification purposes.
	Overexcited, Capacitive, Injecting	100	80					%	100% to 90%	y	

Appendix A: Grid Support Utility Interactive Worksheet

VOLTAGE RIDE-THROUGH		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
OV2	$I_{RMS_MAX@VRT(V = 120\%)}$	12.03						Amps	-	-	Maximum RMS current when voltage goes above to 120% before trip
	$t_{TRIP(V > 120\%)}$	0.05	59.00					Sec.	0.16	Y	Trip time
OV1	$I_{RMS_MAX@VRT(V = 110\%)}$	13.12						Amps	-	-	Maximum RMS current when voltage is between 110% and 120% before trip
	$t_{RIDE-THROUGH(110\% < V \leq 120\%)}$	0.10	30					Sec.	0.92	Y	Ride through time
	$t_{TRIP(110\% < V \leq 120\%)}$	0.10	60.0					Sec.	1	Y	Trip time
Nominal	$I_{RMS_MAX@V(V = 109\%)}$	13.24						Amps	-	-	Maximum RMS current when voltage is 109%
	$I_{RMS@V(V = 100\%)}$	14.43						Amps	-	-	RMS current when voltage is 100%
	$I_{RMS_MIN@V(V = 90\%)}$	14.50						Amps	-	-	Minimum RMS current when voltage is 90%
UV1	$I_{RMS_MIN@VRT(V = 75\%)}$	14.50						Amps	-	-	Minimum RMS current when voltage is between 70% and 88% before trip
	$t_{RIDE-THROUGH(70\% \leq V < 88\%)}$	0.1	30					Sec.	20	Y	Ride through time
	$t_{TRIP(70\% \leq V < 88\%)}$	0.1	60.0					Sec.	21	Y	Trip time
UV2	$I_{RMS_MIN@VRT(V = 70\%)}$	14.50						Amps	-	-	Minimum RMS current when voltage is between 50% and 70% before trip
	$t_{RIDE-THROUGH(50\% \leq V < 70\%)}$	0.10	30					Sec.	10-20	Y	Ride through time
	$t_{TRIP(50\% \leq V < 70\%)}$	0.10	60.0					Sec.	11-21	Y	Trip time
UV3	$I_{RMS_MIN@VRT(V = 50\%)}$	14.50						Amps	-	-	Minimum RMS current when voltage is below 50% before trip
	$t_{RIDE-THROUGH(V < 50\%)}$	0.10	30					Sec.	-	-	Ride through time
	$t_{TRIP(V < 50\%)}$	0.10	60.0					Sec.	2	Y	Trip time

FREQUENCY RIDE-THROUGH		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
OF2	$I_{RMS_MAX@FRT(f = 64Hz)}$	14.50						Amps	-	-	Maximum RMS current when the frequency is above 64 Hz before trip
	$t_{TRIP(f > 64 Hz)}$	0.10	1000.00					Sec.	0.16	Y	Trip time
OF1	$I_{RMS_MAX@FRT(63 Hz < f \leq 64Hz)}$	14.50						Amps	-	-	Maximum RMS current when the frequency is between 63 and 64 Hz before trip
	$t_{RIDE-THROUGH(63 Hz < f \leq 64 Hz)}$	0.10	999					Sec.	20	Y	Ride Through Time
	$t_{TRIP(63 Hz < f \leq 64 Hz)}$	0.1	1000.0					Sec.	21	Y	Trip time
Nominal	$I_{RMS_MAX@f = 63 Hz}$	14.50						Amps	-	-	Maximum RMS current when the frequency is 63 Hz
	$I_{RMS@f = 60 Hz}$	14.50						Amps	-	-	RMS current when the frequency is 60 Hz
	$I_{RMS_MIN@f = 57 Hz}$	14.50						Amps	-	-	Minimum RMS current when the frequency is 57 Hz
UF1	$I_{RMS_MIN@FRT(56 Hz \leq f < 57 Hz)}$	14.50						Amps	-	-	Minimum RMS current when the frequency is between 56 and 57 Hz before trip
	$t_{RIDE-THROUGH(56 Hz \leq f < 57 Hz)}$	0.10	999					Sec.	20	Y	Ride Through Time
	$t_{TRIP(56 Hz \leq f < 57 Hz)}$	0.1	1000.0					Sec.	21	Y	Trip time
UF2	$I_{RMS_MIN@FRT(f < 56 Hz)}$	14.50						Amps	-	-	Minimum RMS current when the frequency is below 56 Hz before trip
	$t_{TRIP(f < 56 Hz)}$	0.1	1000					Sec.	0.16	Y	Trip time

Appendix A: Grid Support Utility Interactive Worksheet

VOLT-VAR, Q(V)	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
V1, UV _{Volt-Var_MIN}	70	100					% V _{NOMINAL}	94	Y	Lowest voltage where Volt-VAr starts at undervoltage
% Q1, VAr _{s@UV_Volt-Var_MIN}	-100	100					% Q (Var Injection)	44	Y	VAr _s at lowest undervoltage Volt-VAR point (-53% for aggregate generating facility >15 kW, -44% for aggregate generating facility <= 15 kW)
V2, UV _{Volt-Var_MAX}	70	100					% V _{NOMINAL}	97	Y	Highest voltage where Volt-VAr finish at undervoltage
% Q2, VAr _{s@UV_Volt-Var_MAX}	-100	100					% Q (0 VAr)	0	Y	VAr _s at highest undervoltage Volt-VAR point
V3, OV _{Volt-Var_MIN}	100	120					% V _{NOMINAL}	103	Y	Lowest voltage where Volt-VAr starts at overvoltage
% Q3, VAr _{s@OV_Volt-Var_MIN}	-100	100					% Q (0 VAr)	0	Y	VAr _s at lowest overvoltage Volt-VAR point
V4, OV _{Volt-Var_MAX}	100	120					% V _{NOMINAL}	106	Y	Highest voltage where Volt-VAr finish at overvoltage
% Q4, VAr _{s@OV_Volt-Var_MAX}	-100	100					% Q (Var Absorption)	-44	Y	VVAr _s at highest overvoltage Volt-VAR point (53% for aggregate generating facility >15 kW, 44% for aggregate generating facility <= 15 kW)
Response Time	0	1000					Sec.	10	Y	Response time (if non-adjustable range, place default value in MIN)
Power Priority	reactive						Unitless	Reactive	Y	Power Priority

POWER RAMP RATE	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
Connect/Reconnect RAMP _{RATE}	0.16	166					% P _{RATED} /sec.	100	Y	Percentage of nominal generated power per second "Ramp Rate"
Soft Start RAMP _{RATE}	0.016	166					% P _{RATED} /sec.	0.33	Y	Percentage of nominal generated power per second "Ramp Rate"

VOLT-WATT	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
Power Rate	0	100					% P _{PRATED} /V	-25	Y	Percentage of power reduction per volt "Volt-Watt rate"
Start voltage	100	120					% V _{nom}	106	Y	Power reduction starting voltage
Stop voltage	100	120					% V _{nom}	110	Y	Power reduction endpoint voltage
Response Time	0	1000					Sec.	10	Y	Response time (If non-adjustable range, place default value in MIN)
Power Reference	P _{pre}						unitless	P _{rated} or P _{pre-disturbance}	Y	Active power output

FREQUENCY-WATT	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
FW _{RATE}	28.6	130					%P _{rated} /Hz	~42	Y	Minimum percentage of power reduction per hertz "frequency-watt rate" (based on KOF = 0.04)
Freq adjustment range at Start frequency	60.01	62					Hz	60.04	Y	Power reduction Starting Frequency (Based on dbOF = 0.036 Hz)
Response Time	3	3					Sec.	0.5 - 3	Y	Response time (if non-adjustable range, place default value in MIN)
Power Reference	P _{pre}						unitless	P _{rated} or P _{pre-disturbance}	Y	Active power output

METHODS FOR APPLYING SETPOINTS

1. Verify installed firmware version 02.84.01.R or higher
 - a. If necessary, download and install latest firmware version for Sunny Tripower TL-US (STPxx000TL-US-10) from SMA website
2. Set inverter operating parameters to comply with HECO Rule 14H GSUI requirements by manual parameter adjustments as described in SMA Technical Note US SA 101-0115-001 rev. 02 (US SA 101-0115-001r02_TN_HECO_Rule_14H_settings_STPTLUS_CORE1)

CERTIFICATE OF COMPLIANCE

Certificate Number 20180329-E210376-B
Report Reference E210376-2013-06-14
Issue Date 2018-03-29

Issued to: SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal GERMANY

**This is to certify that
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STATIC INVERTERS, CONVERTERS AND
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SMA Solar Technology AG Models:
STP15000TL-US-10

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Standard(s) indicated on this Certificate.

Standard(s) for Safety:

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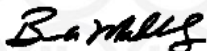
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Bruce Mahrenholz, Director North American Certification Program

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IEEE 1547, IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems.

IEEE 1547.1, IEEE Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.

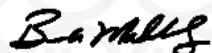
CSA C22.2 No. 107.1-01, General Use Power Supplies.

This description covers the SMA Solar Technology AG Model: STP15000TL-US-10 inverters.

The Certificate is valid for the HP-Version V2.05.01.R.

USL - Evaluated to the requirements of the Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741,

CNL - Additionally evaluated to CAN/CSA C22.2 No. 107.1-1, "General Use Power Supplies." September 2001, Reaffirmed 2011



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CERTIFICATE OF COMPLIANCE

Certificate Number 20180329-E210376-B
Report Reference E210376-2013-06-14
Issue Date 2018-03-29

Products covered by this certificate provide functionality in compliance with UL 1741 Supplement A (SA) when used in a UL Listed end product which has been evaluated by UL for its intended purpose.

Compliance testing was conducted on samples of the products according to the test methods in UL 1741 with compliant results, and product ratings were reviewed for fulfillment of the requirements in the following SRDs:

See also **Appendix A:** Grid Support Utility Interactive Inverter Worksheet

(+)

Grid Support Function	Source Requirement Document(s)	Test Standard(s) and Section(s)	NRTL Certified Date
TRANSIENT OVERVOLTAGE (TrOV-2)	HECO APPENDIX 1: Transient Overvoltage Self-Certification Instructions	N/A (+)	N/A
LOW/HIGH VOLTAGE RIDE-THROUGH	SRD 14H V1.1: Part II.C. Table 4	UL 1741 SA 9	2018-March-09
LOW/HIGH FREQUENCY RIDE-THROUGH	SRD 14H V1.1: Part II.D.1 Table 5	UL 1741 SA 10	2018-March-09
RAMP RATES	SRD 14H V1.1: Part II.G.1	UL 1741 SA 11.2	2018-March-09
RECONNECT BY "SOFT START"	SRD 14H V1.1: Part II.G.2	UL 1741 SA 11.4	2018-March-09
SPECIFIED POWER FACTOR	SRD 14H V1.1: Part II.A.1	UL 1741 SA 12	2018-March-09
DYNAMIC VOLT/VAR OPERATIONS	SRD 14H V1.1: Part II.A.2 Table 2, Figure 2	UL 1741 SA 13	2018-March-09
FREQUENCY-WATT	SRD 14H V1.1: Part II.F Table 7	UL 1741 SA 14	2018-March-09
VOLT-WATT	SRD 14H V1.1: Part II.B Table 3, Figure 3	UL 1741 SA 15	2018-March-09
Anti-Islanding	N/A	UL 1741 SA8	2018-March-09

(+) - Self Certification

B. Mahrenholz

Bruce Mahrenholz, Director North American Certification Program

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Complete all fields highlighted in red.

GENERAL		
VALUE	INFORMATION	NOTES
Manufacturer	SMA America, LCC	
Model #	STP15000TL-US-10	List Applicable Model(s)
Firmware version	02.84.01.R or higher	Provide applicable firmware
Certification / Self-Certification	Certified	Choose 1
NRTL Name		
Certificate #		
SA Certification Date		
Responsible Engineer		
Report #		

MANUFACTURER'S STATED ACCURACY						
VALUE	UNITS	RANGE	RATING			DESCRIPTION
Model	unitless	-	STP15000TL-US-10	-	-	Provide MSA for each model represented
Voltage, RMS	Volts	50 % < V ≤ 120 %	2%	-	-	
Current, RMS	Amps	100 %	1%	-	-	
Frequency	Hz	50 to 66 Hz	0.05 Hz	-	-	
Active Power	Watts	20 % < P ≤ 100 %	5%	-	-	
Reactive Power	VAR	20 % < Q ≤ 100 %	5%	-	-	
Power Factor	Displacement	20 % < P ≤ 100 %	0.01	-	-	
Time	s	100 ms to 600 s	0.001 s	-	-	

INVERTER DC (INPUT) SIDE				
VALUE	RATING		UNITS	DESCRIPTION
	Min	Max		
V _{DC} - rating	150	1000	Volts	DC voltage rating

Appendix A: Grid Support Utility Interactive Worksheet

$V_{MPPT-RANGE}$	300	800	Volts	Maximum power point track range
$I_{DC,max}$	53		Amps	Max input short-circuit current per MPPT

INVERTER AC (OUTPUT) SIDE					
VALUE	RATING			UNITS	DESCRIPTION
$V_{AC-NOMINAL(Phase-neutral)}$	277	-	-	Volts	Nominal Voltage Phase-neutral (if neutral available)
$V_{AC-NOMINAL(Phase-phase)}$	480	-	-	Volts	Nominal Voltage Phase-phase
Number of Phases	3		-	Number	Number of electrical phases
P_{OUT}	15000			VA	Rated Power Output
$I_{NOMINAL-OUTPUT}$	18.10			Amps	Nominal current per phase
$I_{MAXIMUM-OUTPUT (at Vlow)}$	18.10			Amps	Maximum output current at lowest operating voltage

FIXED POWER FACTOR		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
>15 kW	Underexcited, Inductive, Absorbing	NA	NA					%	-85% to 100%	-	Capacitive (var injection) power factor to Reactive (var absorption) power factor range. RULE 14H Default PF = -0.95 (Absorbing) for self certification purposes.
	Overexcited, Capacitive, Injecting	NA	NA					%	100% to 85%	-	
<=15 kW	Underexcited, Inductive, Absorbing	-80	100					%	-90% to 100%	y	Capacitive (var injection) power factor to Reactive (var absorption) power factor range. RULE 14H Default PF = -0.95 (Absorbing) for self certification purposes.
	Overexcited, Capacitive, Injecting	100	80					%	100% to 90%	y	

Appendix A: Grid Support Utility Interactive Worksheet

VOLTAGE RIDE-THROUGH		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
OV2	$I_{RMS_MAX@VRT(V = 120\%)}$	15.04						Amps	-	-	Maximum RMS current when voltage goes above to 120% before trip
	$t_{TRIP(V > 120\%)}$	0.05	59.00					Sec.	0.16	Y	Trip time
OV1	$I_{RMS_MAX@VRT(V = 110\%)}$	16.40						Amps	-	-	Maximum RMS current when voltage is between 110% and 120% before trip
	$t_{RIDE-THROUGH(110\% < V \leq 120\%)}$	0.10	30					Sec.	0.92	Y	Ride through time
	$t_{TRIP(110\% < V \leq 120\%)}$	0.10	60.0					Sec.	1	Y	Trip time
Nominal	$I_{RMS_MAX@V(V = 109\%)}$	16.55						Amps	-	-	Maximum RMS current when voltage is 109%
	$I_{RMS@V(V = 100\%)}$	18.04						Amps	-	-	RMS current when voltage is 100%
	$I_{RMS_MIN@V(V = 90\%)}$	18.10						Amps	-	-	Minimum RMS current when voltage is 90%
UV1	$I_{RMS_MIN@VRT(V = 75\%)}$	18.10						Amps	-	-	Minimum RMS current when voltage is between 70% and 88% before trip
	$t_{RIDE-THROUGH(70\% \leq V < 88\%)}$	0.1	30					Sec.	20	Y	Ride through time
	$t_{TRIP(70\% \leq V < 88\%)}$	0.1	60.0					Sec.	21	Y	Trip time
UV2	$I_{RMS_MIN@VRT(V = 70\%)}$	18.10						Amps	-	-	Minimum RMS current when voltage is between 50% and 70% before trip
	$t_{RIDE-THROUGH(50\% \leq V < 70\%)}$	0.10	30					Sec.	10-20	Y	Ride through time
	$t_{TRIP(50\% \leq V < 70\%)}$	0.10	60.0					Sec.	11-21	Y	Trip time
UV3	$I_{RMS_MIN@VRT(V = 50\%)}$	18.10						Amps	-	-	Minimum RMS current when voltage is below 50% before trip
	$t_{RIDE-THROUGH(V < 50\%)}$	0.10	30					Sec.	-	-	Ride through time
	$t_{TRIP(V < 50\%)}$	0.10	60.0					Sec.	2	Y	Trip time

FREQUENCY RIDE-THROUGH		480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
		Min	Max	Min	Max	Min	Max				
OF2	$I_{RMS_MAX@FRT(f = 64Hz)}$	18.10						Amps	-	-	Maximum RMS current when the frequency is above 64 Hz before trip
	$t_{TRIP(f > 64 Hz)}$	0.10	1000.00					Sec.	0.16	Y	Trip time
OF1	$I_{RMS_MAX@FRT(63 Hz < f \leq 64Hz)}$	18.10						Amps	-	-	Maximum RMS current when the frequency is between 63 and 64 Hz before trip
	$t_{RIDE-THROUGH(63 Hz < f \leq 64 Hz)}$	0.10	999					Sec.	20	Y	Ride Through Time
	$t_{TRIP(63 Hz < f \leq 64 Hz)}$	0.1	1000.0					Sec.	21	Y	Trip time
Nominal	$I_{RMS_MAX@f = 63 Hz}$	18.10						Amps	-	-	Maximum RMS current when the frequency is 63 Hz
	$I_{RMS@f = 60 Hz}$	18.10						Amps	-	-	RMS current when the frequency is 60 Hz
	$I_{RMS_MIN@f = 57 Hz}$	18.10						Amps	-	-	Minimum RMS current when the frequency is 57 Hz
UF1	$I_{RMS_MIN@FRT(56 Hz \leq f < 57 Hz)}$	18.10						Amps	-	-	Minimum RMS current when the frequency is between 56 and 57 Hz before trip
	$t_{RIDE-THROUGH(56 Hz \leq f < 57 Hz)}$	0.10	999					Sec.	20	Y	Ride Through Time
	$t_{TRIP(56 Hz \leq f < 57 Hz)}$	0.1	1000.0					Sec.	21	Y	Trip time
UF2	$I_{RMS_MIN@FRT(f < 56 Hz)}$	18.10						Amps	-	-	Minimum RMS current when the frequency is below 56 Hz before trip
	$t_{TRIP(f < 56 Hz)}$	0.1	1000					Sec.	0.16	Y	Trip time

Appendix A: Grid Support Utility Interactive Worksheet

VOLT-VAR, Q(V)	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
V1, UV _{Volt-Var_MIN}	70	100					% V _{NOMINAL}	94	Y	Lowest voltage where Volt-VAR starts at undervoltage
% Q1, VAr _{s@UV_Volt-Var_MIN}	-100	100					% Q (Var Injection)	44	Y	VAr _s at lowest undervoltage Volt-VAR point (-53% for aggregate generating facility >15 kW, -44% for aggregate generating facility <= 15 kW)
V2, UV _{Volt-Var_MAX}	70	100					% V _{NOMINAL}	97	Y	Highest voltage where Volt-VAR finish at undervoltage
% Q2, VAr _{s@UV_Volt-Var_MAX}	-100	100					% Q (0 VAr)	0	Y	VAr _s at highest undervoltage Volt-VAR point
V3, OV _{Volt-Var_MIN}	100	120					% V _{NOMINAL}	103	Y	Lowest voltage where Volt-VAR starts at overvoltage
% Q3, VAr _{s@OV_Volt-Var_MIN}	-100	100					% Q (0 VAr)	0	Y	VAr _s at lowest overvoltage Volt-VAR point
V4, OV _{Volt-Var_MAX}	100	120					% V _{NOMINAL}	106	Y	Highest voltage where Volt-VAR finish at overvoltage
% Q4, VAr _{s@OV_Volt-Var_MAX}	-100	100					% Q (Var Absorption)	-44	Y	VVAr _s at highest overvoltage Volt-VAR point (53% for aggregate generating facility >15 kW, 44% for aggregate generating facility <= 15 kW)
Response Time	0	1000					Sec.	10	Y	Response time (if non-adjustable range, place default value in MIN)
Power Priority	reactive						Unitless	Reactive	Y	Power Priority

POWER RAMP RATE	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
Connect/Reconnect RAMP _{RATE}	0.16	166					% P _{RATED} /sec.	100	Y	Percentage of nominal generated power per second "Ramp Rate"
Soft Start RAMP _{RATE}	0.016	166					% P _{RATED} /sec.	0.33	Y	Percentage of nominal generated power per second "Ramp Rate"

VOLT-WATT	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
Power Rate	0	100					% P _{PRATED} /V	-25	Y	Percentage of power reduction per volt "Volt-Watt rate"
Start voltage	100	120					% V _{nom}	106	Y	Power reduction starting voltage
Stop voltage	100	120					% V _{nom}	110	Y	Power reduction endpoint voltage
Response Time	0	1000					Sec.	10	Y	Response time (If non-adjustable range, place default value in MIN)
Power Reference	P _{pre}						unitless	P _{rated} or P _{pre-disturbance}	Y	Active power output

FREQUENCY-WATT	480		-		-		UNITS	SRD V1.1 Range	SRD V1.1 Compliant?	DESCRIPTION
	Min	Max	Min	Max	Min	Max				
FW _{RATE}	28.6	130					%P _{rated} /Hz	~42	Y	Minimum percentage of power reduction per hertz "frequency-watt rate" (based on KOF = 0.04)
Freq adjustment range at Start frequency	60.01	62					Hz	60.04	Y	Power reduction Starting Frequency (Based on dbOF = 0.036 Hz)
Response Time	3	3					Sec.	0.5 - 3	Y	Response time (if non-adjustable range, place default value in MIN)
Power Reference	P _{pre}						unitless	P _{rated} or P _{pre-disturbance}	Y	Active power output

METHODS FOR APPLYING SETPOINTS

1. Verify installed firmware version 02.84.01.R or higher
 - a. If necessary, download and install latest firmware version for Sunny Tripower TL-US (STPxx000TL-US-10) from SMA website
2. Set inverter operating parameters to comply with HECO Rule 14H GSUI requirements by manual parameter adjustments as described in SMA Technical Note US SA 101-0115-001 rev. 02 (US SA 101-0115-001r02_TN_HECO_Rule_14H_settings_STPTLUS_CORE1)