REGIONE VENETO
PROVINCIA DI VENEZIA
COMUNE DI VIGASIO

Impianto fotovoltaico ad inseguitori monoassiali per la produzione di energia elettrica, con sistema di accumulo (energy storage system), sito nel Comune di Vigasio (VR) in località Via delle Robinie ex lottizzazione Green Village, avente potenza nominale di 22040 kW e potenza richiesta in immissione di 17970 kW alla tensione rete 20 kV, comprensivo delle opere di rete per la connessione ricadenti nel medesimo Comune di Vigasio (VR)

PROGETTO DEFINITIVO DELL'IMPIANTO DI PRODUZIONE COMPRENSIVO DELLE OPERE DI RETE PER LA CONNESSIONE

ELABORATO

DATASHEET COMPONENTI

DATA: Luglio 2021	**SCALA : --**	

PROPONENTE

NextPower Development Italia S.r.l.
Via San Marco n° 21, 20121 Milano (MI)
Partita IVA 11091860962
PEC: npditalia@legalmail.it

NextPower Development Italia S.r.l.
Via San Marco 21
20121 Milano
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ELABORATO DA:

Entrope Srl
Dott. Sc. Amb. Enrico Forcucci
Via per Vittorito Zona PIP
65026 Popoli (PE)
Tel/Fax 085986763
PIVA 01819520683

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C=IT
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2.5.4.42=ENRICO

Arch. Pasqualino Grifone
Villaggio UNRRA 44
66023 - Francavilla al Mare

ORDINE DEGLI ARCHITETTI, PIANIFICATORI, PAESAGGISTI E CONSERVATORI
PROVINCIA di PESCARA
ARCHITETTO
Pasqualino
GRIFONE
Albo/A
1293

revisione	descrizione	IMP 32
A		
B		
C		

www.jinkosolar.com

Jinko Solar
Building Your Trust in Solar

TR 78M
565-585 Watt
Mono-facial

Tiling Ribbon (TR) Technology

Positive power tolerance of 0~+3%

Tiger Pro

KEY FEATURES

TR technology + Half Cell
TR technology with Half cell aims to eliminate the cell gap to increase module efficiency (mono-facial up to 21.40%)

MBB instead of 5BB
MBB technology decreases the distance between bus bars and finger grid line which is benefit to power increase.

Higher lifetime Power Yield
2% first year degradation,
0.55% linear degradation

Best Warranty
12 year product warranty,
25 year linear power warranty

Strengthened Mechanical Support
5400 Pa snow load, 2400 Pa wind load

PV CYCLE · TÜVRheinland CERTIFIED · CE

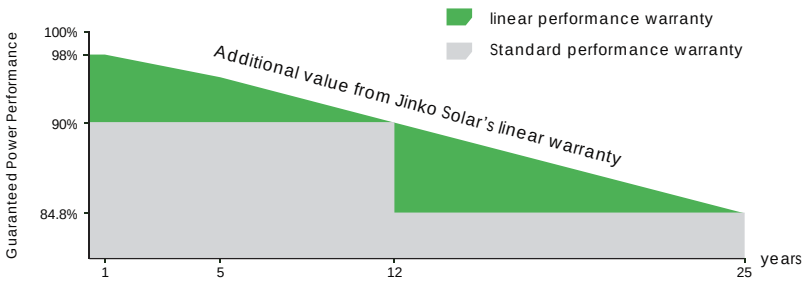
POSITIVE QUALITY™ Continuous Quality Assurance · CLEAN ENERGY COUNCIL MEMBER

ISO9001:2015, ISO14001:2015, ISO45001:2018 certified factory

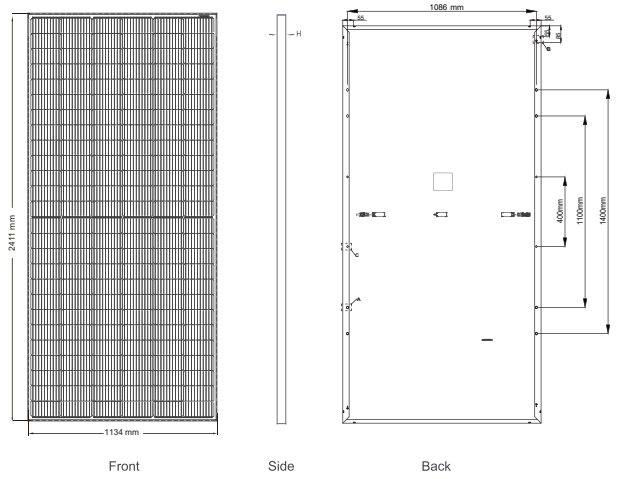
IEC61215, IEC61730 certified product

LINEAR PERFORMANCE WARRANTY

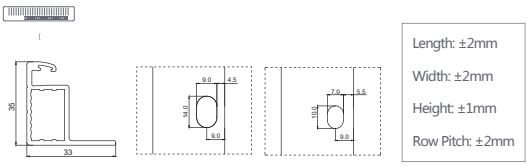
12 Year Product Warranty • 25 Year Linear Power Warranty
0.55% Annual Degradation Over 25 years



Engineering Drawings



Front Side Back

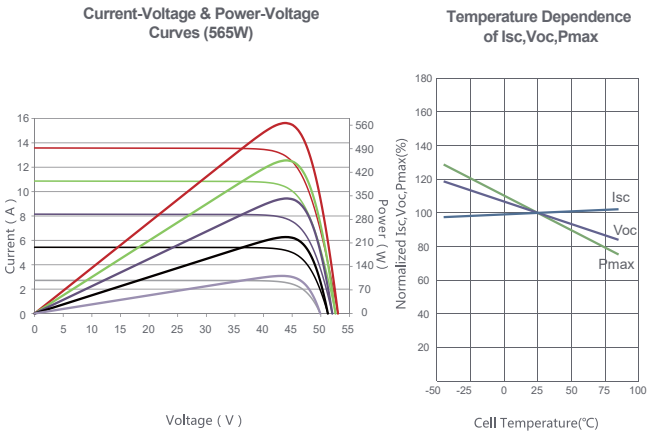


Packaging Configuration

(Two pallets = One stack)

31pcs/pallets, 62pcs/stack, 496pcs/ 40'HQ Container

Electrical Performance & Temperature Dependence



Mechanical Characteristics

Cell Type	P type Mono-crystalline
No.of cells	156 (2×78)
Dimensions	2411×1134×35mm (94.92×44.65×1.38 inch)
Weight	31.1 kg (68.6 lbs)
Front Glass	3.2mm,Anti-Reflection Coating, High Transmission, Low Iron, Tempered Glass
Frame	Anodized Aluminium Alloy
Junction Box	IP68 Rated
Output Cables	TUV 1×4.0mm² (+): 290mm , (-): 145 mm or Customized Length

SPECIFICATIONS

Module Type	JKM565M-7RL4-V		JKM570M-7RL4-V		JKM575M-7RL4-V		JKM580M-7RL4-V		JKM585M-7RL4-V	
	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax)	565Wp	420Wp	570Wp	424Wp	575Wp	428Wp	580Wp	432Wp	585Wp	435Wp
Maximum Power Voltage (Vmp)	43.77V	40.74V	43.89V	40.85V	44.00V	40.96V	44.11V	41.07V	44.22V	41.18V
Maximum Power Current (Imp)	12.91A	10.32A	12.99A	10.38A	13.07A	10.44A	13.15A	10.51A	13.23A	10.57A
Open-circuit Voltage (Voc)	52.97V	50.00V	53.09V	50.11V	53.20V	50.21V	53.31V	50.32V	53.42V	50.42V
Short-circuit Current (Isc)	13.59A	10.98A	13.67A	11.04A	13.75A	11.11A	13.83A	11.17A	13.91A	11.23A
Module Efficiency STC (%)	20.67%		20.85%		21.03%		21.21%		21.40%	
Operating Temperature(℃)	-40℃~+85℃									
Maximum system voltage	1500VDC (IEC)									
Maximum series fuse rating	25A									
Power tolerance	0~+3%									
Temperature coefficients of Pmax	-0.35%/℃									
Temperature coefficients of Voc	-0.28%/℃									
Temperature coefficients of Isc	0.048%/℃									
Nominal operating cell temperature (NOCT)	45±2℃									

*STC: Irradiance 1000W/m² Cell Temperature 25°C AM=1.5

NOCT: Irradiance 800W/m² Ambient Temperature 20°C AM=1.5 Wind Speed 1m/s

SUNNY CENTRAL
2200 / 2475 / 2500-EV / 2750-EV / 3000-EV

SC-2200-10 / SC-2475-10 / SC-2500-EV-10 / SC-2750-EV-10 / SC-3000-EV-10

Efficient

- Up to 4 inverters can be transported in one standard shipping container
- Overdimensioning up to 225% is possible
- Full power at ambient temperatures of up to 35 °C

Robust

- Intelligent air cooling system OptiCool for efficient cooling
- Suitable for outdoor use in all climatic ambient conditions worldwide

Flexible

- Conforms to all known grid requirements worldwide
- Q on demand
- Available as a single device or turnkey solution, including medium-voltage block

Easy to Use

- Improved DC connection area
- Connection area for customer equipment
- Integrated voltage support for internal and external loads

SUNNY CENTRAL 2200 / 2475 / 2500-EV / 2750-EV / 3000-EV

The new Sunny Central: more power per cubic meter

With an output of up to 3000 kVA and system voltages of 1100 V DC or 1500 V DC, the SMA central inverter allows for more efficient system design and a reduction in specific costs for PV power plants. A separate voltage supply and additional space are available for the installation of customer equipment. True 1500 V technology and the intelligent cooling system OptiCool ensure smooth operation even in extreme ambient temperature as well as a long service life of 25 years.

SUNNY CENTRAL 1000 V

Technical Data	Sunny Central 2200	Sunny Central 2475*
Input (DC)		
MPP voltage range V_{DC} (at 25 °C / at 35 °C / at 50 °C)	570 to 950 V / 800 V / 800 V	638 V to 950 V / 800 V / 800 V
Min. input voltage $V_{DC, min}$ / Start voltage $V_{DC, Start}$	545 V / 645 V	614 V / 714 V
Max. input voltage $V_{DC, max}$	1100 V	1100 V
Max. input current $I_{DC, max}$ (at 25°C / at 50°C)	3960 A / 3600 A	3960 A / 3600 A
Max. short-circuit current $I_{DC, sc}$	6400 A	6400 A
Number of DC inputs	24 double pole fused (32 single pole fused)	
Max. number of DC cables per DC input (for each polarity)	2 x 800 kcmil, 2 x 400 mm²	
Integrated zone monitoring	○	
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A	
Output (AC)		
Nominal AC power at cos φ =1 (at 35°C / at 50°C)	2200 kVA / 2000 kVA	2475 kVA / 2250 kVA
Nominal AC power at cos φ =0.8 (at 35°C / at 50°C)	1760 kW / 1600 kW	1980 kW / 1800 kW
Nominal AC current $I_{AC, nom}$ = Max. output current $I_{AC, max}$	3300 A	3300 A
Max. total harmonic distortion	< 3% at nominal power	< 3% at nominal power
Nominal AC voltage / nominal AC voltage range[1) 8)]	385 V / 308 V to 462 V	434 V / 347 V bis 521 V
AC power frequency / range	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz	
Min. short-circuit ratio at the AC terminals[9)]	> 2	
Power factor at rated power / displacement power factor adjustable[8) 10)]	● 1 / 0.8 overexcited to 0.8 underexcited ○ 1 / 0.0 overexcited to 0.0 underexcited	
Efficiency		
Max. efficiency[2)] / European efficiency[2)] / CEC efficiency[3)]	98.6% / 98.4% / 98.0%	98.6% / 98.4% / 98.0%
Protective Devices		
Input-side disconnection point	DC load break switch	
Output-side disconnection point	AC circuit breaker	
DC overvoltage protection	Surge arrester, type I	
AC overvoltage protection (optional)	Surge arrester, class I	
Lightning protection (according to IEC 62305-1)	Lightning Protection Level III	
Ground-fault monitoring / remote ground-fault monitoring	○ / ○	
Insulation monitoring	○	
Degree of protection: electronics / air duct / connection area (as per IEC 60529)	IP65 / IP34 / IP34	
General Data		
Dimensions (W / H / D)	2780 / 2318 / 1588 mm (109.4 / 91.3 / 62.5 inch)	
Weight	< 3400 kg / < 7496 lb	
Self-consumption (max.[4)] / partial load[5)] / average[6)])	< 8100 W / < 1800 W / < 2000 W	
Self-consumption (standby)	< 300 W	
Internal auxiliary power supply	Integrated 8.4 kVA transformer	
Operating temperature range[8)]	−25°C to 60°C / −13°F to 140°F	
Noise emission[7)]	67.0 dB(A)	
Temperature range (standby)	−40°C to 60°C / −40°F to 140°F	
Temperature range (storage)	−40°C to 70°C / −40°F to 158°F	
Max. permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month/year) / 0% to 95%	
Maximum operating altitude above MSL[8)] 1000 m / 2000 m / 3000 m / 4000 m	● / ○ / ○ / ○ (earlier temperature-dependent derating)	
Fresh air consumption	6500 m³/h	
Features		
DC connection	Terminal lug on each input (without fuse)	
AC connection	With busbar system (three busbars, one per line conductor)	
Communication	Ethernet, Modbus Master, Modbus Slave	
Communication with SMA string monitor (transmission medium)	Modbus TCP / Ethernet (FO MM, Cat-5)	
Enclosure / roof color	RAL 9016 / RAL 7004	
Supply transformer for external loads	○ (2.5 kVA)	
Standards and directives complied with	CE, IEC / EN 62109-1, IEC / EN 62109-2, BDEW-MSRL, IEEE1547, UL 840 Cat. IV, Arrêté du 23/04/08	
EMC standards	IEC / EN 61000-6-4, IEC / EN 61000-6-2, EN 55022, IEC 62920, FCC Part 15 Class A, Cispr 11, DIN EN55011:2017	
Quality standards and directives complied with	VDI/VDE 2862 page 2, DIN EN ISO 9001	
● Standard features ○ Optional * preliminary		
Type designation	SC-2200-10	SC-2475-10

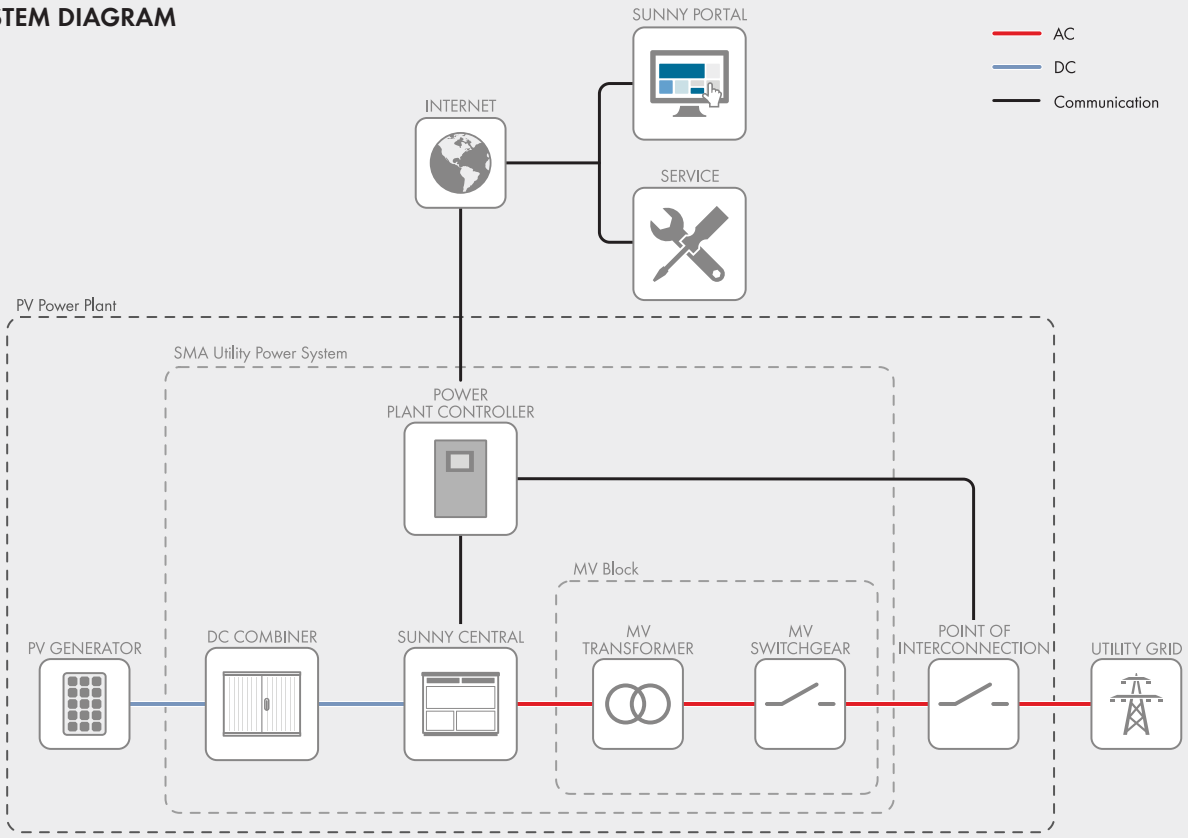
1) At nominal AC voltage, nominal AC power decreases in the same proportion
2) Efficiency measured without internal power supply
3) Efficiency measured with internal power supply
4) Self-consumption at rated operation
5) Self-consumption at < 75% Pn at 25°C
6) Self-consumption averaged out from 5% to 100% Pn at 25°C
7) Sound pressure level at a distance of 10 m
8) Values apply only to inverters. Permissible values for SMA MV solutions from SMA can be found in the corresponding data sheets.
9) A short-circuit ratio of < 2 requires a special approval from SMA
10) Depending on the DC voltage

SUNNY CENTRAL 1500 V

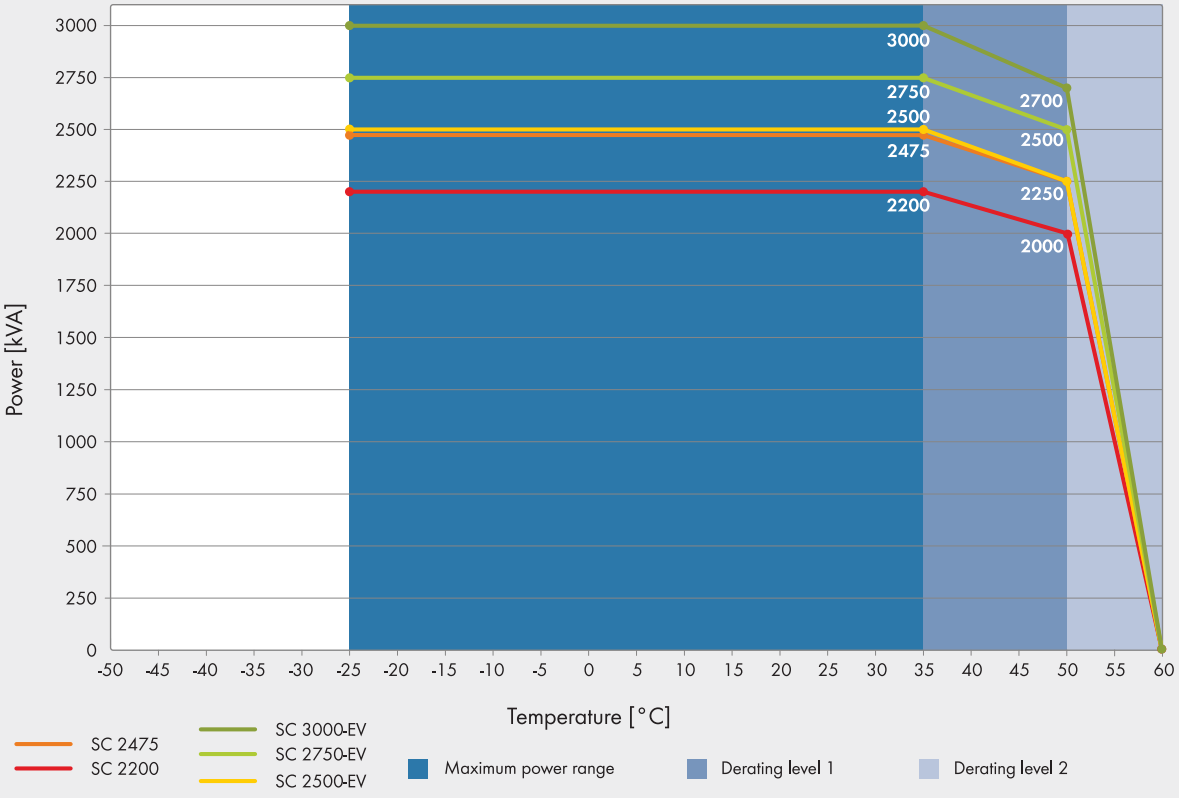
Technical Data	Sunny Central 2500-EV	Sunny Central 2750-EV	Sunny Central 3000-EV*
Input (DC)			
MPP voltage range V_{DC} (at 25°C / at 35°C / at 50°C)	850 V to 1425 V / 1200 V / 1200 V	875 V to 1425 V / 1200 V / 1200 V	956 V to 1425 V / 1200 V / 1200 V
Min. input voltage $V_{DC, min}$ / Start voltage $V_{DC, Start}$	778 V / 928 V	849 V / 999 V	927 V / 1077 V
Max. input voltage $V_{DC, max}$	1500 V	1500 V	1500 V
Max. input current $I_{DC, max}$ (at 25°C / at 50°C)	3200 A / 2956 A	3200 A / 2956 A	3200 A / 2970 A
Max. short-circuit current rating	6400 A	6400 A	6400 A
Number of DC inputs	32	32	32
Max. number of DC cables per DC input (for each polarity)	2 x 800 kcmil, 2 x 400 mm²	2 x 800 kcmil, 2 x 400 mm²	2 x 800 kcmil, 2 x 400 mm²
Integrated zone monitoring	○	○	○
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A		
Output (AC)			
Nominal AC power at cos φ =1 (at 35°C / at 50°C)	2500 kVA / 2250 kVA	2750 kVA / 2500 kVA	3000 kVA / 2700 kVA
Nominal AC power at cos φ =0.8 (at 35°C / at 50°C)	2000 kW / 1800 kW	2200 kW / 2000 kW	2400 kW / 2160 kW
Nominal AC current $I_{AC, nom}$ = Max. output current $I_{AC, max}$	2624 A	2646 A	2624 A
Max. total harmonic distortion	< 3% at nominal power	< 3% at nominal power	< 3% at nominal power
Nominal AC voltage / nominal AC voltage range[1) 8)]	550 V / 440 V to 660 V	600 V / 480 V to 690 V	655 V / 524 V to 721 V[9)]
AC power frequency	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz		
Min. short-circuit ratio at the AC terminals[10)]	> 2		
Power factor at rated power / displacement power factor adjustable[8) 11)]	● 1 / 0.8 overexcited to 0.8 underexcited ○ 1 / 0.0 overexcited to 0.0 underexcited		
Efficiency			
Max. efficiency[2)] / European efficiency[2)] / CEC efficiency[3)]	98.6% / 98.3% / 98.0%	98.7% / 98.5% / 98.5%	98.7% / 98.6% / 98.5%
Protective Devices			
Input-side disconnection point	DC load-break switch		
Output-side disconnection point	AC circuit breaker		
DC overvoltage protection	Surge arrester, type I		
AC overvoltage protection (optional)	Surge arrester, class I		
Lightning protection (according to IEC 62305-1)	Lightning Protection Level III		
Ground-fault monitoring / remote ground-fault monitoring	○ / ○		
Insulation monitoring	○		
Degree of protection: electronics / air duct / connection area (as per IEC 60529)	IP65 / IP34 / IP34		
General Data			
Dimensions (W / H / D)	2780 / 2318 / 1588 mm (109.4 / 91.3 / 62.5 inch)		
Weight	< 3400 kg / < 7496 lb		
Self-consumption (max.[4)] / partial load[5)] / average[6)])	< 8100 W / < 1800 W / < 2000 W		
Self-consumption (standby)	< 370 W		
Internal auxiliary power supply	Integrated 8.4 kVA transformer		
Operating temperature range[8)]	−25 to 60°C / −13 to 140°F		
Noise emission[7)]	67.8 dB(A)		
Temperature range (standby)	−40 to 60°C / −40 to 140°F		
Temperature range (storage)	−40 to 70°C / −40 to 158°F		
Max. permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month / year) / 0 % to 95%		
Maximum operating altitude above MSL[8)] 1000 m / 2000 m / 3000 m	● / ○ / ○ (earlier temperature-dependent derating)		
Fresh air consumption	6500 m³/h		
Features			
DC connection	Terminal lug on each input (without fuse)		
AC connection	With busbar system (three busbars, one per line conductor)		
Communication	Ethernet, Modbus Master, Modbus Slave		
Communication with SMA string monitor (transmission medium)	Modbus TCP / Ethernet (FO MM, Cat-5)		
Enclosure / roof color	RAL 9016 / RAL 7004		
Supply transformer for external loads	○ (2.5 kVA)		
Standards and directives complied with	CE, IEC / EN 62109-1, IEC / EN 62109-2, BDEW-MSRL, IEEE1547, Arrêté du 23/04/08		
EMC standards	CISPR 11, CISPR 22, EN55011:2017, EN 55022, IEC/EN 61000-6-4, IEC/EN 61000-6-2, IEC 62920, FCC Part 15 Class A	CISPR 11, CISPR 22, EN55011:2017, EN 55022, IEC 62920, FCC Part 15 Class A	
Quality standards and directives complied with	VDI/VDE 2862 page 2, DIN EN ISO 9001		
● Standard features ○ Optional * preliminary			
Type designation	SC-2500-EV-10	SC-2750-EV-10	SC-3000-EV-10

1) At nominal AC voltage, nominal AC power decreases in the same proportion
2) Efficiency measured without internal power supply
3) Efficiency measured with internal power supply
4) Self-consumption at rated operation
5) Self-consumption at < 75% Pn at 25°C
6) Self-consumption averaged out from 5% to 100% Pn at 35°C
7) Sound pressure level at a distance of 10 m
8) Values apply only to inverters. Permissible values for SMA MV solutions from SMA can be found in the corresponding data sheets.
9) AC voltage range can be extended to 753V for 50Hz grids only (option „Aux power supply: external" must be selected, option "housekeeping" not combinable).
10) A short-circuit ratio of < 2 requires a special approval from SMA
11) Depending on the DC voltage

SYSTEM DIAGRAM



TEMPERATURE BEHAVIOR (at 1000 m)



MV POWER STATION
2200 / 2475 / 2500 / 2750 / 3000

MVPS 2200-20 / MVPS 2475-20 / MVPS 2500-20 / MVPS 2750-20 / MVPS 3000-20

Robust
- Station and all individual components type-tested
- Optimally suited to extreme ambient conditions

Easy to Use
- Plug and play concept
- Walk-in control rooms
- Completely pre-assembled for easy set-up and commissioning

Cost-Effective
- Easy planning and installation
- Low transport costs due to 20-foot container

Flexible
- Global solution for international markets
- Numerous options
- Compatible with MVPS 4400 – MVPS 6000

MV POWER STATION 2200 / 2475 / 2500 / 2750 / 3000

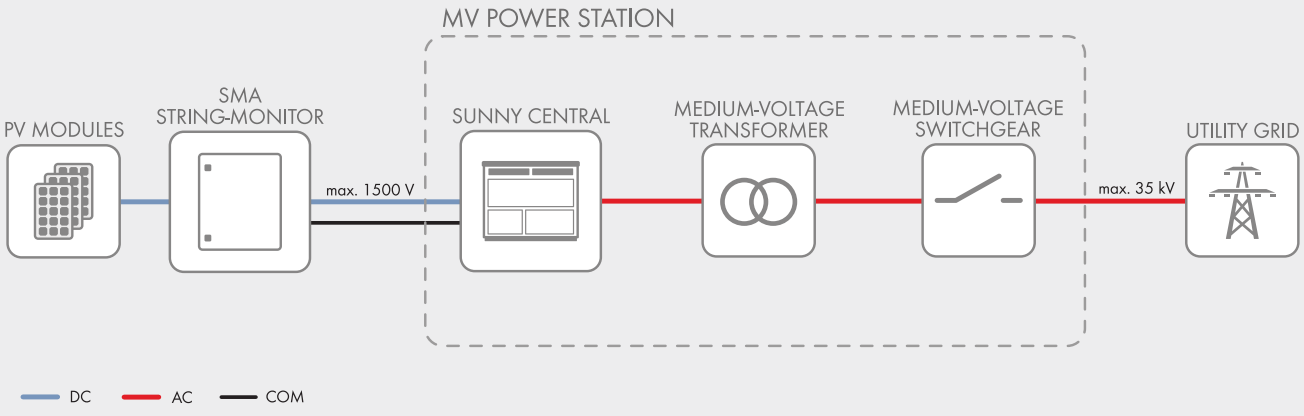
Turnkey Solution for PV Power Plants

With the power of the new robust central inverters, the Sunny Central or Sunny Central Storage, and with perfectly adapted medium-voltage components, the new MV Power Station offers even more power density and is a turnkey solution available worldwide. The solution is the ideal choice for new generation PV power plants operating at 1500 V_{DC}. Delivered pre-configured in a 20-foot container, the solution is easy to transport and quick to assemble and commission. The MVPS and all components are type-tested. The MV Power Station combines rigorous plant safety with maximum energy yield and minimized deployment and operating risk.

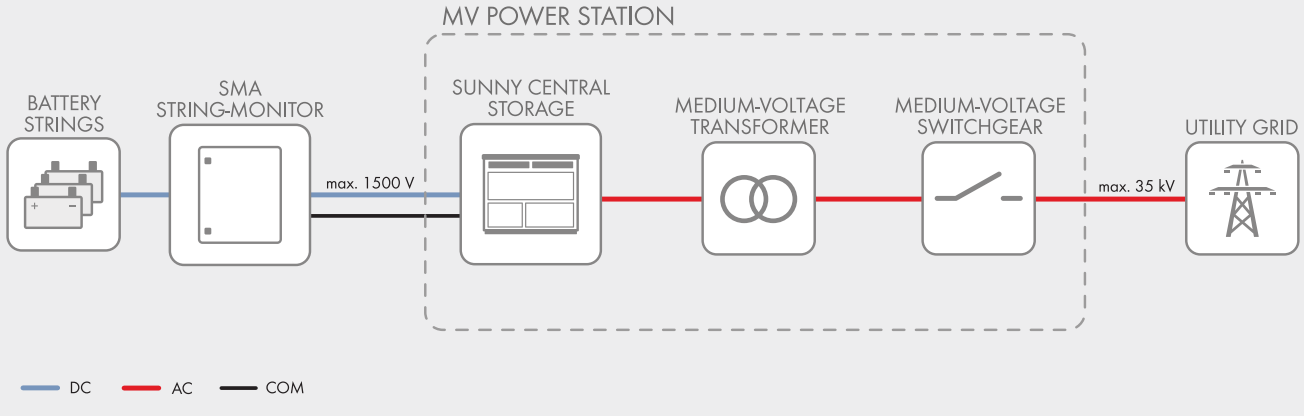
MV POWER STATION
2200 / 2475 / 2500 / 2750 / 3000

Technical Data	MV Power Station 2200
Input (DC)	
Available inverters	1 x SC 2200 or 1 x SCS 2200
Max. input voltage	1100 V
Max. input current	3960 A
Number of DC inputs	24 double pole fused (32 single pole fused)
Integrated zone monitoring	○
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A
Output (AC) on the medium-voltage side	
Standard power at 1000 m and cos φ = 1 (at 35°C / at 40°C / at 45°C)[1]	2200 kVA / 2000 kVA / 0 kVA
Optionale power at 1000 m and cos φ = 1 (at 35°C / at 50°C / at 55°C)[1]	2200 kVA / 2000 kVA / 0 kVA
Typical nominal AC voltages	6.6 kV to 35 kV
AC power frequency	50 Hz / 60 Hz
Transformer vector group Dy11 / YNd11	● / ○
Transformer cooling methods ONAN[2] / KNAN[2]	● / ○
Max. output current at 33 kV	39 A
Transformer no-load losses Standard / Ecodesign[3]	● / ○
Transformer short-circuit losses Standard / Ecodesign[3]	● / ○
Max. total harmonic distortion	< 3%
Reactive power feed-in	○ up to 60% of AC power
Power factor at rated power / displacement power factor adjustable	1 / 0.8 overexcited to 0.8 underexcited
Inverter efficiency	
Max. efficiency	98.6%
European efficiency	98.4%
CEC weighted efficiency[4]	98.0%
Protective devices	
Input-side disconnection point	DC load-break switch
Output-side disconnection point	Medium-voltage vacuum circuit breaker
DC overvoltage protection	Surge arrester type I
Galvanic isolation	●
Internal arc classification medium-voltage control room (according to IEC 62271-202)	IAC A 20 kA 1 s
General Data	
Dimensions of the 20-foot ISO container (W / H / D)[5]	6.058 m / 2.591 m / 2.438 m
Weight	< 16 t
Self-consumption (max. / partial load / average)[1]	< 8.1 kW / < 1.8 kW / < 2.0 kW
Self-consumption (stand-by)[1]	< 300 W
Degree of protection according to IEC 60529	Control rooms IP23D, inverter electronics IP65
Environment: standard / chemically active / dusty	● / ○ / ○
Degree of protection according to IEC 60721-3-4 (4C1, 4S2 / 4C2, 4S2 / 4C2, 4S4)	● / ○ / ○
Maximum permissible value for relative humidity	15% to 95%
Max. operating altitude above mean sea level 1000 m / 2000 m / 3000 m / 4000	● / ○ / ○ / ○ (earlier temperature-dependent de-rating)
Fresh air consumption of inverter and transformer	6500 m³/h
Features	
DC terminal	Terminal lug
AC connection	Outer-cone angle plug
Tap changer for MV-transformer: without / with	● / ○
Shield winding for MV-Transformer: without / with	● / ○
Communication package	○
Station enclosure color	RAL 7004
Transformer for external loads: without / 20 kVA / 30 kVA	● / ○ / ○
Medium-voltage switchgear: without / 2 feeders / 3 feeders 1 or 2 cable feeders with load-break switch, 1 transformer feeder with circuit breaker, internal arc classification IAC A FL 20 kA 1 s according to IEC 62271-200	● / ○ / ○
Accessories for medium-voltage switchgear: without / auxiliary contacts / motor for transformer feeder / cascade control / monitoring	● / ○ / ○ / ○ / ○
Oil containment	○
Industry standards (for other standards see the inverter datasheet)	IEC 62271-202, IEC 62271-200, IEC 60076 , CSC certificate, EN 50588-1
● Standard features ○ Optional features – Not available	
Type designation	MVPS-2200-20

System diagram with Sunny Central



System diagram with Sunny Central Storage



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To whom it may concern

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E-Mail thomas.weiss@sma.de
Date 28.01.2019

Medium Voltage Grid Connection in Italy
MVPS Compliance according to CEI 0-16

Hereby we confirm that our Medium Voltage Power Station (MVPS) is compliant to the Italian Standard CEI 0-16. According paragraph 8.5.13 of this standard there is a limit on 20 kV grid connection for Medium Voltage Transformers (MVT), defined with a transformer power of 2000 kVA and a short circuit voltage Vcc of 6 %. Higher power classes are allowed in case of using higher short circuit impedances, to reduce the short circuit power according to paragraph 8.5.13. SMA will deliver the following transformers for 20 kV grid connection:

MVPS	DC Voltage	MVT power	AC Voltage	Vcc
2200	1000 V	2000 kVA	20 kV	> 6.00 %
2475	1000 V	2250 kVA	20 kV	> 6.75 %
2500	1500 V	2250 kVA	20 kV	> 6.75 %
2750	1500 V	2500 kVA	20 kV	> 7.50 %
3000	1500 V	2700 kVA	20 kV	> 8.10 %

There is also a limit for the maximum power of 6000 kVA that can be energized at the same time according to paragraph 8.5.14 of the standard CEI 0-16. In this case SMA Solar Technology AG can offer the option Cascade Control for a delayed switching of the MV transformers, to reduce the inrush current

Yours sincerely,
SMA Solar Technology AG

i. A. Thomas Weiss
Technical Product Manager
Business Unit Utility

i. A. Bernhard Voll
Platform Product Manager
Business Unit Utility

GE Power

Reservoir Storage Unit

Modular, Scalable Solutions For Utility Scale Applications

RSU-4000 Series

Overview	RSU-4000/20	RSU-4000/16	RSU-4000/12
	RSU-4000/20	RSU-4000/16	RSU-4000/12
Overview			
Nameplate Energy Capacity (KWh.dc, usable)	4184	3347.2	2510.4
Individual Battery Blades - Factory Installed	20 of 20	16 of 20	12 of 20
Maximum Power - Factory Installed (KW.dc)	1200	960	720
Maximum DC Current - Factory Installed (A)	1600	1280	960
Available Augmentation Capacity (% BOL)	0%	25%	67%
Available Augmentation Capacity (kWh.dc)	N/A	836.8	1673.6
Key Features			
Batery Management System		GE Blade Protection Unit (BPU)	
Compatible Inverters		GE RIU-2750MV	
Remote Management		Reservoir Suite	
Solar DC Coupling		Yes (DC:AC Ratio <2.8)	
Integrated PV Combiner		Yes	
Integrated Lockable Disconnect		Module & Rack Level	
Augmentation Options for Lifecyle Management		Yes	
DC Bus Control		DC-IQ Intelligent Bus	
Battery LifeCycle Management		Digital Twin Life Optimization - Optional	
Unit Validation		Factory Built & Tested	
Design life (years)		25	
Battery Information			
Battery Chemistry		Lithium-Ion, NCM	
Battery Module Design		Energy	
Continuous C-Rate		<C/3	
Pulse C-Rate		<C/3	
Voltage Class		1500V	
Nominal DC Voltage (V)		1300	
Minimum DC Voltage (V)		770	
Mechanical Information			
Package Format		20' ISO w/Exterior Acces	
Dimensions (mm) (L X W X H)		6058 x 2438 x 2890 mm	
Weight (kg)	37k	31k	25k
Fully Integrated HVAC		Dual Self-Contained 3 Ton Units (High Efficiency 10. EER)	
- Hot Climate Upgrade		+33% Cooling Capacity	
- Cold Climate Upgrade		+ Electric Heating Package	
Fire Suppression - Aerosol		Optional	
Installation		Pad/Pier	
Cable Entry		Bottom	
Weatherization		NEMA 3R, IP54	
Design Conditions			
Min Operating Temperature (C)		-40°C	
Max operating Temperature (C)		50°C (55°C w/ hot climate upgrade)	
Maximum Altitude (m)		2000	
Maximum Relative Humidity (%)		95%, non-condensing	
Seismic Zone		UBC Zone-4	
Audible Noise		<60 dB at 3M	
Certifications & Compliance			
Certifications		UN38.3, UL 1973, UL 508C, CE	
Compliance		UL1642, UNDOT 38.3, IEC 62477-1, NFPA 70E, IEC 50110, ASTM4169, IEEE 605, IEEE C37.32	

GEPower.com/**EnergyStorage**

GEA-33122-(E)
English
180802

REV2.2 – 02/2019

iTracker™

intelligent tracking by soltigua

Technical specifications

Tracker version: ST

Summary

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R.I., Codice Fiscale e Partita I.V.A.: 00139220404Codice Id. Intra: IT 00139220404 - R.E.A. Forlì-Cesena: n. 26786 Capitale Sociale: Euro 119'520 i.v.

1. Overview

With iTracker™, the intelligent solar tracker, Soltigua bring to the PV market their many years of sun tracking experience in the highly demanding concentrating solar thermal industry.

iTracker™ has many innovative features:

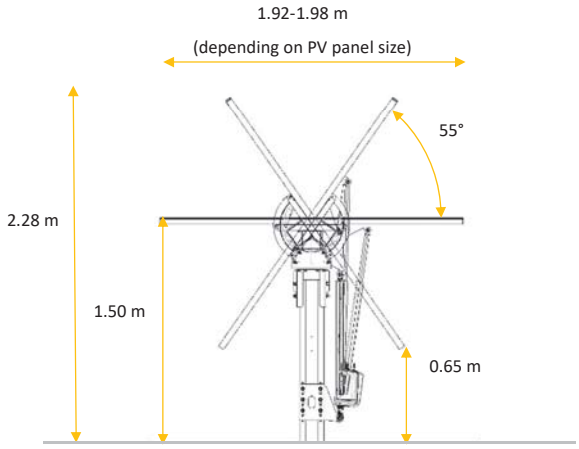
- **Single-row tracking**: no mechanical components in the corridors between tables;
- **Long tracker structure**: up to 100 pv panels per tracker (e.g. 5 strings of 20 modules, 5 strings of 18 modules, etc.) to optimize drive costs;
- **User friendly size**: 1-module-portrait/2-module-landscape configuration to simplify installation and O&M vs. larger tables such as 2-module in portrait;
- **Maintenance free components:** minimized O&M costs;
- **Balanced design:** improved mechanical accuracy and reduced stress on the drive.

2. Tracking features

iTracker is a horizontal single axis, single row tracker.

It can accommodate 1 PV module in portrait or 2 modules in landscape configuration.

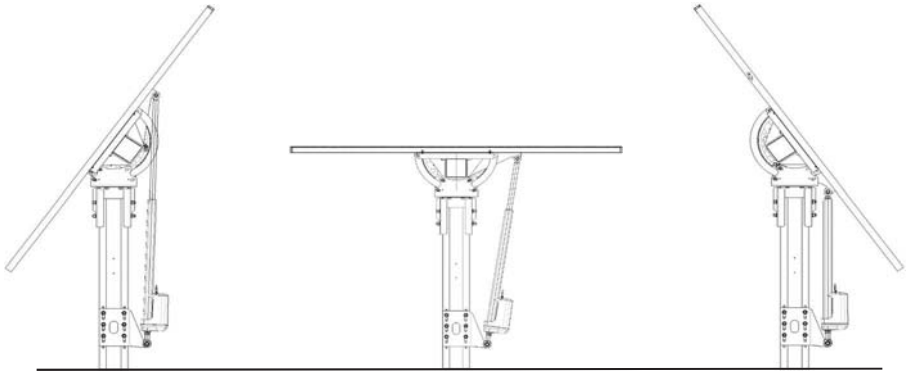
The following drawing shows iTracker's dimensions.



iTracker's main dimensions

In single row tracking each tracker moves independently from the others, guided by its own drive system.

The following drawings show the extreme positions and the position assumed at solar noon.

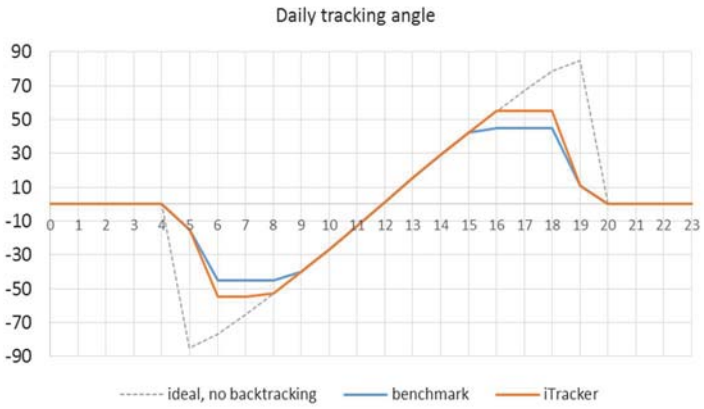


West Extreme position:	Horizontal position:	East Extreme position:
+55°	0°	-55°

iTracker rotation range

iTracker's **extended rotation range** is 110° (-55°; +55°) and it allows for higher energy yields than industry benchmark of (-45°; +45°).

As shown in the following graph, the broader rotation allows iTracker to follow the ideal tracking pattern for a longer period of time.



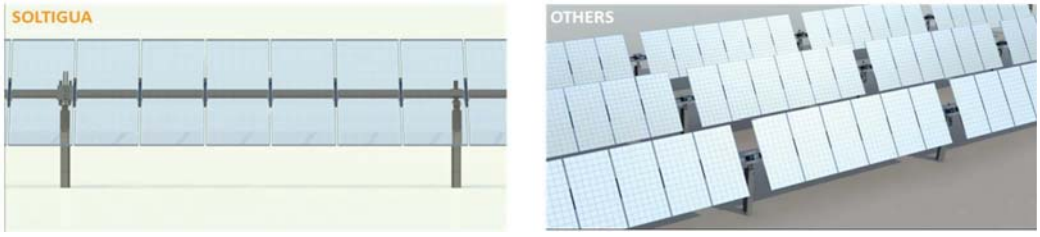
iTracker tracking angle compared to a benchmark solution

When Ground Cover Ratio is lower than 0.5, iTracker's broader rotation translates into an increase in annual yield which can be up to 1%.

Thanks to the **"continuous beam" concept** and a virtual rotation axis, iTracker™ maximizes the power density on the available ground area, increasing the installable peak capacity by up to 14% compared to other trackers. The continuous beam concept generates the following benefits:

- Land savings;
- Capex reduction;
- Higher peak power in limited size plots;

- No shadows from the structure.



Soltigua's continuous beam (left), compared to a benchmark solution which interrupts the structure every 6 modules

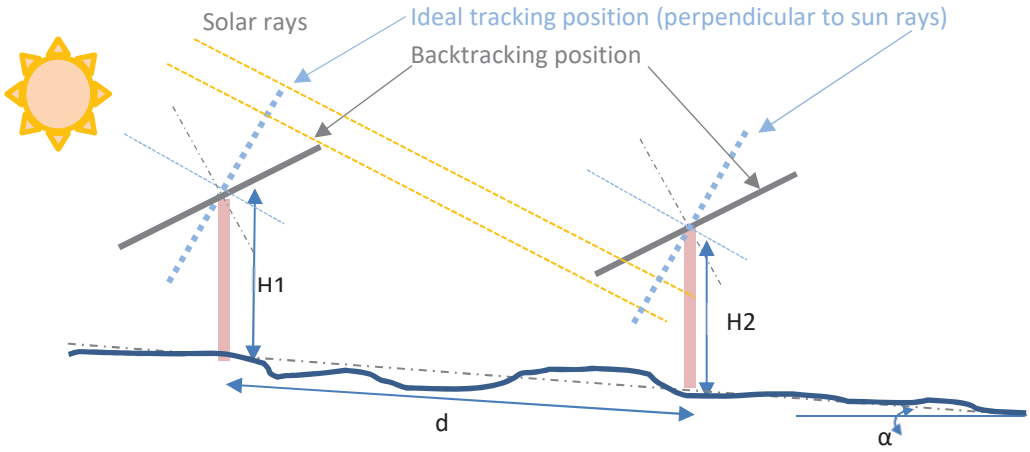
Soltigua's **bearing solution**, with a center-of-mass virtual rotation axis, has the following advantages:

- The structure is balanced, avoiding large tracking errors at the ends of long trackers and also reduces internal mechanical stress in the structure;
- The connection with the piles is stiff, greatly reducing trampoline associated vibrations;
- Torsional vibrations are reduced, avoiding need for dampers and reducing risk of galloping.

2.1 Backtracking

iTracker™ control software includes a **backtracking algorithm** to prevent mutual shadows between adjacent rows. When sun elevation is low, the PV panels rotate off their ideal tracking position to avoid the mutual shadowing, which would reduce the electrical output of the strings. The less-than-ideal inclination reduces the solar radiation available to the PV panels, but increases the overall array output, as PV cells and strings are more evenly exposed to sun irradiance over the entire PV array.

Thanks to individual tracking, Soltigua's backtracking algorithm can optimize the tracking angles of each single tracker, which is particularly helpful in case of uneven or undulated terrains where adjacent trackers are not at the same height.



Individual backtracking concept

Based on the interaxis between trackers, sun inclination and ground slope (typically along East-West), the algorithm evaluates if the adjacent tracker generates shadows (the one on the East side in the morning; the tracker on the West in the afternoon). If this is the case, the tracking angle is reduced by the minimum amount that avoids such shadows.

3. Structural characteristics

iTracker™ **support structure** is made of construction steel, and designed according to **Eurocodes standards**. Most tracker metallic components (torque tube, piles, …) are hot dip galvanized according to ISO 1461 (batch bath) or ISO 3575 (continuous bath) standards. Module rails can be either hot dip galvanized according to ISO 1461, or made in Magnelis, a Zinc-Aluminum-Magnesium coating, applied as well via hot dip bath, which has an even superior resistance in harsh outdoor environments.

Standard module rails are 440 mm long. Different lengths can be priced as an option.

As a standard, all iTracker™ structures are guaranteed 30 years in ISO 14713-1 atmospheric corrosion category up to C2. Different guarantee durations can be agreed as an option.

Mechanical components have been designed with FEM simulations and 3D CAD software, and extensively tested for more than 50 years equivalent service life.

Thermal expansion of the structure is included in the design.

Different tracker lengths are available, accounting for a different number of strings.

3.1 Wind resistance and safety position

iTracker™ design is also the result of **wind tunnel test studies**.

The trackers start the safety procedure when the gust wind speed is higher than 50 km/h, and resist up to 55 km/h during operations.

Based on wind tunnel studies, the safety position assumed in case of excessive wind is not horizontal, but at 35°, so that **wind galloping is avoided**, which otherwise could damage both the PV modules and the tracker structure.

Illustrative stow position of the various rows within the PV array

In safety position, iTracker™ can withstand a gust wind speed of 120 km/h. Higher values are available as an option for dedicated tracker versions.

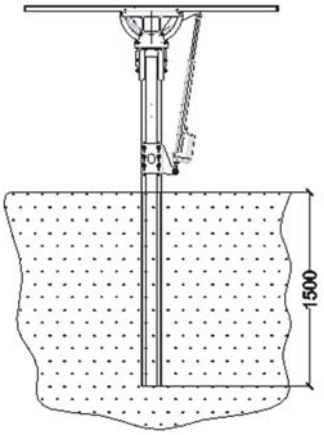
Gust wind speed is the 3 sec mean. Wind speeds are defined as wind velocity at 10 m above ground level in open country terrain, as per Eurocodes definition.

Wind tunnel test studies of PV array allow optimizing the tracker structure

During stowing procedures, trackers are managed in a sequence of 2 groups, in order to optimize the electrical architecture and power consumption. The total stowing time for the array is on average 3 minutes.

3.2 Foundations

iTracker™ can be installed on **different foundations**: concrete blocks, driven piles, screw piles. Piles are C-shaped, and in case of driven piles, they are rammed directly inside the ground. Standard pile embedment length is 1.500 mm ± 150 mm tolerance. Different lengths are available as an option.
A practical pull-test in the field is recommended to verify the actual required pile embedment.



Tracker pile rammed in the ground

4. Ease of use

4.1 Installation

Building on its experience, Soltigua developed iTracker™ to optimize **ease of installation** and minimize installation errors, also when personnel lacks previous experience with trackers and/or specific skills.
Maximum ground slope along the longitudinal axis of rotation of each tracker: 15% (i.e. 8°).
Maximum ground slope along perpendicular to the longitudinal axis of rotation: 100% (i.e. 45°).
The ground level at the basis of each intermediate pile of a given tracker should be within 150 mm from the height of the ideal line connecting the basis of the first pile and of the last pile of that tracker.
No welding nor drilling is required during erection and installation tolerances allowed by iTracker™ rank the highest in the market.

Feature	iTracker	Benchmark
Vertical tolerance (Z)	±45 mm	±20 mm
Transversal tolerance (X)	±25 mm	±20 mm
Longitudinal tolerance (Y)	±50 mm	±35 mm
Tilt	8°	2°
Twist	15°	5°

iTracker installation tolerances compared to a benchmark solution

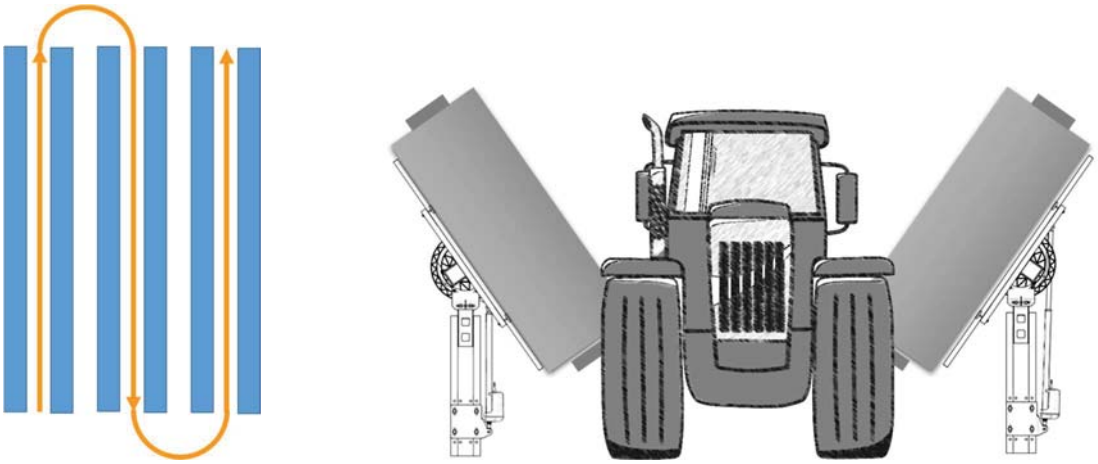
These large installation tolerances help at minimizing site repairs/modifications and ground works and at achieving:

- lower installation costs;
- no delays in project timeline;
- easier project management.

4.2 Maintenance

All components are **maintenance free**, including the linear actuator and its motor, which has an IP66 dynamic rating. The rotation bearings are made of stainless steel rollers with self-lubricating washers.

Single row tracking **simplifies cleaning and vegetation management** because there are no obstacles between rows. Adjacent trackers can be rotated to face each other in order to enable their simultaneous cleaning.



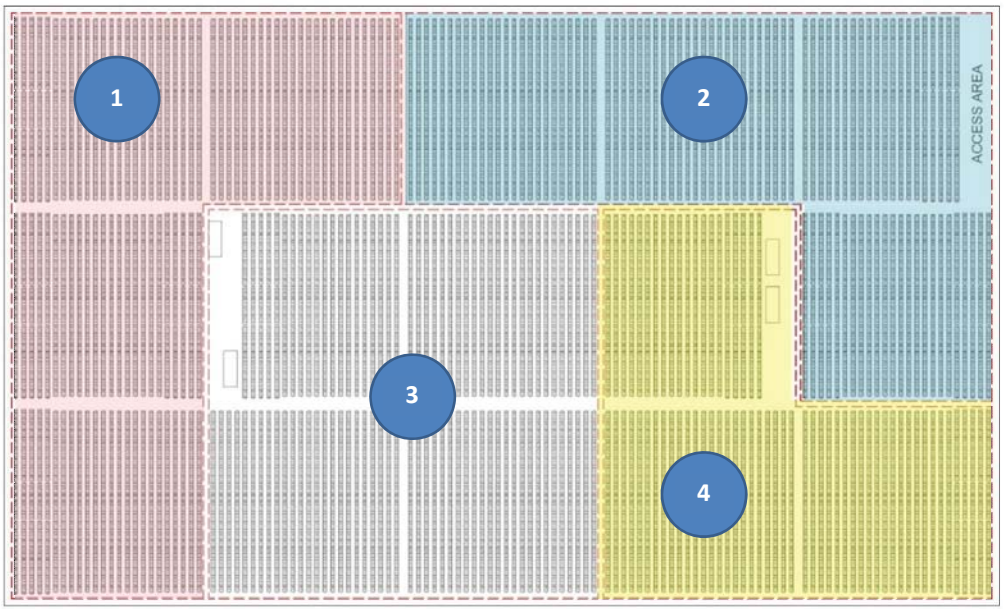
Single row trackers allow cleaning 2 tables at once

Continuous tables are already optimized for autonomous robot cleaning.

SolControl intelligent **monitoring system** enables the operators to evaluate the tracking system status at a glance, even remotely, in an intuitive manner.
If necessary, details down to single tracker level can be checked.

5. Tracking system architecture

The whole tracking system of a PV power plant is usually divided into some sub arrays, each of which coincides with the part of the plant related to a transformer station or to a centralized inverter.



Illustrative PV plant divided into sub-arrays

Each sub-array is provided with a distribution panel (DP) and a back-up UPS (available as an option), which is used to perform the safety procedure in case of lack of electricity.

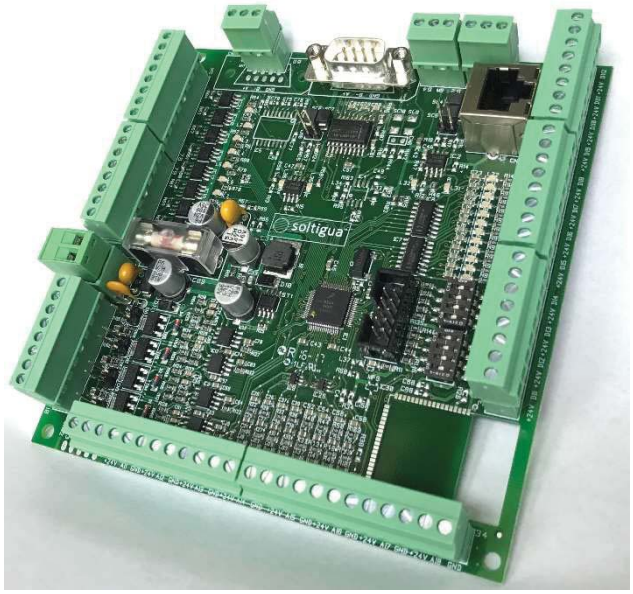
The DP distributes the power to the tracker field panels (FP) of the sub-array, each of which in turns supplies up to 4 tracker motors.

A central Tracker Control Panel (TCP) contains the industrial controller, which manages all the trackers in the PV array. The TCP communicates with the DP and with the FPs, where Soltigua's proprietary printed control boards (PCB) acquire trackers data.

The codification is the following:

CODE	DESCRIPTION
TCP	Tracking system control panel. There is one per PV power plant
xx	Sub-array. there can be several, typically one every 3-5 MWp
xx.DP	Sub- array distribution panel. There is one per sub-array
xx.FPyy	Tracker field panel; yy= 01 … 40
xx.TRzzz	Tracker in the sub-array xx; zzz = 001 … 160

Each PCB acquires data of up to 4 trackers, and communicates them to the central controller via Modbus RTU protocol over an RS-485 network.

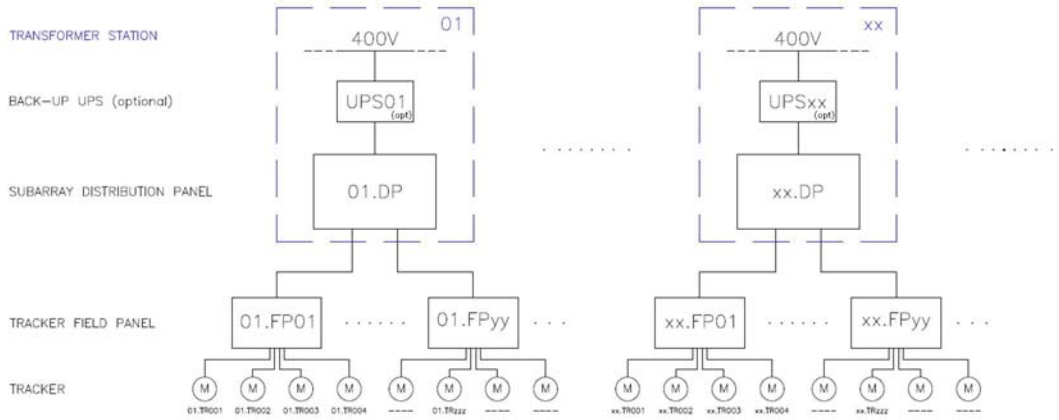


Soltigua's custom Printed Control Board (PCB)

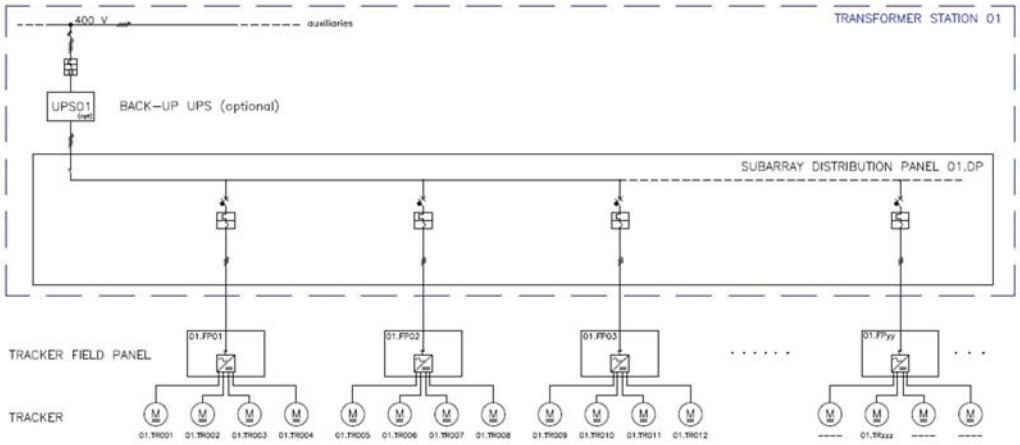
5.1 Power supply

The UPS and distribution panel DP are fed with electricity by the grid/PV plant (400 V AC 50/60 Hz), and supply the field panels FP at 230 V. Each FP supplies the tracker motors at 24V DC.

The following diagrams illustrate the typical power supply architecture, which is highly modular, flexible and scalable.



Example of general power supply architecture



Example of sub-array detailed power supply

Working conditions are as follows:

- distribution panels (DP) and optional UPS: indoor installation, 5°C ÷ 35°C;
- Field panels (FP): outdoor installation; IP 66; -10° ÷ 50°C, with max 90% humidity.

Each tracker has the following power requirements:

- Standby (between one tracking step and the following): 5 W;
- Tracking (with a wind speed of 15 km/h): 77 W.

The average tracking time is less than 1.0% of daylight hours, therefore iTracker™ control software dynamically manages the assembly of trackers in the field by operating them in a sequence of 2 groups, in order to limit peak power consumption and optimize the UPS battery usage. Moreover, at night, all

trackers can be switched off, so that power consumption is further reduced, unless it is advisable to keep them on when ambient temperature falls below 5°C.

Each sub array can include a maximum of 160 iTrackers for an equivalent power capacity of 5 MWp, for a maximum total power consumption of 22 kVA and a maximum inrush current of 45 A @400V. Typically a sub-array will include less trackers, hence will require lower values.

The maximum power consumption is only obtained if the wind blows at the maximum operational wind speed and the trackers are at their maximum working angle.

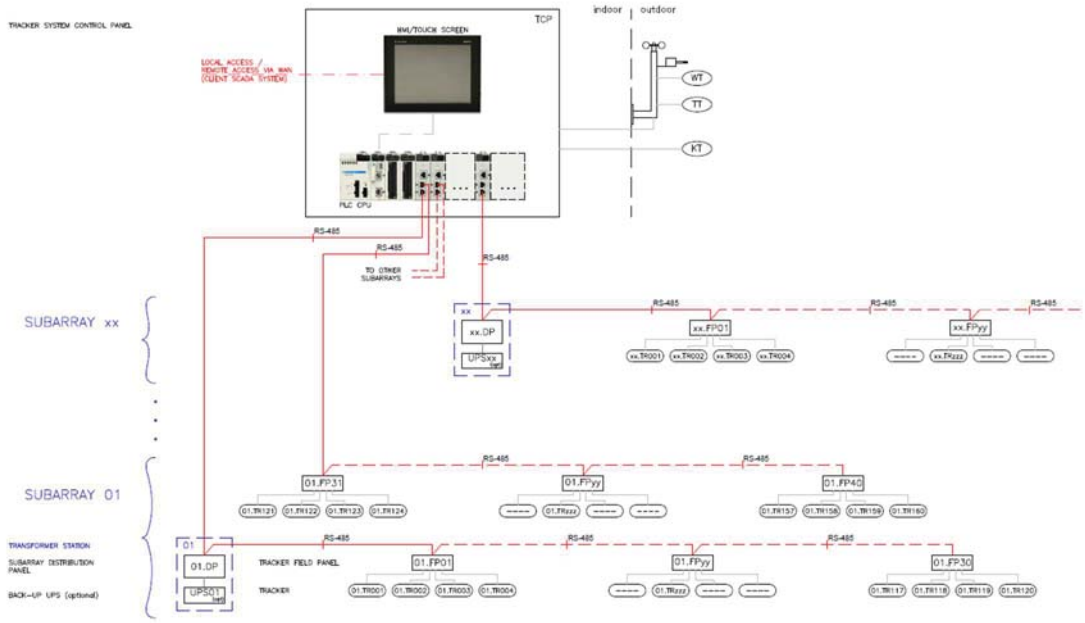
Average power consumption is 0.13 kW/MWp during daytime and 0.01 kW/MWp during nighttime.

5.2 Control and Monitoring

The central controller takes care of the automatic tracking cycle, including the backtracking function and the safety procedure in case of warnings such as high wind. The controller reads the following sensors:

- Wind speed sensor: to check the working conditions;
- Ambient temperature probe: to check for extreme operating temperatures;
- GPS receiver: to communicate with satellites for time update;
- Back-up UPS (optional): to verify its operational functionality.

The following diagram shows the typical I&C architecture.



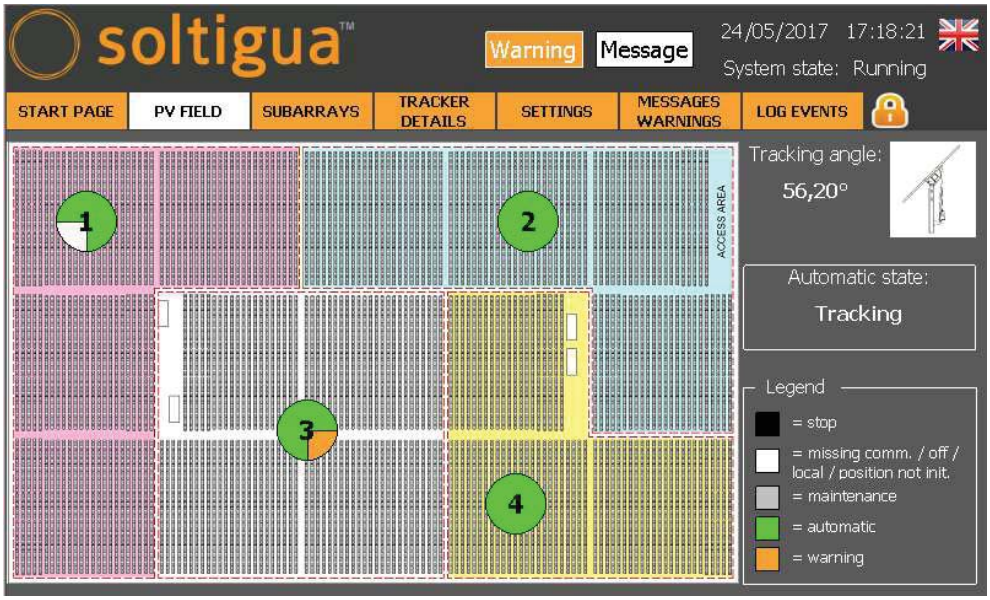
Example of typical communication architecture

Thanks to **Soltigua's SolControl supervision software**, three different interfaces can be used for checking operating data in real time and setting specific functions:

- Local touchscreen monitor on the tracker control panel;
- Locally connected pc (to customer's care);
- Remotely connected pc, via GSM or WAN, thanks to the integrated router.

SolControl specific functions include:

- Rotation to maintenance position of a sub array (for cleaning or other purposes);
- Individual rotation of single trackers to a desired position (special activities on given strings;
- Datalogging;
- Alarms log.



Soltigua's SolControl supervision software

The controller monitors and makes available operational data via Modbus TCP/IP protocol to any other monitoring system. Data are updated every second for continuous communication, whereas a given amount of historical data are stored locally for non-continuous extraction.
In addition, Soltigua can provide remote assistance and monitoring via the integrated WAN/GSM router.

For data extraction possibilities, the following parameters are available in the log file:

- For the whole PV array:
  - Date and time;
  - Sun elevation and sun azimuth;
  - Wind speed;
  - Power plant state;
  - Ideal tracking angle;
- For each sub-array:

- Global working state;
- Active warnings (e.g.: high wind);
- N° of trackers in automatic mode;
- N° of trackers in manual mode;
- N° of trackers in maintenance mode;
- N° of trackers in local alarm;

- For each tracker:
  - Tracking angle;
  - Active alarms.

6. Earthing

iTracker™ rotating structure is connected to earth through its drive pile. In cases where the earthing requirements are not satisfied because of the ground features or because of local code requirements, more piles can be connected to the structure to reduce the resistance to earth by means of optional additional grounding braids.

Modules earthing is not included as a standard, but it can be provided, as an option, via the iTracker™ metallic structure by means of earthing washers or similar items.

iTracker: catching all the sun

iTracker – the intelligent tracker –
maximizes the output of your PV power plant,
thanks to its all-around performance
and Soltigua's customer-tailored solutions

soltigua™

Track and field: iTracker's decathlon

"The decathlon includes ten separate events and they all matter. You can't work on just one of them."

Dan O'Brien
Olympic gold medal

Track

Horizontal single-axis trackers increase the performance of PV power plants by up to 30% with alimited increase of the investment. By following the sun throughout the day PV trackers maximise power generation.
They also better match the grid demand profile, which peeks in the afternoon, and contribute to a smarter and more sustainable energy system.

Field

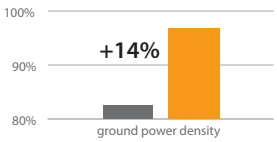
To maximize the actual PV output in the field, trackers must deliver on several dimensions during the different phases of the PV project life: design, installation, operation and maintenance.
Challenges are numerous and diversified, ranging from field configuration to need for local content, from local labour skills to weather conditions, from budgetary constraints all the way down to asset management for a long lifespan.

iTracker's decathlon

Effective tracker performance requires all-around achievements and attention to detail, like a decathlete, who prepares for multiple challenges at the same time.
This is iTracker's intelligence: delivering everywhere it matters!

01 Power Density

Smallest footprint for each installed PV module



- Up to 14% additional capacity for a given area
- Continuous table with no interruptions thanks to virtual axis of rotation
- Length up to 96 meters
- Single row 3D backtracking maximises annual output

02 Site Adaptability

The most flexible tracker on the market

- Optional universal joint for undulating sites avoids ground works
- North South slopes up to 15% - no East West slope limitation
- Independent row tracking enables more flexible layouts
- Alignment is possible in any direction to adapt to site constraints

iTracker™
intelligent tracking by soltigua

03 Wind Management

Holistic approach to wind loads

- Wind tunnel tested, including dynamic analysis
- Intelligent stowing position along the array avoids wind galloping
- Soltigua's patented bearing concept includes a torsional limiter
- An embedded damping factor avoids the addition of external dampers

04 Outdoor Resistance

Ready for the harshest environment

- Linear actuator with IP 66 dynamic rating and IP69K static rating
- IP 65 electric box against moisture, dust and sand
- Broad range of working temperatures from -10°C to +50°C
- HDG metal structure and components with advanced coatings (Zn-Al-Mg)

05 Endurance & Reliability

Designed and field tested for 50-year service

- Patented balanced design reduces mechanical stress on structure and actuator
- Proprietary rugged printed control board can resist temperatures from -20° to +80°C
- Drive and bearing components tested on the field for an equivalent 50-year service
- Technical due diligence available on request

06 Advanced Design

Integrated mechanical engineering

- Tracking precision, balanced design and broad rotation range increase yield by up to 1,5%
- Engineering platform leverages Soltigua's experience in complex CSP collectors
- 3D CAD modelling enables rapid virtual prototyping and in depth analysis
- FEM (Finite Elements) analysis performed for various load cases on critical components

iTracker™
intelligent tracking by soltigua

07 Intelligent Monitoring

Monitoring tailored to specific customer needs

- Individual monitoring and control of each tracker
- Soltigua's cloud-based SCADA shows solar array status at a glance, in an intuitive manner
- Single tracker status can also be detected, including warnings and alerts
- Real time and historical data available

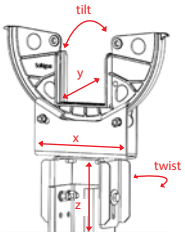
08 Minimized O&M

Minimized operating cost for the pv array

- Simplified cleaning and vegetation management: no obstacles between rows
- Adjacent rows can face each other to allow their simultaneous cleaning
- Continuous table is already optimized for autonomous robot cleaning
- All moving parts are maintenance free, as they are sealed and self lubricated

09 Ease of installation

Fast, simple and user friendly installation



- Highest installation tolerances on the market avoid repair work at construction site
- No specialized tool is required during installation: no welding, no drilling
- Installation manual available to partners and clients
- Installation courses in Soltigua's headquarters and on project sites

10 Certified Quality

100% compliant to state-of-the-art standards

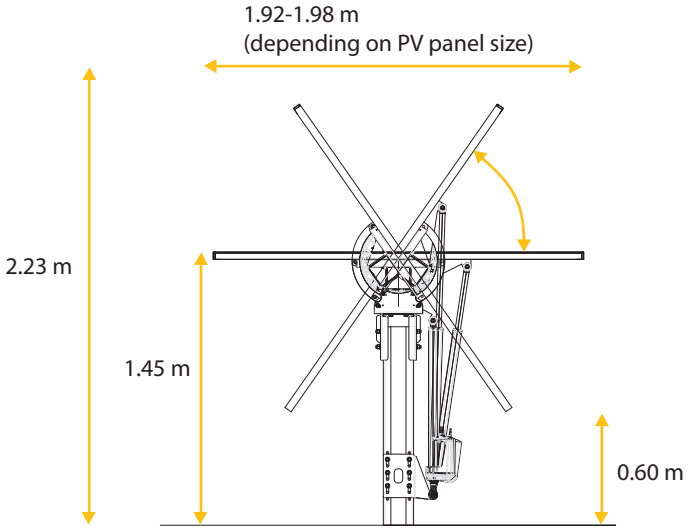
- CE marked according to the Machinery Directive 2006/42/UE
- Structural design compliant with Eurocodes EN 1991-1-1, EN 1991-1-3, EN 1991-1-4
- Electrical design as per EU Directives 2014/35/UE (LV) and 2014/30/UE (EMC)
- Quality system certified by TUV Sud according to ISO 9001:2015

iTracker™
intelligent tracking by soltigua

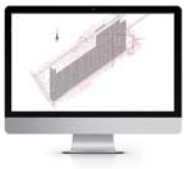
iTracker™
intelligent tracking by soltigua

Technical features

Tracking type	Independent single axis horizontal tracker; Any tracker alignment possible (ideally along North-South direction); Individual 3D backtracking
Tracking algorithm	Accurate astronomical formulas; tracking precision = 0.5°
Rotation range	±55°
Ground cover ratio	Freely configurable by customer (between 34% and 50%)
PV Module compatibility	Framed modules; All major brands
Module mount	1 module portrait; 2 modules landscape
Drive system	1 Independent linear actuator per tracker
Peak power per tracker	Up to 32.64 kWp per tracker (with 340Wp panels)
N° of Module per tracker	Up to 100 72-cell modules (1000 V) or 90 72-cell modules (1500 V)
PV array voltage	1000 V or 1500 V
Power supply	400 V AC (50/60 Hz) / Self powered
Communication	Private wired network / wireless with star topology
Monitoring	Local control via SCADA; Remote control available
Power consumption	≈ 600 kWh/MWp/year
Foundation type	standard: driven pile; compatible also with: cement block; ground screw
Wind resistance (Eurocodes)	In operation: up to 80 km/h in any position, depending on tracker version; Stow position: up to 200+ km/h in stow position, depending on tracker version.
Snow resistance	Up to 1'050 N/m2; depending on tracker version
Tracker stowing time	≤ 3 min
Installation tolerances	North South: ±45 mm; East-West: ±25 mm; Height tolerance: ±40 mm; Tilt: 8°; Twist: 15°
Ground slope	Max 15% slope in longitudinal direction (North- South); Any slope in transversal direction (East-West) [max 70% local slope for rotation clearance]
Installation method	Engineered for fast and easy assembly; no welding nor drilling required on site
Materials	HDG construction steel; Maintenance free drive components (actuator and bearings)
Certifications/Compliance	CE 2006/42/UE; Eurocodes EN1991-1-1/3/4; LV 2014/35/UE; EMC 2014/30/UE; ISO 9001-2015
Warranty	Structure: 10 years; Drive and electronics: 5 years; Warranty extension available



Dedicated global service



Project engineering - Tailored to the needs of each individual plant

- Choice of optimal trackers based on project features (PV modules, land, wind etc.)
- Detailed layout development already during proposal
- Optimization during basic engineering

Scope of supply - Flexible battery limits for goods and services

- On-site presence adapted to customer preference: from simple supervision to full turn-key
- If wished, selected structural components can be sourced locally by the client

Project management - Reliable network across 4 continents

- 100+ year of cumulative experience in project management
- Extensive network of local partners for seamless client service
- Projects successfully delivered and commissioned across 4 continents

Post sale assistance - Guaranteed support - online and onsite

- 99% availability guarantee included as sales contract standard
- Suitable stock of spare parts supplied and maintained available on site
- Remote monitoring service available upon request

Training - Supporting continuous learning during the entire life of the plant

- Dedicated courses at Soltigua's headquarters for construction partners
- On-site sessions during erection and commissioning phase
- Comprehensive manuals for detailed reference during O&M

A unique product portfolio

Soltigua is the only PV tracker supplier with a 10-year experience in engineering and manufacturing concentrating collectors for solar heat up to 320°C.
By manufacturing both parabolic troughs and Fresnel collectors, Soltigua can offer the most suitable solution to any solar thermal installation.

For more information and quotes write to sales@soltigua.com

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soltigua™
solar tracking since 2007

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