

REGIONE SARDEGNA
COMUNE DI CODRONGIANOS
PROVINCIA DI SASSARI

PROGETTO DEFINITIVO
PER LA REALIZZAZIONE E L'ESERCIZIO DI UN IMPIANTO SOLARE
AGRIVOLTAICO A TERRA DELLA POTENZA DI PICCO (DC) PARI A
39,99 MWp CON SISTEMA DI ACCUMULO, CON CONNESSIONE ALLA
RETE TERNA PER UNA POTENZA (AC) PARI A 30,8 MW.



Proponente: **SOLAR TORRES SRL**

VIA BORBOGNA, 8 - 20122 MILANO (MI)

TAVOLA:

D1.R09

ELABORATO:

DATASHEET

DATA STESURA
SETTEMBRE 2023

AGGIORNAMENTO

SCALA
-

PROPONENTE



SOLAR TORRES s.r.l.

Via Borgogna, 8
20122 Milano (MI)
PEC: solartorres@legalmail.it
P.IVA 10670410967



PROGETTAZIONE



MARE s.r.l.s.

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Via Galluzzi 5
70044 Polignano a Mare (BA)
Tel. 3382263891
P.IVA 08324050726



DEEP BLUE 4.0

Mono

630W n-type Bifacial Double Glass
High Efficiency Mono Module
JAM72D42 605-630/LB Series

Introduction

Power by the latest SMBB n-type solar cell, half-cell configuration, these modules have higher output power, lower LID, better weak illumination response, and better temperature coefficient.



Higher power generation
better LCOE



n-type with very Lower LID



Better weak illumination response



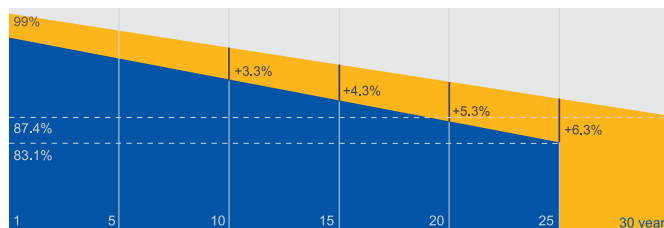
Better Temperature Coefficient

Superior Warranty

- 12-year product warranty
- 30-year linear power output warranty

1% 1st-year Degradation

0.4% Annual Degradation
Over 30 years



■ n-type Bifacial Double Glass Module
Linear Performance Warranty

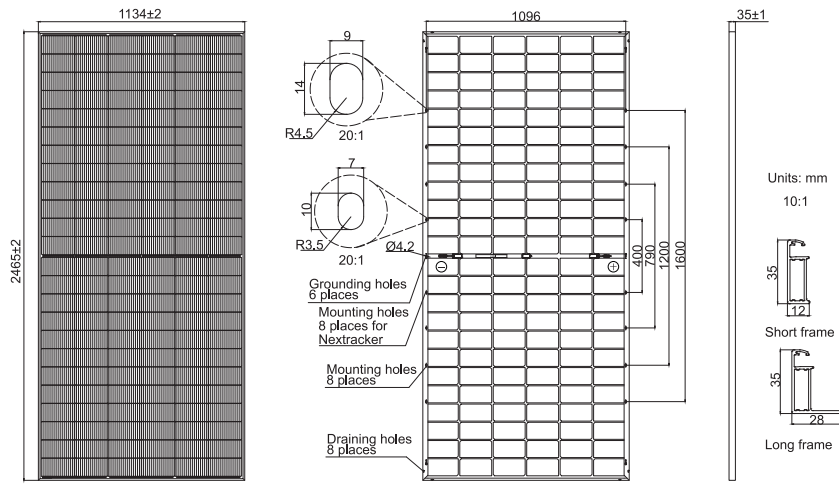
■ Standard Module Linear
Performance Warranty

Comprehensive Certificates

- IEC 61215, IEC 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- ISO 45001: 2018 Occupational health and safety management systems
- IEC 62941: 2019 Terrestrial photovoltaic (PV) modules - Quality system for PV module manufacturing



MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request

SPECIFICATIONS

Cell	Mono-16BB
Weight	34.6kg
Dimensions	2465±2mm×1134±2mm×35±1mm
Cable Cross Section Size	4mm ² (IEC), 12 AWG(UL)
No. of cells	144(6×24)
Junction Box	IP68, 3 diodes
Connector	QC 4.10-351/ MC4-EVO2A
Cable Length (Including Connector)	Portrait: 200mm(+)/300mm(-); 800mm(+)/800mm(-)(Leapfrog) Landscape: 1500mm(+)/1500mm(-)
Front Glass/Back Glass	2.0mm/2.0mm
Packaging Configuration	31pcs/Pallet, 496pcs/40HQ Container

ELECTRICAL PARAMETERS AT STC

TYPE	JAM72D42 -605/LB	JAM72D42 -610/LB	JAM72D42 -615/LB	JAM72D42 -620/LB	JAM72D42 -625/LB	JAM72D42 -630/LB
Rated Maximum Power(Pmax) [W]	605	610	615	620	625	630
Open Circuit Voltage(Voc) [V]	51.27	51.47	51.67	51.86	52.05	52.24
Maximum Power Voltage(Vmp) [V]	42.91	43.11	43.31	43.51	43.71	43.90
Short Circuit Current(Isc) [A]	14.83	14.88	14.93	14.98	15.03	15.08
Maximum Power Current(Imp) [A]	14.10	14.15	14.20	14.25	14.30	14.35
Module Efficiency [%]	21.6	21.8	22.0	22.2	22.4	22.5
Power Tolerance	0~+5W					
Temperature Coefficient of Isc(α _{Isc})	+0.046%/°C					
Temperature Coefficient of Voc(β _{Voc})	-0.260%/°C					
Temperature Coefficient of Pmax(γ _{Pmp})	-0.300%/°C					
STC	Irradiance 1000W/m ² , cell temperature 25°C, AM1.5G					

Remark: Electrical data in this catalog do not refer to a single module and they are not part of the offer.They only serve for comparison among different module types.

ELECTRICAL CHARACTERISTICS WITH 10% SOLAR IRRADIATION RATIO

OPERATING CONDITIONS

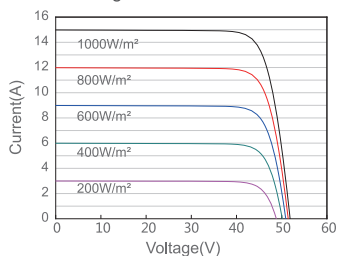
TYPE	JAM72D42 -605/LB	JAM72D42 -610/LB	JAM72D42 -615/LB	JAM72D42 -620/LB	JAM72D42 -625/LB	JAM72D42 -630/LB	Maximum System Voltage	1500V DC
Rated Max Power(Pmax) [W]	653	659	664	670	675	680	Operating Temperature	-40°C~+85°C
Open Circuit Voltage(Voc) [V]	51.27	51.47	51.67	51.86	52.05	52.24	Maximum Series Fuse Rating	30A
Max Power Voltage(Vmp) [V]	42.91	43.11	43.31	43.51	43.71	43.90	Maximum Static Load,Front*	5400Pa(112 lb/ft ²)
Short Circuit Current(Isc) [A]	16.01	16.07	16.12	16.18	16.23	16.29	Maximum Static Load,Back*	2400Pa(50 lb/ft ²)
Max Power Current(Imp) [A]	15.23	15.28	15.34	15.39	15.44	15.50	NOCT	45±2°C
Irradiation Ratio (rear/front)	10%						Bifaciality**	80%±10%
							Fire Performance	UL Type 29

*For Nextacker installations, maximum static load please take compatibility approve letter between JA Solar and Nextacker for reference.

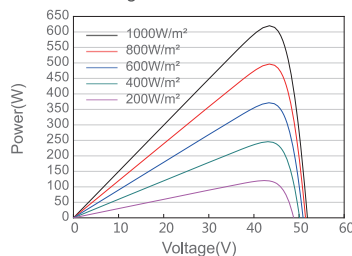
**Bifaciality=Pmax,rear/Rated Pmax,front

CHARACTERISTICS

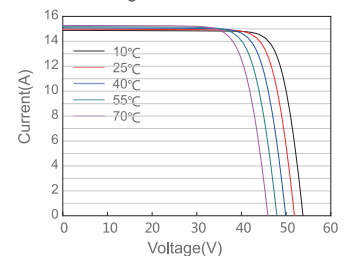
Current-Voltage Curve JAM72D42-620/LB



Power-Voltage Curve JAM72D42-620/LB



Current-Voltage Curve JAM72D42-620/LB





Agrivoltaic TRJ Tracker



Agrivoltaic

Agrivoltaic (or Agrovoltatics or Agrophotovoltaic), is a new technology approach which has the goal of enhancing the synergy between photovoltaic production and agriculture

It is becoming more and more popular thanks to new photovoltaic technology and efficiency

The main Idea is that photovoltaic structures coexist in the same portion of land of the crops (or other cultivation)



Italian Decree-law (LEGGE 29 luglio 2021, n. 108 sono agri-voltaici quegli impianti:



“che adottino soluzioni integrative innovative con montaggio dei moduli elevati da terra, anche prevedendo la rotazione dei moduli stessi, comunque in modo da non compromettere la continuità delle attività di coltivazione agricola e pastorale, anche consentendo l’applicazione di strumenti di agricoltura digitale e di precisione.”

Agrivoltaic

Has been demonstrated that Agrivoltaic configurations enhance both food and energy production compared to pursuing each activity as a standalone:

- Partial shading (e.g. crops, salads, artichokes, cherry tomato, ...) reduces the heat stress and drought
- Due to the cooling effect of plant transpiration there are also marginal improvements to electricity production



Valmont Solar TRJ tracker supporting medium size trees in the south of Italy

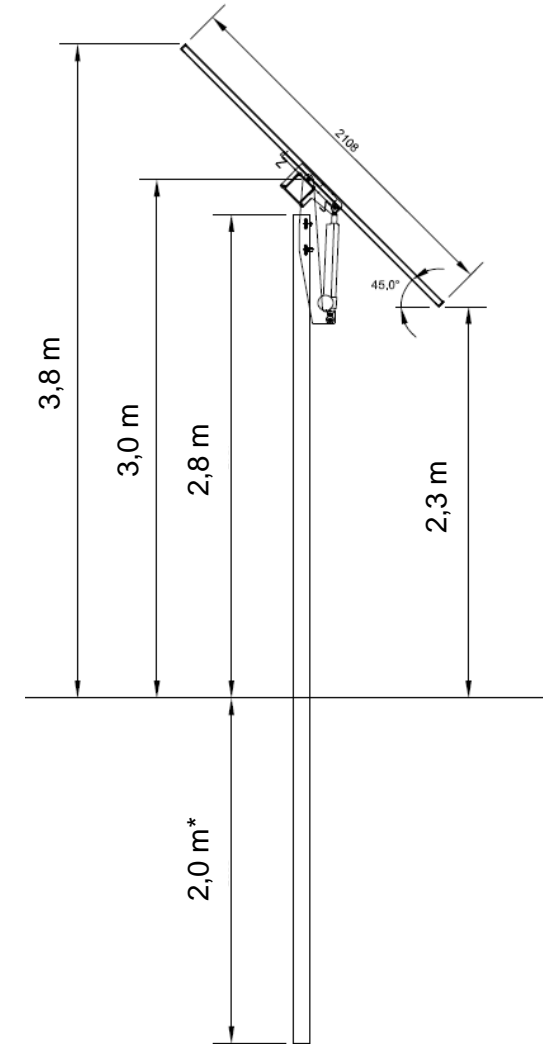
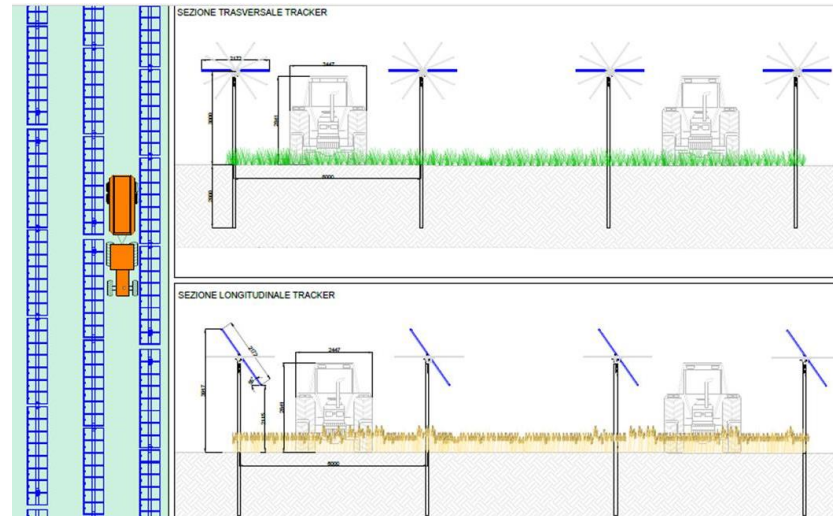
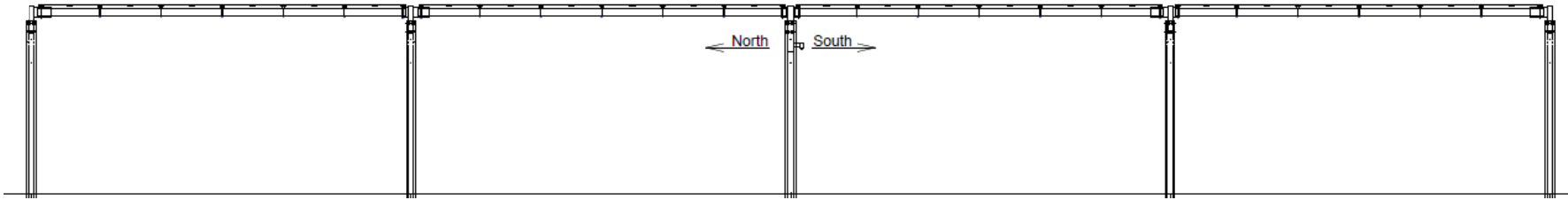


Valmont Solar TRJ shading flock of sheep in Spain

Image: Enel Green Power

TRJ Agrovoltaic

Tracker structure will be higher to allow the cultivation below to grow without problems



*depending of the type of soil

TRJ Agrovoltaic



TRJ Agrovoltaic



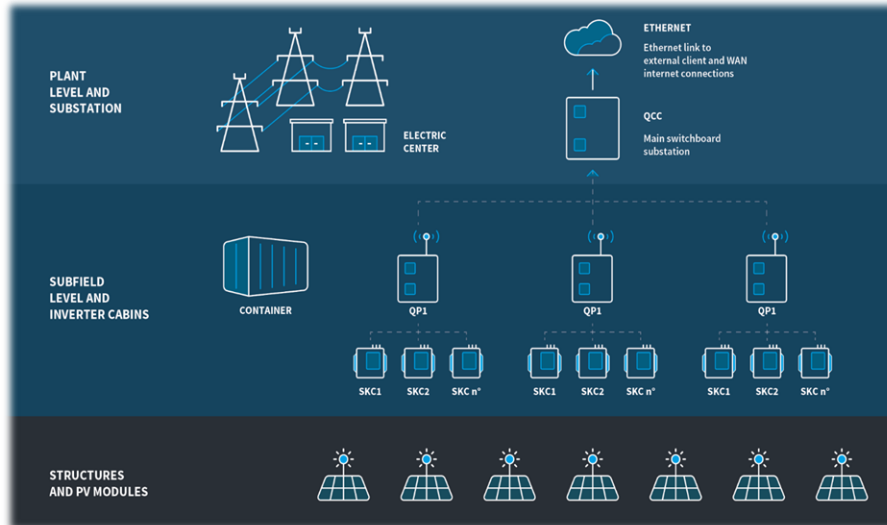
Monitoring and integration

TRJ-AI

- GPS, Snow, Wind
- Communication wired or wireless
- Production strategies (diffuse, backtrack, etc.)
- Cybersecurity
- Compatible with customer scada

Integration

- Plant's growth pattern
- Daily weather forecasts
- Farm sensors: temperature, humidity, growth
- Lower temperature peaks
- Reduction of soil water stress



Convert as active driver

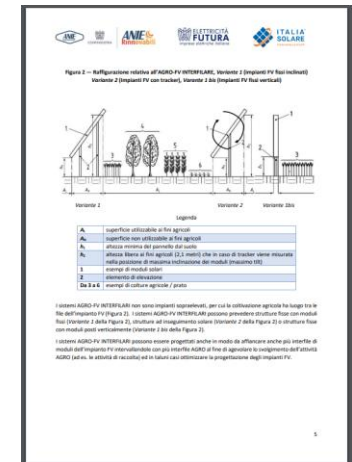
Research and Development

- First technology meetings with partners
- Limit for the technology
- Existing experiences
- Future developments (demo structures)



Lobbying

- Round table with trade associations
- Clear definition of the technology
- Round tables for definition of Best Practice
- Discussion about incentive schemes





Next Steps

- Clear definition of markets size for Italy and Europe
- Development of incentive schemes favorable for trackers
- Structural definition and wind tunnel testing

Symbiosyst EU Project

First meeting (end of Oct-22) for the SYMBIOSYS EU Project at “Centro di Sperimentazione Laimburg”

Main goal:

- To discuss the future steps of the Projects
- To check the field of apple trees
- To understand limits for tracker application
- To discuss about why an apple per day keeps the doctor away



Technical take aways

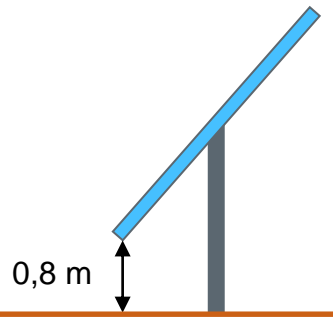
- In the Region (Trentino) it is forbidden to install PV on the ground → Agrivoltaics can avoid this limit.
- Distance between trees row 2m or 3m
- Minimum height of the tree 3m – 3,5m + anti-hail cover (around 4m)
- Foundations for the apple trees are in concrete (9x9 cm), depth 80cm below the ground, height 4,8m



Different approach for AgriSun 2.0

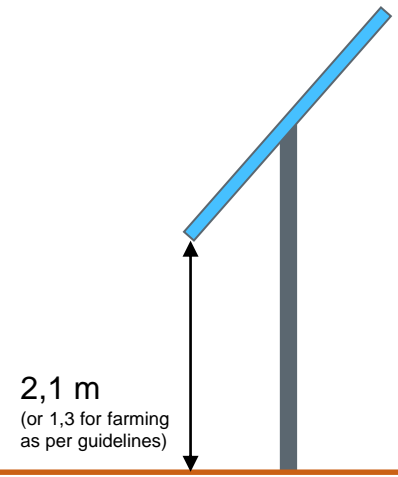
No incentives

AgriSun Crops

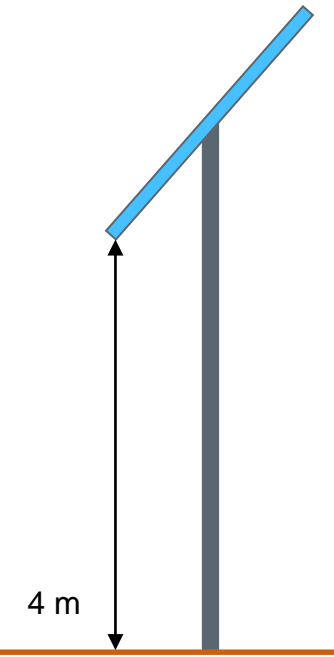


Incentives

AgriSun Fruits (Scalea)



AgriSun Apple



**MEDIUM VOLTAGE
POWER STATION
CUSTOMIZED UP
TO 7.65 MVA,
WITH ALL THE
COMPONENTS
SUPPLIED ON TOP
OF THE SAME
SKID PLATFORM**

From 2500 up to 7650 kVA

This medium-voltage solution integrates all the necessary elements to develop a large-scale solar PV plant.

Maximize your investment with a minimal effort

Ingeteam's FSK power station is a compact, customizable and flexible solution that can be configured to suit each customer's requirements. It is supplied together with up to two photovoltaic inverters. All the equipment is suitable for outdoor installation, so there is no need of any kind of housing.

Higher adaptability and power density

This power station is now more versatile, as it presents the MV transformer integrated into a steel platform together with the LV and MV components, including the PV inverters. Moreover, it features one of the market's greatest power densities.

Plug & Play technology

This MV solution integrates power conversion equipment (up to 7.65 MVA), liquid-filled hermetically sealed transformer up to 36 kV and

provision for low voltage equipment. The MV Skid is delivered pre-assembled for a fast on-site connection with up to two PV inverters from Ingeteam's INGECON® SUN 3Power C Series inverter family.

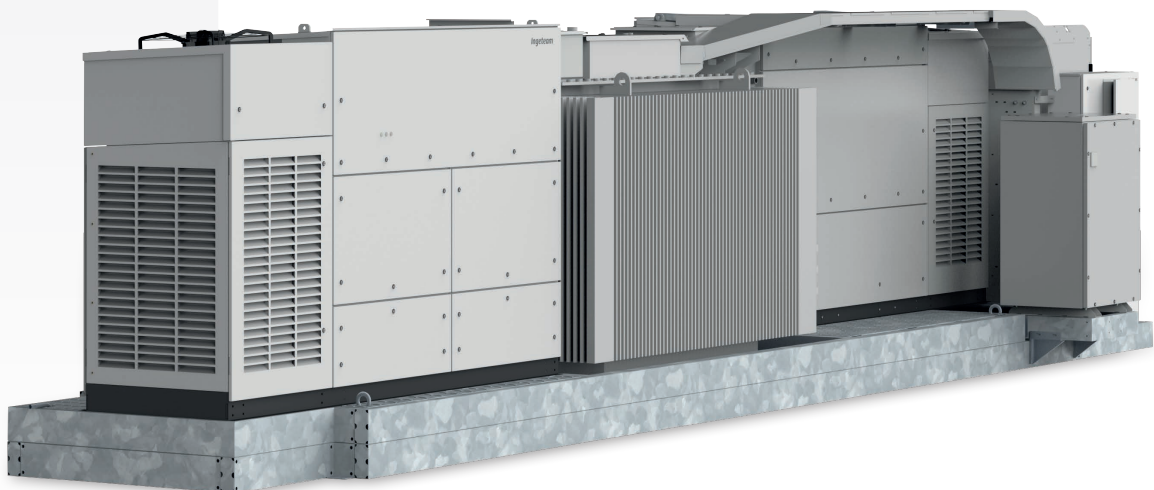
Complete accessibility

Thanks to the lack of housing, the inverters, the switchgear and the transformer can have immediate access. Furthermore, the design of the 3Power C Series central inverters has been conceived to facilitate maintenance and repair works.

Maximum protection

Ingeteam's 3Power C Series central inverters feature an IP65 protection class for their power stacks thanks to a combined water and air cooling system that optimises the operating temperature of the power electronics.

Apart from that, they feature the main electrical protections and they deploy grid support functionalities, such as low voltage ride-through capability, reactive power deliverance and active power injection control.



CONSTRUCTION

- Steel base frame.
- Suitable for slab or piers mounting.
- Compact design, minimising freight costs.
- Minimum installation at project site.

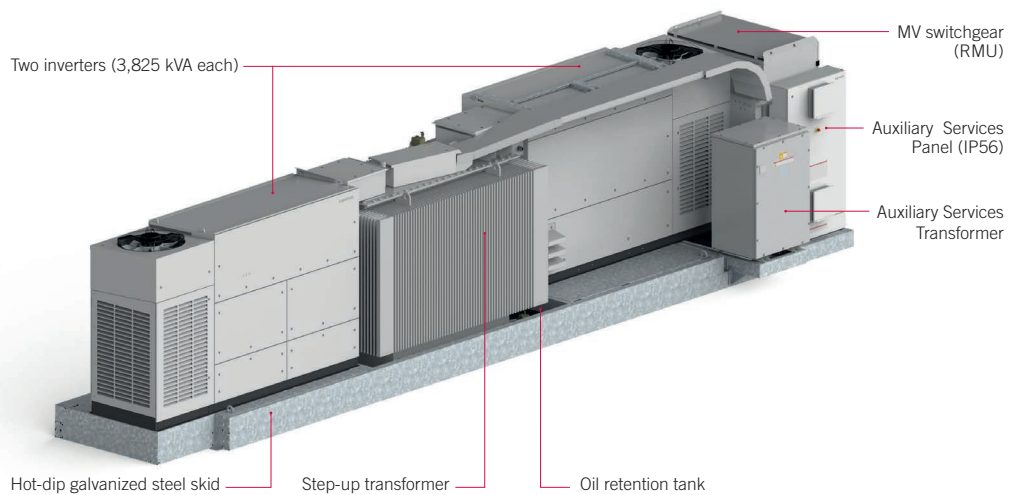
OPTIONAL ACCESSORIES

- Auxiliary services transformer (up to 60 kVA, Dyn11).
- MV Surge arresters.
- Auxiliary services panel (IP56)
- Power plant commissioning.
- High-speed Ethernet / fibre optic communication infrastructure for Plug & Play connection to the Power Plant Controller and/or SCADA systems.
- INGECON® SUN StringBox with 16 / 24 / 32 input channels. Intelligent or passive string combiner box.
- Energy meter for auxiliary services and/or energy production.
- Insulation monitoring relay for continuous monitoring of IT systems insulation.
- Reactive power regulation when there is no PV power available.
- Ground connection of the PV array.

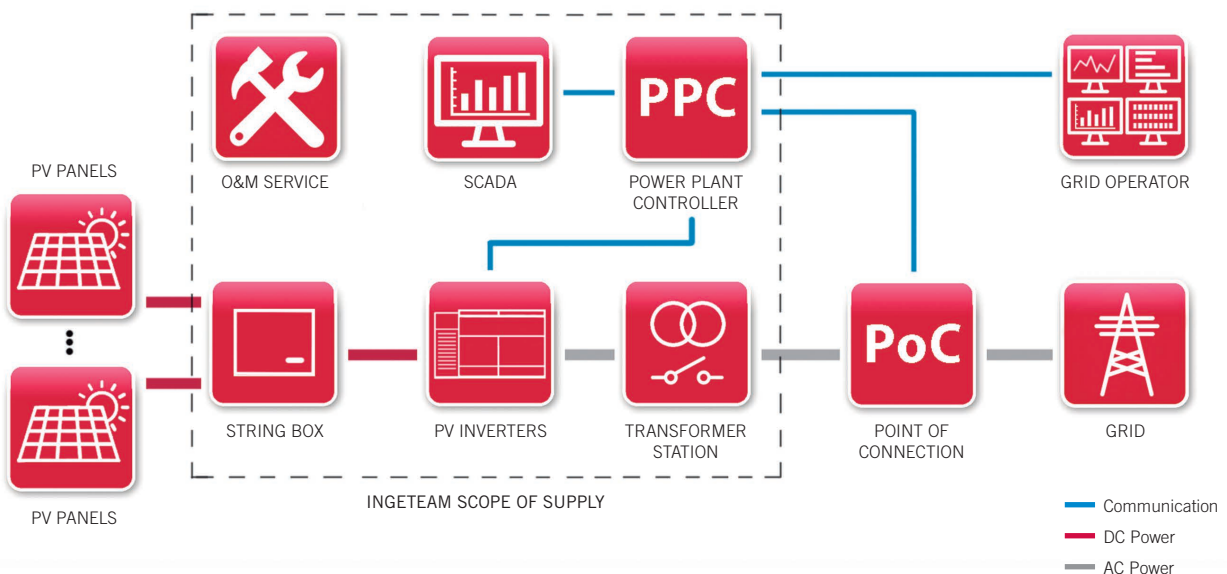
STANDARD EQUIPMENT

- Up to two inverters with an output power of 7.65 MVA.
- Liquid-filled hermetically-sealed transformer up to 36 kV.
- 1L1A MV switchgear (2L1A optional).
- Oil-retention tank.
- Metal frame for installation of LV equipment.

COMPONENTS



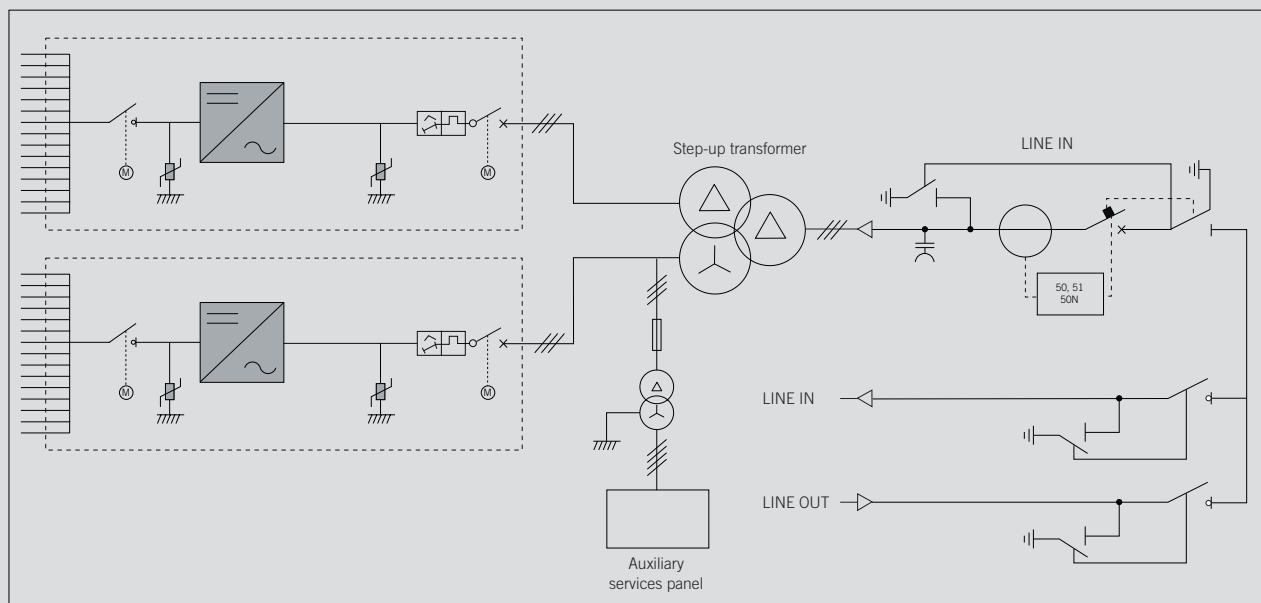
PLANT CONFIGURATION



	3825 FSK C Series	7650 FSK C Series
General information		
Number of inverters	1	2
Max. power. @35 °C / 95 °F ⁽¹⁾	3,824 kVA	7,648 kVA
Operating temperature range	from -5 °C to +50 °C	
Relative humidity (non condensing)	0 - 100%	
Maximum altitude	3,000 masl (power derating starting at 1,000 masl)	
LV/MV Transformer		
Medium voltage	From 20 kV up to 36 kV, 50-60 Hz	
Cooling system	ONAN (KNAN optionally)	
Minimum PEI (Peak Efficiency Index) ⁽²⁾	99,50%	
Protection degree	IP54	
MV Switchgear (RMU)		
Medium voltage	24 kV / 36 kV / 40.5 kV	
Rated current	630 A	
Cooling system	Natural air ventilation	
Protection degree	IP54 (IP55 optionally)	
Equipment		
Auxiliary services panel	Standard version (optional monitoring system)	
Step-up transformer	Oil-immersed hermetically sealed transformer	
MV Switchgear	1L1A cells (2L1A optional)	
Mechanical information		
Structure type	Hot dip galvanized steel skid	
Dimensions Full Skid (W x D x H)	9,500 x 2,600 x 2,620 mm	11,390 x 2,600 x 2,620 mm
Full Skid	16 T	25 T
Standards	IEC 62271-212, IEC 62271-200, IEC 60076, IEC 61439-1	

Notes: ⁽¹⁾ Maximum power calculated with the inverter model INGECON® SUN 3825TL C690. For other inverter models, please contact Ingeteam's Solar sales department ⁽²⁾ For European installations, ECO design according to the EU 548/2014 and EU 2019/1783 standards.

Configuration with two C Series solar inverters



**DC/DC CONVERTER
FOR 1,500 V
BATTERY ENERGY
STORAGE SYSTEMS**

Bi-directional buck-boost converter directed at standalone or PV-coupled 1,500 V battery energy storage systems.

Modular design

It features a modular design that combines up to four 90 A power conversion modules that could operate in parallel or independently. Thus, providing 360 A of total current. This modularity means that a single DC/DC converter could be connected to one battery sys-

tem or to two or four independent battery systems / racks. Parallel battery energy storage systems could be added without limitation, increasing dramatically the number of hours of capacity of the overall system.

BESS augmentation strategy

This converter allows for deploying a modular BESS augmentation strategy to compensate battery degradation over time.

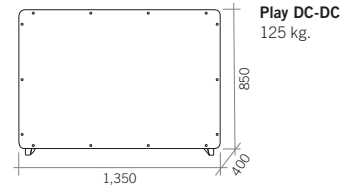
PROTECTIONS

- Type II surge arresters.
- Reverse polarity.
- Insulation failure monitoring.
- Overheat protection.

FEATURES

- Three-level topology.
- Modular design with four 90 A power conversion modules.
- Different battery input configurations for one, two or four independent BESS.
- Rack-level battery management.
- Compatible with 1,500 V battery systems.
- Forced air ventilation for an optimized converter cooling.
- High protection degree IP65 / NEMA 3R.
- Fast & easy commissioning.
- Integrated web interface.

SIZE AND WEIGHT (MM)



PV input optional

Optionally, it could integrate an additional solar PV input for solar+storage hybrid systems with an oversized PV system or for DC microgrids. In this case, a MPPT function would be included. For DC microgrids, an MPPT function would be included.

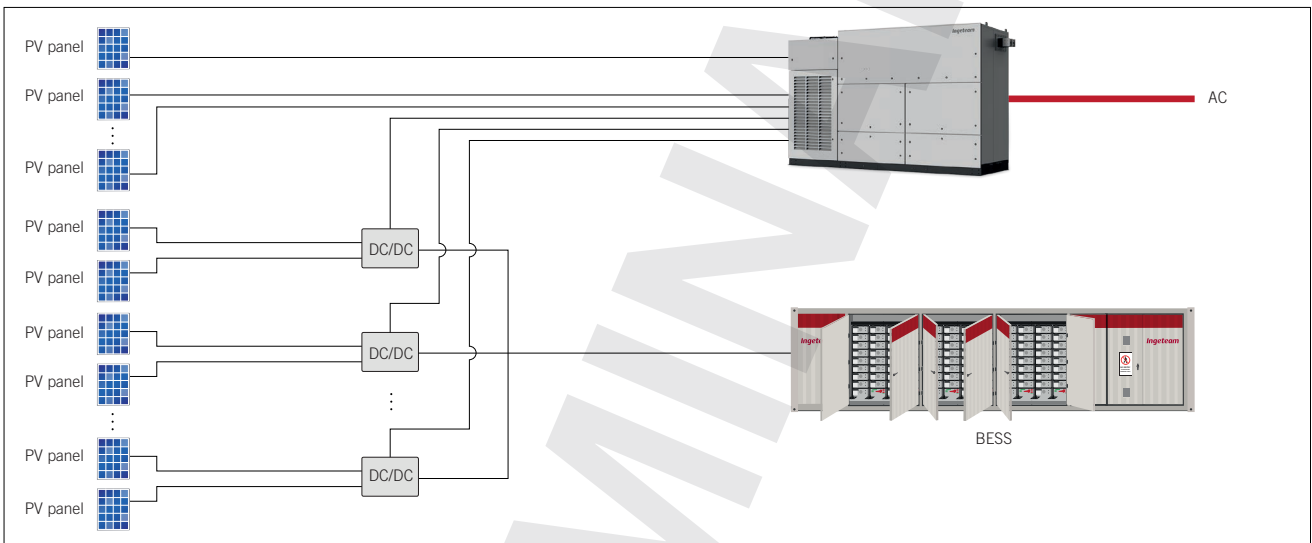
DC-coupled Solar+Storage systems

A very interesting application for this converter is the creation of DC-coupled solar+storage hybrid systems at utility scale. In combination with Ingeteam's central photovoltaic inverters, the DC-DC converter enables to oversize the solar PV array, while adding a battery energy storage system.

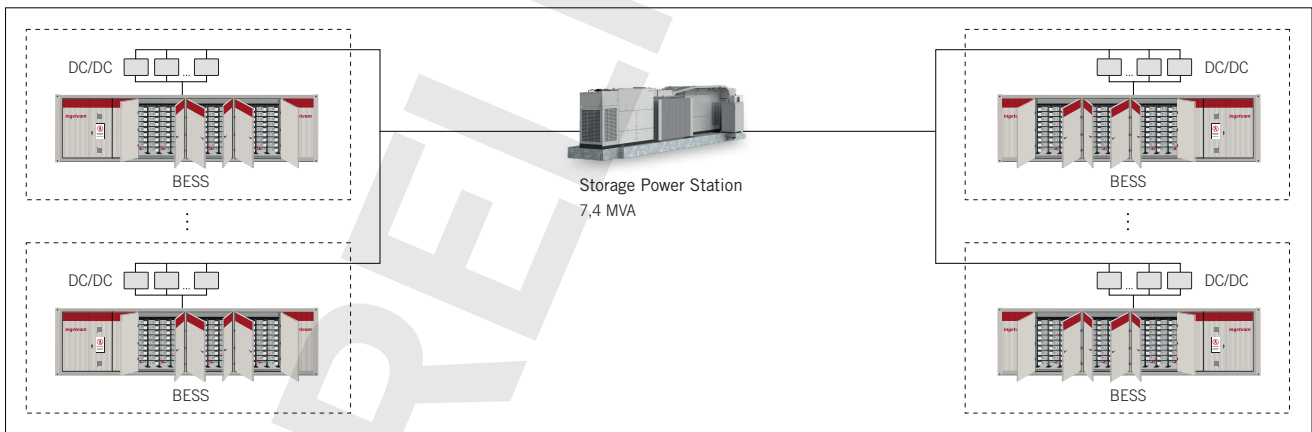
DC/AC ratio control algorithm

An advanced control algorithm allows for an improved control of the DC/AC ratio at utility scale solar farms.

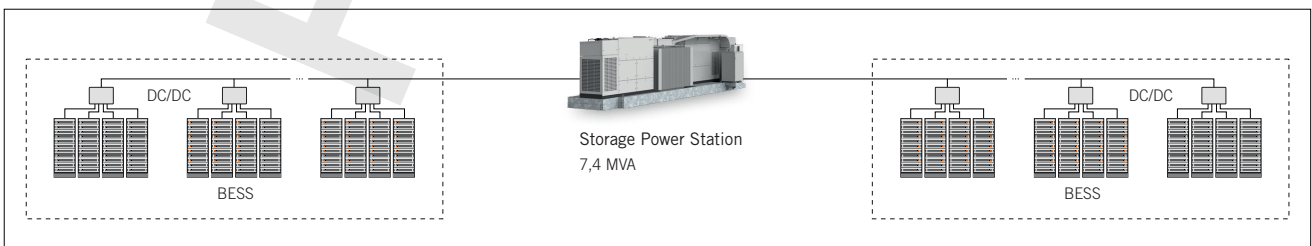
SOLUTION FOR DC-COUPLED SOLAR+STORAGE SYSTEMS



SOLUTION FOR BATTERY CONTAINERS WITH A SINGLE OUTPUT: converters with battery input and DC bus input in parallel



SOLUTION FOR INDEPENDENT RACKS: Converters with DC bus input in parallel



430 DC-DC

Rated power			
Nominal power @ 1,200 Vdc	432 kW		
Battery side			
Max. DC voltage	1,500 V		
Operating voltage range	500 - 1,500 V		
Number of inputs	1	2	4
Max. DC current per input @35 °C / 50 °C	360 A / 310 A	180 A / 155 A	90 A / 77.5 A
DC bus side			
Max. DC voltage	1,500 V		
Operating voltage range	500 - 1,500 V		
Max. DC current	360 A		
PV input (optional)			
Number of inputs	2		
Maximum total current	500 A		
Fuse dimensions	Up to 630 A / 1,500 V		
Protections			
Overvoltage protections	Type II surge arresters		
Reverse polarity	Yes		
Insulation failure monitoring	Yes		
Overheat protection	Yes		
General information			
Maximum efficiency	99%		
Cooling system	Forced ventilation		
Air flow	900 m ³ /h		
Stand-by consumption	25 W		
Operation temperature	-30 °C to +60 °C		
Relative humidity (non-condensing)	0 - 100%		
Protection class	IP65 / NEMA 3R		
Residual current monitoring unit	Yes		
Maximum operating altitude	4,000 m		
Marking	CE		
Compliance	IEC 62477-1; IEC 62109-1; UL1741		

Single-line diagram

