

**BATTERY  
INVERTERS WITH  
A DCAC CABINET**

**500TL X400 DCAC Indoor / 750TL X400 DCAC Indoor /  
1000TL X400 DCAC Indoor**

Ingeteam has developed the INGECON® SUN STORAGE PowerMax (EMS: *Energy Management Solutions*) family of inverters, designed to integrate energy storage systems into PV plants.

**Integration of batteries into PV plants**

The use of energy storage systems at PV plants helps to improve the integration of solar energy into the electricity grid, particularly in the case of a weak grid or one with a high solar energy penetration.

The INGECON® SUN STORAGE PowerMax inverters are compatible with the range of battery technologies currently available, such as Lead, Ni-Cd, Redox and Lithium, ensuring that the most suitable technology can be used for each specific application.

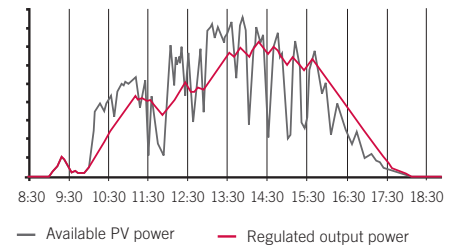
The use of energy storage systems makes it possible to implement different plant operating strategies, such as the control of the plant power output variability or the generation of a constant power output.

**Control of the power output variability**

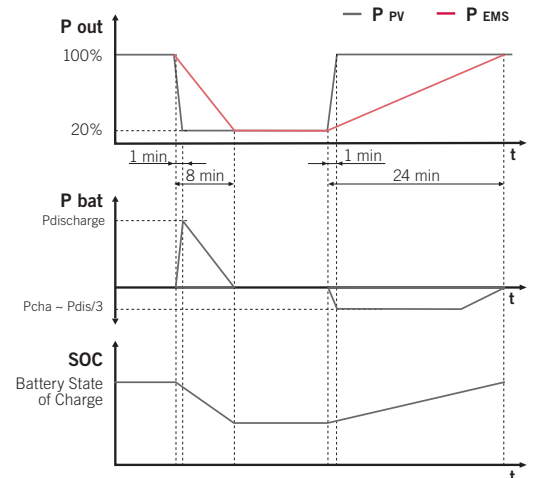
The variation in irradiance caused by passing clouds produces power output variations that can be as great as 80% of the rated power of the plant per minute, depending on the size of the plant and the weather conditions at the site.

The use of INGECON® SUN STORAGE PowerMax inverters, together with their corresponding batteries, makes it possible to reduce the dynamics of these variations and to adapt to the requirements imposed by grid operators, improving the quality of supply and ensuring the high integration of solar energy into the electricity system.

An energy storage system makes it possible to control the plant power output ramps, based on pre-established values. Whenever a cloud passes over, with the subsequent loss of irradiance, the storage system provides the energy required to offset the energy shortfall, whilst the power output is progressively reduced until it is equal to the PV power. Once the cloud has gone, the available power increases sharply and this is used to charge the batteries whilst smoothly increasing the power output.



Output power at an actual 1 MW PV plant on a day with scattered clouds, with and without energy storage systems, implementing constant power control.



Example of the system performance in the face of an 80%/min fluctuation in irradiance (up and down), in accordance with the 10%/min output power variation requirement.

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This option is based on conventional grid-connected inverters for the PV generation and dedicated inverters to connect the batteries to the electricity grid. This option can be installed in PV plants that are already operating. It offers the possibility of providing reactive energy with the battery inverters, thereby avoid-

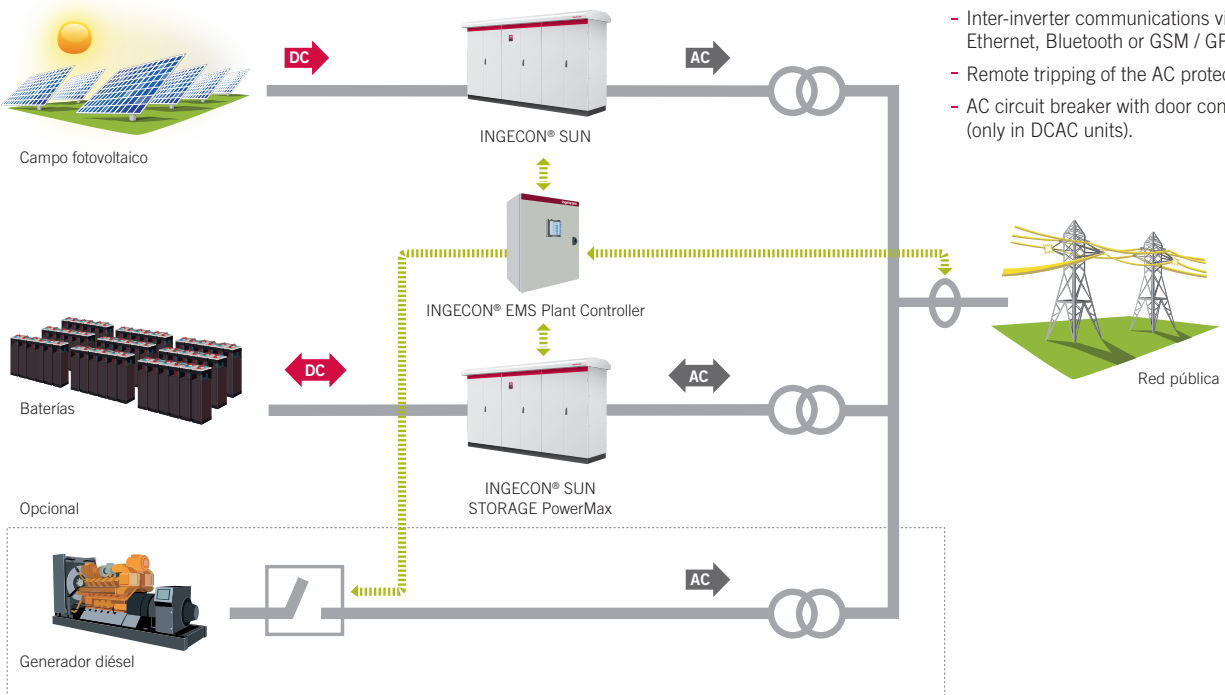
ing the need to over-size the PV inverters should there be strict reactive power delivery requirements. For this topology, a plant controller manages the energy flow between the grid and the batteries, adjusting the plant generation to a pre-established pattern.

PROTECTIONS

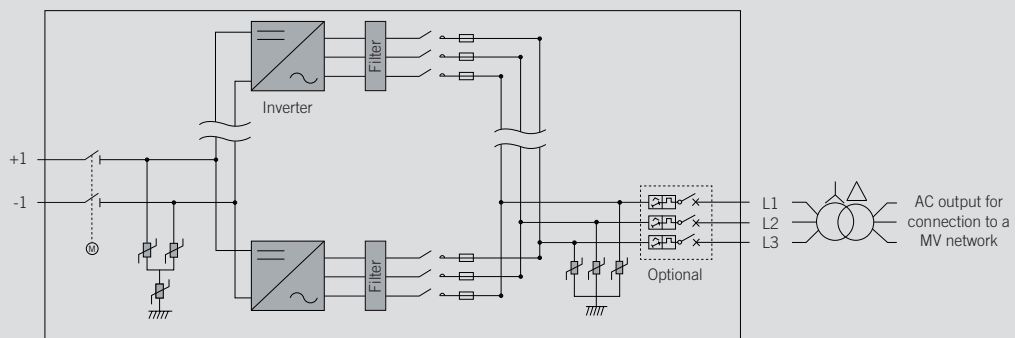
- Short-circuits and overloads at the output.
- Anti-islanding with automatic disconnection.
- Isolation monitor.
- DC load break switch.
- Lightning induced DC and AC surge arresters, type 2.

OPTIONAL ACCESSORIES

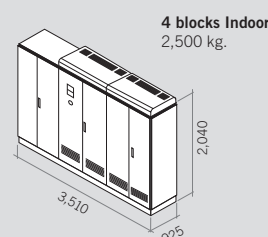
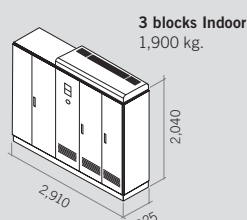
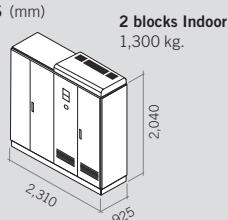
- Inter-inverter communications via Ethernet, Bluetooth or GSM / GPRS.
- Remote tripping of the AC protection.
- AC circuit breaker with door control (only in DCAC units).



SUN STORAGE PowerMax DCAC



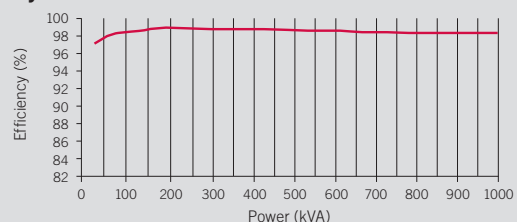
Weight and dimensions (mm)



	500TL X400 DCAC Indoor	750TL X400 DCAC Indoor	1000TL X400 DCAC Indoor
<b>Input (DC) (Battery)</b>			
Battery voltage range	636 - 820 V	636 - 820 V	636 - 820 V
Maximum current	900 A	1,350 A	1,800 A
Type of battery	Li-ion, lead, Ni-Cd		
Connection type	Connection to fuse holder copper bars, cable entry from the bottom through D40 cable glands (max. cable diameter: 40 mm)		
<b>Input protections</b>			
Overvoltage protections	Type 2 DC surge arresters (for each power stage)		
DC switch	Motorized DC switch with door control		
Other protections	Up to 16 pairs of DC fuses, DC insulation monitor with alarm, emergency pushbutton		
<b>Output (AC)</b>			
Rated power <sup>(1)</sup>	510 kVA	764 kVA	1,019 kVA
Maximum current	736 A	1,104 A	1,472 A
Rated voltage	400 V IT System	400 V IT System	400 V IT System
Frequency	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz
Phi Cosine <sup>(2)</sup>	1	1	1
Phi Cosine adjustable	Yes. Smax=510 kVA	Yes. Smax=764 kVA	Yes. Smax=1,019 kVA
THD (Total Harmonic Distortion) <sup>(3)</sup>	<3%	<3%	<3%
Connection type	Connection to fuse holder copper bars, cable entry from the bottom through D40 cable glands (max. cable diameter: 40 mm)		
<b>Output protections</b>			
Overvoltage protections	Type 2 AC surge arresters		
AC breaker	Optional AC circuit breaker with door control, motorized or remote trip		
Anti-islanding protection	Yes, with automatic disconnection (for each power stage)		
Other protections	AC fuses, AC short circuits and overloads (for each power stage)		
<b>Features</b>			
Maximum efficiency	98.8%	98.8%	98.8%
Euroefficiency	98.6%	98.6%	98.6%
CEC	98.1%	98.1%	98.1%
Stand-by consumption <sup>(4)</sup>	120 W	120 W	120 W
<b>General Information</b>			
Ambient temperature	-20 °C to +65 °C	-20 °C to +65 °C	-20 °C to +65 °C
Relative humidity (non-condensing)	0 - 95%	0 - 95%	0 - 95%
Protection class	IP20	IP20	IP20
Max. altitude <sup>(5)</sup>	3,000 m	3,000 m	3,000 m
Cooling system	Forced air with temperature control (230 V phase + neutral power supply)		
Air volume	2,670 m <sup>3</sup> /h (fans: 1,230 W)	4,640 m <sup>3</sup> /h (fans: 2,050 W)	5,340 m <sup>3</sup> /h (fans: 2,460 W)
Noise emission	<55 dB(A) at 4 m and <67 dB(A) at 1 m with fans working at maximum power		
Marking	CE		
EMC & Security standards	EN 50178, IEC 61000-6-2, IEC 61000-6-4, FCC Part 15		
Grid connection standards	BDEW MT, RD 661/2007, P.O.12.3, CEI 11-20, CEI 0-16, Allegato 70 TERNA, Arrêté 23-04-2008, IEEE 1547, G59/2		

**Notes:** <sup>(1)</sup> AC Power for 45 °C ambient temperature. For each °C of increase, the output power will be reduced at the rate of 1.8% <sup>(2)</sup> For P<sub>out</sub>>25% of the rated power <sup>(3)</sup> For P<sub>out</sub>>25% of the rated power and voltage in accordance with IEC 61000-3-4 <sup>(4)</sup> Consumption from PV field <sup>(5)</sup> Over 1,000 m temperature for rated power (45 °C) is reduced at the rate of 4.5 °C for each 1,000 m.

**Efficiency INGECON® SUN STORAGE 1000TL X400** V<sub>dc</sub> = 650 V





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