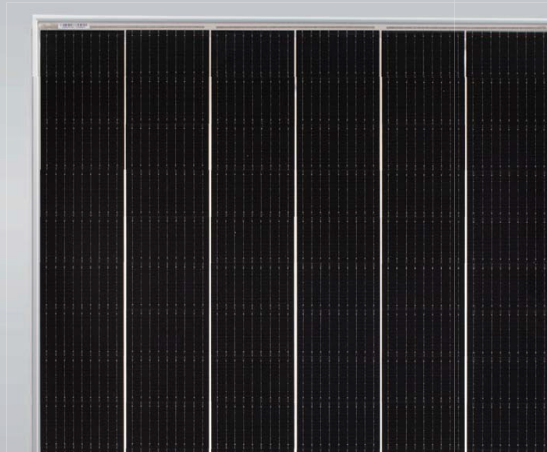


TR Bifacial

545-565 Watt

Tiling Ribbon (TR) Technology

Positive power tolerance of 0~+3%



KEY FEATURES



TR technology + Half Cell

TR technology with Half cell aims to eliminate the cell gap to increase module efficiency (bi-facial up to 21.11%)



9BB instead of 5BB

9BB 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,
0.45% linear degradation



Best Warranty

12 year product warranty,
30 year linear power warranty



Avoid debris, cracks and broken gate risk effectively

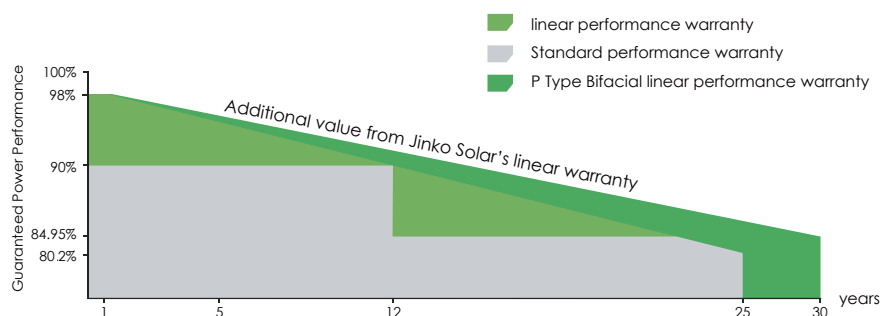
9BB technology using circular ribbon that could avoid debris, cracks and broken gate risk effectively



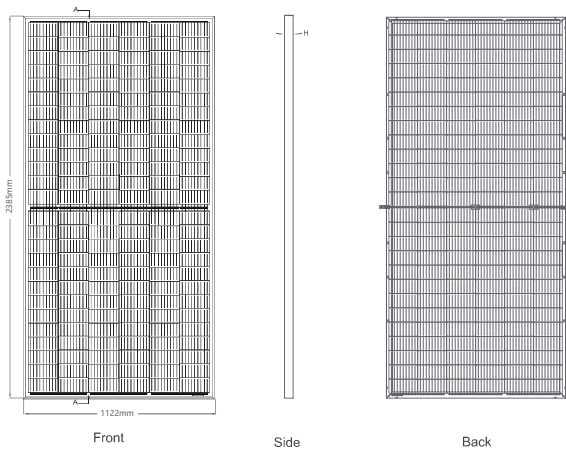
- ISO9001:2015, ISO14001:2015, ISO45001:2018 certified factory
- IEC61215, IEC61730, UL61730 certified product

LINEAR PERFORMANCE WARRANTY

12 Year Product Warranty • 30 Year Linear Power Warranty
0.45% Annual Degradation Over 30 years



Engineering Drawings



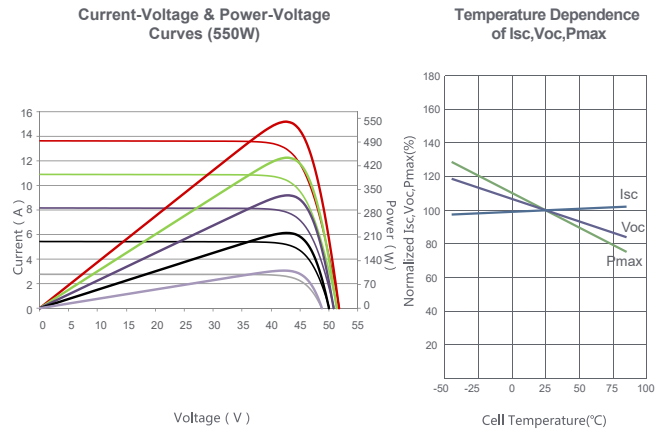
Length: $\pm 2\text{mm}$
Width: $\pm 2\text{mm}$
Height: $\pm 1\text{mm}$
Row Pitch: $\pm 2\text{mm}$

Packaging Configuration

(Two pallets = One stack)

27pcs/pallets, 54pcs/stack, 540pcs/ 40'HQ Container

Electrical Performance & Temperature Dependence



Mechanical Characteristics

Cell Type	P type Mono-crystalline
No. of cells	156 (2×78)
Dimensions	2385×1122×35mm (93.90×44.17×1.38 inch)
Weight	30.3 kg (66.8 lbs)
Front Glass	3.2mm, Anti-Reflection Coating, High Transmission, Low Iron, Tempered Glass
Frame	Anodized Aluminium Alloy
Junction Box	IP67 Rated
Output Cables	TUV 1×4.0mm ² (+): 250mm, (-): 150mm or Customized Length

SPECIFICATIONS

Module Type	JKM545M-7RL4-TV		JKM550M-7RL4-TV		JKM555M-7RL4-TV		JKM560M-7RL4-TV		JKM565M-7RL4-TV	
	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax)	545Wp	405Wp	550Wp	409Wp	555Wp	413Wp	560Wp	417Wp	565Wp	420Wp
Maximum Power Voltage (Vmp)	44.14V	40.59V	44.22V	40.72V	44.33V	40.88V	44.42V	40.97V	44.49V	41.05V
Maximum Power Current (Imp)	12.35A	9.99A	12.44A	10.05A	12.52A	10.10A	12.61A	10.17A	12.70A	10.24A
Open-circuit Voltage (Voc)	52.60V	49.65V	52.70V	49.74V	52.80V	49.84V	52.90V	49.93V	53.00V	50.03V
Short-circuit Current (Isc)	13.15A	10.62A	13.24A	10.69A	13.33A	10.77A	13.42A	10.84A	13.51A	10.91A
Module Efficiency STC (%)	20.37%		20.55%		20.74%		20.93%		21.11%	
Operating Temperature(°C)	-40°C~+85°C									
Maximum system voltage	1500VDC (IEC)									
Maximum series fuse rating	25A									
Power tolerance	0~+3%									
Temperature coefficients of Pmax	-0.35%/°C									
Temperature coefficients of Voc	-0.28%/°C									
Temperature coefficients of Isc	0.048%/°C									
Nominal operating cell temperature (NOCT)	45±2°C									
Refer. Bifacial Factor	70±5%									

BIFACIAL OUTPUT-REAR SIDE POWER GAIN

		5%		15%		25%	
		Maximum Power (Pmax)	Module Efficiency STC (%)	Maximum Power (Pmax)	Module Efficiency STC (%)	Maximum Power (Pmax)	Module Efficiency STC (%)
5%	Maximum Power (Pmax)	572Wp	23.12%	578Wp	23.33%	583Wp	23.54%
	Module Efficiency STC (%)	23.12%	23.33%	23.33%	23.54%	23.54%	23.76%
15%	Maximum Power (Pmax)	627Wp	23.42%	633Wp	23.64%	638Wp	23.85%
	Module Efficiency STC (%)	23.42%	23.64%	23.64%	23.85%	23.85%	24.07%
25%	Maximum Power (Pmax)	681Wp	25.46%	688Wp	25.69%	694Wp	25.93%
	Module Efficiency STC (%)	25.46%	25.69%	25.69%	25.93%	25.93%	26.16%

* 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

* Power measurement tolerance: $\pm 3\%$

The company reserves the final right for explanation on any of the information presented hereby. Specifications included in this datasheet are subject to change after certification.

TR JKM545-565M-7RL4-TV-D4-EN



Single-Axis
Tracker

General Technical Description

Bankability Report available:

Black & Veatch, DNV-GL

Wind Tunnel Tested:

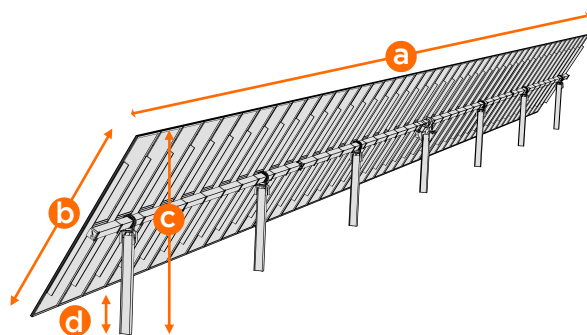
RWDI, CPP-Wind, IDR-UPM

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1. OVERVIEW

SF7 is an independent row solar tracker. It allows great installation flexibility in foundation, communication and size terms.



PV modules Configuration	Dimension*	Metric (meters)	Imperial (feet)
2x28	a	28.2	92.5
2x29	a	29.4	96.5
2x30	a	30.8	101
2x42	a	42.1	138.1
2x43.5	a	44.1	144.7
2x45	a	45.1	148
	b	3.9	12.8
	c**	3.9	12.9
	d***	0.5	1.6

*PV Modules of 1956mm x 992mm (77inch x 39inch) **Max. height tracker at 60° ***Min. clearance tracker at 60°

Tracking Range	+120° (configurable)
Power Supply	Self-Powered: Autonomous PV Series Power Supply Grid-Powered: AC single phase
Drive Power	Self-Powered: 250 W max. Grid-Powered: 75 W max.
Energy Consumption	563 kWh/MWp-year
Time to stow at 0° from 60° full tilt	Self-Powered: < 3 min Grid-Powered: < 11 min
Tracking algorithm	Astronomical with TeamTrack Assymetric Backtracking
Monitoring and control	Tracker Monitoring System (TMS)
Communication	Hybrid: 2.4GHz Radio communications between Head-Trackers and Sub-Trackers, RS485 Wired communications between Head-Trackers and Gateways. Wired: Full wired RS485 Communications
Maximum wind resistance (in any position)	32-50 mph (60-80 km/h)
Maximum wind resistance (in stow position)	Configurable according to local regulations
PV Module fasteners	Bolts, rivets, clamps
PV Modules supported	60-72 c-Si Crystalline, thin-film (First Solar, Solar Frontier...), Bifacial

2. MAIN FEATURES

Cost-effectiveness is the principal innovation criteria that SF7 standardization has followed. The feature-elements of cost-effectiveness are summarized here:

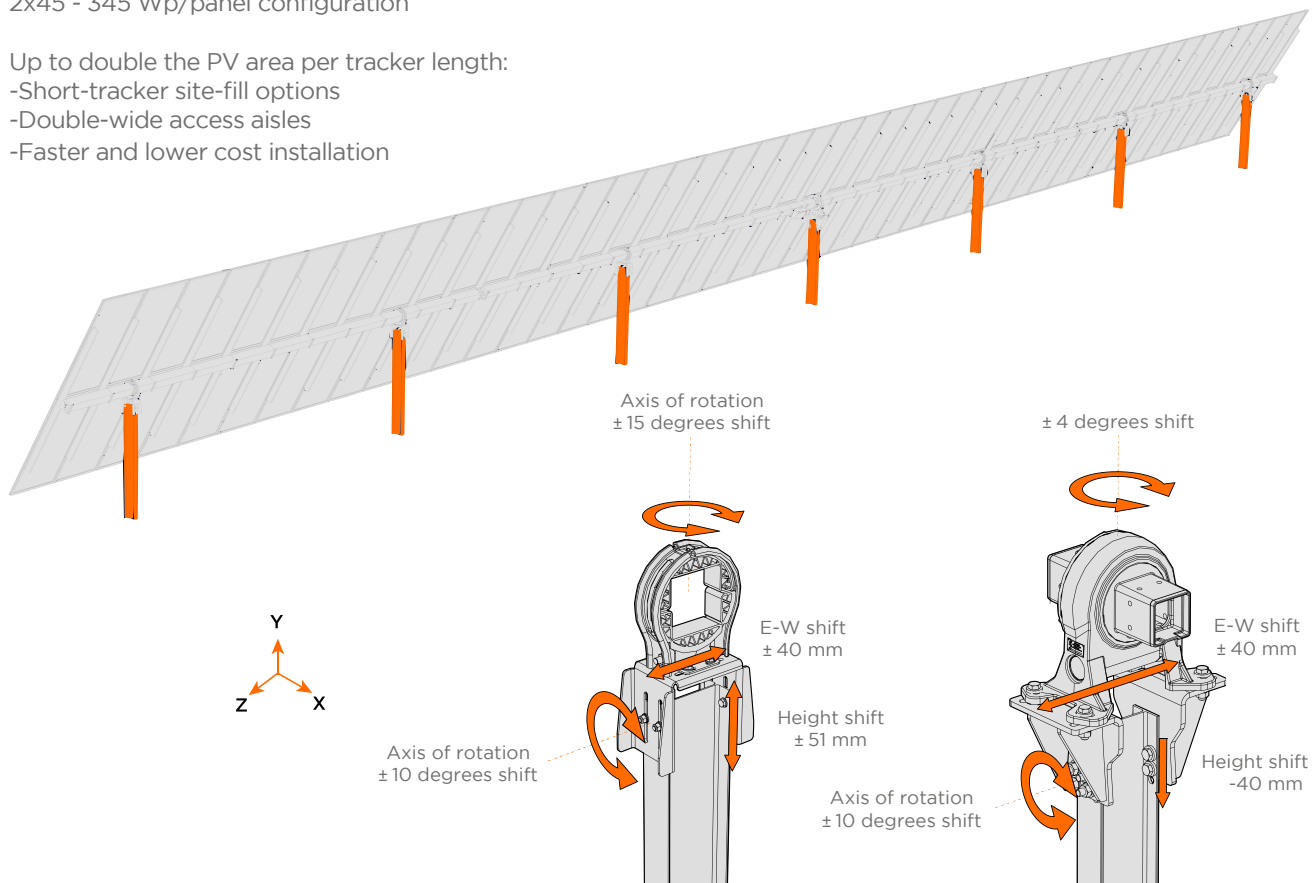
Yield enabler	Less array-gap on the tracker. Less site-gaps on the ground. Tracking range of + 120°. TeamTrack Asymmetric Backtracking.
Land-use enabler	Independent-row, short-tracker design reaches into non-square site corners and over irregular land. Extends yield potential to where others cannot build without additional non-standard cost.
High installation tolerances	Steep-slope tolerance to 17% grade on NS axis. Contours tolerance to + 0.2m (0.66 ft). Short-steps tolerance <48m (157 f). Piles vertical plumb tolerance +2°. Market highest assembly tolerances in all three axes of pile mounting bracket installation.
Tolerance features savings	Reduce civil works, installation labor, timeline, and delays.

Lowest piles-per-MW

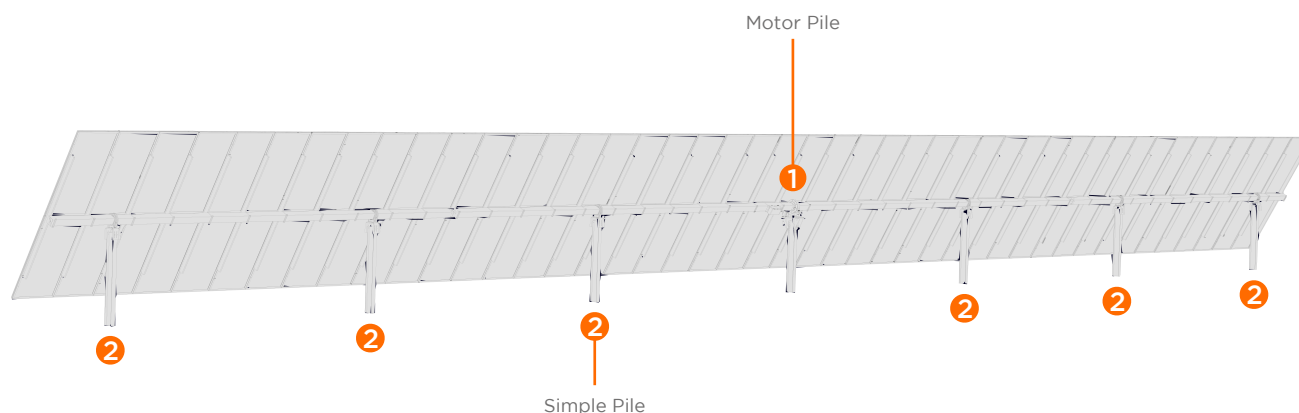
7 piles-per-tracker: 225 piles-per-MW
2x45 - 345 Wp/panel configuration

Up to double the PV area per tracker length:

- Short-tracker site-fill options
- Double-wide access aisles
- Faster and lower cost installation



3. MECHANICAL STRUCTURE



	Profile	Coating	Standards	Standard pile dimensions**	
Foundation*	1 Motor pile: W8x13 or W8x15 or W8x18 or W8x21 2 Simple pile: W8x10 or CF 200	Hot dip galvanized	ASTM A123/ ISO 1461	meters	feet
				Total	3.3 10.8
				Height	1.8 5.9
				Embedment	1.5 4.9

*Optional: Motor and simple pile foundation screw

**Dimensions may vary depending on project

	Material	Coating	Standards
Pile	A57250 ksi / A57260 ksi	Hot dip galvanized	ASTM A123/ ISO 1461
Mounting Brackets	A57250 ksi / A57260 ksi	Pregalvanized Hot dip galvanized Magnelis® / PosMAC	ASTM A123/ ISO 1461 EN 10346
Torque tube	A57250 ksi / A57260 ksi	Pregalvanized Hot dip galvanized Magnelis® / PosMAC	ASTM A123/ ISO 1461 EN 10346
Module support	A57250 ksi / A57260 ksi	Pregalvanized Hot dip galvanized Magnelis® / PosMAC	ASTM A123/ ISO 1461 EN 10346
Hardware	Steel 6.8, 8.8, 10.9, 12.9	Delta Protekt®	ISO 10683

		Material	Coating
PV Module fasteners	Bolt connection M8x25, DIN 603	Steel 6.8	Delta Protekt®
	Rivet, Ø 6.4mm	Stainless steel Aluminum	- Anodized
	Clamps	Stainless steel Aluminum	- Anodized
	Cinch-Clips	Steel	Magni®

4. TRACKERS POWER SUPPLY

4.1 Self-Powered Tracker

With the unique **PV Series Power Supply** at each tracker, high system availability is assured by leveraging the tremendous series-string power availability to supply the lowest cost operational power onsite; and with zero impact on revenue generating PV active-area.

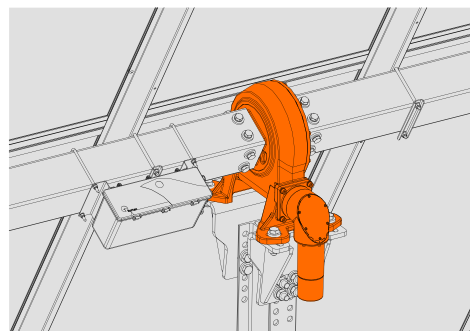
Eliminates grid-powered distribution wiring and power bills
String voltage drop <3V in normal operation
EMI filtering reduces voltage ripple to <0.5V
Provides 2 day normal operation autonomy
Circuit protections for string, battery, and load
No maintenance VRLA battery, fast and easy install
Patent pending Isolated DC/DC power supply

4.2 Grid-Powered Tracker

Power conversion is provided at each tracker from single-phase AC to 24 VDC tracker operational power supply.

Input range: 90 Vac to 264 Vac
Input frequency: 50/60 Hz
Isolated AC/DC power supply
Input phase configuration: Single-Phase
Temperature range Standard: -20° to +55° C Extended: -40° to +55° C
No maintenance

5. DRIVE SYSTEM

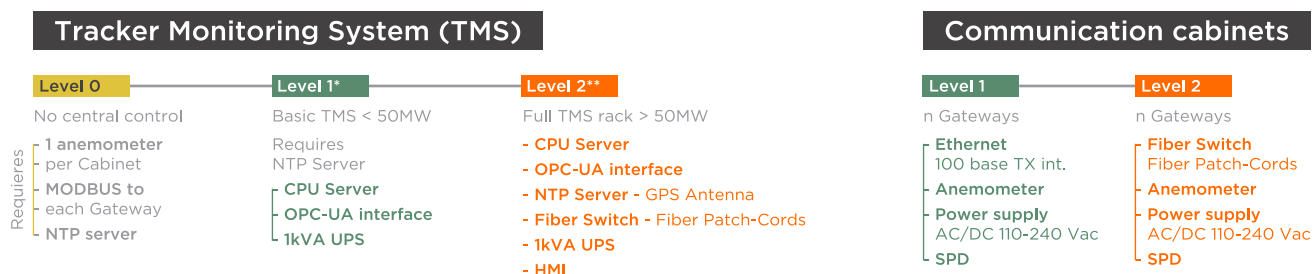


Nominal voltage	24 VDC
Maximum power	Self-Powered: 250W Grid-Powered: 75W
Energy consumption	20.2 kWh/day/tracker
Enclosure Protection	IP55
Temperature range	Standard range: -20° to +55° C Extended: -40° to +55° C

6. MONITORING & CONTROL

6.1 Soltec Communications System

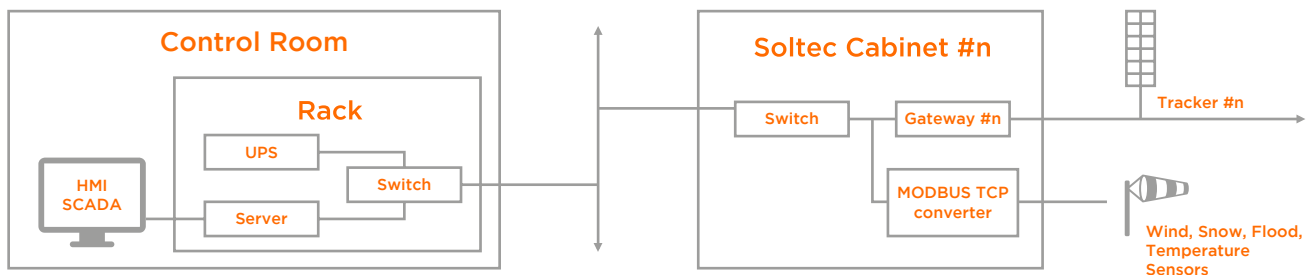
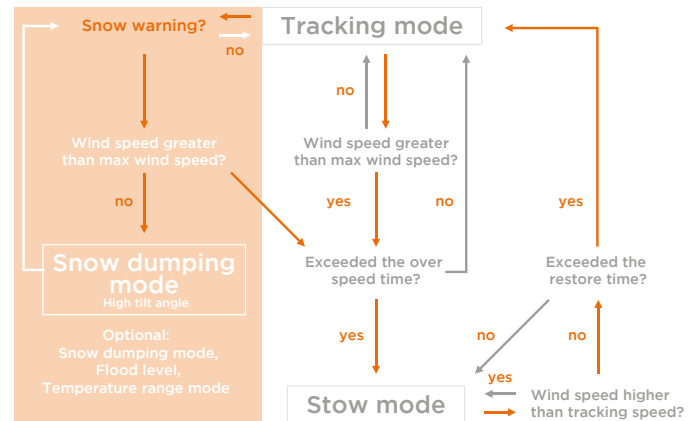
Breakdown of components included in the scope of supply:



Extras not included: *HMI computer, SCADA client software, Face2Face, Night Position, Snow-Flood-Extreme Temp. Control or Cleaning Robot Integration.
**Face2Face, Night Position, Snow-Flood-Extreme Temp. Control or Cleaning Robot Integration.

The proprietary Tracker Monitoring System (TMS) software monitors tracker status. The control algorithm considers the following parameters, and automatically actuates positioning from TRACK to STOW per the following mode-logic schematic:

Features
Latitude, Longitude, Altitude, Time (UTC)
Tilt angle orientation, Land slope, Tracker tilt
Optional: Snow/Flood level/Temperature
Network Time Server for tracker synchronization
Teamtrack asymmetric backtracking control
Wind sensor trigger Stow Mode (high-wind resp.)
Database management, events and alarms log
Interface for intuitive control of the overall plant.

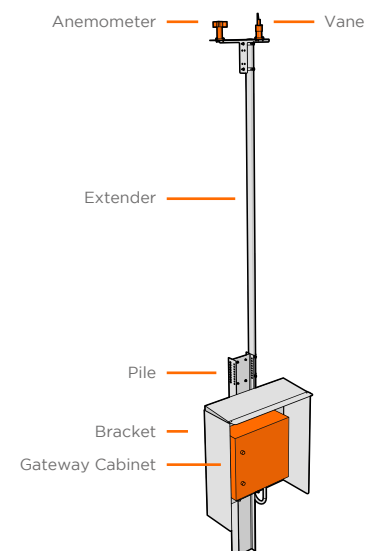


In order for Soltec to provide the product warranty, the client will be required to provide realtime data access from the tracker network to Soltec HQ. The customer commits to ease solar plant IT services to coordinate with Soltec on an IP address configuration for a securely controlled network access.

6.2 Gateway set

The TMS communicates to the gateway devices through TCP / IP protocol over ethernet. RS-485 or wireless network connects gateway cabinets to the tracker controllers.

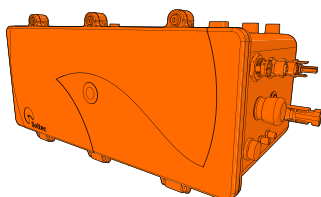
Web based configuration, monitoring, and control. Allows commissioning without TMS
Remote software updates
Each Gateway connects to several Headtrackers with a unique RS-485 daisy-chain communication cable
Outdoor cabinet (Indoor cabinets suited for too low or too high temperatures, preferably installed inside the Control Room)
8 gateways per box, 75 SF7 trackers per gateway maximum
Wind sensor to actuate Stow Mode on high wind alarm condition



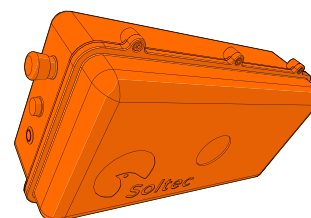
6.3 Tracker Controller

Each tracker has an individual controller. This device is connected to TMS via Gateway. Self-Powered Controller is **only** included with the Self-Powered configuration.

Self-Powered



Grid-Powered



Hybrid RS-485 + Radio communication	RS-485 full wired or hybrid
PV Series Power Supply, protections, and monitoring	-
Emergency stop with manual lock-out	
Inclinometer	
Tracker Status indicator	
Drive motor protected for overvoltage, overcurrent, and motor failure	
Fused-protected power conversion DC/DC	
Integrated electronic limit switch (patent pending) / optional: exterior mechanical limit switch	
Near Field Communication (NFC) with smartphones for instant data sharing and remote tracker control	

6.4 Typologies of communication

a. Hybrid RS-485 + Radio Communication

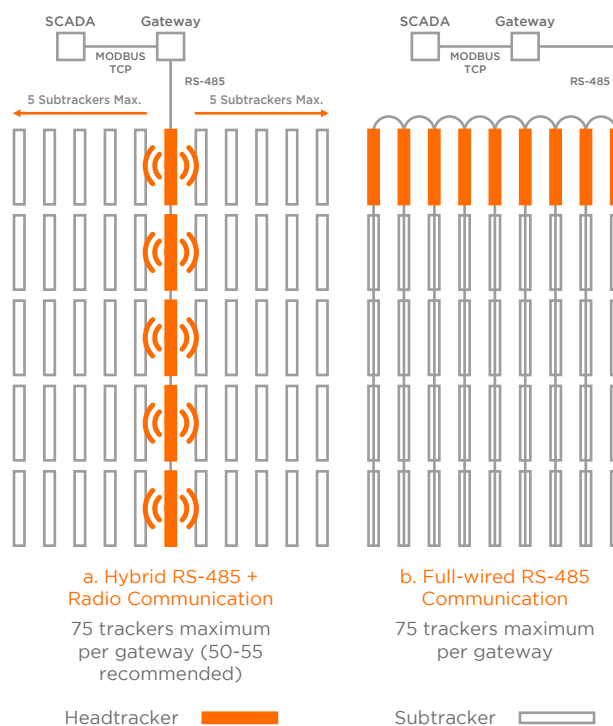
SF7 hybrid communications are based on a mix of a standard RS-485 communication protocol for Headtrackers and a wireless radio mesh network for Subtrackers.

- Wireless subtrackers: about 80%
- Mesh routing topology improves robustness
- Cable-saving installation

b. Full-wired RS-485 Communication

SF7 wired communications are based on a standard RS-485 protocol, structured in two levels:

1. Head-line: Connects every Headtracker with the gateway cabinet. Headtrackers work as data repeaters for Subtrackers.
2. Sub-line: Repeats Head-line signal.



2.4GHz wireless technology.
IEEE-802.15.4 based network protocol
RS-485 cable not included in Soltec scope

7. CONDITIONS FOR PROPER FOUNDATION

7.1 Pre-existing field considerations

Pull tests are usually performed over a representative survey of specific locations on an unaltered field. The tests show the behavior of a certain number of piles under specific loads. Soltec designs tracker foundations according to the data provided (pull test reports, geotechnical reports, ...). Civil works might change the features of the soil and latent defects not related in the project documentation might be found later (soft or rocky areas, land holes, underwater flows, existence of faults, active erosion processes, ...). Due to these reasons, Soltec will not be liable in case the initially suggested foundation design is not applicable. Then, Soltec could additionally propose and quote the customer alternative solutions of foundation.

7.2 Requirements of drainage of surface waters

Before a project begins, Soltec requires civil works to comply with the following requirements:

- Drain activities included in the hydrological survey of the project shall be carried out.
 - Necessary measures to prevent water accumulation in tracker foundations shall be implemented.
 - Actions needed to protect foundations against erosion induced by surface and subsurface water flows shall be performed.
- Soltec will not be liable of any construction delay or tracker component affected in case the customer do not comply with this requirement. Plus, Soltec will be entitled to charge the additional costs that inaction might take.

7.3 Conditions of fill compaction

Soltec requires civil work land-fills to comply with the following requirements:

- Proctor or modified Proctor compaction percentage ensuring that the CBR index* is within 5 and 30 or, alternatively, its NSPT is between 15 and 40.
- Material used shall have a low organic matter content and be free of tree branches, roots...
- Material used shall be free of pebbles and rocks with a size that might difficult the piles driving process.
- Material used shall not have a higher concentration of corrosive agents (chlorides, sulfates, sulfides, water-soluble salts) than the original soil of the lower layers to prevent altering the project's identified service life protection of the foundations.
- Minimum distance between piles and trenches (or another interferences) = 1 m (40 inches).

(* It is possible to establish a correlation in the lab between the CBR index and the standard or modified Proctor for the fill material used, as that would facilitate field compaction checks)

8. MAINTENANCE

No scheduled parts replacement. Only Bi-annual slewing-drive lubrication and self-powered battery replacement when required (between 5 and 10 years life).

Inspection Item	Yearly
Hot dip galvanizing state	✓
Positioning verification	✓
Simple pile bearings	✓
Fasteners	✓
Grounding cable	✓
Motor status	✓
Cabling and connectors	✓
Emergency stop function	✓
Limit switch	✓
Battery	✓

9. CERTIFICATES OF QUALITY

OHSAS 18001:2007
OHSAS 18001 Occupational
Health and Safety Management



ISO 9001:2015
ISO 9001 Quality
Management Systems



ISO 14001:2015
ISO 14001 Environmental
Management Systems



IEC 62817:2014
IEC 62817 Photovoltaic systems,
Design qualification of solar trackers



UL 3703
UL 3703 standard for solar trackers

