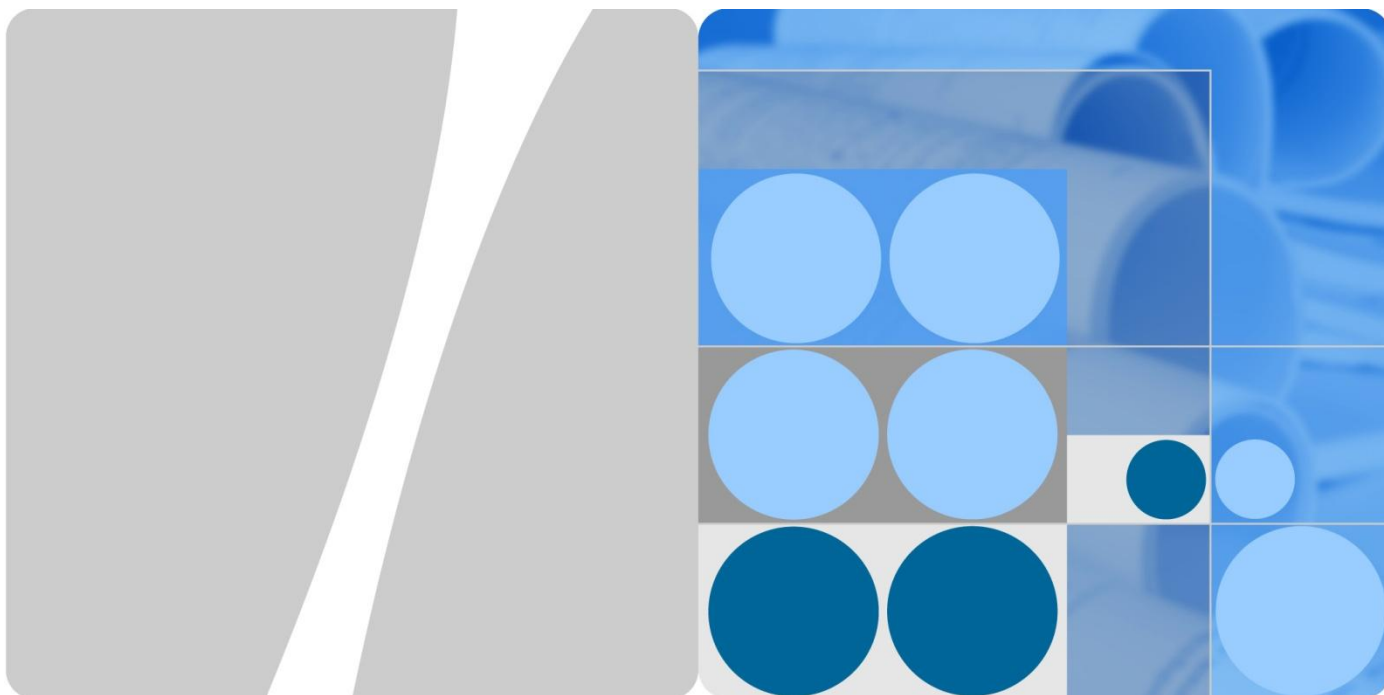




SUN2000 8-28KTL Planning Tool Guide

Issue V2.1

Release date 2014-07

Huawei Technologies Co., Ltd.



Contents

1 Introduction and Basic Information	1-1
1.1 Introduction.....	1-1
1.2 Basic information.....	1-1
1.2.1 Languages	1-1
Three basic languages are provided: English, German and Chinese. 1-1	
1.2.2 Location	1-1
1.2.3 PV Module Type	1-2
1.2.4 Inverter Type.....	1-4
2 PV System Design	2-5
2.1 Temperature effects.....	2-5
2.1.1 Ambient Temperature	2-5
2.1.2 Mounting Mode	2-5
2.1.3 DC Voltage Calculation.....	2-6
2.2 DC Input Voltage and MPPT Power Calculation	2-7
2.3 PF setting & DC Input Power Calculation	2-8
3 Yield Yearly Calculation.....	3-9

1 Introduction and Basic Information

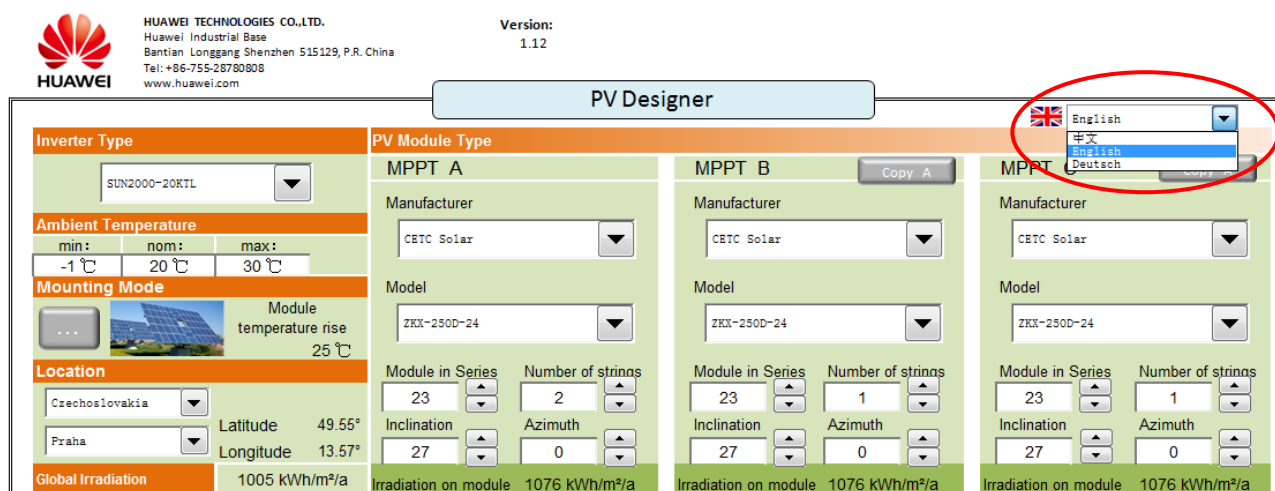
1.1 Introduction

SUN2000 Planning Tool is used for PV system designing with SUN2000 series string inverters. Based on different countries and regions, users can use it to do PV system designs with different PV panels. The objective of this document is to describe how to use SUN2000 Planning Tool.

1.2 Basic Information

1.2.1 Languages

Three basic languages are provided: English, German and Chinese. Users can select the languages in the right side as shown in picture 1.



Picture 1 Languages Selection

1.2.2 Location

Over 90 country and regions are provided in the planning tool. In each country and region, main cities are provided. When the location is selected, the latitude and longitude will be shown. The irradiation is decided by the location and the data is sourced from NASA.

Picture 2 Location Selection

If the location is not provided in the tool, you can add a new location as illustrated in picture 3.

Add Site

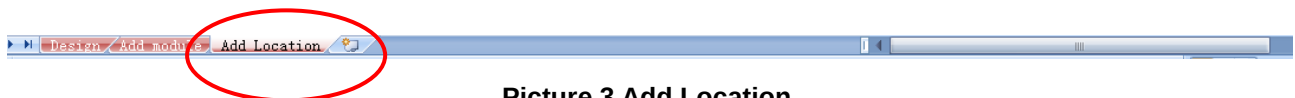
Country	Latitude	Longitude	City	Monthly	Global Irradiation(kWh/m²)
					1 2 3 4 5 6 7 8 9 10 11 12
					Diffuse Irradiation(kWh/m²) (It could be left blank if no information available for diffuse irradiation.)
					1 2 3 4 5 6 7 8 9 10 11 12

Please make sure that all parameters are correct!

Delete Site

Country	Latitude	Longitude	City	Monthly	Global Irradiation(kWh/m²)
Bolivia	-16.24°				1 2 3 4 5 6 7 8 9 10 11 12
					229 179 201 196 196 165 179 202 220 248 241 233
					Diffuse Irradiation(kWh/m²) (It could be left blank if no information available for diffuse irradiation.)
					1 2 3 4 5 6 7 8 9 10 11 12
					68 65 62 44 36 32 32 37 42 50 57 68

Please make sure you want to delete the site before pressing the "DEL" button!



Picture 3 Add Location

1.2.3 PV Module Type

Over 300 companies' are provided in the tool. And for each companies, different type of products are provided. For different MPPTs, user can use different PV mdules.



HUAWEI TECHNOLOGIES CO.,LTD.
Huawei Industrial Base
Bantian Longgang Shenzhen 515129, P.R. China
Tel: +86-755-28780808
www.huawei.com

Version:
1.12

PV Designer

Inverter Type

SUN2000-20KTL

Ambient Temperature

min: -1 °C nom: 20 °C max: 30 °C

Mounting Mode

Module temperature rise: 25 °C

Location

Germany Latitude: 52.25°
Berlin Longitude: 13.15°

Global Irradiation

1004 kWh/m²/a

PV Module Type

MPPT A

Manufacturer: CETC Solar

Model: ZKX-250D-24

Module in Series: 23
Inclination: 27

Number of strings: 2
Azimuth: 0

Irradiation on module: 1091 kWh/m²/a

MPPT B Copy A

Manufacturer: CETC Solar

Model: ZKX-250D-24

Module in Series: 23
Inclination: 27

Number of strings: 1
Azimuth: 0

Irradiation on module: 1091 kWh/m²/a

MPPT C Copy A

Manufacturer: CETC Solar

Model: ZKX-250D-24

Module in Series: 23
Inclination: 27

Number of strings: 1
Azimuth: 0

Irradiation on module: 1091 kWh/m²/a

Picture 4 PV Module Type

If the PV Module is not provided, new module types can be added to the database.

Add Module

Manufacturer	
Model	
Pmpp	
Uoc	
Ump	
Isc	
Impp	
Tcolsc	
TcoUoc	
Efficiency	

Please make sure that all parameters are correct!



Delete Module

Manufacturer	Algatec
Model	ASM-mon 2-5/185
Pmpp	185 Wp
Uoc	44.80 V
Ump	36.40 V
Isc	5.43 A
Impp	5.10 A
Tcolsc	2.55 mA/K
TcoUoc	-120.00 mV/K
Efficiency	14.23%

Please make sure you want to delete the module before pressing the "DEL" button!



Picture 5 Add Module

1.2.4 Inverter Type

Inverter Type can be selected as follows:



HUAWEI TECHNOLOGIES CO.,LTD.

Huawei Industrial Base

Bantian Longgang Shenzhen 515129, P.R. China

Tel: +86-755-28780808

www.huawei.com

Version:

1.12

PV Designer

English

Inverter Type

SUN2000-20KTL

SUN2000-8KTL

SUN2000-10KTL

SUN2000-12KTL

SUN2000-15KTL

SUN2000-17KTL

SUN2000-20KTL

Ambient

min: -1

Mounting Mode

Module temperature rise 25

Location

Germany

Berlin

Latitude 52.25°

Longitude 13.15°

Global Irradiation

1004 kWh/m²/a

PV Module Type

MPPT A

Manufacturer

CETC Solar

Model

ZKX-250D-24

Module in Series

23

Number of strings

2

Inclination

27

Azimuth

0

Irradiation on module

1091 kWh/m²/a

MPPT B

Copy A

Manufacturer

CETC Solar

Model

ZKX-250D-24

Module in Series

23

Number of strings

1

Inclination

27

Azimuth

0

Irradiation on module

1091 kWh/m²/a

MPPT C

Copy A

Manufacturer

CETC Solar

Model

ZKX-250D-24

Module in Series

23

Number of strings

1

Inclination

27

Azimuth

0

Irradiation on module

1091 kWh/m²/a

Picture 6 Inverter Type

1-4

华为专有和保密信息

2 PV System Design

Several factors will affect Solar PV System's yield, they are: Temperature, DC voltage, DC power and PF. This section will cover all the factors.

2.1 Temperature Effects

2.1.1 Ambient Temperature

Ambient temperature should be edited by the user, according to local temperature.

HUAWEI TECHNOLOGIES CO.,LTD.
Huawei Industrial Base
Bantian Longgang Shenzhen 515129, P.R. China
Tel: +86-755-28780808
www.huawei.com

Version: 1.12

PV Designer

English

Inverter Type
SUN2000-20KTL

Ambient Temperature
min: -1 °C nom: 20 °C max: 30 °C

Mounting Mode
Roof top

Location
Germany
Berlin
Latitude 52.25°
Longitude 13.15°

Global Irradiation
1004 kWh/m²/a

PV Module Type
MPPT A
Manufacturer: CETC Solar
Model: ZKX-250D-24
Module in Series: 23
Number of strings: 2
Inclination: 27°
Azimuth: 0°
Irradiation on module: 1091 kWh/m²/a

MPPT B
Manufacturer: CETC Solar
Model: ZKX-250D-24
Module in Series: 23
Number of strings: 1
Inclination: 27°
Azimuth: 0°
Irradiation on module: 1091 kWh/m²/a

MPPT C
Manufacturer: CETC Solar
Model: ZKX-250D-24
Module in Series: 23
Number of strings: 1
Inclination: 27°
Azimuth: 0°
Irradiation on module: 1091 kWh/m²/a

Picture 7 Ambient Temperature

2.1.2 Mounting Mode

Three mounting modes are provided: Roof top, Ground mounted and Built-on-tracker. For different modes, temperature increases will vary. For Roof top, the temperature increase will be 40°C; for Ground mounted, the temperature rise will be 30°C and for Built-on-trackers, the temperature increase will be 25°C.

Ambient Temperature
min: -10 °C, nom: 25 °C, max: 50 °C

Mounting Mode
Module temperature rise: 25 °C

Location
New Zealand, Auckland
Latitude: -37.2°, Longitude: 175.1°

Global Irradiation
1535 kWh/m²/a

PV Parameters (STC: Irradiance 1000W/m², module temperature 25 °C)
Manufacturer: CETC Solar, Model: ZKX-250D-24, Pmpp: 250 Wp, Uoc: 37.70 V, Isc: 8.85 A

Mounting Mode
Roof top: The module are installed on a roof top.
Ground mounted: The module are on racks.
Built on tracker: The modules are mounted on Tracker.

Back, Continue

Picture 8 Mounting Mode

2.1.3 DC Voltage Calculation

This calculation is based on PV modules temperature coefficient to avoid system DC voltage rising above the inverter specification. Normally Uoc voltage is not allowed to over 1000Vdc at minimum ambient temperature.

HUAWEI TECHNOLOGIES CO.,LTD.
Huawei Industrial Base
Bantian Longgang Shenzhen 518129, P.R. China
Tel: +86-755-28780808
www.huawei.com

Version: 1.12

PV Designer

Inverter Type
SUN2000-20KTL

Ambient Temperature
min: -1 °C, nom: 20 °C, max: 30 °C

Mounting Mode
Module temperature rise: 25 °C

Location
Germany, Berlin
Latitude: 52.25°, Longitude: 13.15°

Global Irradiation
1004 kWh/m²/a

PV Module Type
MPPT A, MPPT B, MPPT C
Manufacturer: CETC Solar, Model: ZKX-250D-24
Module in Series: 23, Number of strings: 2
Inclination: 27°, Azimuth: 0°

Uoc (Open Circuit Voltage)
MPPT A: 880.90 V, MPPT B: 880.90 V, MPPT C: 880.90 V

Picture 9 DC Voltage Calculation

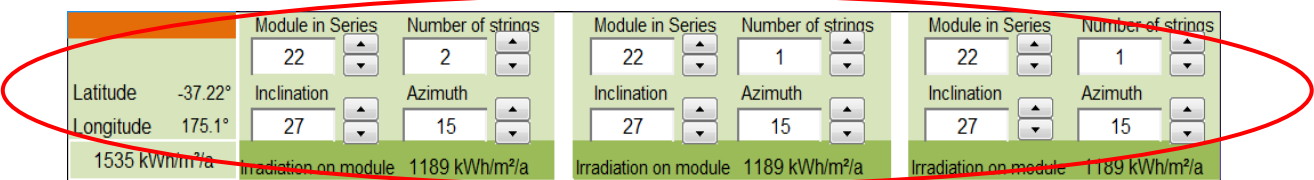
2.2 DC Input Voltage and MPPT Power Calculation

- DC input voltage:** According to inverter efficiency curve, SUN2000 will have highest efficiency at MPP voltage 600Vdc (the inverter working at one stage, boost circuit is bypass). So the string voltage is designed at 600Vdc MPP voltage for higher efficiency. In some cases, to achieve optimum system costs, string voltage configurations may be lower than 600V and the numbers of strings will increase accordingly.

For three inputs, it is recommended that the three input voltage is symmetrical. The reason being, when the MPPT voltage is symmetrical, it is easy to control them working at one stage condition and increase the efficiency. If one MPPT voltage is 500, and one is 600, the boost circuit of 500V input voltage will start to work and two stage conversion will be in operation.

- MPPT input power:** There are two strings in parallel for each MPPTs. **Normally, the maximum short current for each string is about 8.3A, Two strings is 16.6A. So the maximum current is limited at 18A.** The Power limit for each MPPT is shown within the table below for the different inverters. This setting can meet all the requirements of current PV modules in the market.

TYPE	SUN2000 8KTL	SUN2000 10KTL	SUN2000 12KTL	SUN2000 15KTL	SUN2000 17KTL	SUN2000 20KTL
Each MPPT Power Limit	6KW	8KW	9KW	9KW	10KW	12KW



	Module in Series	Number of strings	Module in Series	Number of strings	Module in Series	Number of strings
Latitude	-37.22°	2	22	1	22	1
Longitude	175.1°	15	27	15	27	15
Irradiation on module	1189 kWh/m²/a	1189 kWh/m²/a	1189 kWh/m²/a	1189 kWh/m²/a	1189 kWh/m²/a	1189 kWh/m²/a
Module number:	44	22	22	22	22	22
PV Nominal Power:	11,000 Wp	5,500 Wp	5,500 Wp	5,500 Wp	5,500 Wp	5,500 Wp
Umpp(min) at 65 °C	612.45 V	OK	612.45 V	OK	612.45 V	OK
Umpp at 50 °C	645.95 V	OK	645.95 V	OK	645.95 V	OK
Umpp(max) at -10 °C	779.98 V	OK	779.98 V	OK	779.98 V	OK
Uoc(max) at -10 °C	921.80 V	OK	921.80 V	OK	921.80 V	OK
Uoc at 25 °C	829.40 V	OK	829.40 V	OK	829.40 V	OK
Max. MPP Current :	15.70 A	OK	7.85 A	OK	7.85 A	OK

Picture 10 DC input votage and MPPT Power Calculation

2.3 PF setting & DC Input Power Calculation

Layout factor: This factor is decided by the EPC engineer, basing on their experience in different locations. If the direction is South, the figure should be smaller. If the direction is east & west, it should be bigger.

Cos(ϕ) setting: This figure is decided by local electrical company. 0.9&0.95 is common but this must be confirmed locally..

DC input power alarm threshold:

If $\cos(\phi) \geq 0.9$, Maximum total input power will be: Max. AC output apparent power kVA*layout factor* cos (ϕ).

If $\cos(\phi) < 0.9$, Maximum total input power will be: Nominal AC output apparent power kVA* layout factor* cos(ϕ).

Layout factor	1.17	Total Input Power: 22,000 Wp OK	
PV Parameters (STC: Irradiance 1000W/m²,module temperature 25℃,AM=1.5)			
Manufacturer	CETC Solar	CETC Solar	CETC Solar
Model	ZKX-250D-24	ZKX-250D-24	ZKX-250D-24
Pmpp:	250 Wp	250 Wp	250 Wp
Uoc:	37.70 V	37.70 V	37.70 V
Isc:	8.85 A	8.85 A	8.85 A
Umpp:	31.90 V	31.90 V	31.90 V
Impp:	7.85 A	7.85 A	7.85 A
TcoUmpp:	-101.54 mV/K	-101.54 mV/K	-101.54 mV/K
TcoUoc:	-120.00 mV/K	-120.00 mV/K	-120.00 mV/K
Efficiency:	15.37%	15.37%	15.37%
Max. Voltage:	1000V	1000V	1000V
Inverter Parameters SUN2000-20KTL		System Result	
Rated Power:	20,000 W	Max. output Power:	22,000 W
Max.input Power:	22,500 W	Rated output Voltage:	3×230/400V
Max.input Voltage:	1000 V	AC Power Frequency:	50/60 Hz
MPP Voltage Range:	480V~ 800V	Max. output current:	32 A
Operating Voltage:	250-850 V	Power Factor:	±0.8
Rated input Voltage:	620 V	Max. Total Harmonic Distortion(THD):	<3%
Number of input:	6	Operating Temperature:	-25℃~+60℃
Number of MPP trackers:	3	Max. efficiency:	98.60%
Max. MPP Current:	18 A	Euro. Efficiency:	98.30%
		Total modules:	88
		Total Input Power:	22,000 Wp
		Power Ratio:	1.10 (Nominal PV Power / Nominal Inverter Power)
		Module area:	143.17 m²
		cos(φ):	1.00
		Yield yearly:	21,373 kWh
		Performance Ratio:	0.817

Picture 11 PF & DC input Power Calculation

3 Yield Yearly Calculation

Inclination: This is the angle for the PV module. You can adjust the angle at different location to capture more irradiation. **Azimuth:** This is the clockwise angle to the South. The figure should be 0~360. For example, West should be 90 deg. whereas East should be 270 deg. This figure will affect irradiation value.

Performance Ratio: This is total system efficiency. It should be decided by the system loss calculation result, which is calculated by the EPC design engineer. Normally the value should be 0.75~0.85. It is edited by user

Yield yearly: This value is decided by the irradiation, the input power and the performance ratio.

Module in Series		Number of strings		Module in Series		Number of strings		Module in Series		Number of strings	
Latitude	-37.22	Inclination	27	Azimuth	15	Latitude	-37.22	Inclination	27	Azimuth	15
Longitude	179.1*					Longitude	179.1*				
1535 kWh/m ² /a		Irradiation on module		1189 kWh/m ² /a		1535 kWh/m ² /a		Irradiation on module		1189 kWh/m ² /a	
Module number: 44		22		22		Module number: 22		22		22	
PV Nominal Power: 11,000 Wp		5,500 Wp		5,500 Wp		PV Nominal Power: 5,500 Wp		5,500 Wp		5,500 Wp	
Umpp(min) at 65 °C 612.45 V OK		612.45 V OK		612.45 V OK		Umpp(min) at 65 °C 612.45 V OK		612.45 V OK		612.45 V OK	
Umpp at 50 °C 645.95 V OK		645.95 V OK		645.95 V OK		Umpp at 50 °C 645.95 V OK		645.95 V OK		645.95 V OK	
Umpp(max) at -10 °C 779.98 V OK		779.98 V OK		779.98 V OK		Umpp(max) at -10 °C 779.98 V OK		779.98 V OK		779.98 V OK	
Uoc(max) at -10 °C 921.80 V OK		921.80 V OK		921.80 V OK		Uoc(max) at -10 °C 921.80 V OK		921.80 V OK		921.80 V OK	
Uoc at 25 °C 829.40 V OK		829.40 V OK		829.40 V OK		Uoc at 25 °C 829.40 V OK		829.40 V OK		829.40 V OK	
Max. MPP Current: 15.70 A OK		7.85 A OK		7.85 A OK		Max. MPP Current: 7.85 A OK		7.85 A OK		7.85 A OK	
Layout factor 1.17		Total Input Power: 22,000 Wp OK		Total Input Power: 22,000 Wp OK		Layout factor 1.17		Total Input Power: 22,000 Wp OK		Total Input Power: 22,000 Wp OK	
PV Parameters (STC: Irradiance 1000W/m ² , module temperature 25°C, AM=1.5)											
Manufacturer CETC Solar		CETC Solar		CETC Solar		Manufacturer CETC Solar		CETC Solar		CETC Solar	
Model ZKX-250D-24		ZKX-250D-24		ZKX-250D-24		Model ZKX-250D-24		ZKX-250D-24		ZKX-250D-24	
Pmpp: 250 Wp		250 Wp		250 Wp		Pmpp: 250 Wp		250 Wp		250 Wp	
Uoc: 37.70 V		37.70 V		37.70 V		Uoc: 37.70 V		37.70 V		37.70 V	
Isc: 8.85 A		8.85 A		8.85 A		Isc: 8.85 A		8.85 A		8.85 A	
Umpp: 31.90 V		31.90 V		31.90 V		Umpp: 31.90 V		31.90 V		31.90 V	
Imp: 7.85 A		7.85 A		7.85 A		Imp: 7.85 A		7.85 A		7.85 A	
TcoUmpp: -101.54 mV/K		-101.54 mV/K		-101.54 mV/K		TcoUmpp: -101.54 mV/K		-101.54 mV/K		-101.54 mV/K	
TcoUoc: -120.00 mV/K		-120.00 mV/K		-120.00 mV/K		TcoUoc: -120.00 mV/K		-120.00 mV/K		-120.00 mV/K	
Efficiency: 15.37%		15.37%		15.37%		Efficiency: 15.37%		15.37%		15.37%	
Max. Voltage: 1000V		1000V		1000V		Max. Voltage: 1000V		1000V		1000V	
Inverter Parameters SUN2000-20KTL						System Result					
Rated Power: 20,000 W		Max. output Power: 22,000 W		Total modules: 88		Rated Power: 20,000 W		Max. output Power: 22,000 W		Total modules: 88	
Max. input Power: 22,500 W		Rated output Voltage: 3×230/400V		Total Input Power: 22,000 Wp		Max. input Power: 22,500 W		Rated output Voltage: 3×230/400V		Total Input Power: 22,000 Wp	
Max. input Voltage: 1000 V		AC Power Frequency: 50/60 Hz		Power Ratio: 1.10		Max. input Voltage: 1000 V		AC Power Frequency: 50/60 Hz		Power Ratio: 1.10	
MPP Voltage Range: 480V~ 800V		Max. output current: 32 A		(Nominal PV Power / Nominal Inverter Power)		MPP Voltage Range: 480V~ 800V		Max. output current: 32 A		(Nominal PV Power / Nominal Inverter Power)	
Operating Voltage: 250-850 V		Power Factor: ±0.8		Module area: 143.17 m ²		Operating Voltage: 250-850 V		Power Factor: ±0.8		Module area: 143.17 m ²	
Rated input Voltage: 620 V		Max. Total Harmonic Distortion(THD): <3%		cos(φ): 1.00		Rated input Voltage: 620 V		Max. Total Harmonic Distortion(THD): <3%		cos(φ): 1.00	
Number of input: 6		Operating Temperature: -25°C~+60°C		Yield yearly: 21,375 kWh		Number of input: 6		Operating Temperature: -25°C~+60°C		Yield yearly: 21,375 kWh	
Number of MPP trackers: 3		Max. efficiency: 98.60%		Performance Ratio: 0.817		Number of MPP trackers: 3		Max. efficiency: 98.60%		Performance Ratio: 0.817	
Max. MPP Current: 18 A		Euro. Efficiency: 98.30%				Max. MPP Current: 18 A		Euro. Efficiency: 98.30%			

Picture 11 Yield Yearly Calculation

If you have any queries, please contact our Technical Manager, Stephan Linz by email:

Stephan.Linz@huawei.com