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# VASCO Solar

Inverter for solar pumping applications



# Photovoltaic energy applied to pumping systems

VASCO Solar inverters come to power traditional pumping systems using photovoltaic energy.

In this way it's possible to convert old systems in renewable energy installations or to use the same AC pumps in the creation of independent, cost-saving and environmentally sustainable water systems.

VASCO Solar is able to convert DC voltage coming from photovoltaic panels into AC voltage for powering any pump driven by three phase asynchronous motor.

Pump speed is constantly adapted to available solar irradiation thus maximizing the amount of pumped water and making possible operation even in low irradiation conditions.

VASCO Solar also offers complete pump protection against over-voltage, over-current and dry running.



## VASCO Solar: designed to resist



VASCO Solar is entirely built of aluminum to ensure maximum cooling and durability. All metal parts are AISI 304 stainless steel made thus resistant to corrosion.

IP65 protection degree makes possible installation even outdoor.

Two independent external fans and an internal fan provide perfect cooling. Their operation is adjusted according to actual thermal conditions thus extending life.

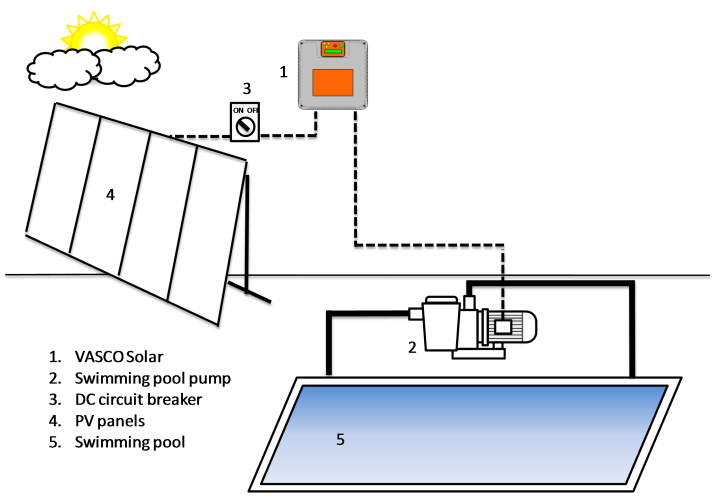
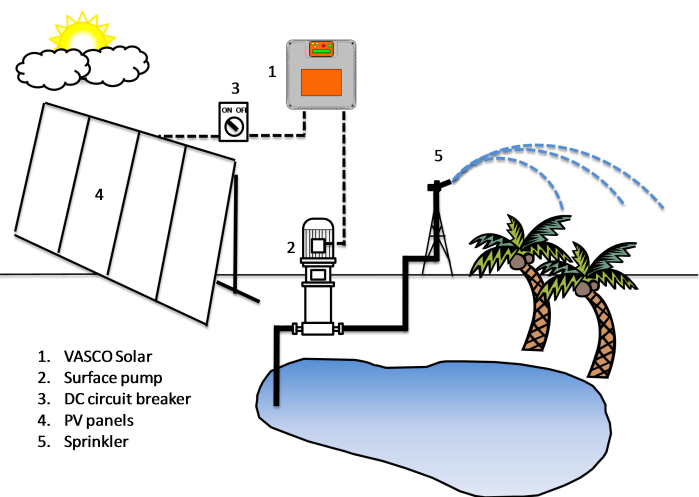
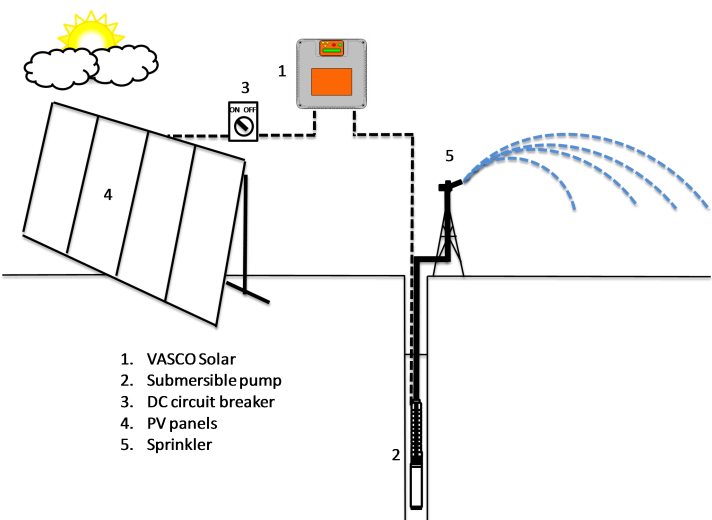
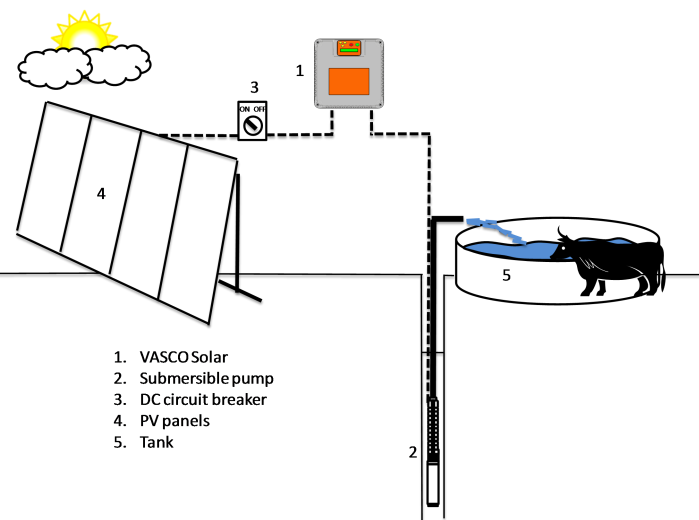
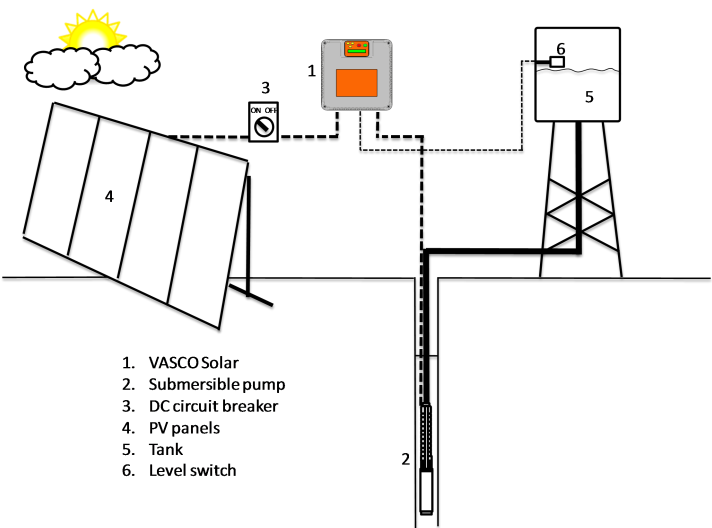
The membrane keyboard-cover protects the display from UV rays.

# Maximum flexibility of use

VASCO Solar can be used with any type of traditional AC pump thus offering maximum flexibility in several application areas.

In the use with submersible pumps, VASCO Solar allows to fill tanks for watering livestock or simply irrigate lawns or crops.

In the use with surface pumps, VASCO Solar can serve an irrigation fishing from a nearby water reserve or feed with no energy cost a pool pump.



# MPPT: always the maximum power available

In the application with photovoltaic panels MPPT (Maximum Power Point Tracking) maximizes, for various conditions of irradiation and temperature, the electrical power drawn from the panels so the amount of pumped water.

When the irradiation grows, the pump increases its rotation speed and so water flow increases.

When the irradiation decreases (passage of clouds or different times of the day), the pump reduces the frequency and thus the flow but continues to provide water until the irradiation does not fall below a minimum necessary to ensure the operation.

## Multiple operation modes

VASCO Solar, apart from MPPT control, offers other several operation modes such as:

- Fix frequency operation with 1 or 2 reference values selectable via digital input.
- Operation by external frequency reference adjustable via analog input 4-20 mA or 0-10 VDC (trimmer).
- Operation at constant pressure with 1 or 2 reference values.

This last operation mode is particularly indicated in those plants where it's preferred to store electrical energy in batteries and use it when it occurs.

To ensure maximum energy saving, and lengthen batteries life, it's useful to select constant pressure mode in which the pump speed, and so the power consumption, is varied while maintaining a constant desired pressure.

## Parameters monitoring

VASCO Solar is equipped with a backlit alphanumeric display and it's designed to monitor key electrical parameters such as input voltage, power, current and motor power factor.

It's also possible to connect a pressure or flow sensor thus detecting provided performance.

In the diagnosis menu are recorded inverter and motor hours, operation statistics, and the last eight alarms occurred.

The programming menus are password-protected to

prevent unwanted tampering.

## Advanced connectivity

VASCO Solar allows to connect:

- An alarm signal
- A motor run/stop signal
- A pressure sensor or a flow sensor for performance monitoring
- Up to four digital inputs for pump start and stop (float switch, level sensors, etc ...)

## Complete pump protection

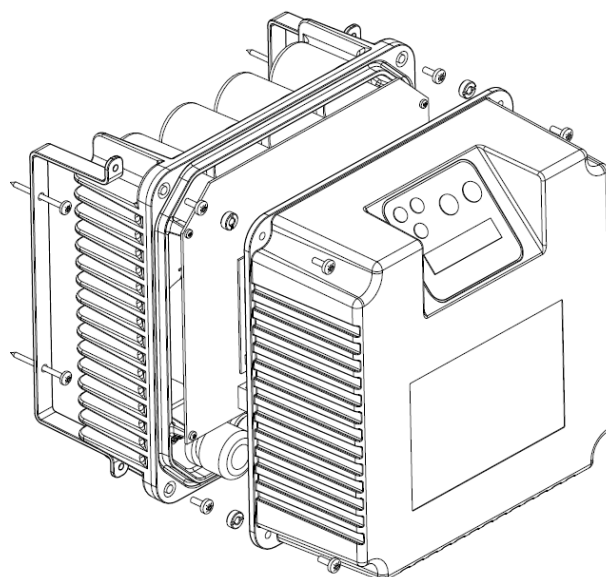
VASCO Solar is able to protect the pump against overload and dry running.

In particular, dry running protection is performed by monitoring motor power factor and therefore use of probes is not required.

VASCO Solar also protects itself against over-voltage and over-temperature.

## Easy installation

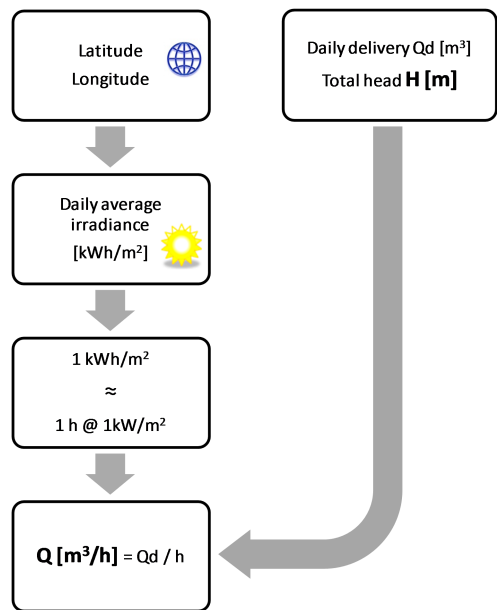
VASCO Solar can be fixed to the wall with included wall-kit. The integrated fans are easily replaceable in case of failure or maintenance.



# PV system sizing

The pumping system must be designed considering daily flow rate required, total head and installation site.

In particular, the choice of the pump must be carried out considering the average daily radiation.



Once determined the required pump, must need to know:

- Rated pump power ( $P_2$ )
- Electrical motor power ( $P_1$ ).  $P_1$  can be derived by dividing  $P_2$  with motor efficiency.
- Rated motor current
- Rated motor voltage (3 x 230 VAC or 3 x 400 VAC)

VASCO Solar model to be used is determined by considering voltage and rated motor current.

To ensure maximum performance, the PV system, consisting of 1 or more strings of solar panels connected in series, must provide:

- Electrical motor power ( $P_1$ )

The photovoltaic power ( $W_p$ ) must be at least equal to the electric motor power ( $P_1$ ). Typically, taking into account the efficiency loss due to panels temperature, it is recommended to increase  $W_p$  of 15% respect to  $P_1$ .

- Rated motor voltage at maximum power

The rated voltage of each PV string ( $V_{mp}$ ) must be at least equal to the rated motor voltage multiplied by the factor 1,4.

- The short-circuit voltage of each string ( $V_{oc}$ ) must be less than the maximum operating voltage of VASCO Solar.

Example:

## Pump nameplate

- Rated motor power:  $P_2 = 3$  kW
- Electric motor power:  $P_1 = 4$  kW
- Rated motor current: 8.3 A
- Rated motor voltage: 3 x 400 VAC

## VASCO Solar selection

Being the rated motor voltage 400 VAC and the rated current 8.3 A, the most suitable model for the application is VASCO Solar 409.

## PV system sizing

PV panels used:

- $W_p = 240$  W
- $V_{mp} = 30$  VDC
- $V_{oc} = 37$  VDC
- $I_{mp} = 8$  A

Since  $P_1 = 4$  kW, considering efficiency loss due to temperature, the required electrical power is increased of 15% so  $W_p = 4.6$  kW.

To develop 4.6 kW are needed 19 panels of 240 W.

$V_{mp} = 19 \times 30 = 570$  VDC is greater than the rated motor voltage multiplied by 1.4 ( $400 \times 1.4 = 560$  VDC) and  $V_{oc} = 19 \times 37 = 703$  VDC is less than the maximum voltage of VASCO Solar 409 (850 VDC).

For this reason a single string of 19 PV panels can be installed.

# General characteristics

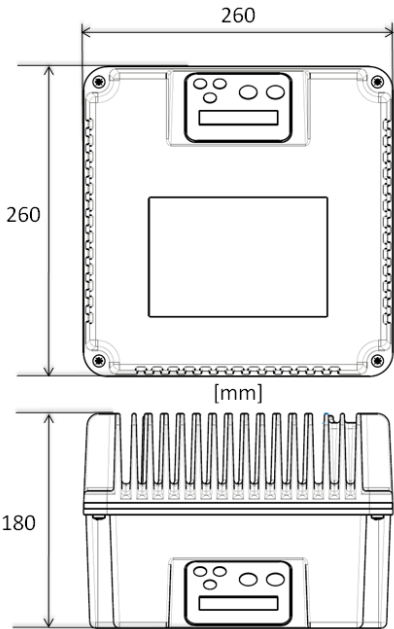
Model	Vin	Vin P1 nom *	Max Vout	Max I out	Typical motor P2 **		Weight
	[VDC]	[VDC]	[VAC]	[A]	[VAC]	[kW]	[kg]
VASCO Solar 212	120 – 650	> 320	3 x 230	12	3 x 230	2,2	8,2
VASCO Solar 409	320 – 850	> 560	3 x 400	9	3 x 400	3	8,3
VASCO Solar 412	320 – 850	> 560	3 x 400	12	3 x 400	4	8,5
VASCO Solar 415	320 – 850	> 560	3 x 400	15	3 x 400	5,5	8,5
VASCO Solar 418	320 – 850	> 560	3 x 400	18	3 x 400	7,5	8,5
VASCO Solar 425	320 – 850	> 560	3 x 400	25	3 x 400	11	8,5
VASCO Solar 430	320 – 850	> 560	3 x 400	30	3 x 400	15	8,7

\* Input voltage necessary to obtain 100% of rated motor power.

\*\* Typical motor power. It is recommended to refer to rated motor current when selecting VASCO Solar model.

## Electrical characteristics

- Ambient temperature: -10 - 50 ° C (14-122 ° F)
- Max altitude at rated load and temperature up to 1000 m
- Degree of protection: IP65 (NEMA 4)
- Output configurable digital N.A or N.C:
- Engine run signal
- Alarm signal
- Analog inputs, (10 or 15 Vdc):
  - 4-20 mA
  - 4-20 mA
  - 4-20 mA / 0-10 VDC (configurable)
  - 4-20 mA / 0-10 VDC (configurable)
- 4 digital inputs, configurable NO or NC, to start and stop engine
- RS485 serial



## Mechanical characteristics

- Aluminium body, AISI 304 metal parts
- PA cable glands : 2 x M25 + 4 x M16
- PE keyboard membrane with UV protection

Nastec is able to offer a wide range of accessories including pressure sensor and flow sensor as well as dv/dt or sinusoidal output filters to protect motor windings even in the presence of very long cables. For more information, please refer to the accessories catalogue.