

GENERAL CATALOGUE 2011

Solar Inverters **SIRI** 



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Power and Energy. Naturally



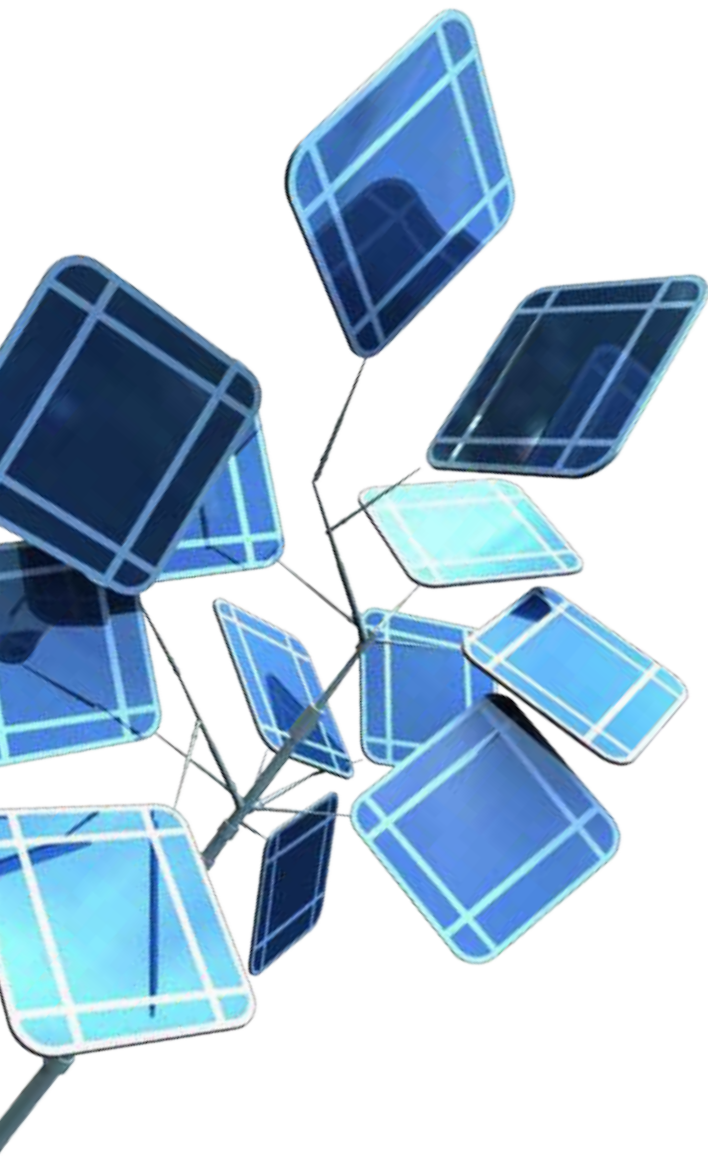
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Solar inverters **SIRI** 



The company

AROS, the power of nature, the wonder of technology.

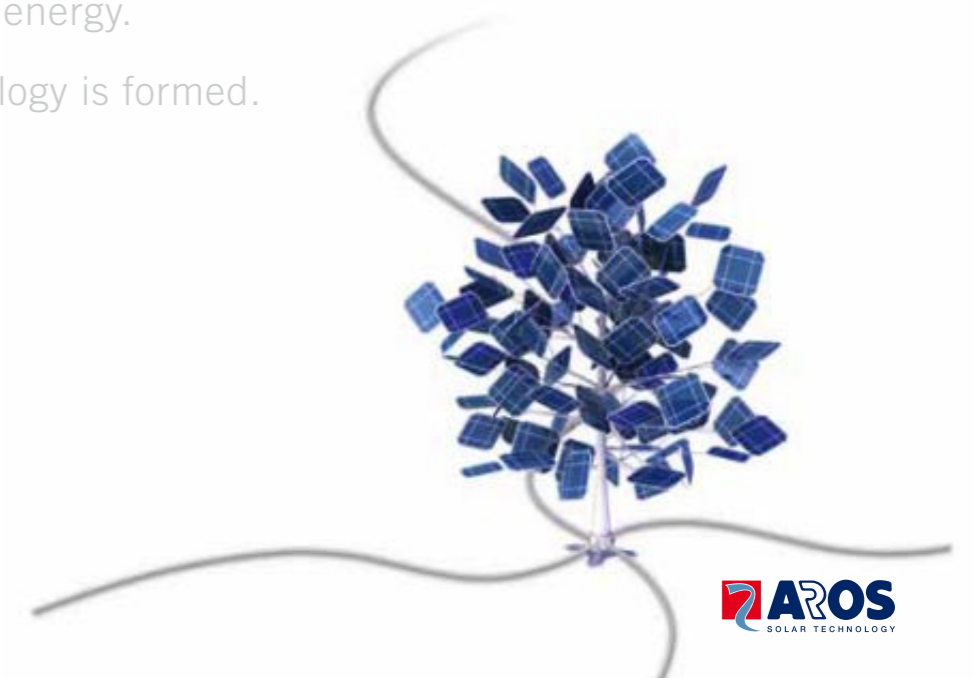


Being a leader in a specific and differentiating field such as that for inverters for photovoltaic applications is not an easy goal to achieve, even with 70 years of experience and ongoing growth behind you. Although AROS has always been about the certainty of results, sophisticated technology, highly qualified personnel, being a leader in a sector which is so important to the future of technology and for the wellbeing and development of the planet is only possible thanks to commitment which is inexhaustible, like the sun's energy, continued commitment. Continuity is the word on which AROS was founded. It is its operating field, sophisticated technology on which the efficiency of any electrical system depends, but also the strength to always pursue the highest standards of production and constantly anticipate market demands. Continuity is tireless pursuit of technology, solutions and products: it is a promise of continued commitment in an effort to respect the environment and to learn, from the environment and its riches, to work for even better energies.

This is AROS Solar Technology. And this is what it will continue to be. Today, Aros is a division of Riello Elettronica, a holding company for businesses operating in civil and industrial electronics, and in the plant engineering and energy IT sector, in the production of uninterruptible power supplies and in security and home automation systems. The core business of the group, founded and administered by Pierantonio Riello, are companies that operate in the area of energy conversion and in the production of electronic UPSs. In this context, Riello Elettronica is one of the top ten producers in the world, with a range of products able to meet any energy supply need.

1935: production of radio speakers. **1940:** manufacture of transformers for radios and for electrical power supplies. **1945:** marketing of the first ballasts for fluorescent lamps. **1950-1959:** production of magnetic ballasts for fluorescent lamps and discharge lamps. **1960-1969:** first delivery of components for IBM. Production of ferroresonant stabilisers. **1970-1979:** manufacture of electronic components for stabilisers **1980-1989:** production of uninterruptible power supplies (UPS), switching power supplies and electronic ballasts. **1990-1999:** expanding the range of uninterruptible power systems for different applications (IT, industrial). **2000-2010:** growth and consolidation in the UPS market and expansion of the range with the production of photovoltaic inverters. **2011:** Riello Elettronica hands AROS the baton of renewable energy.

AROS Solar Technology is formed.

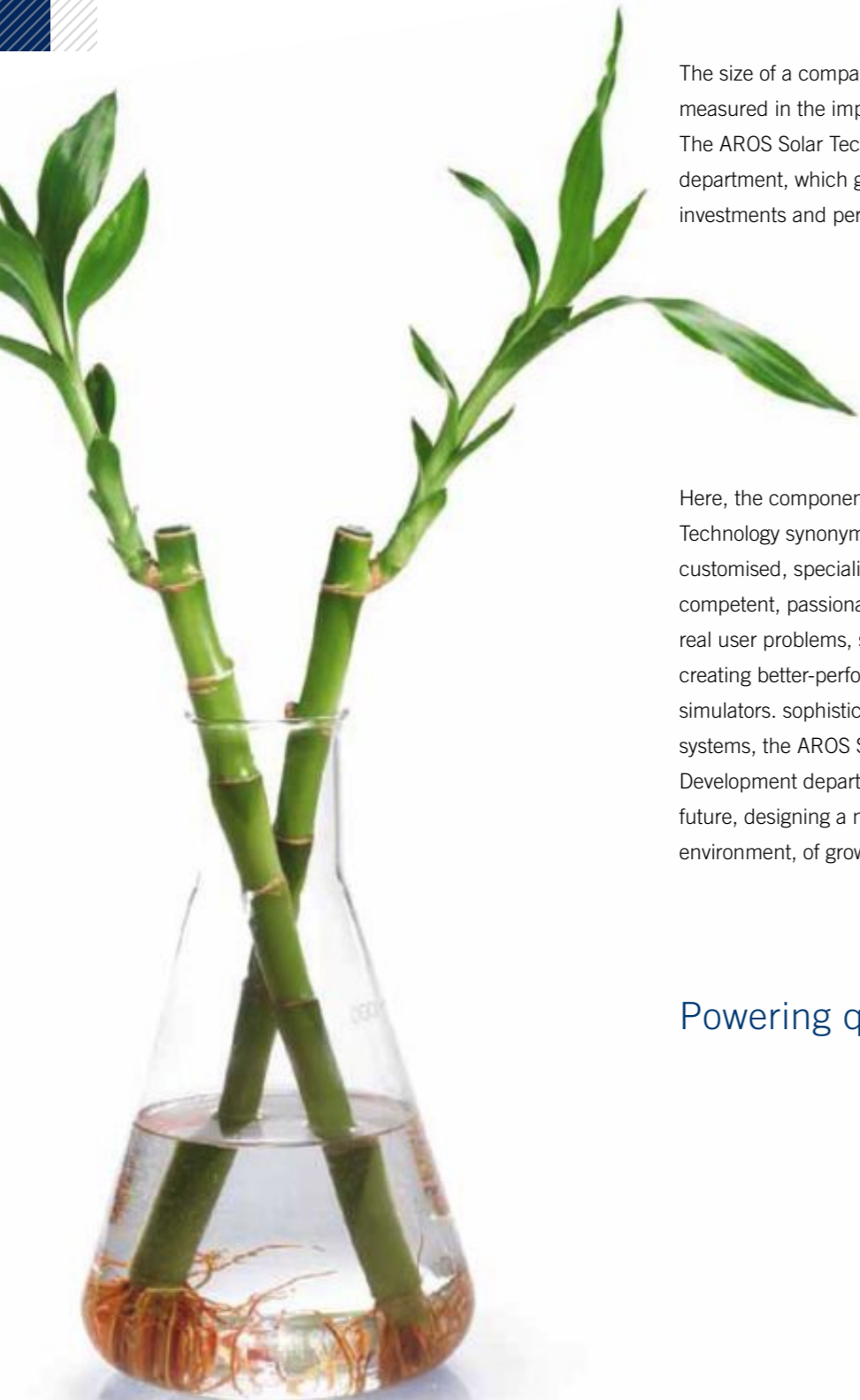


Research and development

The size of a company and its vocation for growth is measured in the importance of its efforts in research. The AROS Solar Technology Research and Development department, which grows each year in terms of investments and personnel, is our beating heart.

Here, the components that make AROS Solar Technology synonymous with innovation and customised, specialised solutions are designed. Here, competent, passionate people spend every day solving real user problems, seeking, in each problem, the key to creating better-performing inverters. Using environment simulators, sophisticated analysis tools and CAD systems, the AROS Solar Technology Research and Development department creates the technologies of the future, designing a new way of living, of relating to the environment, of growing together.

Powering quality directly.



Certification

The basis of a solid relationship.

Obtaining prestigious certification such as Quality System certification (issued by DNV) and UNI EN ISO 9001/2008 for the design, production, sales and after-sales service for its products, it is not a source of pride for AROS Solar Technology but represents a relationship, with its customers and its employees, which is destined to grow day by day. Those who, like AROS Solar Technology, provide state-of-the-art technology solutions, must necessarily be subject to ongoing, strict controls of their business processes and must safeguard and protect their employees and customers. To continue to believe in quality and pursue excellence.

COMPANY WITH INTEGRATED
MANAGEMENT SYSTEM CERTIFIED BY DNV
= UNI EN ISO 9001:2008 =
UNI EN ISO 14001:2004



Service

In a company like AROS Solar Technology, support and services to users and the company employees are part of a project for the ongoing search for quality and excellence, representing the starting point for building a partnership with customers which becomes stronger every day. That's why the Control Centre, the feather in the cap of a system built around the real needs of those who use AROS Solar Technology products and solutions, is able to read the status of the appliances in real-time across the network, and obtain immediate intervention in the event of an emergency.

That's why ongoing training for technical and commercial operators at the main AROS Solar Technology site or at the sites of its customers ensures high problem solving expertise and very low response times. That's why the success of AROS Solar Technology goes beyond national borders.

The value of being
a partner.

The environment

Natural attention.



The commitment to design, produce and distribute products and solutions with a low environmental impact, paying attention to the natural environment and its protection are not only proven by certification such as ISO 14001:2004, or verified procedures such as the management and recycling of waste electrical and electronic equipment in compliance with EU guidelines (RAEE). AROS Solar Technology's commitment to the environment is an integral part of its mission: choosing a sector such as renewable energy, which is crucial for the future of us all, is the clearest demonstration of the awareness of AROS Solar Technology, which does not use hazardous substances in the products it sells (RoHS), but with every product, attempts to find the most accurate response for a high-efficiency future in an environment that needs to be safeguarded and protected.

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Solar energy: an intelligent solution for the environment

The sun can satisfy all our needs if we learn to rationally take advantage of the energy that constantly irradiates toward the Earth. It shines in the sky from less than 5 billion years and however, it has been calculated that it has reached only half of its life expectancy. Just think that during this year the sun will irradiate towards the earth four thousand times more energy than that which the entire world population could consume. Thanks to available technology it would be a crime not to take advantage of it, considering that such energy source is free, clean and never ending and that this could finally free us from oil dependence and from other not safe and contaminating alternatives. This energy can be directly used or transformed into electricity. Opportunely treated and controlled it is possible to sell the energy produced to the electricity administrator following national norms and laws. The choice of a PV solution represents an investment of sure returns and easily calculable thanks to financing schemes estimated by different national laws.

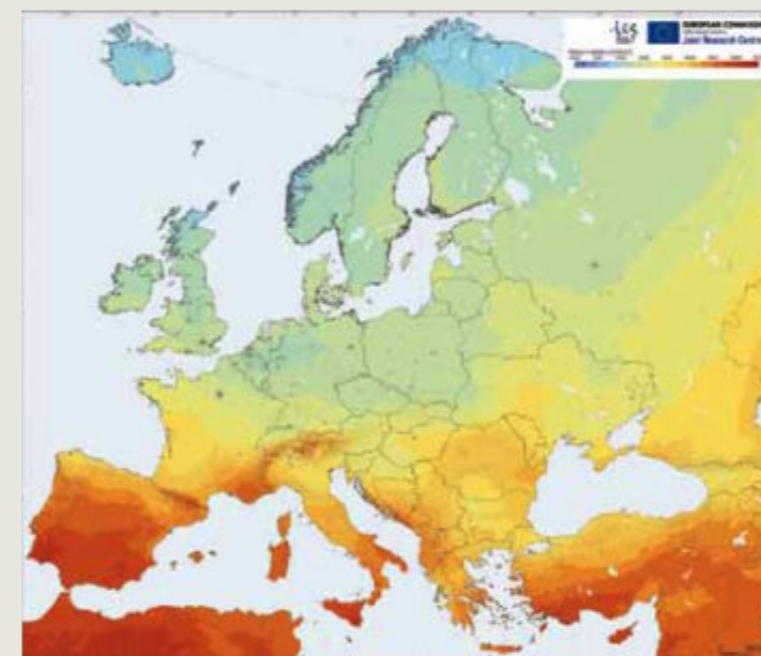
The price of oil is always increasing and the pollution is less sustainable making renewable alternate sources of energy an irremissible necessity. Economic incentives and giant steps forward in electronic technology consent the use of photovoltaic plants in an easy and economically convenient way; the use of machinery permits the direct connection to the power grid that allows selling efficiently and in a practical manner to the distributor the energy produced and not used. The use of an inverter without transformer, for the direct connection the photovoltaic plants to the grid is creating more and more interest due to the reduction of costs and high efficiency of the solution. Aros, using its own experience in power supplies, has put together an innovative series of inverters for photovoltaic plants connected to the grid made with highly durable quality components.



Solar radiation

Solar radiation is electromagnetic energy emitted by the fusion of hydrogen in the sun; such energy does not reach the Earth's surface in a constant manner and its amount varies during the day, between seasons and depends on the cloudiness, from the angle of incidence and the reflectivity of the surfaces. The radiation that a square meter on a horizontal surface receives is called global radiation and is the result of the sum of the direct and diffuse radiation. The direct radiation is that which reaches the Earth directly from the sun while the diffuse radiation is that which is reflected by the sky, clouds and other surfaces. Direct radiation is present only when the sun is well visible. During the winter diffuse radiation is higher in percentage and on an annual basis and is equal to 55% of the global total. In the calculation of dimensions of the photovoltaic solar systems it is often opportune to take into consideration the amount of solar radiation that is reflected by the surfaces near the photovoltaic modules (Albedo's coefficient).

The intensity of the solar radiation on the ground depends on the inclination angle of the radiation itself: the smaller the angle that the sun rays form with the horizontal surface and greater the amount of atmosphere they have to travel means consequent lower radiation that reaches the surface. As we have seen, a surface received the maximum amount when the solar rays hit perpendicularly on it. The sun's position varies during the day and during the seasons and thus also the angle with which the sun's rays hit a surface varies. The amounts thus depend on the position and inclination of the PV modules. A horizontal surface receives the maximum amount of energy during the summer when the sun's position is high and the days are long while a vertical surface set toward the south receives higher amount during the winter than during the summer – about 1.5 times more than the horizontal surface. The best orientation of a vertical or inclined surface that must capture the most sun rays is thus that one set towards a southern direction.



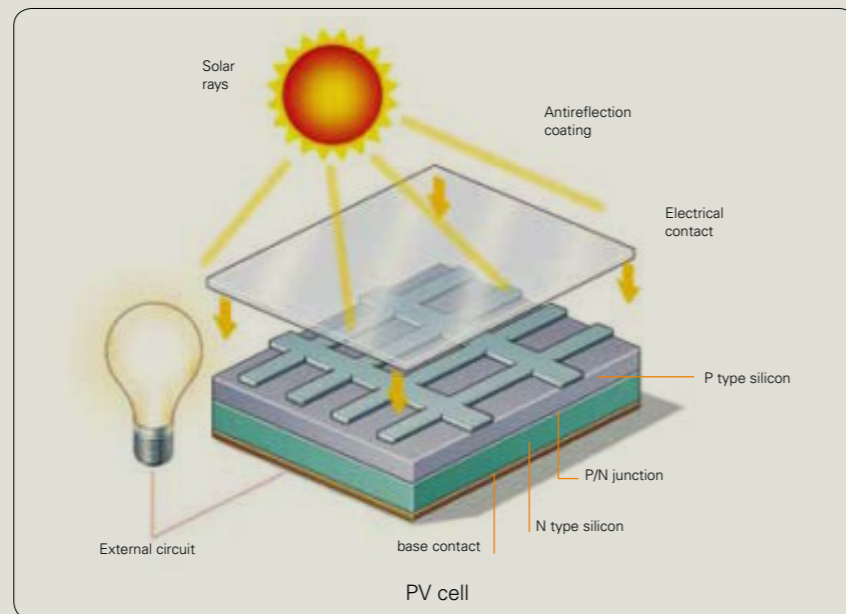
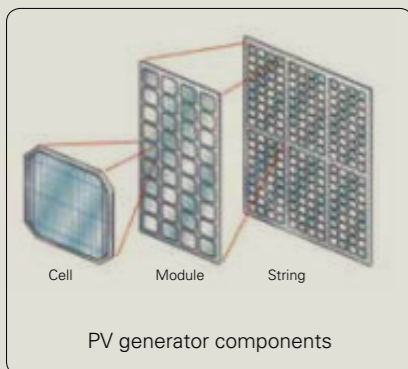
Albedos's coefficient

Gravel roads:	0,04
Forest in winter:	0,07
Bitumen and gravel surfaces:	0,13
Clayey soils:	0,14
Dry grass:	0,20
Cement:	0,22
Green grass:	0,26
Dark walls of buildings:	0,27
Dry leaves:	0,30
Clear walls of buildings:	0,60
Water surfaces:	0,75
Fresh snow:	0,75

Technology used in photovoltaic plants

The working of photovoltaic systems is based upon the capacity of some semiconductor materials opportunely treated to convert solar radiation energy into electric current in DC with the need of moving mechanical parts. The semiconductor material almost universally used today is silicon. The basic element of a photovoltaic plant is the so-called photovoltaic cell, a type of thin silicon rectangular or square sheet. For example, a 150x150mm² cell can produce a current of more than 7A with a tension of 0.5V, therefore a strength of 3.5 Watts under standard conditions. This means that when it is in 25 C it has the power of solar radiation equal to 1000W/m². More cells assembled and connected together in a series/parallel they create a single structure called a "Photovoltaic Module". The module made up of 60 of these cells has a surface of about 1.6 m² and produces, under standard conditions, about 230Wp. A group of panels connected serially create a "String" that if they are parallel connected they constitute a photo-

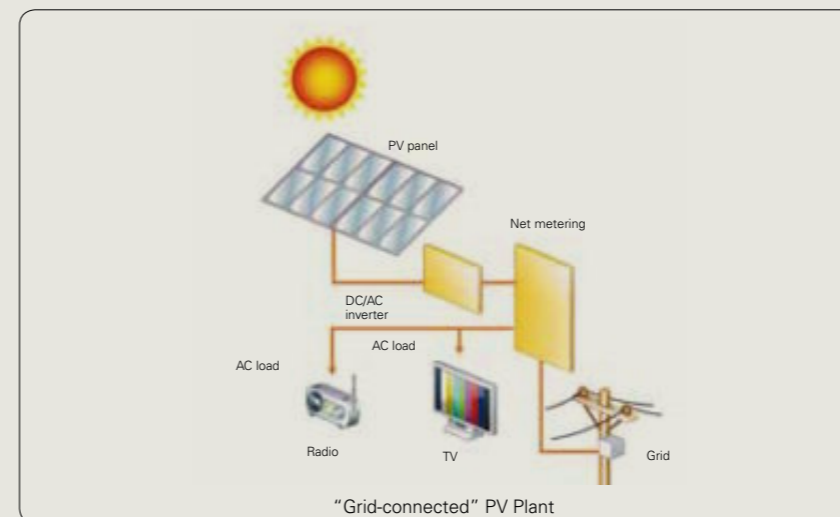
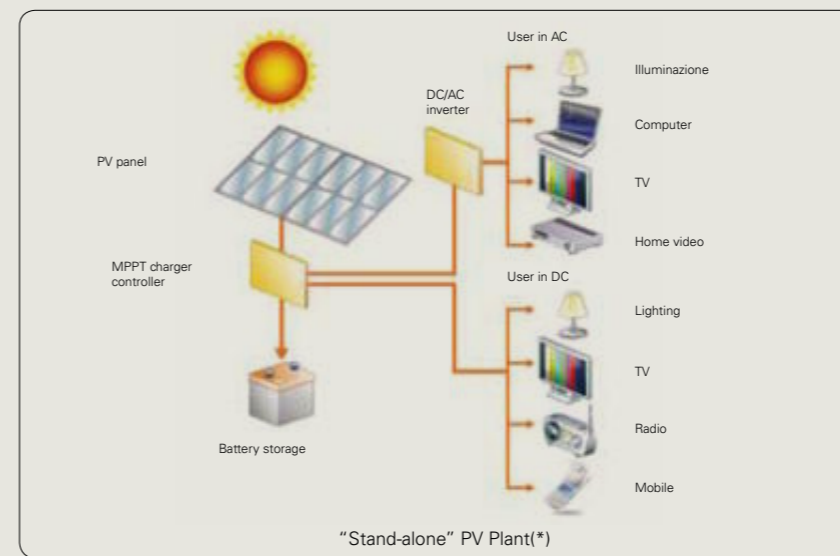
voltaic generator (or Array). PV plants are generally divided into two big families: stand-alone plants and grid-connected. The stand-alone plants are used to give electricity to isolated users, distant from the electricity grid and that are hard to feed because they are in poorly accessible areas or ones characterized by low electricity usage that do not make the connection to the public grid convenient. It is necessary at these plants to store the energy produced by the photovoltaic modules with batteries to guarantee energy continuity at night or when there is no sun. The small plants for only illumination can be made completely in DC at 12V or for greater use at 24V or 48V. To always have electricity in alternate form (AC) or the same as that of ones own power supplier, it is necessary to install in the plant an inverter that transforms energy from the batteries in DC to AC with 220V. The heart of the isolated photovoltaic system is the power regulator that preserves battery efficiency and prolongs their life expectancy via several methods:



- Recharge the batteries by DC and controlled tension;
- Location of the MMPT (Maximum Power Point Tracker);
- Disconnect the battery from the photovoltaic if the voltage is below the useful level for example at sunset;
- Disconnect the battery from the photovoltaic should the battery be completely recharged;
- Disconnect the battery from the electric load if it is completely discharged.

The grid-connected systems are those parallel connected to the public electric grid and are designed to input the energy produced into the same thus becoming little "power plants" able to nullify or reduce the energetic needs of any building for public or industrial use, private home, etc. The plant parallel connected with the grid is composed of a determined surface of photovoltaic modules connected together in an opportune way which feed with the appropriate device, the inverter, which adapts the energy produced to the standards of the mono-phase or tri-phase grid and inputs it into the same. The net metering then takes care of quantifying the amount of energy input into the grid so such amount can be deducted from that which the users consumed.

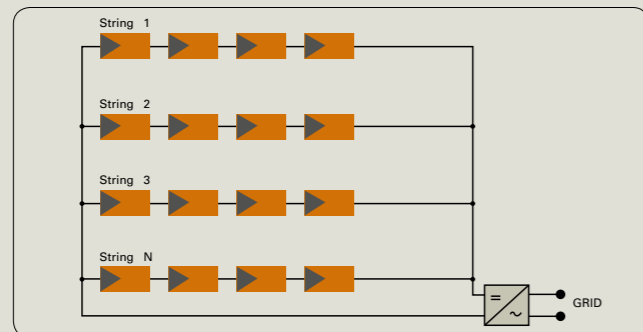
* The scheme is only explanatory. Siroio inverters are only compatible with "grid-connected" plants



Inverter technology for Grid-Connected plants

A photovoltaic generator produces direct electric current and can therefore only supply loads which work with this form of current, mainly with voltages of 12, 24 and 48V. Usually loads work with alternating current and if the plant is connected to the electricity transmission grid the output current must be of this type; European standards envisage 230V / 50Hz for single-phase and 400V / 50Hz for three-phase grid. Thus the need to transform direct current output from the PV generator to alternating current. This is done by the inverter, which apart from the DC/AC conversion also increases the output voltage up to

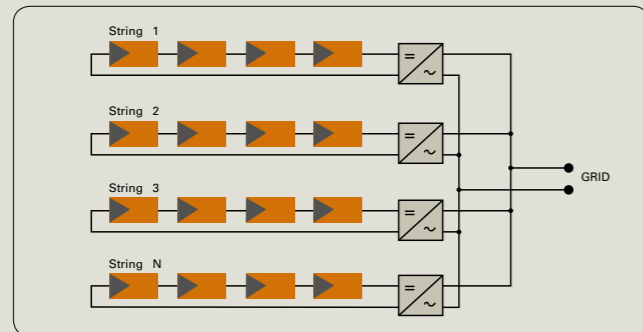
the electricity network voltage level for inclusion in the grid. The current introduced must in fact have a sinusoidal waveform and be synchronized with the network frequency and, in case of power failure, even for short periods, the inverter must be capable of disconnecting immediately. Another fundamental feature for inverters is the optimization of the effective energy production of the plant with respect to the incident solar radiation, by regulating the Maximum Power Point (MPP).



Optimum technical solutions according to local conditions have resulted in the classification of three different types of inverter and configurations:

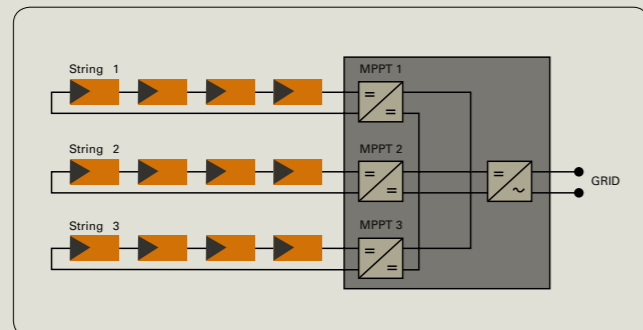
Centralized inverter

A single inverter handles the whole plant, which can supply power even in the MW range. All the strings, made up of modules connected in series, are joined together in a parallel connection. Advantages of this solution are limited economic investments, plant simplification and reduced maintenance costs. One disadvantage is the sensitivity to partial shading thus limiting the optimum exploitation of every string. It is ideal for solar fields with uniform orientation, inclination and conditions of shade.



String inverter

Every string, made up of various modules in series, has its own inverter representing an independent mini-plant. Efficiency is improved with this configuration compared to centralized inverters using single MPPT devices, reducing losses due to shading. It is suitable for joined solar fields with various conditions of radiation. It can also be used for plants made up of several geographically distributed solar fields.



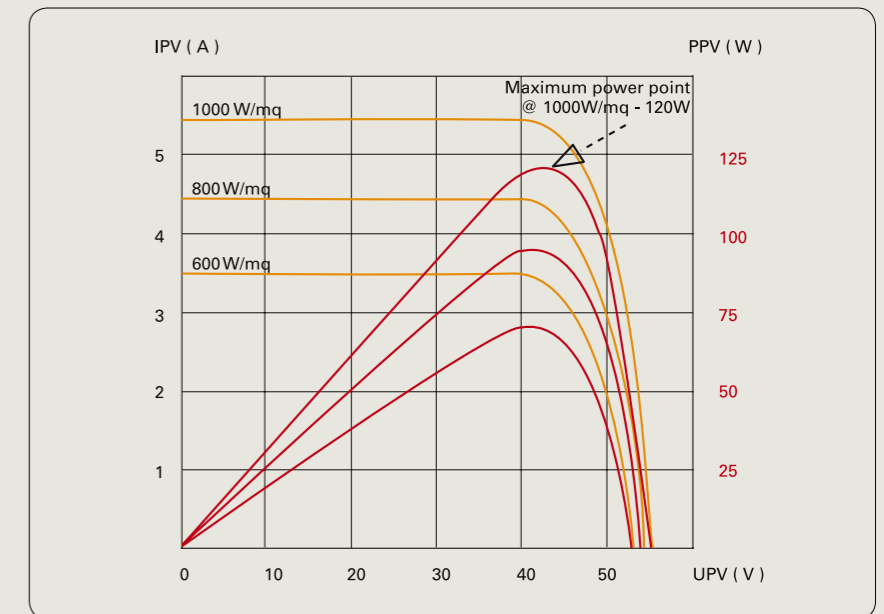
Multi-string inverter

This topology is a trade-off between centralized inverters and string inverters, allowing the connection of two or three strings for each unit with different orientations, inclinations and power. From the DC generator aspect the strings are connected to dedicated inputs handled by independent MPPTs and from the aspect of inclusion in the network they operate like a centralized inverter optimizing the efficiency.

The importance of MPPT (Maximum Power Point Tracker)

Solar irradiation that hits the photovoltaic modules has a strongly variable character depending on the latitude, orientation of the solar field, the season and hour of the day. During the course of a day, a shadow may be cast on the cell that may be foreseen, as in the case of a building near the solar field or unforeseeable as those created by clouds.

Also the energy produced by each photovoltaic cell depends on the irradiation and temperature. From these considerations, the necessity to identify instant by instant that particular point on the VxI characteristic of the PV generator in which there is the maximum amount of power transfer to the grid occurs.



Graphically, the point of maximum power corresponds to the tangent point between the characteristics of the photovoltaic generator for a certain value of the irradiation and the hyperbole of the equation $V \times I = \text{corresponding constant}$. As we have seen, the tangent point varies instantly in function of the solar

irradiation conditions and with the variations in temperature. The MPPT's duty is to identify instant by instant such a maximum power point.

Rating

The inverter

During the plant design phase and when selecting the PV system components, the compatibility between the PV generator's electrical characteristics and those of the DC/AC converter i.e. the inverter, must be verified.

The main photovoltaic generator parameters to consider are power, voltage and current generated by the generator itself under the various operation conditions. For the inverter it is necessary to know:

- the MPPT interval, which is the voltage range in which the inverter is capable of tracking the maximum power point;
- the maximum d.c. voltage in open circuit;
- the maximum input current.

The photovoltaic field

The ideal photovoltaic generator power is generally 10÷25% more than the maximum power supplied by the inverter in order to compensate for the loss of power of the PV modules due to dirt accumulated over time, the operating temperature, cable and inverter losses apart from performance degradation of the PV module due to ageing. The conditions of installation of the field itself (latitude, orientation, slope, etc.) must also be taken into account. In particular exceptional conditions when the supplied power in the network is greater than the maximum acceptable for the inverter, the inverter protects itself by lowering said power to the rated value (or the overloading value for a limited period). Some inverter manufacturers use the power value of the photovoltaic field to

identify its model. This value should not to be confused with the real power supplied to the network which can be much less; in fact our Sirio 2800 is capable of supplying a maximum AC power of 3000W, while some inverters labelled as "3000" have rated AC power values of 2500W.

Clearly the two models are not equivalent and the correct choice of product must be carefully considered to guarantee the best performance for your plant. As far as the open circuit maximum voltage of the modules is concerned, it must be remembered that the values supplied by the manufacturers are normally specified at a temperature of 25C. The PV modules supply a voltage to their ends which varies as a function of the operating temperature; more precisely, their voltage increases as the temperature decreases.

All this implies that the verification of the maximum open circuit voltage must be carried out according to the assumed minimum operating temperature and at that temperature the voltage must be less than the maximum applied at the inverter input.

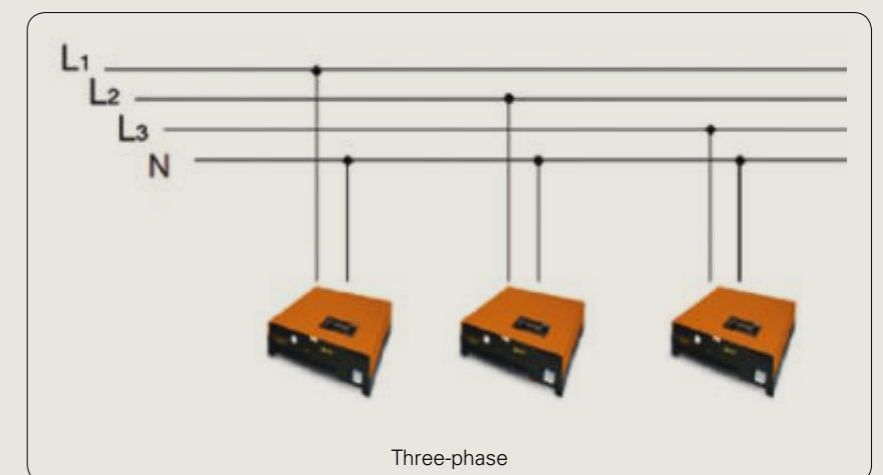
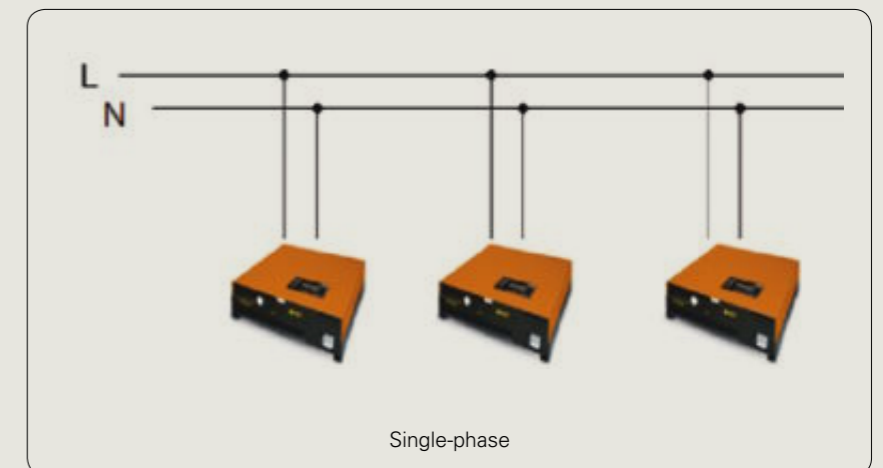
Connecting to the electrical grid

To obtain the desired power it is possible to connect more inverters in parallel to the grid. In Italy when the total power exceeds 6kW the three-phase connection (Italy: CEI 11-20; V1) becomes mandatory, obtainable also by connecting several single-phase inverters between a phase and neutral. If the latter solution is used, the power should be distributed equally on the three phases maintaining the imbalance under 6kW.

Utilizing more inverters means placing more MPPTs with the result of being able to run each unit separately, optimizing the configuration and consequently the performance of the entire plant. Furthermore in the event of inverter malfunction, only the part involved in the malfunction is affected and not the entire production as in the case of the single inverter.

NOTE:

It must be remembered that in Italy if the plant production exceeds 20kW the galvanic separation between the direct current part and the alternating current part by means of an isolating transformer becomes necessary. It is furthermore mandatory to insert a single interface system surpassing the three units installed in the plant.



Rating

Sizing example

To better understand the mechanisms that regulate the choice of the PV field, in the example below, we will create an imaginary 12.6 kWp system. Looking at the Sirio K12 model, we will check the electrical characteristics required for correct sizing:

Characteristics of the Sirio K 12 inverter	
Rated alternating current power	12kW
Maximum alternating current power	13.2kW
Max. open circuit direct voltage.....	800V
MPPT range.....	330V to 700V
Maximum input current (Imax Inv.)	36A

Now let's look at the technical data sheet for the photovoltaic panel

Characteristics (STC Standard Test Condition) of the PV Module	
Peak power (Wp).....	210W
Voltage at maximum power (Vpm).....	28.3V
Open circuit voltage (Voc).....	36.9V
Current at maximum power (Ipm)	7.4A
Voltage coefficient according to the temperature (ΔV%/°C)	-0.34%

First we have to calculate the number of modules required to obtain the desired power:

$$12,600Wp / 210Wp = 60 \text{ modules}$$

Now we need to check the minimum and maximum number of modules making up the string. To do this, we calculate the minimum and maximum voltage which can be reached by our photovoltaic module:

The **maximum voltage** of a module is found in no-load operating conditions, at the minimum cell temperature.

$$V_{max} = V_{oc} \text{ a } ^\circ\text{t min.}$$

The variation of the Voc per degree centigrade is equal to:

$$\begin{aligned} \Delta V / ^\circ\text{C} &= V_{oc} \times \Delta V \% / ^\circ\text{C} \rightarrow \\ \Delta V / ^\circ\text{C} &= 36,9V \times 0,34\% = 0,125V \\ &\text{for each } ^\circ\text{C} \end{aligned}$$

Multiplying the result by 35, which is the deviation of the estimated minimum cell operating temperature (-10 °C) compared to the STC temperature of 25°C:

$$\Delta V = 0,125V \times 35 = 4,37V$$

By adding the calculated increase at the operating temperature of -10 °C to the Voc, we have:

$$V_{max} = 36,9V + 4,37V = 41,27V$$

The **minimum voltage** of the module should be calculated in operating conditions at the rated power and the maximum temperature which can be reached by the photovoltaic module cell.

$$V_{min} = V_{mp} \text{ a } ^\circ\text{t max.}$$

The variation of the Vmp per degree centigrade is equal to:

$$\begin{aligned} \Delta V / ^\circ\text{C} &= V_{mp} \times \Delta V \% / ^\circ\text{C} \\ \Delta V / ^\circ\text{C} &= 28,3V \times 0,34\% = 0,096V \\ &\text{for each } ^\circ\text{C} \end{aligned}$$

Multiplying the result by 45, which is the deviation of the estimated maximum cell operating temperature (70 °C) compared to the STC temperature of 25°C:

$$\Delta V = -0,096V \times 45 = -4,32V$$

By adding the value calculated to the Vmp, we have:

$$V_{min} = 28,3V - 4,32V = 23,9V$$

Having the minimum and maximum voltages which can be reached by the PV module, we can proceed to calculate the minimum and maximum "length" of the string.

Dividing the inverter's max. direct open circuit voltage value by the Vmax which has just been calculated, we have:

$$\begin{aligned} \text{Max. no. modules} &= 800V / 41,27V = \\ &= 19,38 \text{ which, rounded down, comes to } \\ &= 19 \text{ modules.} \end{aligned}$$

Dividing the min. direct voltage value of the inverter's MPPT range by the Vmin calculated previously:

$$\begin{aligned} \text{Min. no. modules} &= 330V / 23,9V = 13,8 \\ &\text{which, rounded up, comes to } 14 \text{ modules.} \end{aligned}$$

Knowing the minimum and maximum number of modules making up the string, we just have to find the closest combination to the requirements in the design phase. In this case, we can make 4 strings of 15 modules for a total of 60 photovoltaic modules.

Once we have identified the number of strings, we will check that their total current does not exceed the inverter's maximum input current:

$$\begin{aligned} I_{dc \text{ max}} &= I_{mp} \times \text{no. of strings} \\ &= 7,4A \times 4 = 29,6A \end{aligned}$$

As the inverter's maximum input current (Inv Imax) is equal to 36A, the Idc max < Imax Inv condition is respected.

To check the choice of your photovoltaic system, we recommend using PV Configurator, special software which can be downloaded free from www.aros-solar.com

Standards

Electromagnetic compatibility EMC

- Directives: 2004/108/ EEC
- Standards: EN61000

Safety

- Directives: 2006/95/EC
- Standards: IEC 62103; EN50178

Certifications

- Italy: DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione powe grid"
- Germany: VDE 0126-1-1; 2006-02
- Spain: Real Decreto 1663-2000



01

Choosing Table

TL INVERTERS



MODEL	Sirio 1500	Sirio 2000	Sirio 2800
Approximate power of the photovoltaic field	max 1900 Wp min 1000 Wp	max 2500 Wp min 1400 Wp	max 3500 Wp min 1960 Wp
Rated AC power	1500 W	2000 W	2800 W
Maximum AC power	1650 W	2200 W	3000 W
INPUT	Sirio 1500	Sirio 2000	Sirio 2800
Maximum DC voltage in an open circuit	450 Vdc	500 Vdc	500 Vdc
MPPT operating range	100 ÷ 450 Vdc	100 ÷ 500 Vdc	100 ÷ 500 Vdc
MPPT full rating range	200 ÷ 405 Vdc	250 ÷ 450 Vdc	250 ÷ 450 Vdc
Maximum input current	8,9 Adc	10 Adc	13 Adc
Voltage during system startup	120 Vdc	120 Vdc	120 Vdc
Initial feeding voltage	150 Vdc	150 Vdc	150 Vdc
Ripple voltage	<10%	<10%	<10%
Number of inputs	1	1	1
MPPT number	1	1	1
OUTPUT	Sirio 1500	Sirio 2000	Sirio 2800
Operating voltage	230 Vac	230 Vac	230 Vac
Operating interval	190 ÷ 260 Vac	190 ÷ 260 Vac	190 ÷ 260 Vac
Maximum power range	210 ÷ 260 Vac	210 ÷ 260 Vac	210 ÷ 260 Vac
Frequency range	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz
Settable frequency range	49 ÷ 51 Hz	49 ÷ 51 Hz	49 ÷ 51 Hz
Nominal current	6,6 Aac	8,7 Aac	12,2 Aac
Maximum current	7,9 Aac	10,5 Aac	14,3 Aac
DC current injection (max.)	<30 mA	<40 mA	<60 mA
Current Harmonic Distorsion (THDi)	<3%	<3%	<3%
Power factor	>0,99	>0,99	>0,99
Galvanic separation	NO	NO	NO
SYSTEM	Sirio 1500	Sirio 2000	Sirio 2800
Maximum efficiency	>96,3%	>96,5%	>97,1%
European efficiency	>95%	>95,1%	>96%
Off-Grid protection	YES	YES	YES
Detecting earth leakage	YES	YES	YES
Heat dissipation	convection	convection	convection
FEATURES	Sirio 1500	Sirio 2000	Sirio 2800
Dimensions (WxDxH)	315x120x270	350x120x303	350x135x301
Weight	8,5 Kg	11,4 Kg	12,5 Kg
Protection level	IP43	IP43	IP43



Sirio 3100	Sirio 4000	Sirio 4000P	Sirio 4600P	Sirio 6000P	Sirio 10000P
max 3900 Wp min 2400 Wp	max 5000 Wp min 2800 Wp	max 5000 Wp min 2800 Wp	max 5700 Wp min 3200 Wp	max 7500 Wp min 4200 Wp	max 12500 Wp min 7000 Wp
3100 W	4000 W	4000 W	4600 W	6000 W	10000 W
3400 W	4400 W	4400 W	5100 W	6000 W	11000 W
Sirio 3100	Sirio 4000	Sirio 4000P	Sirio 4600P	Sirio 6000P	Sirio 10000P
500 Vdc	500 Vdc	500 Vdc	750 Vdc	550 Vdc	800 Vdc
100 ÷ 500 Vdc	100 ÷ 500 Vdc	100 ÷ 500 Vdc	100 ÷ 750 Vdc	130 ÷ 550 Vdc	200 ÷ 800 Vdc
190 ÷ 450 Vdc	250 ÷ 450 Vdc	250 ÷ 450 Vdc	190 ÷ 700 Vdc	230 ÷ 500 Vdc	270 ÷ 720 Vdc
20 Adc	20 Adc	20 Adc	8,5 Adc MTTP	27,5 Adc	13 Adc MTTP
120 Vdc	120 Vdc	120 Vdc	120 Vdc	150 Vdc	260 Vdc
150 Vdc	150 Vdc	150 Vdc	150 Vdc	180 Vdc	350 Vdc
<10%	<10%	<10%	<10%	<10%	<10%
2	2	3	3	3	3
1	1	1	3	1	3
Sirio 3100	Sirio 4000	Sirio 4000P	Sirio 4600P	Sirio 6000P	Sirio 10000P
230 Vac	230 Vac	230 Vac	230 Vac	230 Vac	400 Vac
190 ÷ 260 Vac	190 ÷ 260 Vac	190 ÷ 260 Vac	190 ÷ 260 Vac	190 ÷ 260 Vac	320 ÷ 480 Vac
210 ÷ 260 Vac	210 ÷ 260 Vac	210 ÷ 260 Vac	210 ÷ 260 Vac	210 ÷ 260 Vac	330 ÷ 480 Vac
49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz
49 ÷ 51 Hz	49 ÷ 51 Hz	49 ÷ 51 Hz	49 ÷ 51 Hz	49 ÷ 51 Hz	49 ÷ 51 Hz
13,5 Aac	17,4 Aac	17,4 Aac	20 Aac	26 Aac	14,5 Aac each phase
16,2 Aac	20 Aac	20 Aac	26 Aac	28,6 Aac	17,5 Aac each phase
<80 mA	<80 mA	<80 mA	<100 mA	<130 mA	<100 mA
<3,5%	<3%	<3%	<3%	<3%	<3%
>0,99	>0,99	>0,99	>0,99	>0,99	>0,99
NO	NO	NO	NO	NO	NO
Sirio 3100	Sirio 4000	Sirio 4000P	Sirio 4600P	Sirio 6000P	Sirio 10000P
>96,1%	>96,2%	>96,2%	>96,2%	>97,6%	>96,2%
>95,3%	>95,7%	>95,7%	>95,2%	>96,6%	>94,6%
YES	YES	YES	YES	YES	YES
YES	YES	YES	YES	YES	YES
convection	convection	convection	convection	convection	forced air
Sirio 3100	Sirio 4000	Sirio 4000P	Sirio 4600P	Sirio 6000P	Sirio 10000P
424x120x367	424x120x367	434x135x387	430x130x530	430x155x531	444x151x584
16,4 Kg	16,4 Kg	19,5 Kg	27 Kg	30 Kg	37 Kg
IP43	IP43	IP65	IP65	IP65	IP65

02

Choosing Table

CENTRAL INVERTERS



MODEL	Sirio K12	Sirio K15	Sirio K18	Sirio K25
Approximate power of the photovoltaic field	max 14 kWp min 9 kWp	max 18 kWp min 12 kWp	max 21 kWp min 16 kWp	max 30 kWp min 20 kWp
Rated AC power	12 kW	15 kW	18 kW	25 kW
Maximum AC power	13,2 kW	17 kW	20 kW	28 kW
INPUT	Sirio K12	Sirio K15	Sirio K18	Sirio K25
Maximum DC voltage in an open circuit	800 Vdc	800 Vdc	800 Vdc	800 Vdc
Recommended Vo@STC voltage	540 ÷ 640 Vdc	540 ÷ 640 Vdc	540 ÷ 640 Vdc	540 ÷ 640 Vdc
MPPT operating range	330 ÷ 700 Vdc	330 ÷ 700 Vdc	330 ÷ 700 Vdc	330 ÷ 700 Vdc
Maximum input current	36 Adc	54 Adc	63 Adc	80 Adc
Initial feeding voltage	390 Vdc	390 Vdc	390 Vdc	390 Vdc
Ripple voltage	<1%	<1%	<1%	<1%
Number of inputs	1	1	1	1
MPPT number	1	1	1	1
OUTPUT	Sirio K12	Sirio K15	Sirio K18	Sirio K25
Operating voltage	400 Vac	400 Vac	400 Vac	400 Vac
Operating interval	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac
Maximum power range	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac
Frequency range	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz
Nominal current	17,3 Aac	21,7 Aac	26,0 Aac	36 Aac
Maximum current	22,4 Aac	28,1 Aac	33,0 Aac	46 Aac
Current Harmonic Distorsion (THDi)	<3%	<3%	<3%	<3%
Power factor	>0,99	>0,99	>0,99	>0,99
Galvanic separation	LF transformer	LF transformer	LF transformer	LF transformer
SYSTEM	Sirio K12	Sirio K15	Sirio K18	Sirio K25
Maximum efficiency	95,8%	95,8%	95,8%	95,8%
European efficiency	94,8%	94,8%	94,8%	94,9%
Off-Grid protection	YES	YES	YES	YES
Detecting earth leakage	optional	optional	optional	optional
Heat dissipation	fans	fans	fans	fans
FEATURES	Sirio K12	Sirio K15	Sirio K18	Sirio K25
Dimensions (WxDxH)	555x720x1200	555x720x1200	555x720x1200	555x720x1200
Weight	260 Kg	280 Kg	300 Kg	300 Kg
Protection level	IP20	IP20	IP20	IP20



Sirio K33	Sirio K40	Sirio K64	Sirio K80	Sirio K100	Sirio K200
max 40 kWp min 30 kWp	max 50 kWp min 36 kWp	max 80 kWp min 55 kWp	max 100 kWp min 70 kWp	max 125 kWp min 80 kWp	max 250 kWp min 180 kWp
33 kW	40 kW	64 kW	80 kW	100 kW	200 kW
36 kW	44 kW	71 kW	88 kW	110 kW	220 kW
Sirio K33	Sirio K40	Sirio K64	Sirio K80	Sirio K100	Sirio K200
800 Vdc	800 Vdc	800 Vdc	800 Vdc	800 Vdc	800 Vdc
540 ÷ 640 Vdc	540 ÷ 640 Vdc	540 ÷ 640 Vdc	540 ÷ 640 Vdc	540 ÷ 640 Vdc	540 ÷ 640 Vdc
330 ÷ 700 Vdc	330 ÷ 700 Vdc	330 ÷ 700 Vdc	330 ÷ 700 Vdc	330 ÷ 700 Vdc	330 ÷ 700 Vdc
105 Adc	130 Adc	205 Adc	260 Adc	320 Adc	650 Adc
390 Vdc	390 Vdc	390 Vdc	390 Vdc	390 Vdc	390 Vdc
<1%	<1%	<1%	<1%	<1%	<1%
1	1	1	1	1	1
1	1	1	1	1	1
Sirio K33	Sirio K40	Sirio K64	Sirio K80	Sirio K100	Sirio K200
400 Vac	400 Vac	400 Vac	400 Vac	400 Vac	400 Vac
340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac
340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac
49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz
47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz
48 Aac	58 Aac	92 Aac	115 Aac	145 Aac	289 Aac
60 Aac	73 Aac	117 Aac	146 Aac	182 Aac	364 Aac
<3%	<3%	<3%	<3%	<3%	<3%
>0,99	>0,99	>0,99	>0,99	>0,99	>0,99
LF transformer	LF transformer	LF transformer	LF transformer	LF transformer	LF transformer
Sirio K33	Sirio K40	Sirio K64	Sirio K80	Sirio K100	Sirio K200
95,8%	95,8%	96,1%	96,1%	96,1%	96,2%
94,9%	95%	95%	95%	95,1%	95,2%
YES	YES	YES	YES	YES	YES
optional	optional	optional	optional	optional	optional
fans	fans	fans	fans	fans	fans
Sirio K33	Sirio K40	Sirio K64	Sirio K80	Sirio K100	Sirio K200
555x720x1200	555x720x1200	800x800x1900	800x800x1900	800x800x1900	1630x1000x1900
330 Kg	420 Kg	600 Kg	650 Kg	720 Kg	1580 Kg
IP20	IP20	IP20	IP20	IP20	IP20

02

Choosing Table

HV CENTRAL INVERTERS



MODEL	Sirio K25 HV	Sirio K33 HV	Sirio K40 HV
Approximate power of the photovoltaic field	max 30 kWp min 20 kWp	max 40 kWp min 30 kWp	max 50 kWp min 36 kWp
Rated AC power	25 kW	33 kW	40 kW
Maximum AC power	28 kW	36 kW	44 kW
INPUT	Sirio K25 HV	Sirio K33 HV	Sirio K40 HV
Maximum DC voltage in an open circuit	880 Vdc	880 Vdc	880 Vdc
Recommended Vo@STC voltage	710 ÷ 760 Vdc	710 ÷ 760 Vdc	710 ÷ 760 Vdc
MPPT operating range	450 ÷ 760 Vdc	450 ÷ 760 Vdc	450 ÷ 760 Vdc
Maximum input current	59 Adc	79 Adc	98 Adc
Initial feeding voltage	540 Vdc	540 Vdc	540 Vdc
Ripple voltage	<1%	<1%	<1%
Number of inputs	1	1	1
MPPT number	1	1	1
OUTPUT	Sirio K25 HV	Sirio K33 HV	Sirio K40 HV
Operating voltage	400 Vac	400 Vac	400 Vac
Operating interval	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac
Maximum power range	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac
Frequency range	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz
Nominal current	36 Aac	48 Aac	58 Aac
Maximum current	46 Aac	60 Aac	73 Aac
Current Harmonic Distorsion (THDi)	<3%	<3%	<3%
Power factor	>0,99	>0,99	>0,99
Galvanic separation	LF transformer	LF transformer	LF transformer
SYSTEM	Sirio K25 HV	Sirio K33 HV	Sirio K40 HV
Maximum efficiency	96,4%	96,3%	96,2%
European efficiency	95,3%	95,3%	95,3%
Off-Grid protection	YES	YES	YES
Detecting earth leakage	optional	optional	optional
Heat dissipation	fans	fans	fans
FEATURES	Sirio K25 HV	Sirio K33 HV	Sirio K40 HV
Dimensions (WxDxH)	555x720x1200	555x720x1200	555x720x1200
Weight	300 Kg	330 Kg	420 Kg
Protection level	IP20	IP20	IP20



Sirio K64 HV	Sirio K80 HV	Sirio K100 HV	Sirio K200 HV	Sirio K250 HV
max 80 kWp min 55 kWp	max 100 kWp min 70 kWp	max 125 kWp min 80 kWp	max 250 kWp min 180 kWp	max 320 kWp min 220 kWp
64 kW	80 kW	100 kW	200 kW	250 kW
71 kW	88 kW	110 kW	220 kW	250 kW
Sirio K64 HV	Sirio K80 HV	Sirio K100 HV	Sirio K200 HV	Sirio K250 HV
880 Vdc	880 Vdc	880 Vdc	880 Vdc	880 Vdc
710 ÷ 760 Vdc	710 ÷ 760 Vdc	710 ÷ 760 Vdc	710 ÷ 760 Vdc	710 ÷ 760 Vdc
450 ÷ 760 Vdc	450 ÷ 760 Vdc	450 ÷ 760 Vdc	450 ÷ 760 Vdc	450 ÷ 760 Vdc
157 Adc	196 Adc	245 Adc	500 Adc	590 Adc
540 Vdc	540 Vdc	540 Vdc	540 Vdc	540 Vdc
<1%	<1%	<1%	<1%	<1%
1	1	1	1	1
1	1	1	1	1
Sirio K64 HV	Sirio K80 HV	Sirio K100 HV	Sirio K200 HV	Sirio K250 HV
400 Vac	400 Vac	400 Vac	400 Vac	400 Vac
340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac
340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac	340 ÷ 460 Vac
49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz
47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz
92 Aac	115 Aac	145 Aac	289 Aac	361 Aac
117 Aac	146 Aac	182 Aac	364 Aac	420 Aac
<3%	<3%	<3%	<3%	<3%
>0,99	>0,99	>0,99	>0,99	>0,99
LF transformer	LF transformer	LF transformer	LF transformer	LF transformer
Sirio K64 HV	Sirio K80 HV	Sirio K100 HV	Sirio K200 HV	Sirio K250 HV
96,1%	96,1%	96,1%	96,3%	96,3%
94,9%	95%	95,1%	95,2%	95,3%
YES	YES	YES	YES	YES
optional	optional	optional	optional	optional
fans	fans	fans	fans	fans
Sirio K64 HV	Sirio K80 HV	Sirio K100 HV	Sirio K200 HV	Sirio K250 HV
800x800x1900	800x800x1900	800x800x1900	1630x1000x1900	1630x1000x1900
600 Kg	650 Kg	720 Kg	1580 Kg	1630 Kg
IP20	IP20	IP20	IP20	IP20

03

Choosing Table

HV-MT CENTRAL INVERTERS:
WITHOUT TRANSFORMER FOR
CONNECTION TO A MEDIUM
VOLTAGE GRID

MODEL
Rated AC power
Maximum AC power
INPUT
Maximum DC voltage in an open circuit
Recommended $V_{o@STC}$ voltage
MPPT operating range
Maximum input current
Initial feeding voltage
Ripple voltage
Number of inputs
MPPT number
OUTPUT
Operating voltage
Operating interval
Maximum power range
Frequency range
Settable frequency range
Nominal current
Maximum current
Current Harmonic Distorsion (THDi)
Power factor
Galvanic separation
SYSTEM
Maximum efficiency
European efficiency
Off-Grid protection
Detecting earth leakage
Heat dissipation
FEATURES
Dimensions (WxDxH)
Weight
Protection level



SIRIO K200 HV-MT	Sirio K250 HV-MT	Sirio K500 HV-MT
200 KW	250 KW	500 KW
220 KW	250 KW	500 KW
SIRIO K200 HV-MT	Sirio K250 HV-MT	Sirio K500 HV-MT
880 Vdc	880 Vdc	880 Vdc
710 ÷ 760 Vdc	710 ÷ 760 Vdc	710 ÷ 760 Vdc
450 ÷ 760 Vdc	450 ÷ 760 Vdc	450 ÷ 760 Vdc
500 Adc	590 Adc	1180 Adc
540 Vdc	540 Vdc	540 Vdc
<1%	<1%	<1%
1	1	2
1	1	1
SIRIO K200 HV-MT	Sirio K250 HV-MT	Sirio K500 HV-MT
270 Vac	270 Vac	270 Vac
245 ÷ 300 Vac	245 ÷ 300 Vac	245 ÷ 300 Vac
245 ÷ 300 Vac	245 ÷ 300 Vac	245 ÷ 300 Vac
49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz	49,7 ÷ 50,3 Hz
47 ÷ 52 Hz	47 ÷ 52 Hz	47 ÷ 52 Hz
428 Aac	535 Aac	1070 Aac
554 Aac	630 Aac	1260 Aac
<3%	<3%	<3%
>0,99	>0,99	>0,99
NO	NO	NO
SIRIO K200 HV-MT	Sirio K250 HV-MT	Sirio K500 HV-MT
98,1%	98,1%	98,1%
97,5%	97,5%	97,5%
YES	YES	YES
optional	optional	optional
fans	fans	fans
SIRIO K200 HV-MT	Sirio K250 HV-MT	Sirio K500 HV-MT
1630x1000x1900	1630x1000x1900	1500x1000x1900
1100 Kg	1150 Kg	1340 Kg
IP20	IP20	IP20

TL Inverters

Quality power distribution

The range of Sirio TL inverters for photovoltaic plants uses high quality innovative technologies and components, having a large margin compared with normal operating conditions, and reaching a high level of reliability (Mean Time Between Failure > 100.000 hours). These technologies and components mean that the periodic maintenance of the equipment can be avoided without compromising the operating flexibility of any photovoltaic system and any electrical grid. Sirio TL inverters integrate protection against input and output overvoltage and are equipped with redundant control and protection devices, especially in the output phase (double relay with double control microprocessor), giving further guarantee of operability and continuity of operation.

High conversion efficiency

In small photovoltaic plants reduction of energy loss during the conversion process is essential. In the search for maximum efficiency to reduce losses, inverters of the Sirio series up to 10kWp are made without transformers and moving parts(*). This construction philosophy allows for the reduction in the footprint and weight of the inverters and increases reliability over time by eliminating the parts subjected to mechanical wear. Thanks to this "transformerless" technology, Sirio TL inverters guarantee a conversion efficiency up to 97% which is amongst the highest levels in this category.

(* except for the model 10000P which is provided with fans.



Easy installation and use

Light, compact and with an attractive design, the Sirio TL series inverters are easy to use and simple to install. An LCD display on the front panel provides a simple and intuitive display of all the main data: power, energy produced and any failures. The display can also show other parameters such as grid voltage, photovoltaic module voltage and grid frequency.

Reduced noise

The Sirio TL series of photovoltaic inverters have been designed with static electronic devices without the use of rotating components and cooling ventilators, thus reducing noise considerably.

Simple communication

All models in the series have a standard RS232 serial connection (RS485, Mod-BUS and Ethernet optional) enabling all information accessible locally on the display to be available from remote locations.

MPPT device

The MPPT (Maximum Power Point Tracker) device ensures the inverter works in such a way as to make the most of the maximum power of the photovoltaic generator as a function of the solar radiation and the temperature of the cells. The MPPT system response times ensures always the maximum power generated by the solar field, regardless of operating conditions.

GFCI (Ground Fault Circuit Interrupter)

Sirio TL series inverters are equipped with an advanced fault-protection circuit that constantly monitors the dispersion of current towards earth. In the event of an earth fault, the inverter is deactivated and the fault is shown by a red LED on the front control panel.

Certifications

The complete range complies with:

Italy:

ENEL DK5940 Ed. 2.2 and subsequent "Guide for connections to the ENEL DISTRIBUZIONE power grid"

Germany:

VDE 0126-1-1 2006-02

Spain:

Real Decreto 1663-2000



**CERTIFICATIONS**

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- VDE 0126-1-1 2006-02
- Real Decreto 1663-2000

**RCD TYPE B**

Each device comes with internal RCD protection type B, in accordance with IEC 60755

Model	Sirio 1500
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Approximate power of the photovoltaic field	max 1900 Wp min 1000 Wp
Rated AC power	1500 W
Maximum AC power	1650 W

Input

Maximum DC voltage in an open circuit	450 Vdc
MPPT operating range	100 ÷ 450 Vdc
MPPT at full rating range	200 ÷ 405 Vdc
Working range	100 ÷ 450 Vdc
Maximum input current	8,9 Adc
Voltage during system startup	120 Vdc
Initial feeding voltage	150 Vdc
Shutdown voltage	70 Vdc
Ripple voltage	<10%
Number of inputs	1
MPPT number	1
D.C. connectors	MC4 or compatible

Output

Operating voltage	230 Vac
Operating interval	190 ÷ 260 Vac
Maximum power range	210 ÷ 260 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	49 ÷ 51 Hz
Nominal current	6,6 Aac
Maximum current	7,9 Aac
Fault level contribution	7,9 Aac
DC current injection (max.)	<30 mA
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Terminal block

System

Maximum efficiency	>96,3%
European efficiency	>95%
Stand-by consumption	~7 W
Night consumption	~0 W
Internal protections	protection DC/AC side (RCD type B in accordance with IEC 60755). Overvoltage protection (OVR type 3)
Off-Grid protection	YES
Detecting earth leakage	YES
Heat dissipation	Convection
Operating temperature	-20°C ÷ 55°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 1033
Dimensions (WxDxH): 315x120x270 mm
Weight: 8,5 kg
Protection level: IP43
Acoustic noise: <35dBA

COMMUNICATION

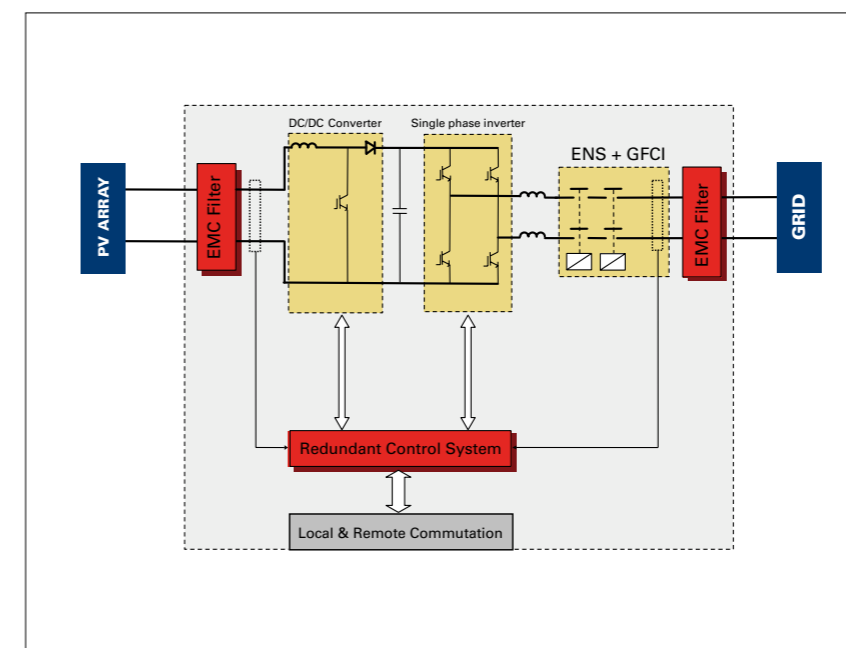
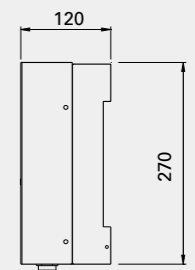
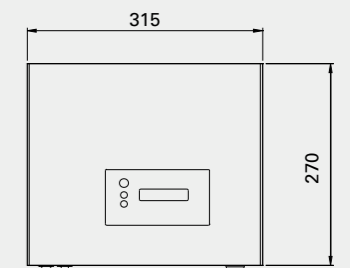
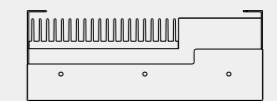
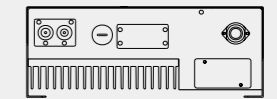
Display: Multilingual LCD display (Italian, English and Spanish), 1 row, 16 characters.
Communication interface: RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

STANDARDS

EMC: Directive 89/336/EEC EN 6100-6-4 (EN 55014, EN 55011 group 1, class B), EN 6100-6-1 (EMV interferences immunity), EN 61000-3-2.

Grid monitoring: Independent disconnection device (MSD, Mains monitoring with allocated Switching Devices) in conformity with VDEW; VDE 0126-1-1, ENEL DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real Decreto 1663-2000.

Directives: Directive 73/23/EEC EN 50178 (4.98) (VDE 0160) (which shall become IEC62103) EN 60146 part 1-1 (3.94).



**CERTIFICATIONS**

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- VDE 0126-1-1 2006-02
- Real Decreto 1663-2000

**RCD TYPE B**

Each device comes with internal RCD protection type B, in accordance with IEC 60755

Model	Sirio 2000
Approximate power of the photovoltaic field	max 2500 Wp min 1400 Wp
Rated AC power	2000 W
Maximum AC power	2200 W
Input	
Maximum DC voltage in an open circuit	500 Vdc
MPPT operating range	100 ÷ 500 Vdc
MPPT at full rating range	250 ÷ 450 Vdc
Working range	100 ÷ 500 Vdc
Maximum input current	10 Adc
Voltage during system startup	120 Vdc
Initial feeding voltage	150 Vdc
Shutdown voltage	70 Vdc
Ripple voltage	<10%
Number of inputs	1
MPPT number	1
D.C. connectors	MC4 or compatible
Output	
Operating voltage	230 Vac
Operating interval	190 ÷ 260 Vac
Maximum power range	210 ÷ 260 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	49 ÷ 51 Hz
Nominal current	8,7 Aac
Maximum current	10,5 Aac
Fault level contribution	10,5 Aac
DC current injection (max.)	<40 mA
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Terminal block
System	
Maximum efficiency	>96,5%
European efficiency	>95,1%
Stand-by consumption	~7 W
Night consumption	~0 W
Internal protections	protection DC/AC side (RCD type B in accordance with IEC 60755) Overvoltage protection (OVR type 3)
Off-Grid protection	YES
Detecting earth leakage	YES
Heat dissipation	Convection
Operating temperature	-20°C ÷ 55°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 1033

Dimensions (WxDxH): 350x120x303 mm

Weight: 11,4 kg

Protection level: IP43

Acoustic noise: <35dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English and Spanish), 1 row, 16 characters.

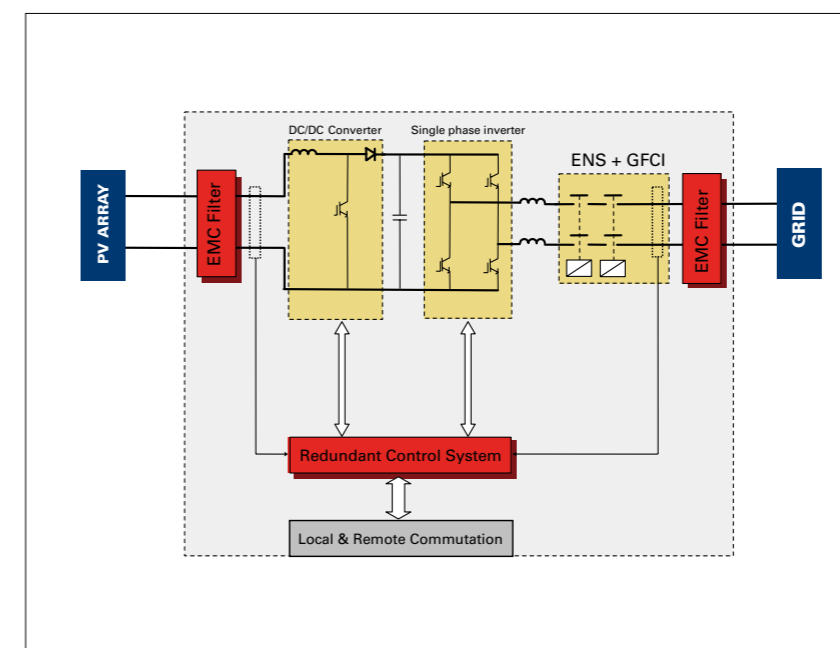
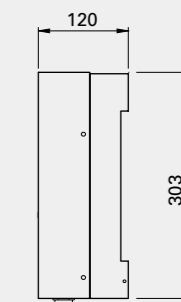
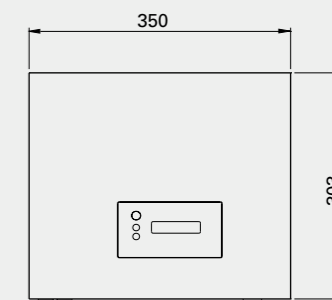
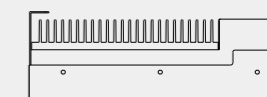
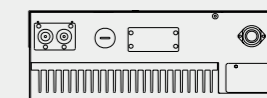
Communication interface: RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

STANDARDS

EMC: Directive 89/336/EEC EN 6100-6-4 (EN 55014, EN 55011 group 1, class B), EN 6100-6-1 (EMV interferences immunity), EN 61000-3-2.

Grid monitoring: Independent disconnection device (MSD, Mains monitoring with allocated Switching Devices) in conformity with VDEW; VDE 0126-1-1, ENEL DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real Decreto 1663-2000.

Directives: Directive 73/23/EEC EN 50178 (4.98) (VDE 0160) (which shall become IEC62103) EN 60146 part 1-1 (3.94).



Sirio 2800

TL INVERTERS

**CERTIFICATIONS**

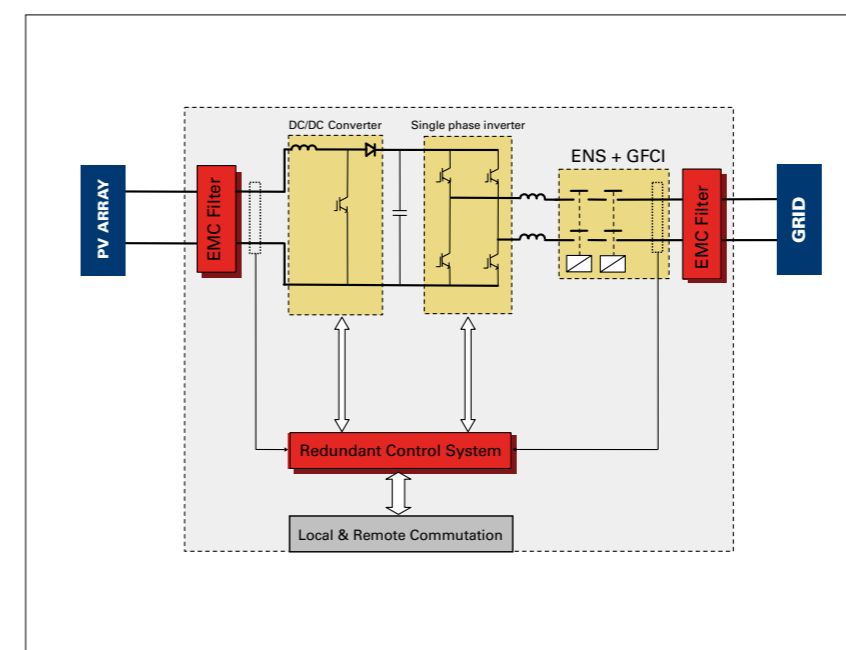
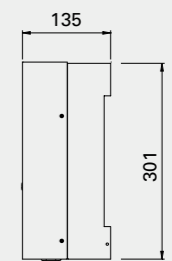
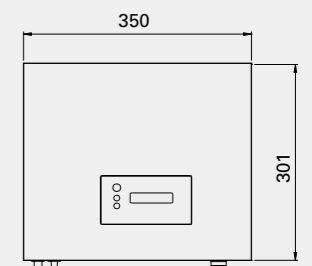
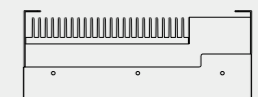
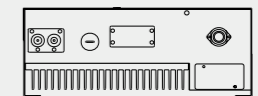
The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- VDE 0126-1-1 2006-02
- Real Decreto 1663-2000

**RCD TYPE B**

Each device comes with internal RCD protection type B, in accordance with IEC 60755

Model	Sirio 2800
Approximate power of the photovoltaic field	max 3500 Wp min 1960 Wp
Rated AC power	2800 W
Maximum AC power	3000 W
Input	
Maximum DC voltage in an open circuit	500 Vdc
MPPT operating range	100 ÷ 500 Vdc
MPPT at full rating range	250 ÷ 450 Vdc
Working range	100 ÷ 500 Vdc
Maximum input current	13 Adc
Voltage during system startup	120 Vdc
Initial feeding voltage	150 Vdc
Shutdown voltage	70 Vdc
Ripple voltage	<10%
Number of inputs	1
MPPT number	1
D.C. connectors	MC4 or compatible
Output	
Operating voltage	230 Vac
Operating interval	190 ÷ 260 Vac
Maximum power range	210 ÷ 260 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	49 ÷ 51 Hz
Nominal current	12,2 Aac
Maximum current	14,3 Aac
Fault level contribution	14,3 Aac
DC current injection (max.)	<60 mA
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Terminal block
System	
Maximum efficiency	>97,1%
European efficiency	>96%
Stand-by consumption	~7 W
Night consumption	~0 W
Internal protections	protection DC/AC side (RCD type B in accordance with IEC 60755). Overvoltage protection (OVR type 3)
Off-Grid protection	YES
Detecting earth leakage	YES
Heat dissipation	Convection
Operating temperature	-20°C ÷ 55°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES**Colour:** RAL 1033**Dimensions (WxDxH):** 350x135x301 mm**Weight:** 12,5 kg**Protection level:** IP43**Acoustic noise:** <35dBA**COMMUNICATION****Display:** Multilingual LCD display (Italian, English and Spanish), 1 row, 16 characters.**Communication interface:** RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).**STANDARDS****EMC:** Directive 89/336/EEC EN 6100-6-4 (EN 55014, EN 55011 group 1, class B), EN 6100-6-1 (EMV interferences immunity), EN 61000-3-2.**Grid monitoring:** Independent disconnection device (MSD, Mains monitoring with allocated Switching Devices) in conformity with VDEW; VDE 0126-1-1, ENEL DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real Decreto 1663-2000.**Directives:** Directive 73/23/EEC EN 50178 (4.98) (VDE 0160) (which shall become IEC62103) EN 60146 part 1-1 (3.94).

Sirio 3100

TL INVERTERS

**CERTIFICATIONS**

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- VDE 0126-1-1 2006-02
- Real Decreto 1663-2000

**RCD TYPE B**

Each device comes with internal RCD protection type B, in accordance with IEC 60755

Model Sirio 3100

Approximate power of the photovoltaic field	max 3900 Wp min 2400 Wp
Rated AC power	3100 W
Maximum AC power	3400 W

Input

Maximum DC voltage in an open circuit	500 Vdc
MPPT operating range	100 ÷ 500 Vdc
MPPT at full rating range	190 ÷ 450 Vdc
Working range	100 ÷ 500 Vdc
Maximum input current	20 Adc
Voltage during system startup	120 Vdc
Initial feeding voltage	150 Vdc
Shutdown voltage	70 Vdc
Ripple voltage	<10%
Number of inputs	2
MPPT number	1
D.C. connectors	MC4 or compatible

Output

Operating voltage	230 Vac
Operating interval	190 ÷ 260 Vac
Maximum power range	210 ÷ 260 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	49 ÷ 51 Hz
Nominal current	13,5 Aac
Maximum current	16,2 Aac
Fault level contribution	16,2 Aac
DC current injection (max.)	<80 mA
Current Harmonic Distorsion (THDi)	<3,5%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Terminal block

System

Maximum efficiency	>96,1%
European efficiency	>95,3%
Stand-by consumption	~7 W
Night consumption	~0 W
Internal protections	protection DC/AC side (RCD type B in accordance with IEC 60755). Overvoltage protection (OVR type 3)
Off-Grid protection	YES
Detecting earth leakage	YES
Heat dissipation	Convection
Operating temperature	-20°C ÷ 55°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

**FEATURES**

Colour: RAL 1033
Dimensions (WxDxH): 424x120x367 mm
Weight: 16,4 kg
Protection level: IP43
Acoustic noise: <35dBA

COMMUNICATION

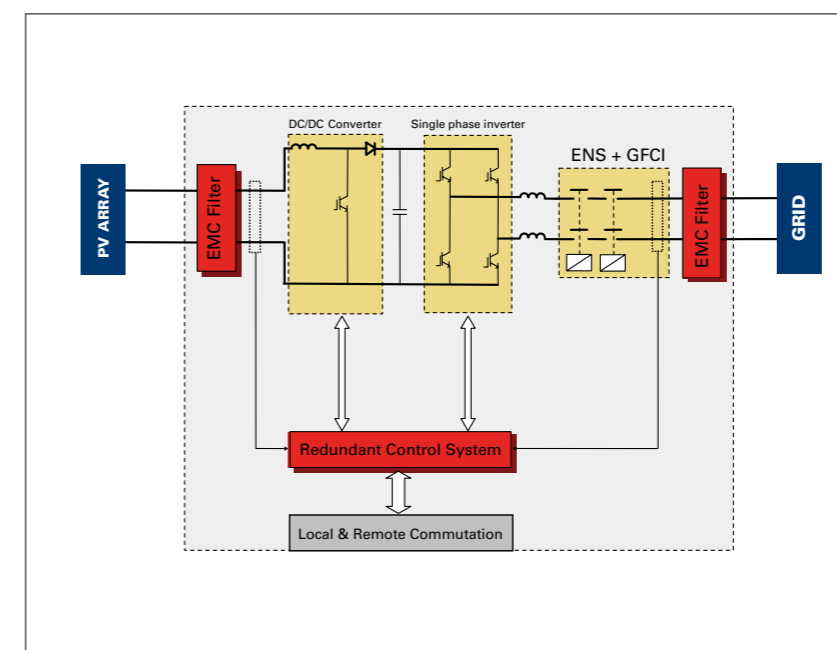
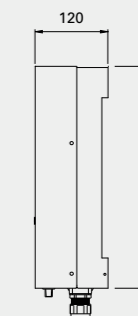
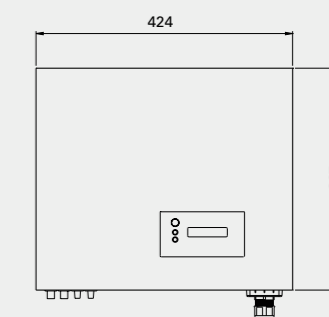
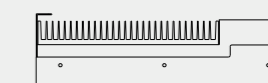
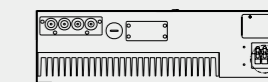
Display: Multilingual LCD display (Italian, English and Spanish), 1 row, 16 characters.
Communication interface: RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

STANDARDS

EMC: Directive 89/336/EEC EN 6100-6-4 (EN 55014, EN 55011 group 1, class B), EN 6100-6-1 (EMV interferences immunity), EN 61000-3-2.

Grid monitoring: Independent disconnection device (MSD, Mains monitoring with allocated Switching Devices) in conformity with VDEW; VDE 0126-1-1, ENEL DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real Decreto 1663-2000.

Directives: Directive 73/23/EEC EN 50178 (4.98) (VDE 0160) (which shall become IEC62103) EN 60146 part 1-1 (3.94).



Sirio 4000

TL INVERTERS

**CERTIFICATIONS**

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- VDE 0126-1-1 2006-02
- Real Decreto 1663-2000

**RCD TYPE B**

Each device comes with internal RCD protection type B, in accordance with IEC 60755



Model	Sirio 4000
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Approximate power of the photovoltaic field	max 5000 Wp min 2800 Wp
Rated AC power	4000 W
Maximum AC power	4400 W

Input

Maximum DC voltage in an open circuit	500 Vdc
MPPT operating range	100 ÷ 500 Vdc
MPPT at full rating range	250 ÷ 450 Vdc
Working range	100 ÷ 500 Vdc
Maximum input current	20 Adc
Voltage during system startup	120 Vdc
Initial feeding voltage	150 Vdc
Shutdown voltage	70 Vdc
Ripple voltage	<10%
Number of inputs	2
MPPT number	1
D.C. connectors	MC4 or compatible

Output

Operating voltage	230 Vac
Operating interval	190 ÷ 260 Vac
Maximum power range	210 ÷ 260 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	49 ÷ 51 Hz
Nominal current	17,4 Aac
Maximum current	20 Aac
Fault level contribution	20 Aac
DC current injection (max.)	<80 mA
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Terminal block

System

Maximum efficiency	>96,2%
European efficiency	>95,7%
Stand-by consumption	7 W
Night consumption	0 W
Internal protections	protection DC/AC side (RCD type B in accordance with IEC 60755). Overvoltage protection (OVR type 3)
Off-Grid protection	YES
Detecting earth leakage	YES
Heat dissipation	Convection
Operating temperature	-20°C ÷ 55°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 1033
Dimensions (WxDxH): 424x120x367 mm
Weight: 16,4 kg
Protection level: IP43
Acoustic noise: <35dBA

COMMUNICATION

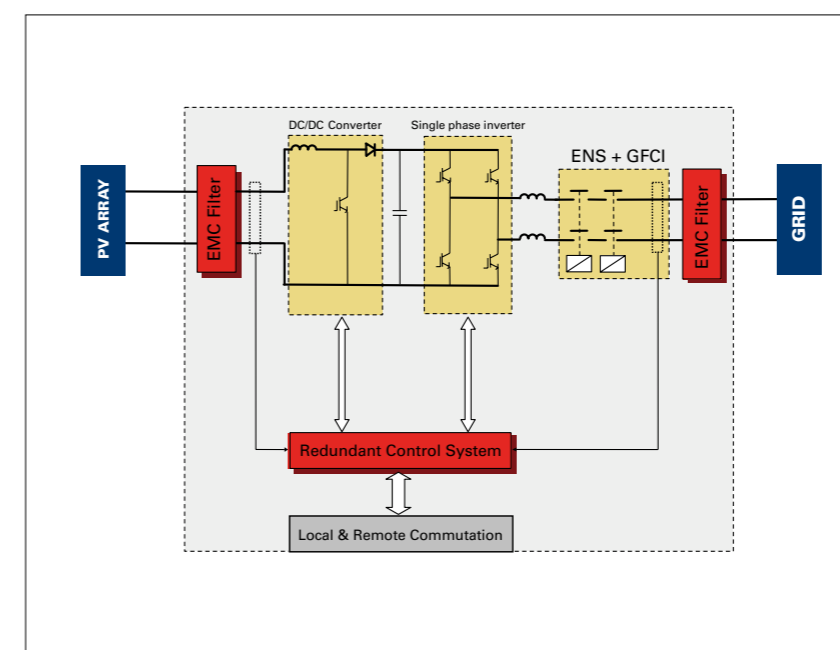
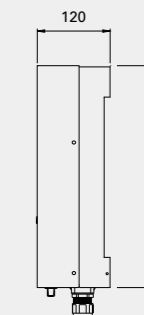
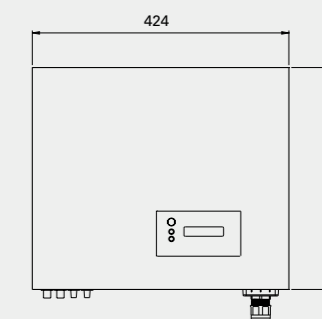
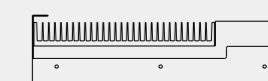
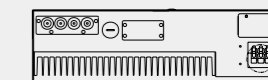
Display: Multilingual LCD display (Italian, English and Spanish), 1 row, 16 characters.
Communication interface: RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

STANDARDS

EMC: Directive 89/336/EEC EN 6100-6-4 (EN 55014, EN 55011 group 1, class B), EN 6100-6-1 (EMV interferences immunity), EN 61000-3-2.

Grid monitoring: Independent disconnection device (MSD, Mains monitoring with allocated Switching Devices) in conformity with VDEW; VDE 0126-1-1, ENEL DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real Decreto 1663-2000.

Directives: Directive 73/23/EEC EN 50178 (4.98) (VDE 0160) (which shall become IEC62103) EN 60146 part 1-1 (3.94).



**CERTIFICATIONS**

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- VDE 0126-1-1 2006-02
- Real Decreto 1663-2000

**RCD TYPE B**

Each device comes with internal RCD protection type B, in accordance with IEC 60755

Model	Sirio 4000P
Approximate power of the photovoltaic field	max 5000 Wp min 2800 Wp
Rated AC power	4000 W
Maximum AC power	4400 W
Input	
Maximum DC voltage in an open circuit	500 Vdc
MPPT operating range	100 ÷ 500 Vdc
MPPT at full rating range	250 ÷ 450 Vdc
Working range	100 ÷ 500 Vdc
Maximum input current	20 Adc
Voltage during system startup	120 Vdc
Initial feeding voltage	150 Vdc
Shutdown voltage	70 Vdc
Ripple voltage	<10%
Number of inputs	3
MPPT number	1
D.C. connectors	MC4 or compatible
Output	
Operating voltage	230 Vac
Operating interval	190 ÷ 260 Vac
Maximum power range	210 ÷ 260 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	49 ÷ 51 Hz
Nominal current	17,4 Aac
Maximum current	20 Aac
Fault level contribution	20 Aac
DC current injection (max.)	<80 mA
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Terminal block
System	
Maximum efficiency	>96,2%
European efficiency	>95,7%
Stand-by consumption	~7 W
Night consumption	~0 W
Internal protections	protection DC/AC side (RCD type B in accordance with IEC 60755). Overvoltage protection (OVR type 3)
Off-Grid protection	YES
Detecting earth leakage	YES
Heat dissipation	Convection
Operating temperature	-20°C ÷ 55°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

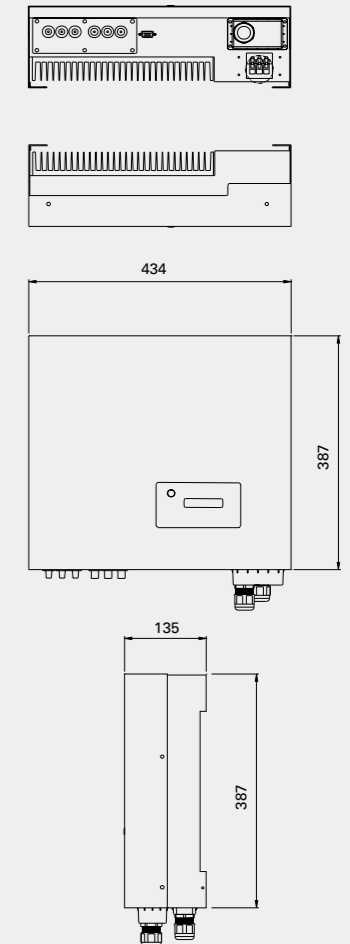
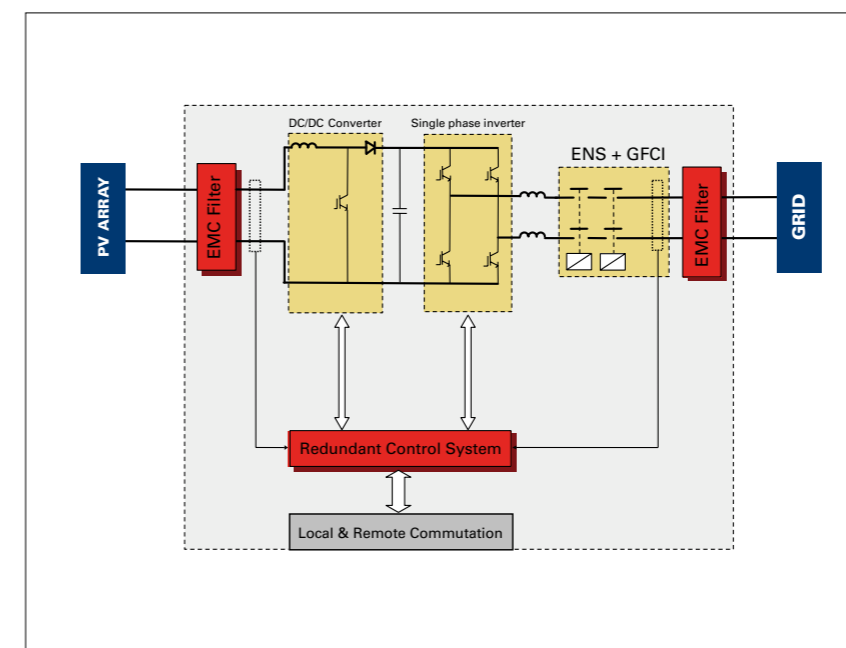
Colour: RAL 1033
Dimensions (WxDxH): 434x135x387 mm
Weight: 19,5 kg
Protection level: IP65
Acoustic noise: <35dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English and Spanish), 1 row, 16 characters.
Communication interface: RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

STANDARDS

EMC: Directive 89/336/EEC EN 6100-6-4 (EN 55014, EN 55011 group 1, class B), EN 6100-6-1 (EMV interferences immunity), EN 61000-3-2.
Grid monitoring: Independent disconnection device (MSD, Mains monitoring with allocated Switching Devices) in conformity with VDEW; VDE 0126-1-1, ENEL DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real Decreto 1663-2000.
Directives: Directive 73/23/EEC EN 50178 (4.98) (VDE 0160) (which shall become IEC62103) EN 60146 part 1-1 (3.94).



Sirio 4600P

TL INVERTERS



CERTIFICATIONS

The complete range complies with:
 - DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
 - VDE 0126-1-1 2006-02
 - Real Decreto 1663-2000



RCD TYPE B

Each device comes with internal RCD protection type B, in accordance with IEC 60755

Model	Sirio 4600P
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Approximate power of the photovoltaic field	max 5700 Wp min 3200 Wp
Rated AC power	4600 W
Maximum AC power	5100 W

Input	
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Maximum DC voltage in an open circuit	750 Vdc
MPPT operating range	100 ÷ 750 Vdc
MPPT at full rating range	190 ÷ 700 Vdc
Working range	100 ÷ 750 Vdc
Maximum input current	8,5 Adc per tracker
Voltage during system startup	120 Vdc
Initial feeding voltage	150 Vdc
Shutdown voltage	80 Vdc
Ripple voltage	<10%
Number of inputs	3
MPPT number	3
D.C. connectors	MC4 or compatible

Output	
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Operating voltage	230 Vac
Operating interval	190 ÷ 260 Vac
Maximum power range	210 ÷ 260 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	49 ÷ 51 Hz
Nominal current	20 Aac
Maximum current	26 Aac
Fault level contribution	26 Aac
DC current injection (max.)	<100 mA
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Terminal block

System	
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Maximum efficiency	>96,2%
European efficiency	>95,2%
Stand-by consumption	~8 W
Night consumption	~0 W
Internal protections	protection DC/AC side (RCD type B in accordance with IEC 60755). Overvoltage protection (OVR type 3)
Off-Grid protection	YES
Detecting earth leakage	YES
Heat dissipation	Convection
Operating temperature	-20°C ÷ 55°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

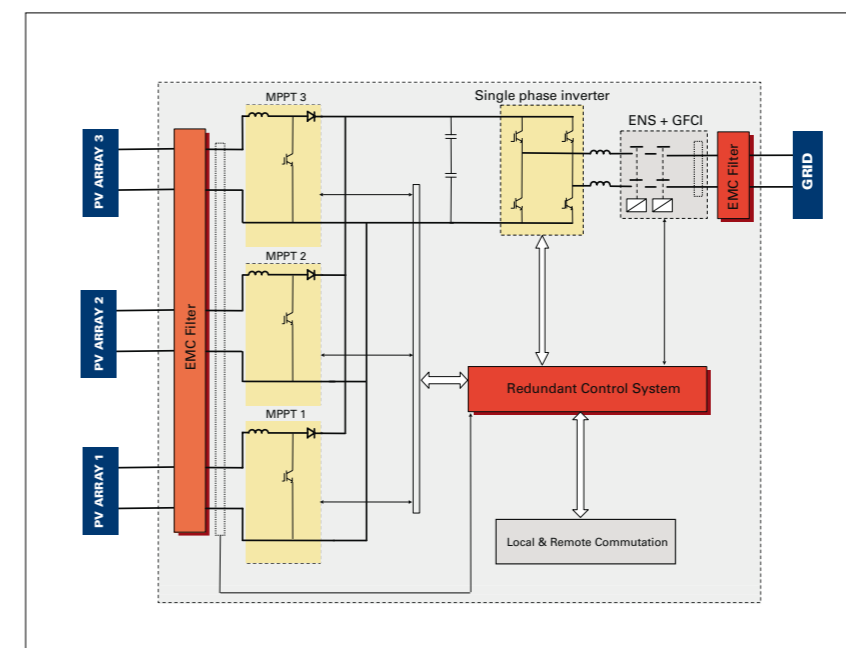
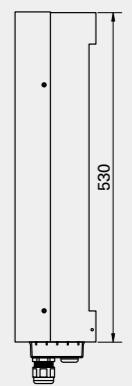
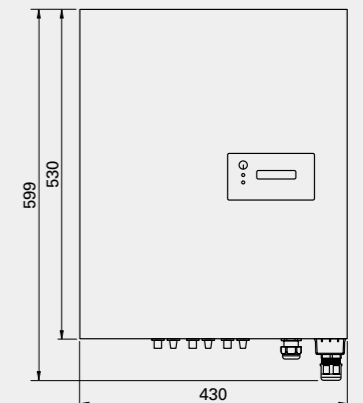
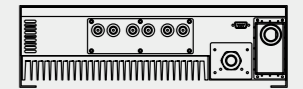
- Colour:** RAL 1033
- Dimensions (WxDxH):** 430x130x530 mm
- Weight:** 27 kg
- Protection level:** IP65
- Acoustic noise:** <35dBA

COMMUNICATION

- Display:** Multilingual LCD display (Italian, English and Spanish), 1 row, 16 characters.
- Communication interface:** RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

STANDARDS

- EMC:** Directive 89/336/EEC EN 6100-6-4 (EN 55014, EN 55011 group 1, class B), EN 6100-6-1 (EMV interferences immunity), EN 61000-3-2.
- Grid monitoring:** Independent disconnection device (MSD, Mains monitoring with allocated Switching Devices) in conformity with VDEW; VDE 0126-1-1, ENEL DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real Decreto 1663-2000.
- Directives:** Directive 73/23/EEC EN 50178 (4.98) (VDE 0160) (which shall become IEC62103) EN 60146 part 1-1 (3.94).



Sirio 6000P

TL INVERTERS

**CERTIFICATIONS**

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- VDE 0126-1-1 2006-02
- Real Decreto 1663-2000

**RCD TYPE B**

Each device comes with internal RCD protection type B, in accordance with IEC 60755

Model	Sirio 6000P
Approximate power of the photovoltaic field	max 7500 Wp min 4200 Wp
Rated AC power	6000 W
Maximum AC power	6000 W
Input	
Maximum DC voltage in an open circuit	550 Vdc
MPPT operating range	130 ÷ 550 Vdc
MPPT at full rating range	230 ÷ 500 Vdc
Working range	130 ÷ 550 Vdc
Maximum input current	27,5 Adc
Voltage during system startup	150 Vdc
Initial feeding voltage	180 Vdc
Shutdown voltage	100 Vdc
Ripple voltage	<10%
Number of inputs	3
MPPT number	1
D.C. connectors	MC4 or compatible
Output	
Operating voltage	230 Vac
Operating interval	190 ÷ 260 Vac
Maximum power range	210 ÷ 260 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	49 ÷ 51 Hz
Nominal current	26 Aac
Maximum current	28,6 Aac
Fault level contribution	28,6 Aac
DC current injection (max.)	<130 mA
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Terminal block
System	
Maximum efficiency	>97,6%
European efficiency	>96,6%
Stand-by consumption	~8 W
Night consumption	~0 W
Internal protections	protection DC/AC side (RCD type B in accordance with IEC 60755). Overvoltage protection (OVR type 3)
Off-Grid protection	YES
Detecting earth leakage	YES
Heat dissipation	Convection
Operating temperature	-20°C ÷ 55°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

**FEATURES**

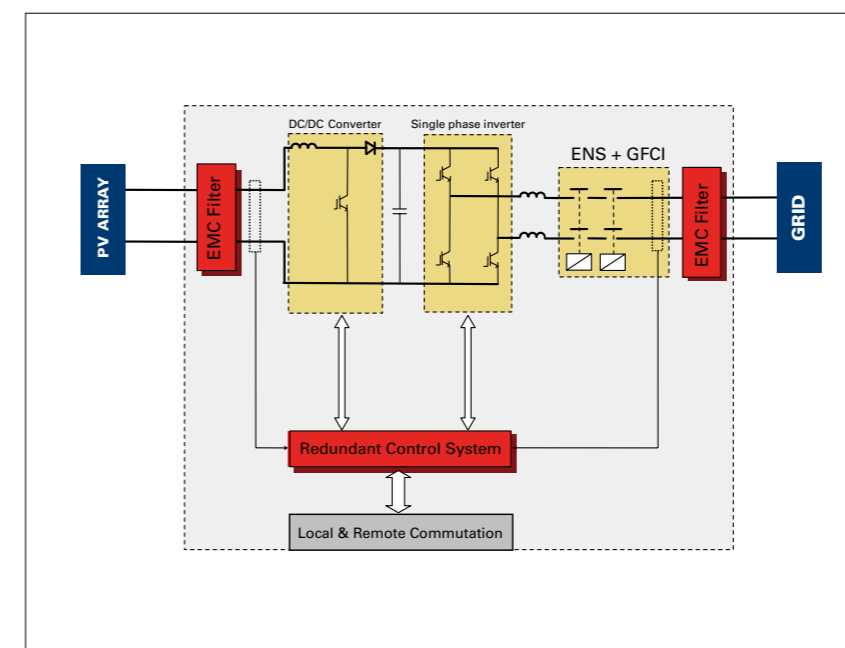
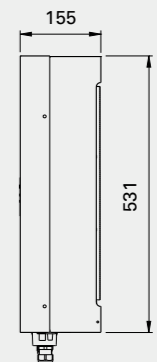
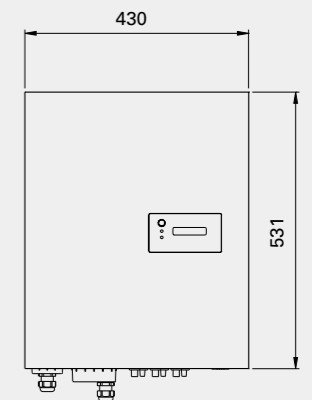
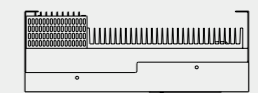
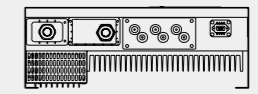
Colour: RAL 1033
Dimensions (WxDxH): 430x155x531 mm
Weight: 30 kg
Protection level: IP65
Acoustic noise: <35dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English and Spanish), 1 row, 16 characters.
Communication interface: RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

STANDARDS

EMC: Directive 89/336/EEC EN 6100-6-4 (EN 55014, EN 55011 group 1, class B), EN 6100-6-1 (EMV interferences immunity), EN 61000-3-2.
Grid monitoring: Independent disconnection device (MSD, Mains monitoring with allocated Switching Devices) in conformity with VDEW; VDE 0126-1-1, ENEL DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real Decreto 1663-2000.
Directives: Directive 73/23/EEC EN 50178 (4.98) (VDE 0160) (which shall become IEC62103) EN 60146 part 1-1 (3.94).



**CERTIFICATIONS**

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- VDE 0126-1-1 2006-02
- Real Decreto 1663-2000

**RCD TYPE B**

Each device comes with internal RCD protection type B, in accordance with IEC 60755

Model	Sirio 10000P
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Approximate power of the photovoltaic field	max 12500 Wp min 7000 Wp
Rated AC power	10000 W
Maximum AC power	11000 W

Input

Maximum DC voltage in an open circuit	800 Vdc
MPPT operating range	200 ÷ 800 Vdc
MPPT at full rating range	270 ÷ 720 Vdc
Working range	200 ÷ 800 Vdc
Maximum input current	13 Adc per MPPT
Voltage during system startup	260 Vdc
Initial feeding voltage	350 Vdc
Shutdown voltage	200 Vdc
Ripple voltage	<10%
Number of inputs	3
MPPT number	3
D.C. connectors	MC4 or compatible

Output

Operating voltage	400 Vac
Operating interval	320 ÷ 480 Vac
Maximum power range	330 ÷ 480 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	49 ÷ 51 Hz
Nominal current	14,5 Aac per phase
Maximum current	17,5 Aac per phase
Fault level contribution	17,5 Aac per phase
DC current injection (max.)	<100 mA
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Terminal block

System

Maximum efficiency	>96,2%
European efficiency	>94,6%
Stand-by consumption	<30 W
Night consumption	<5 W
Internal protections	protection DC/AC side (RCD type B in accordance with IEC 60755). Overvoltage protection (OVR type 3)
Off-Grid protection	YES
Detecting earth leakage	YES
Heat dissipation	forced air
Operating temperature	-20°C ÷ 55°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 1033
Dimensions (WxDxH): 444x151x584 mm
Weight: 37 kg
Protection level: IP65
Acoustic noise: <45dBA

COMMUNICATION

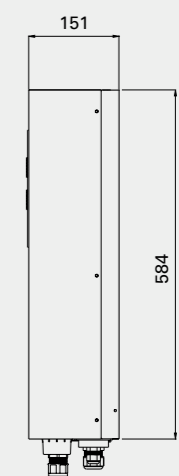
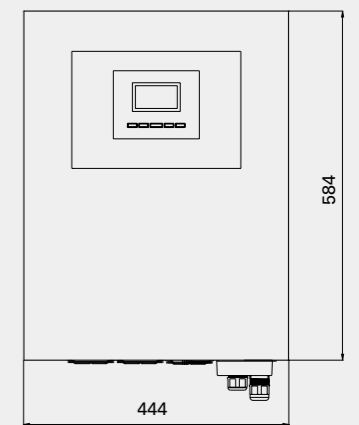
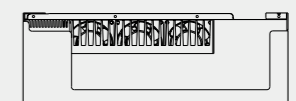
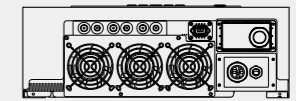
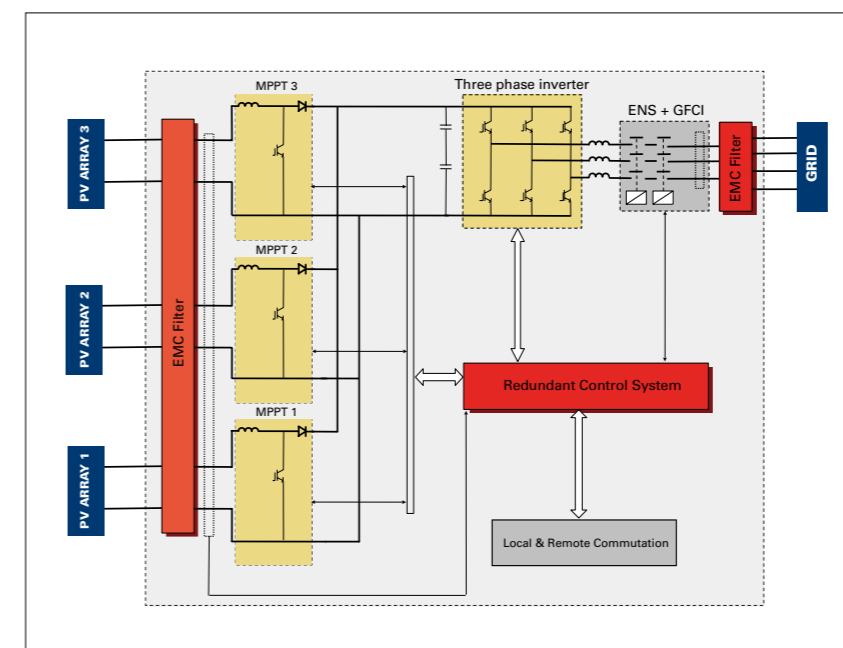
Display: Graphic 3 colors.
Communication interface: RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

STANDARDS

EMC: Directive 89/336/EEC EN 6100-6-4 (EN 55014, EN 55011 group 1, class B), EN 6100-6-1 (EMV interferences immunity), EN 61000-3-2.

Grid monitoring: Independent disconnection device (MSD, Mains monitoring with allocated Switching Devices) in conformity with VDEW; VDE 0126-1-1, ENEL DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real Decreto 1663-2000.

Directives: Directive 73/23/EEC EN 50178 (4.98) (VDE 0160) (which shall become IEC62103) EN 60146 part 1-1 (3.94).



Sirio Central inverters allow direct connection to the low voltage grid ensuring the galvanic separation compared to direct current installations. The generous rating of the transformer and the other inverter components provides a return of the highest among the machines of the same category.

Maximum energy and safety

The Maximum Power Point Tracking (MPPT) research algorithm implemented in the control system of Sirio Central inverters allows full use of the photovoltaic generator in any radiation and temperature conditions, making the plant work constantly at maximum efficiency. In the absence of solar radiation the converter goes on standby and resumes normal operation when there is radiation again. This feature reduces self-consumption to a minimum

and maximizes energy efficiency. The use of speed-controlled fans helps to optimize the overall efficiency of the inverter. Fan operation that is linked to the temperature also increases the expected lifespan and reduces costs incurred for extraordinary maintenance. All these design features, the careful choice of components and guaranteed quality of production according to ISO 9001 standards make the three-phase inverters Sirio extremely efficient and reliable and guarantee maximum energy production.

Advanced communication

The Sirio Central series inverters have an intuitive man-machine interface, made up of an integrated display and keyboard with which it is possible to control the photovoltaic system's main parameters and interact with it to control its operation. The display and keyboard facilitate diagnosis and solutions to any operating problems at local level while interaction with the remote inverter is possible through the most common of media (local serial link, Local Area Network, GSM, etc.). Communication interfaces and related software are common to the family of Sirio TL inverters, which can be referred to for more detailed information.

Easy installation and maintenance

The footprint of these devices has been considerably reduced and there is no need to leave space at the side or back (except for the models up to K40) of the equipment since the electronics and power components are fully accessible from the front. Fully automatic operation ensures ease of use and facilitates installation and startup, thus avoiding installation and configuration errors which could lead to failures or reduced plant productivity.

Conformance

Sirio Central inverters with low frequency isolation transformers conform fully with European safety standards LVD and EMC and with Italian and international regulations regarding parallel connection to the public distribution network.

- Electromagnetic Compatibility Directive (89/336/EEC and subsequent amendments 92/31/EEC, 93/68/EEC and 93/97/EEC);
- CEI 11-20 Electrical energy production systems and uninterruptible power supplies connected to I and II class networks;
- CEI 11-20, V1 Electrical energy production systems and uninterruptible power supplies connected to I and II class networks;-V1
- Guide for connections to the ENEL DISTRIBUZIONE power grid, Ed. 2.2.

Personalized solutions

AROS is able on request to supply Sirio Central inverters specific to the client's needs. Available options include the integrated isolation control and the pole/earth connection kit (positive or negative) that is required for some kinds of photovoltaic modules.





GUIDE FOR CONNECTION TO THE POWER GRID

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000



OPTIONS ON REQUEST

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model Sirio K12

Approximate power of the photovoltaic field	max 14 kWp min 9 kWp
Rated AC power	12 kW
Maximum AC power	13,2 kW

Input

Maximum DC voltage in an open circuit	800 Vdc
Recommended Vo@STC voltage	540÷640 Vdc
Intervallo MPPT	330÷700 Vdc
Working range	330÷700 Vdc
Maximum input current	36 Adc
Initial feeding voltage	390 Vdc
Ripple voltage	<1%
Number of inputs	1
MPPT number	1
D.C. connectors	Screw terminals

Output

Operating voltage	400 Vac
Operating interval	340 ÷ 460 Vac
Maximum power range	340 ÷ 460 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current	17,3 Aac
Maximum current	22,4 Aac
Fault level contribution	22,4 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	LF transformer
A.C. connectors	Screw terminals

System

Maximum efficiency	95,8%
European efficiency	94,8%
Stand-by consumption	<32 W
Night consumption	<32 W
Internal protections	MCCB AC side and switch DC side
Off-Grid protection	YES
Detecting earth leakage	Optional
Heat dissipation	Fans
Operating temperature	0°C ÷ 45°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 555x720x1200 mm

Weight: 260 Kg

Protection level: IP20

Acoustic noise: <66dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

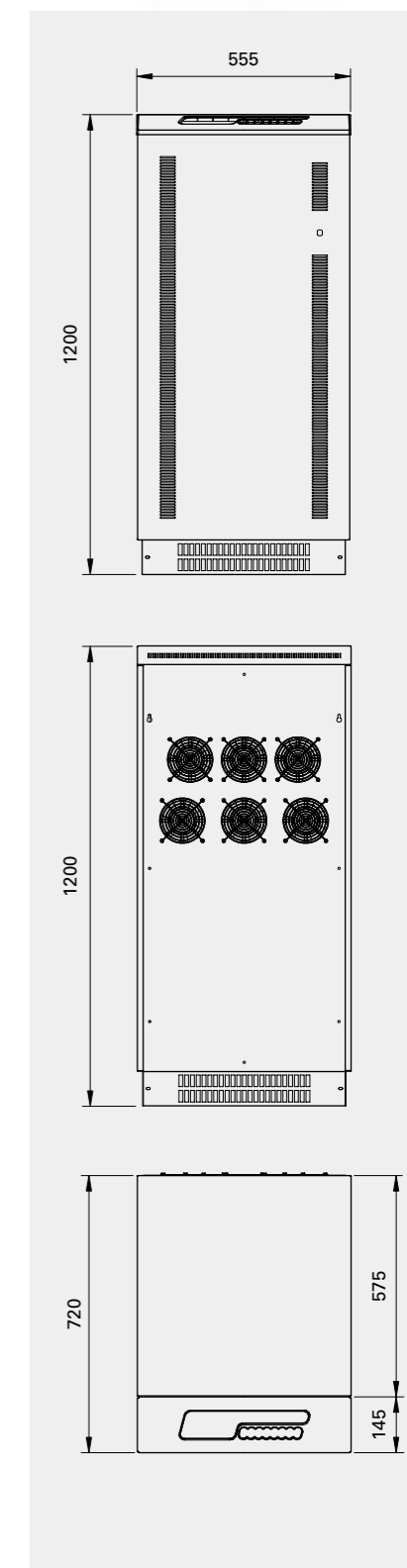
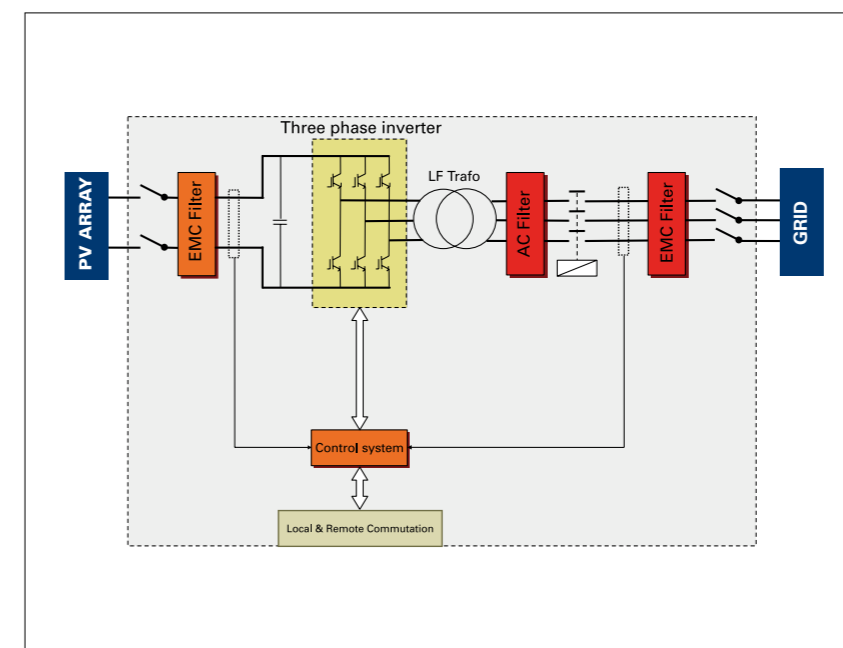
STANDARDS

EMC: EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.





GUIDE FOR CONNECTION TO THE POWER GRID

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000



OPTIONS ON REQUEST

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K15
Approximate power of the photovoltaic field	max 18 kWp min 12 kWp
Rated AC power	15 kW
Maximum AC power	17 kW
Input	
Maximum DC voltage in an open circuit	800 Vdc
Recommended Vo@STC voltage	540÷640 Vdc
Intervallo MPPT	330÷700 Vdc
Working range	330÷700 Vdc
Maximum input current	54 Adc
Initial feeding voltage	390 Vdc
Ripple voltage	<1%
Number of inputs	1
MPPT number	1
D.C. connectors	Screw terminals
Output	
Operating voltage	400 Vac
Operating interval	340 ÷ 460 Vac
Maximum power range	340 ÷ 460 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current	21,7 Aac
Maximum current	28,1 Aac
Fault level contribution	28,1 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	LF transformer
A.C. connectors	Screw terminals
System	
Maximum efficiency	95,8%
European efficiency	94,8%
Stand-by consumption	<32 W
Night consumption	<32 W
Internal protections	MCCB AC side and switch DC side
Off-Grid protection	YES
Detecting earth leakage	Optional
Heat dissipation	Fans
Operating temperature	0°C ÷ 45°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 555x720x1200 mm

Weight: 280 Kg

Protection level: IP20

Acoustic noise: <66dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

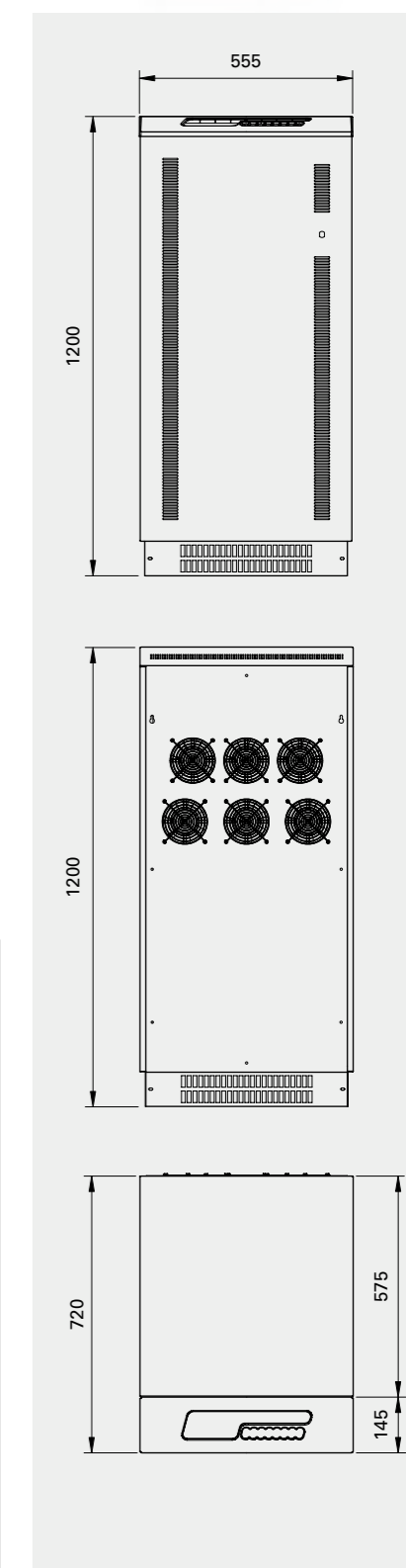
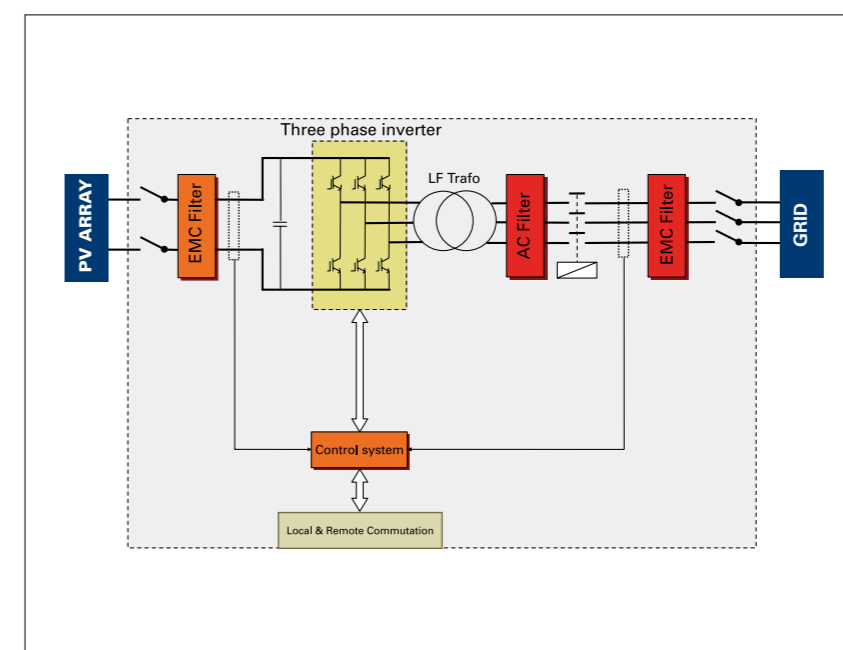
STANDARDS

EMC: EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.





GUIDE FOR CONNECTION TO THE POWER GRID

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000



OPTIONS ON REQUEST

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K18
Approximate power of the photovoltaic field	max 21 kWp min 16 kWp
Rated AC power	18 kW
Maximum AC power	20 kW
Input	
Maximum DC voltage in an open circuit	800 Vdc
Recommended Vo@STC voltage	540÷640 Vdc
Intervallo MPPT	330÷700 Vdc
Working range	330÷700 Vdc
Maximum input current	63 Adc
Initial feeding voltage	390 Vdc
Ripple voltage	<1%
Number of inputs	1
MPPT number	1
D.C. connectors	Screw terminals
Output	
Operating voltage	400 Vac
Operating interval	340 ÷ 460 Vac
Maximum power range	340 ÷ 460 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current	26 Aac
Maximum current	33 Aac
Fault level contribution	33 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	LF transformer
A.C. connectors	Screw terminals
System	
Maximum efficiency	95,8%
European efficiency	94,8%
Stand-by consumption	<32 W
Night consumption	<32 W
Internal protections	MCCB AC side and switch DC side
Off-Grid protection	YES
Detecting earth leakage	Optional
Heat dissipation	Fans
Operating temperature	0°C ÷ 45°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 555x720x1200 mm

Weight: 300 Kg

Protection level: IP20

Acoustic noise: <66dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

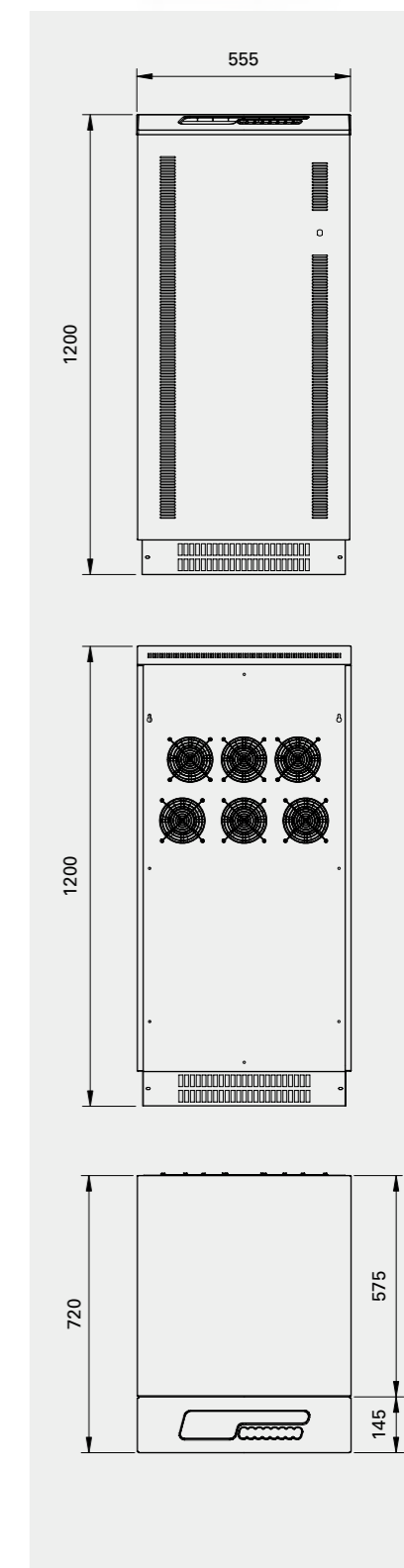
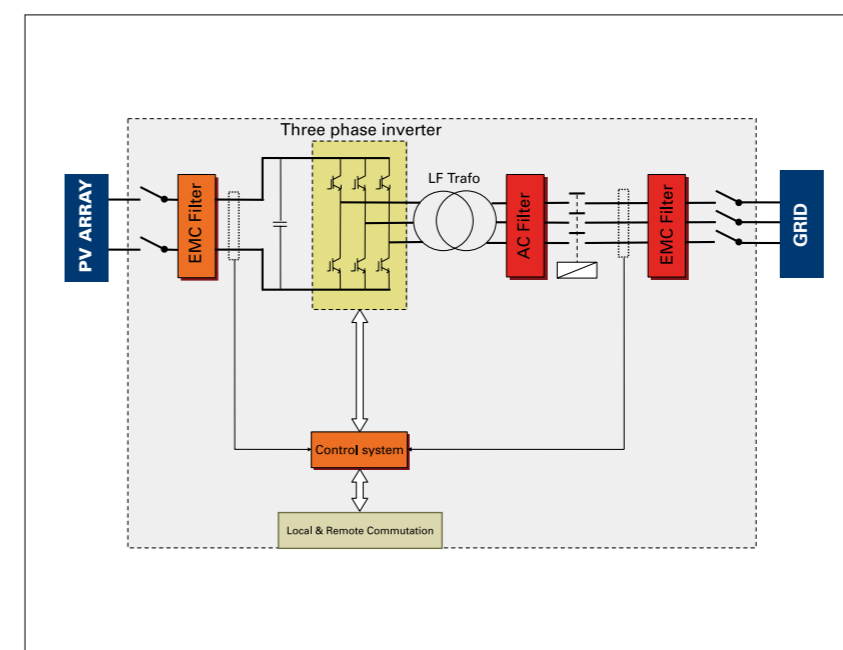
STANDARDS

EMC: EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.



Sirio K25 and K25 HV

CENTRAL INVERTERS

**GUIDE FOR CONNECTION TO THE POWER GRID**

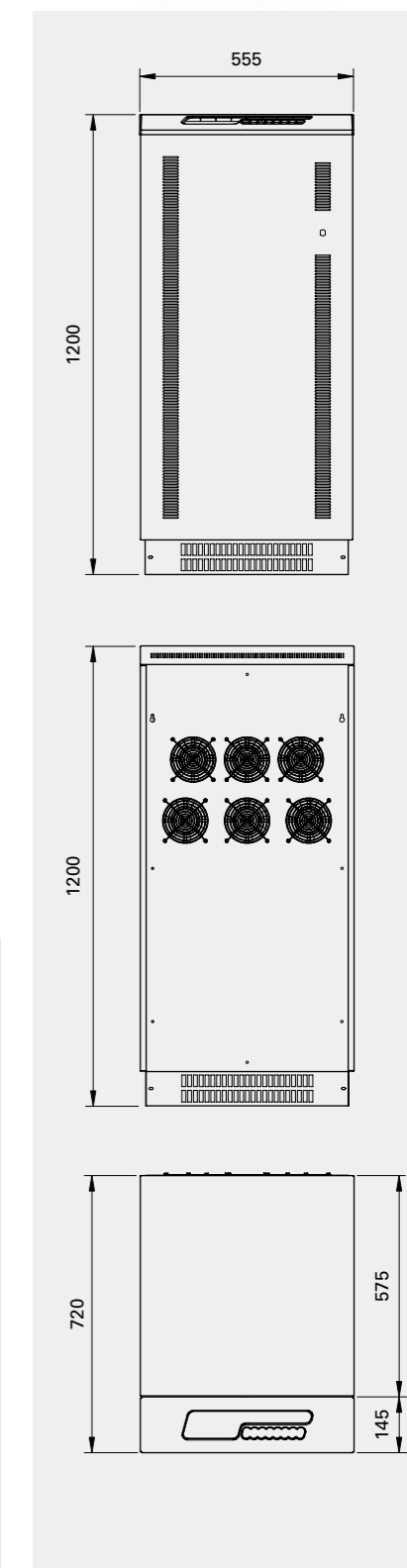
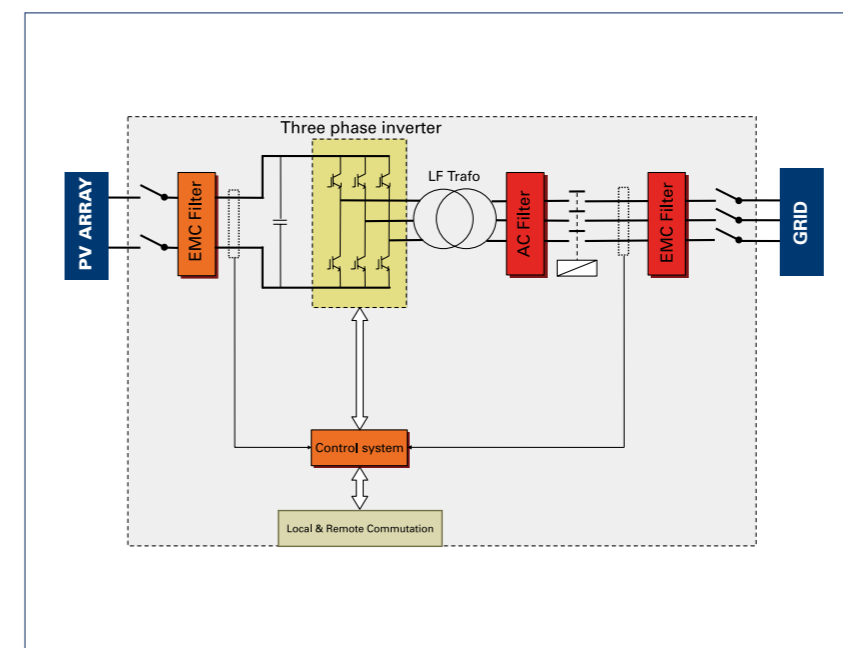
The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000

**OPTIONS ON REQUEST**

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K25	Sirio K25 HV
Approximate power of the photovoltaic field	max 30 kWp min 20 kWp	
Rated AC power	25 kW	
Maximum AC power	28 kW	
Input		
Maximum DC voltage in an open circuit	800 Vdc	880 Vdc
Recommended $V_{o@STC}$ voltage	540÷640 Vdc	710÷760 Vdc
Intervallo MPPT	330÷700 Vdc	450÷760 Vdc
Working range	330÷700 Vdc	450÷760 Vdc
Maximum input current	80 Adc	59 Adc
Initial feeding voltage	390 Vdc	540 Vdc
Ripple voltage	<1%	
Number of inputs	1	
MPPT number	1	
D.C. connectors	Screw terminals	
Output		
Operating voltage	400 Vac	
Operating interval	340 ÷ 460 Vac	
Maximum power range	340 ÷ 460 Vac	
Frequency range	49,7 ÷ 50,3 Hz	
Settable frequency range	47 ÷ 52 Hz	
Nominal current	36 Aac	
Maximum current	46 Aac	
Fault level contribution	46 Aac	
Current Harmonic Distorsion (THDi)	<3%	
Power factor	>0,99	
Galvanic separation	LF transformer	
A.C. connectors	Screw terminals	
System		
Maximum efficiency	95,8%	96,4%
European efficiency	94,9%	95,3%
Stand-by consumption	<32 W	
Night consumption	<32 W	
Internal protections	MCCB AC side and switch DC side	
Off-Grid protection	YES	
Detecting earth leakage	Optional	
Heat dissipation	Fans	
Operating temperature	0°C ÷ 45°C	
Storage temperature	-20°C ÷ 70°C	
Humidity	0 ÷ 95% non-condensing	

FEATURES**Colour:** RAL 7035 / RAL 1033**Dimensions (WxDxH):** 555x720x1200 mm**Weight:** 300 kg**Protection level:** IP20**Acoustic noise:** <66dBA**COMMUNICATION****Display:** Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.**Communication interface:** 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).**STANDARDS****EMC:** EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.**Safety:** EN50178.**Directives:** Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.**Guide for connection to the power grid:** Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.

Sirio K33 and K33 HV

CENTRAL INVERTERS

**GUIDE FOR CONNECTION TO THE POWER GRID**

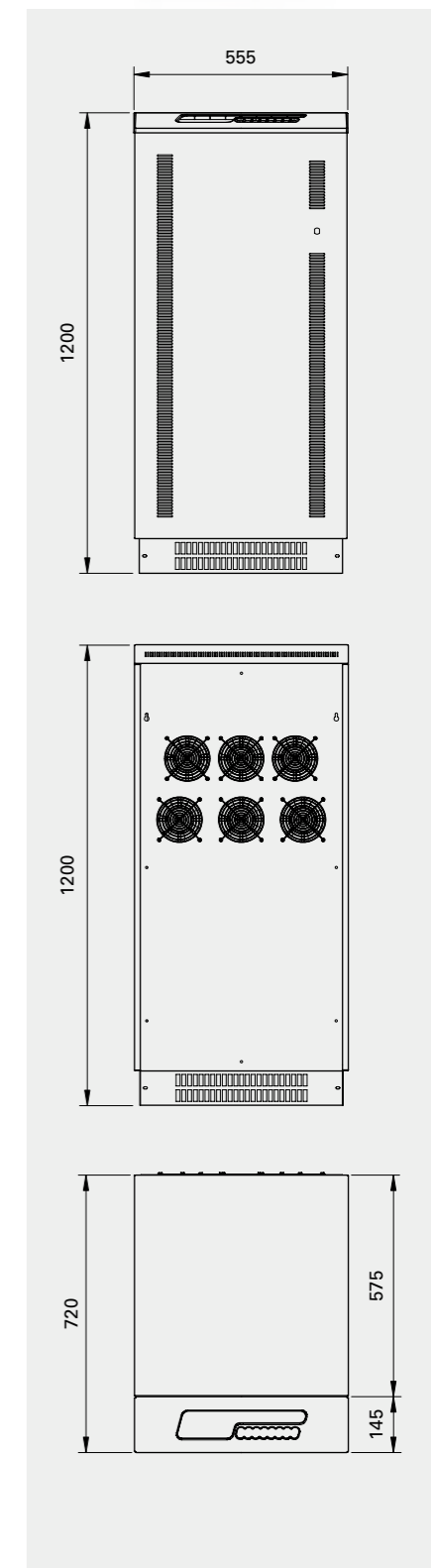
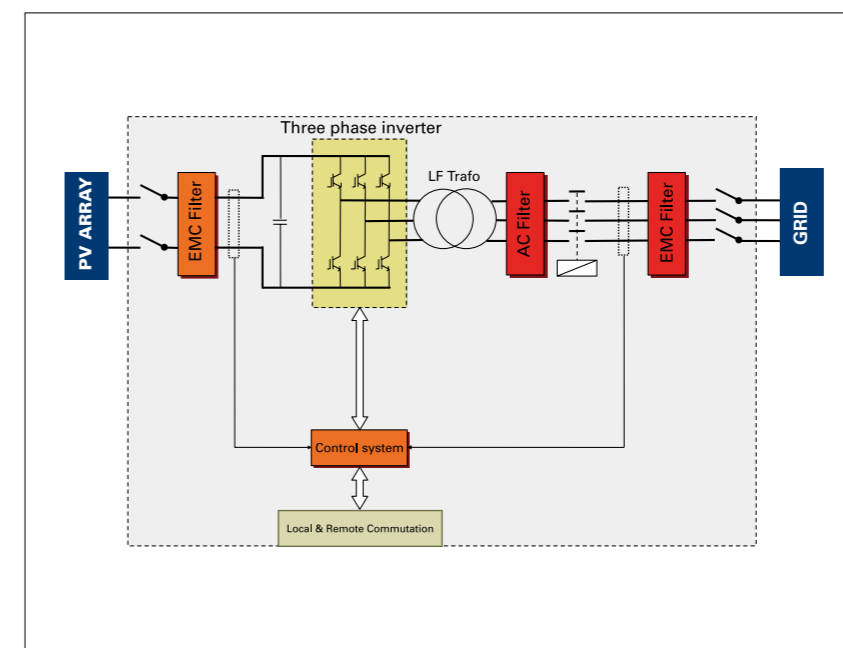
The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000

**OPTIONS ON REQUEST**

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K33	Sirio K33 HV
Approximate power of the photovoltaic field	max 40 kWp min 30 kWp	
Rated AC power	33 kW	
Maximum AC power	36 kW	
Input		
Maximum DC voltage in an open circuit	800 Vdc	880 Vdc
Recommended Vo@STC voltage	540÷640 Vdc	710÷760 Vdc
Intervallo MPPT	330÷700 Vdc	450÷760 Vdc
Working range	330÷700 Vdc	450÷760 Vdc
Maximum input current	105 Adc	79 Adc
Initial feeding voltage	390 Vdc	540 Vdc
Ripple voltage	<1%	
Number of inputs	1	
MPPT number	1	
D.C. connectors	Screw terminals	
Output		
Operating voltage	400 Vac	
Operating interval	340 ÷ 460 Vac	
Maximum power range	340 ÷ 460 Vac	
Frequency range	49,7 ÷ 50,3 Hz	
Settable frequency range	47 ÷ 52 Hz	
Nominal current	48 Aac	
Maximum current	60 Aac	
Fault level contribution	60 Aac	
Current Harmonic Distorsion (THDi)	<3%	
Power factor	>0,99	
Galvanic separation	LF transformer	
A.C. connectors	Screw terminals	
System		
Maximum efficiency	95,8%	96,3%
European efficiency	94,9%	95,3%
Stand-by consumption	<32 W	
Night consumption	<32 W	
Internal protections	MCCB AC side and switch DC side	
Off-Grid protection	YES	
Detecting earth leakage	Optional	
Heat dissipation	Fans	
Operating temperature	0°C ÷ 45°C	
Storage temperature	-20°C ÷ 70°C	
Humidity	0 ÷ 95% non-condensing	

FEATURES**Colour:** RAL 7035 / RAL 1033**Dimensions (WxDxH):** 555x720x1200 mm**Weight:** 330 kg**Protection level:** IP20**Acoustic noise:** <66dBA**COMMUNICATION****Display:** Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.**Communication interface:** 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).**STANDARDS****EMC:** EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.**Safety:** EN50178.**Directives:** Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.**Guide for connection to the power grid:** Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.

Sirio K40 and K40 HV



GUIDE FOR CONNECTION TO THE POWER GRID

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000



OPTIONS ON REQUEST

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K40	Sirio K40 HV
Approximate power of the photovoltaic field	max 50 kWp min 36 kWp	
Rated AC power	40 kW	
Maximum AC power	44 kW	

Input		
Maximum DC voltage in an open circuit	800 Vdc	880 Vdc
Recommended Vo@STC voltage	540÷640 Vdc	710÷760 Vdc
Intervallo MPPT	330÷700 Vdc	450÷760 Vdc
Working range	330÷700 Vdc	450÷760 Vdc
Maximum input current	130 Adc	98 Adc
Initial feeding voltage	390 Vdc	540 Vdc
Ripple voltage	<1%	
Number of inputs	1	
MPPT number	1	
D.C. connectors	Screw terminals	

Output		
Operating voltage	400 Vac	
Operating interval	340 ÷ 460 Vac	
Maximum power range	340 ÷ 460 Vac	
Frequency range	49,7 ÷ 50,3 Hz	
Settable frequency range	47 ÷ 52 Hz	
Nominal current	58 Aac	
Maximum current	73 Aac	
Fault level contribution	73 Aac	
Current Harmonic Distorsion (THDi)	<3%	
Power factor	>0,99	
Galvanic separation	LF transformer	
A.C. connectors	Screw terminals	

System		
Maximum efficiency	95,8%	96,2%
European efficiency	95%	95,3%
Stand-by consumption	<32 W	
Night consumption	<32 W	
Internal protections	MCCB AC side and switch DC side	
Off-Grid protection	YES	
Detecting earth leakage	Optional	
Heat dissipation	Fans	
Operating temperature	0°C ÷ 45°C	
Storage temperature	-20°C ÷ 70°C	
Humidity	0 ÷ 95% non-condensing	

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 555x720x1200 mm

Weight: 420 kg

Protection level: IP20

Acoustic noise: <66dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

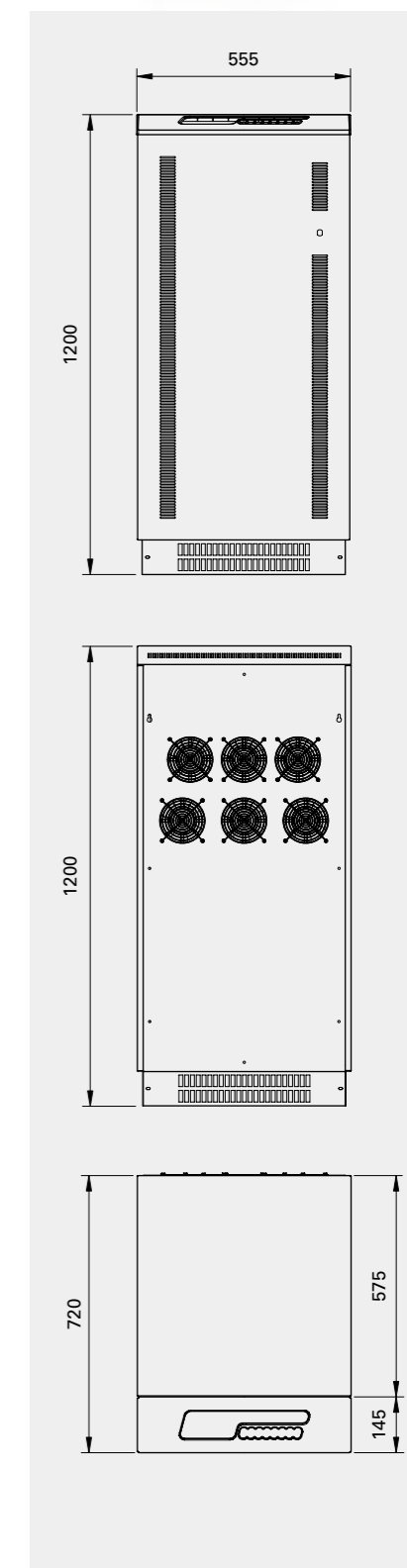
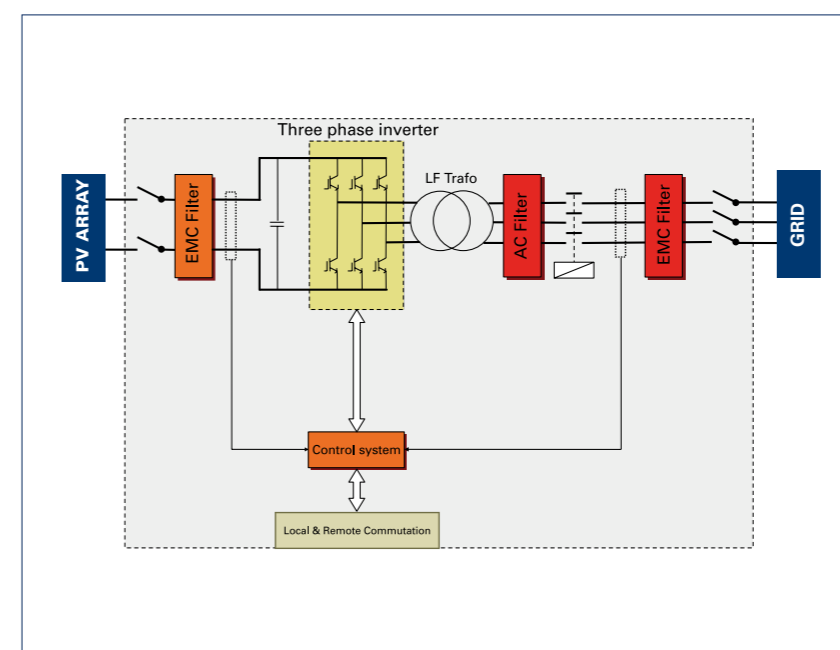
STANDARDS

EMC: EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.



Sirio K64 and K64 HV



GUIDE FOR CONNECTION TO THE POWER GRID

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000



OPTIONS ON REQUEST

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K64	Sirio K64 HV
Approximate power of the photovoltaic field	max 80 kWp min 55 kWp	
Rated AC power	64 kW	
Maximum AC power	71 kW	
Input		
Maximum DC voltage in an open circuit	800 Vdc	880 Vdc
Recommended Vo@STC voltage	540÷640 Vdc	710÷760 Vdc
Intervallo MPPT	330÷700 Vdc	450÷760 Vdc
Working range	330÷700 Vdc	450÷760 Vdc
Maximum input current	205 Adc	157 Adc
Initial feeding voltage	390 Vdc	540 Vdc
Ripple voltage	<1%	
Number of inputs	1	
MPPT number	1	
D.C. connectors	Bus bar	
Output		
Operating voltage	400 Vac	
Operating interval	340 ÷ 460 Vac	
Maximum power range	340 ÷ 460 Vac	
Frequency range	49,7 ÷ 50,3 Hz	
Settable frequency range	47 ÷ 52 Hz	
Nominal current	92 Aac	
Maximum current	117 Aac	
Fault level contribution	117 Aac	
Current Harmonic Distorsion (THDi)	<3%	
Power factor	>0,99	
Galvanic separation	LF transformer	
A.C. connectors	Bus bar	
System Bus bar		
Maximum efficiency	96,1%	
European efficiency	95%	94,9%
Stand-by consumption	<32 W	
Night consumption	<32 W	
Internal protections	MCCB AC side and switch DC side	
Off-Grid protection	YES	
Detecting earth leakage	Optional	
Heat dissipation	Fans	
Operating temperature	0°C ÷ 45°C	
Storage temperature	-20°C ÷ 70°C	
Humidity	0 ÷ 95% non-condensing	

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 800x800x1900 mm

Weight: 600 kg

Protection level: IP20

Acoustic noise: <68dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

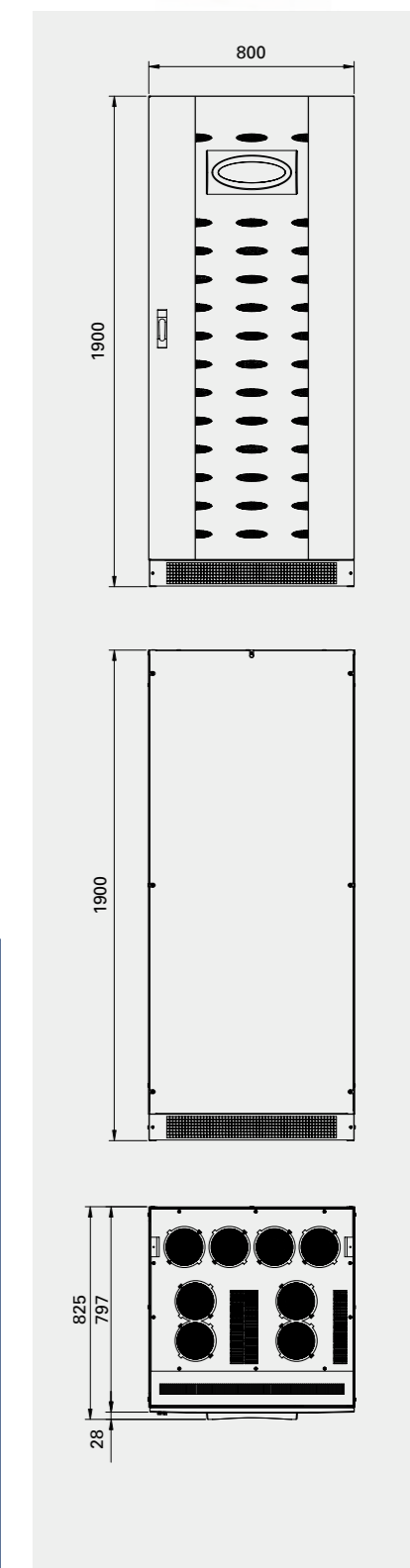
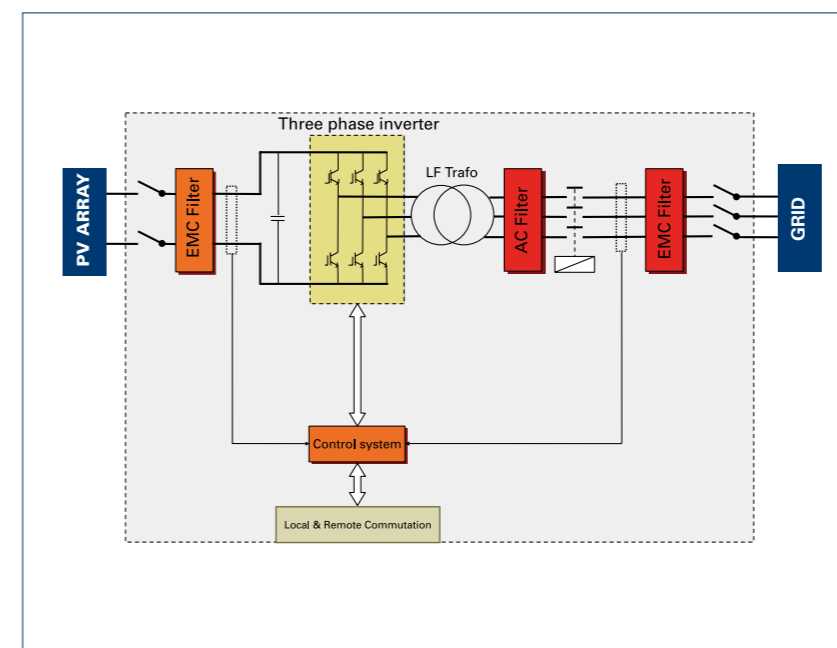
STANDARDS

EMC: EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.

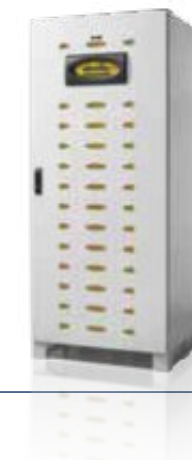
Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.



Sirio K80 and K80 HV



GUIDE FOR CONNECTION TO THE POWER GRID

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000



OPTIONS ON REQUEST

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K80	Sirio K80 HV
Approximate power of the photovoltaic field	max 100 kWp min 70 kWp	
Rated AC power	80 kW	
Maximum AC power	88 kW	
Input		
Maximum DC voltage in an open circuit	800 Vdc	880 Vdc
Recommended Vo@STC voltage	540÷640 Vdc	710÷760 Vdc
Intervallo MPPT	330÷700 Vdc	450÷760 Vdc
Working range	330÷700 Vdc	450÷760 Vdc
Maximum input current	260 Adc	196 Adc
Initial feeding voltage	390 Vdc	540 Vdc
Ripple voltage	<1%	
Number of inputs	1	
MPPT number	1	
D.C. connectors	Bus bar	
Output		
Operating voltage	400 Vac	
Operating interval	340 ÷ 460 Vac	
Maximum power range	340 ÷ 460 Vac	
Frequency range	49,7 ÷ 50,3 Hz	
Settable frequency range	47 ÷ 52 Hz	
Nominal current	115 Aac	
Maximum current	146 Aac	
Fault level contribution	146 Aac	
Current Harmonic Distorsion (THDi)	<3%	
Power factor	>0,99	
Galvanic separation	LF transformer	
A.C. connectors	Bus bar	
System		
Maximum efficiency	96,1%	
European efficiency	95%	
Stand-by consumption	<32 W	
Night consumption	<32 W	
Internal protections	MCCB AC side and switch DC side	
Off-Grid protection	YES	
Detecting earth leakage	Optional	
Heat dissipation	Fans	
Operating temperature	0°C ÷ 45°C	
Storage temperature	-20°C ÷ 70°C	
Humidity	0 ÷ 95% non-condensing	

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 800x800x1900 mm

Weight: 650 kg

Protection level: IP20

Acoustic noise: <68dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

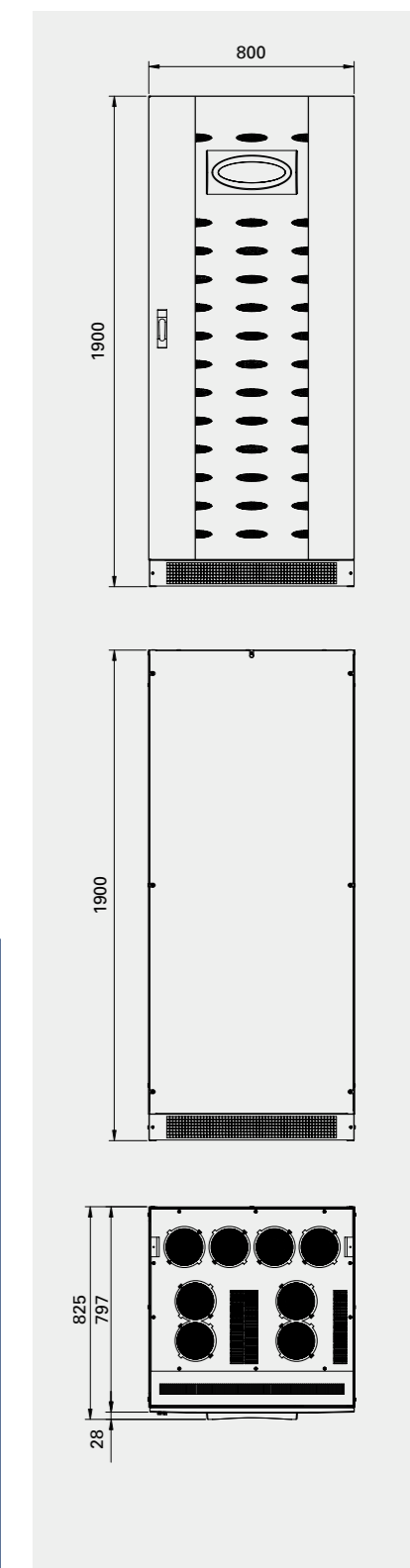
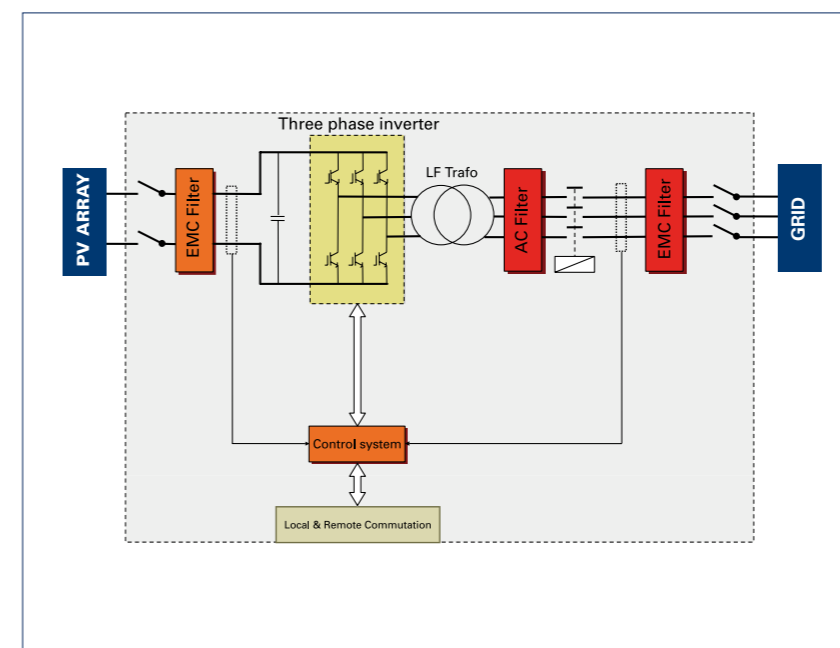
STANDARDS

EMC: EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.



Sirio K100 and K100 HV



GUIDE FOR CONNECTION TO THE POWER GRID

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000



OPTIONS ON REQUEST

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K100	Sirio K100 HV
Approximate power of the photovoltaic field	max 125 kWp min 80 kWp	
Rated AC power	100 kW	
Maximum AC power	110 kW	
Input		
Maximum DC voltage in an open circuit	800 Vdc	880 Vdc
Recommended Vo@STC voltage	540÷640 Vdc	710÷760 Vdc
Intervallo MPPT	330÷700 Vdc	450÷760 Vdc
Working range	330÷700 Vdc	450÷760 Vdc
Maximum input current	320 Adc	245 Adc
Initial feeding voltage	390 Vdc	540 Vdc
Ripple voltage	<1%	
Number of inputs	1	
MPPT number	1	
D.C. connectors	Bus bar	
Output		
Operating voltage	400 Vac	
Operating interval	340 ÷ 460 Vac	
Maximum power range	340 ÷ 460 Vac	
Frequency range	49,7 ÷ 50,3 Hz	
Settable frequency range	47 ÷ 52 Hz	
Nominal current	145 Aac	
Maximum current	182 Aac	
Fault level contribution	182 Aac	
Current Harmonic Distorsion (THDi)	<3%	
Power factor	>0,99	
Galvanic separation	LF transformer	
A.C. connectors	Bus bar	
System		
Maximum efficiency	96,1%	
European efficiency	95,1%	
Stand-by consumption	<32 W	
Night consumption	<32 W	
Internal protections	MCCB AC side and switch DC side	
Off-Grid protection	YES	
Detecting earth leakage	Optional	
Heat dissipation	Fans	
Operating temperature	0°C ÷ 45°C	
Storage temperature	-20°C ÷ 70°C	
Humidity	0 ÷ 95% non-condensing	

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 800x800x1900 mm

Weight: 720 kg

Protection level: IP20

Acoustic noise: <68dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

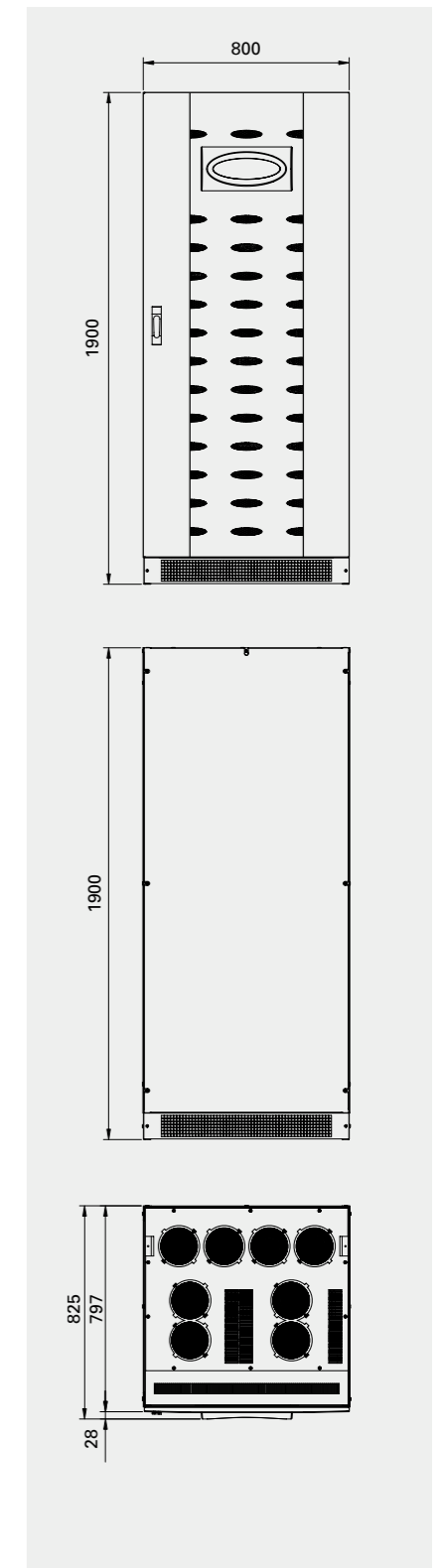
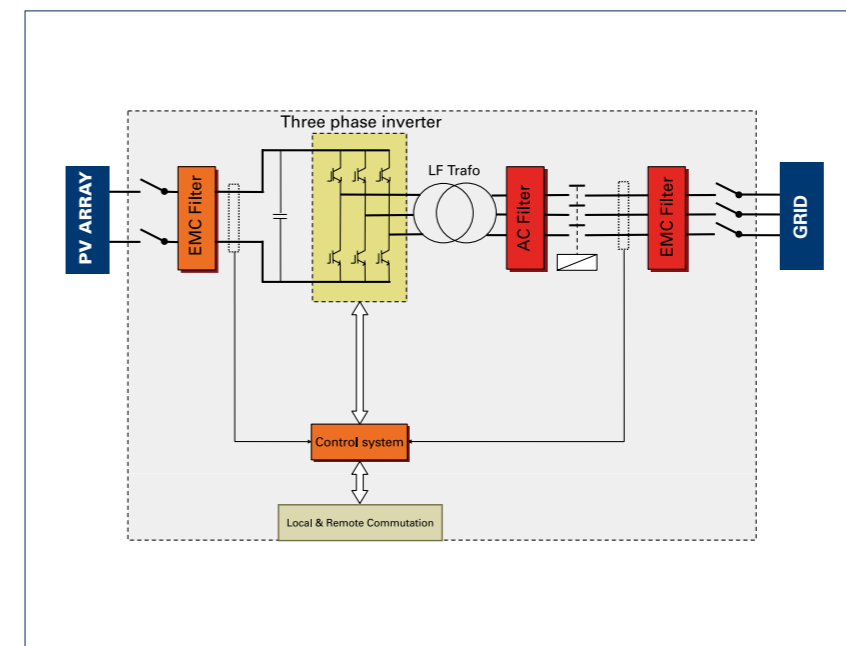
STANDARDS

EMC: EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.





GUIDE FOR CONNECTION TO THE POWER GRID

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000



OPTIONS ON REQUEST

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K200	Sirio K200 HV
Approximate power of the photovoltaic field	max 250 kWp min 180 kWp	
Rated AC power	200 kW	
Maximum AC power	220 kW	

Input

Maximum DC voltage in an open circuit	800 Vdc	880 Vdc
Recommended Vo@STC voltage	540÷640 Vdc	710÷760 Vdc
Intervallo MPPT	330÷700 Vdc	450÷760 Vdc
Working range	330÷700 Vdc	450÷760 Vdc
Maximum input current	650 Adc	500 Adc
Initial feeding voltage	390 Vdc	540 Vdc
Ripple voltage	<1%	
Number of inputs	1	
MPPT number	1	
D.C. connectors	Bus bar	

Output

Operating voltage	400 Vac	
Operating interval	340 ÷ 460 Vac	
Maximum power range	340 ÷ 460 Vac	
Frequency range	49,7 ÷ 50,3 Hz	
Settable frequency range	47 ÷ 52 Hz	
Nominal current	289 Aac	
Maximum current	364 Aac	
Fault level contribution	364 Aac	
Current Harmonic Distorsion (THDi)	<3%	
Power factor	>0,99	
Galvanic separation	LF transformer	
A.C. connectors	Bus bar	

System

Maximum efficiency	96,2%	96,3%
European efficiency	95,2%	
Stand-by consumption	<32 W	
Night consumption	<32 W	
Internal protections	MCCB AC side and switch DC side	
Off-Grid protection	YES	
Detecting earth leakage	Optional	
Heat dissipation	Fans	
Operating temperature	0°C ÷ 45°C	
Storage temperature	-20°C ÷ 70°C	
Humidity	0 ÷ 95% non-condensing	

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 1630x1000x1900 mm

Weight: 1580 kg

Protection level: IP20

Acoustic noise: <72dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

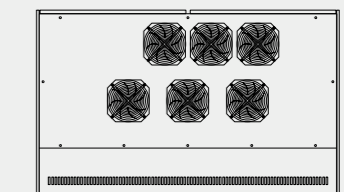
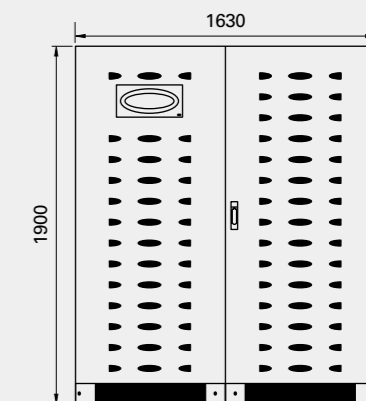
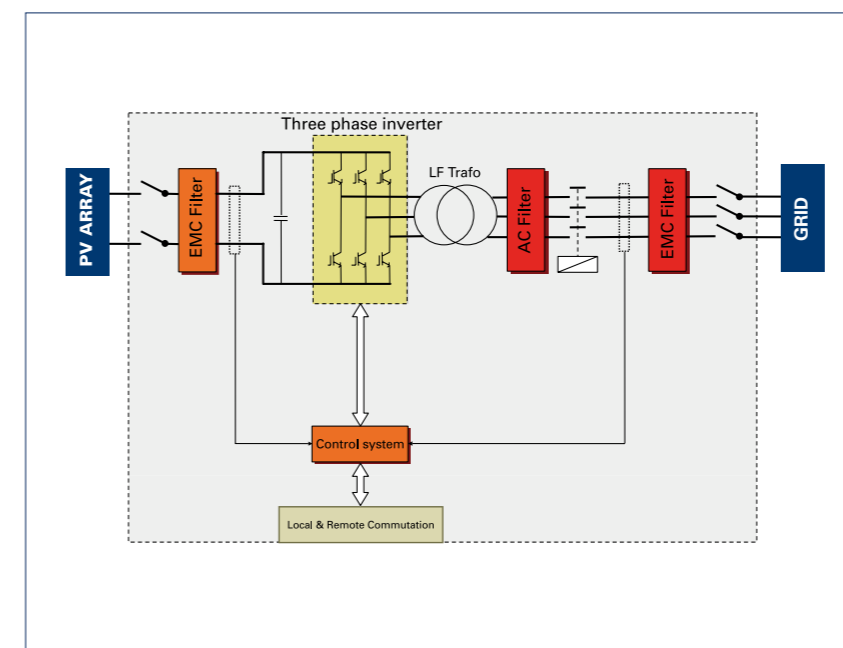
STANDARDS

EMC: EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.





GUIDE FOR CONNECTION TO THE POWER GRID

The complete range complies with:

- DK5940 ed. 2.2 and subsequent "Guide for connections to the ENEL Distribuzione power grid"
- Real Decreto 1663-2000



OPTIONS ON REQUEST

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K250 HV
Approximate power of the photovoltaic field	max 320 kWp min 220 kWp
Rated AC power	250 kW
Maximum AC power	250 kW
Input	
Maximum DC voltage in an open circuit	880 Vdc
Recommended Vo@STC voltage	710÷760 Vdc
Intervallo MPPT	450÷760 Vdc
Working range	450÷760 Vdc
Maximum input current	590 Adc
Initial feeding voltage	540 Vdc
Ripple voltage	<1%
Number of inputs	1
MPPT number	1
D.C. connectors	Bus bar
Output	
Operating voltage	400 Vac
Operating interval	340 ÷ 460 Vac
Maximum power range	340 ÷ 460 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current	361 Aac
Maximum current	420 Aac
Fault level contribution	420 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	LF transformer
A.C. connectors	Bus bar
System	
Maximum efficiency	96,3%
European efficiency	95,3%
Stand-by consumption	<32 W
Night consumption	<32 W
Internal protections	MCCB AC side and switch DC side,
Off-Grid protection	YES
Detecting earth leakage	Optional
Heat dissipation	Fans
Operating temperature	0°C ÷ 45°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 1630x1000x1900 mm

Weight: 1630 kg

Protection level: IP20

Acoustic noise: <72dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish and French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

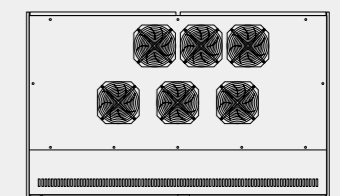
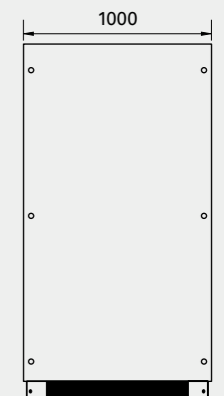
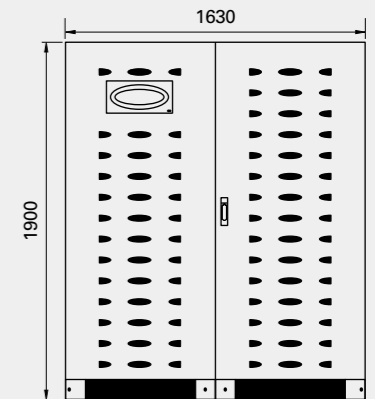
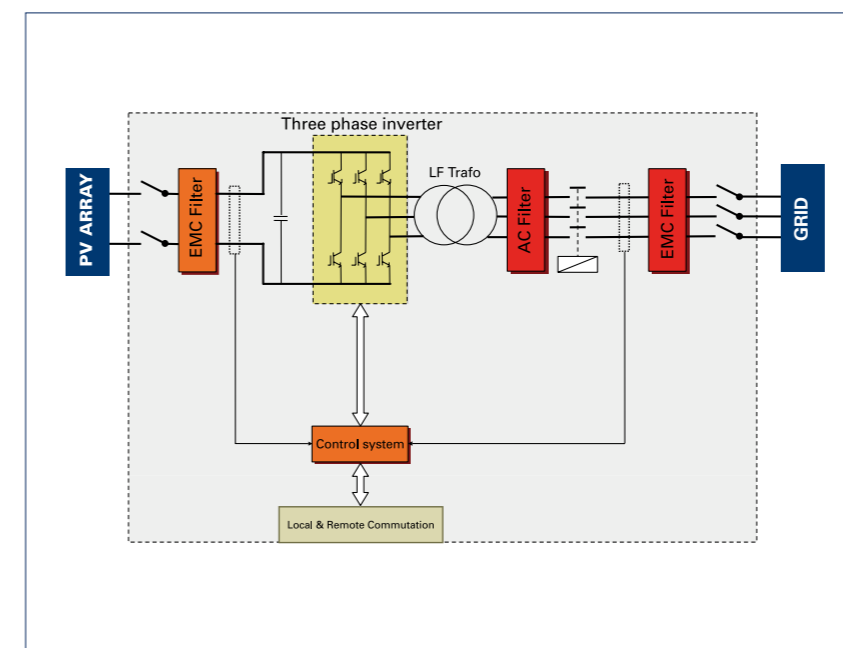
STANDARDS

EMC: EN61000-6-3, EN61000-6-2, EN61000-3-11, EN61000-3-12.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: Enel DK5940 and subsequent "Guide for connections to the ENEL Distribuzione power grid", Real decreto 1663-2000.



HV-MT Central Inverters

In order to increase overall plant efficiency, the Sirio HV-MT Central inverters do not have an integrated transformer. This feature and the meticulous design make them ideal for use in medium-high power plants connected to a medium voltage grid.

Maximum energy and safety

The Maximum Power Point Tracking (MPPT) research algorithm implemented in the control system of Sirio HV-MT Central inverters allows full use of the photovoltaic generator under any radiation and temperature conditions, making the plant work constantly at maximum efficiency. In the absence of solar radiation the converter goes on standby and resumes normal operation when there is radiation again. This feature reduces self-consumption to a minimum and maximizes energy efficiency.

The use of speed-controlled fans helps to optimize the overall efficiency of the inverter. Fan operation that is linked to the temperature also increases the expected lifespan and reduces costs incurred for extraordinary maintenance. All these design features, the careful choice of components and guaranteed quality of production according to ISO 9001 standards make the Sirio three phase inverters extremely efficient and reliable and guarantee maximum energy production.



Advanced communication

The Sirio HV-MT Central series inverters have an intuitive man-machine interface, made up of an integrated display and keyboard with which to control the photovoltaic system's main parameters and interact with it to control its operation. The display and keyboard facilitate diagnosis and solutions to any operating problems at local level while interaction with the inverter to know the plant's status and to assess statistics about its operation is possible remotely through most common media (local series link, Local Area Network, GSM, etc.). The communication interfaces and related software are common to the family of TL inverters, which can be referred to for more detailed information.

Easy installation and maintenance

The footprint of these devices has been considerably reduced and there is no need to leave space at the side or back of the equipment since the electronics and power components are fully accessible from the front. Fully automatic operation ensures ease of use and facilitates installation and startup, thus avoiding installation and configuration errors which could lead to failures or reduced plant productivity.

Conformance

Sirio HV-MT Central inverters conform fully with European safety standards LVD and EMC and with Italian and international regulations regarding parallel connection to the public distribution network.

- Electromagnetic Compatibility Directive (89/336/EEC and subsequent amendments 92/31/EEC, 93/68/EEC and 93/97/EEC);
- CEI 11-20 Electrical energy production systems and uninterruptible power supplies connected to I and II class networks;
- CEI 11-20, V1 Electrical energy production systems and uninterruptible power supplies connected to I and II class networks;-V1

Personalized solutions

AROS is able to supply on request Sirio HV-MT Central inverters specific to the client's needs. Available options include the integrated isolation control and the pole/earth connection kit that is required for back-contact modules.





GUIDE FOR CONNECTION TO THE POWER GRID

- CEI 0-16: Reference technical rules for the connection of active and passive Users to the HV and MV grid of electricity distribution Companies



OPTIONS ON REQUEST

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K200 HV-MT
Rated AC power	200 kW
Maximum AC power	220 kW

Input	
Maximum DC voltage in an open circuit	880 Vdc
Recommended Vo@STC voltage	710÷760 Vdc
Intervallo MPPT	450÷760 Vdc
Working range	450÷760 Vdc
Maximum input current	500 Adc
Initial feeding voltage	540 Vdc
Ripple voltage	<1%
Number of inputs	1
MPPT number	1
D.C. connectors	Bus bar

Output	
Operating voltage	270 Vac
Operating interval	245÷300 Vac
Maximum power range	245÷300 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current	428 Aac
Maximum current	554 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Bus bar

System	
Maximum efficiency	98,1%
European efficiency	97,5%
Stand-by consumption	<32 W
Night consumption	<32 W
Internal protections	MCCB AC side and switch DC side
Off-Grid protection	YES
Detecting earth leakage	Optional
Heat dissipation	Fans
Operating temperature	0°C ÷ 45°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 1630x1000x1900 mm

Weight: 1150 kg

Protection level: IP20

Acoustic noise: <72dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish, French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

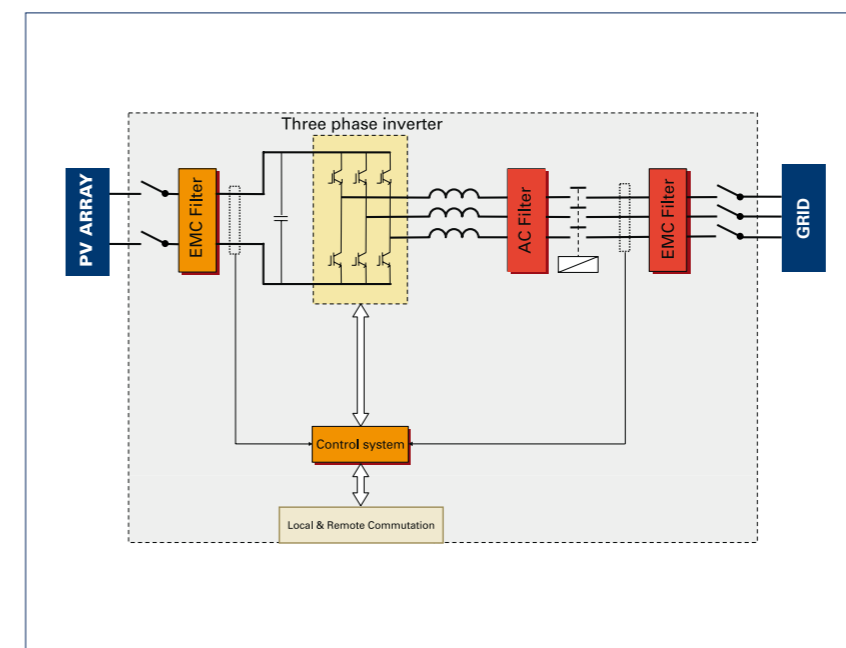
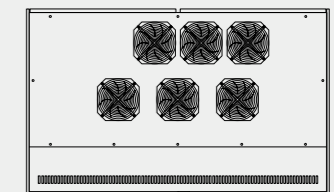
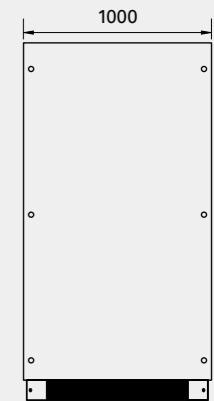
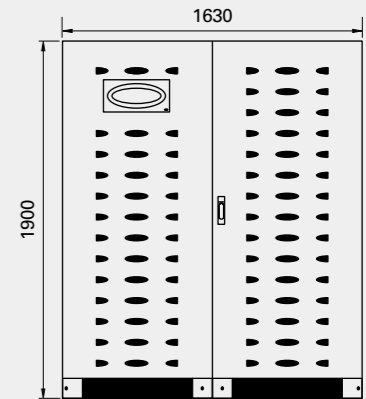
STANDARDS

EMC: EN61000-6-4, EN61000-6-2.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: CEI 0-16: Reference technical rules for the connection of active and passive Users to the HV and MV grid of electricity distribution Companies.



Sirio K250 HV-MT

HV-MT CENTRAL INVERTERS

**GUIDE FOR CONNECTION TO THE POWER GRID**

- CEI 0-16: Reference technical rules for the connection of active and passive Users to the HV and MV grid of electricity distribution Companies

**OPTIONS ON REQUEST**

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model Sirio K250 HV-MT

Rated AC power	250 kW
Maximum AC power	250 kW

Input

Maximum DC voltage in an open circuit	880 Vdc
Recommended Vo@STC voltage	710÷760 Vdc
Intervallo MPPT	450÷760 Vdc
Working range	450÷760 Vdc
Maximum input current	590 Adc
Initial feeding voltage	540 Vdc
Ripple voltage	<1%
Number of inputs	1
MPPT number	1
D.C. connectors	Bus bar

Output

Operating voltage	270 Vac
Operating interval	245÷300 Vac
Maximum power range	245÷300 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current	535 Aac
Maximum current	630 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Bus bar

System

Maximum efficiency	98,1%
European efficiency	97,5%
Stand-by consumption	<32 W
Night consumption	<32 W
Internal protections	MCCB AC side and switch DC side
Off-Grid protection	YES
Detecting earth leakage	Optional
Heat dissipation	Fans
Operating temperature	0°C ÷ 45°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 1630x1000x1900 mm

Weight: 1150 kg

Protection level: IP20

Acoustic noise: <72dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish, French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

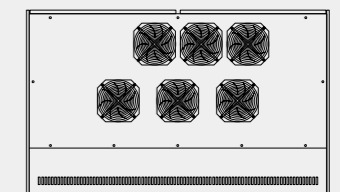
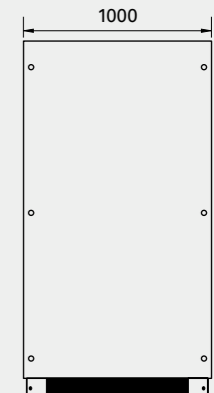
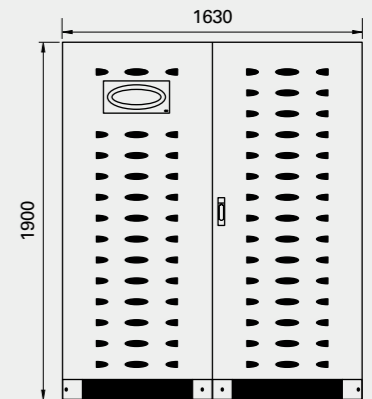
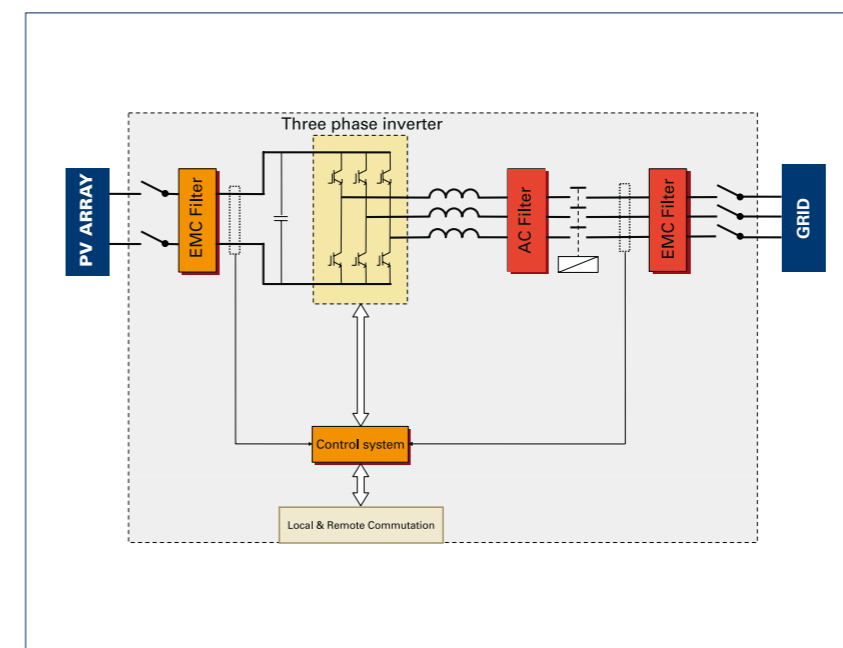
STANDARDS

EMC: EN61000-6-4, EN61000-6-2.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: CEI 0-16: Reference technical rules for the connection of active and passive Users to the HV and MV grid of electricity distribution Companies.



Sirio K500 HV-MT

HV-MT CENTRAL INVERTERS

**GUIDE FOR CONNECTION TO THE POWER GRID**

- CEI 0-16: Reference technical rules for the connection of active and passive Users to the HV and MV grid of electricity distribution Companies

**OPTIONS ON REQUEST**

- Integrated isolation control
- Pole/earth connection kit (positive or negative)
- Overvoltage protection (SPD)

Model	Sirio K500 HV-MT
Rated AC power	500 kW
Maximum AC power	500 kW

Input	
Maximum DC voltage in an open circuit	880 Vdc
Recommended $V_{o@STC}$ voltage	710÷760 Vdc
Intervallo MPPT	450÷760 Vdc
Working range	450÷760 Vdc
Maximum input current	1180 Adc
Initial feeding voltage	540 Vdc
Ripple voltage	<1%
Number of inputs	2
MPPT number	1
D.C. connectors	Bus bar

Output	
Operating voltage	270 Vac
Operating interval	245÷300 Vac
Maximum power range	245÷300 Vac
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current	1070 Aac
Maximum current	1260 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99
Galvanic separation	NO
A.C. connectors	Bus bar

System	
Maximum efficiency	98,1%
European efficiency	97,5%
Stand-by consumption	<32 W
Night consumption	<32 W
Internal protections	MCCB AC side and switch DC side
Off-Grid protection	YES
Detecting earth leakage	Optional
Heat dissipation	Fans
Operating temperature	0°C ÷ 45°C
Storage temperature	-20°C ÷ 70°C
Humidity	0 ÷ 95% non-condensing

FEATURES

Colour: RAL 7035 / RAL 1033

Dimensions (WxDxH): 1500x1000x1900 mm

Weight: 1340 kg

Protection level: IP20

Acoustic noise: <72dBA

COMMUNICATION

Display: Multilingual LCD display (Italian, English, German, Spanish, French), 2 rows, 40 characters.

Communication interface: 2 x RS232 supplied as standard, optional RS485, ModBUS and Ethernet (slot version).

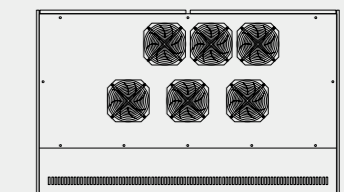
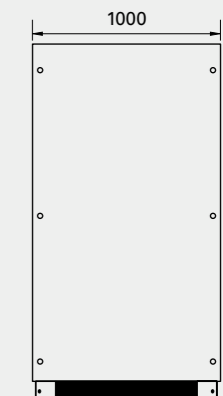
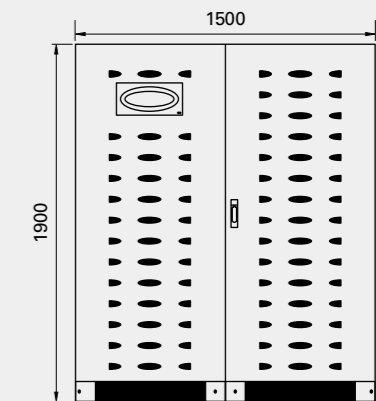
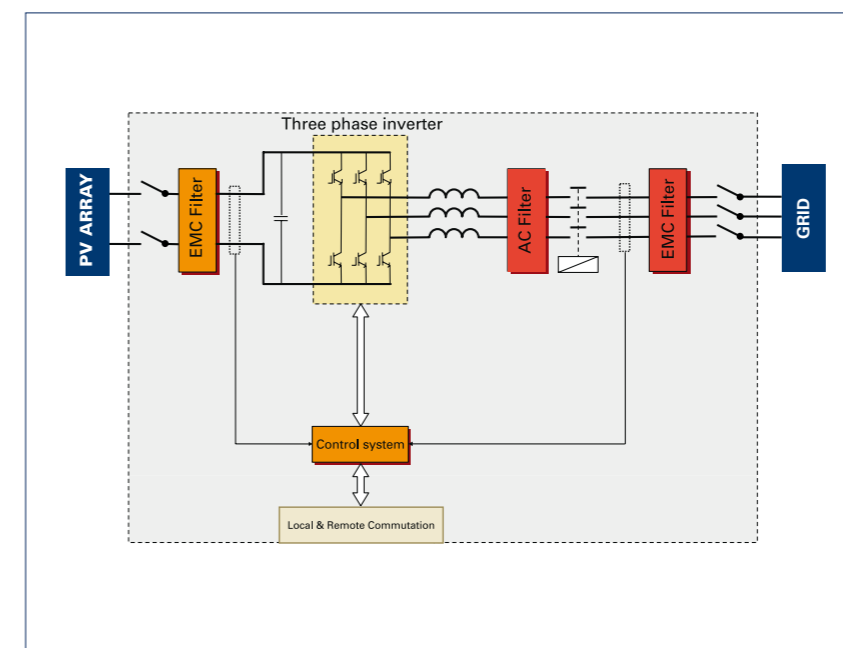
STANDARDS

EMC: EN61000-6-4, EN61000-6-2.

Safety: EN50178.

Directives: Low Voltage Directive: 2006/95/EC, EMC Directive: 2004/108/EC.

Guide for connection to the power grid: CEI 0-16: Reference technical rules for the connection of active and passive Users to the HV and MV grid of electricity distribution Companies.



How to increase the overall efficiency of a conversion system and cut installation costs. This objective can be achieved by using a Sirio Central Station (SCS) system with Sirio HV-MT Central inverters connected to a common medium voltage transformer. The devices are installed in concrete stations to prolong their useful life, improve thermal insulation and to provide resistance to atmospheric agents and the most unfavourable environmental conditions.

An integral system for large plants

Sirio Central Station is available in 500kW, 750kW and 1MW versions and is a complete, safe and high-performing "Plug&Play" solution. The modular system, which uses inverters housed in separate stations, each with its own MV/LV transformer, enables the inverters to have a barycentric position within the photovoltaic field to optimize installation.

The logic of having separate stations cuts production losses caused by failures and during ordinary and extraordinary maintenance operations. The stations are built in vibrated reinforced concrete, in accordance with the CEI.0-16 standards currently in force, with the Guide for Connections to the Enel Distribuzione Power Grid Ed. 1 December 2008 and with the Enel DG 2092 Construction Specifications Ed. 1 December 2008. The structures are

particularly resistant to atmospheric agents since they are treated with special plastic and waterproofing coatings which protect against the formation of cracks and seepages.

The external walls are coated with a quartz/rubber paint with a textured finish to provide optimal resistance to atmospheric agents, even in marine, mountain, industrial or very polluted environments. The normal operating conditions of the installed equipment are guaranteed by a natural ventilation system using air vents thus avoiding recourse to air conditioning systems.

The whole structure is assembled entirely with electromechanical equipment in the factory in accordance with the CEI EN 61330 standard, and electrical equipment where applicable, ready to be placed on site for subsequent start-up.

Optional solutions

AROS can also offer pre-assembled solutions for:

- stations for utility providers and general protection with ENEL-approved medium voltage switchboard panels housing the incoming MV line devices and the measurement unit where the electricity distribution utility takes its readings;
- protection and interfacing stations housing all the MV, protection, measurement, interface and control panels;
- in addition to the versions in the catalog, intermediate configurations from 200kW are available.

Practical and complete

The SCS provides solutions that can be defined as "All in One" since they reduce the normal design phases, cut transport and installation times and come already equipped with all that is needed for system start-up.

The significantly lower costs, the excellent efficiency of the whole system (due to the inverters and transformers used) and the time saving in the start-up phases make the Sirio Central Station an attractive choice for optimizing return on investment.



04

SCS 500-2

SIRIO CENTRAL STATION - SCS

Approximate power of the photovoltaic field	max 600 kWp min 450 kWp
Rated AC power	500 kW

Input

Maximum DC voltage in an open circuit	880 Vdc
Intervallo MPPT	450÷760 Vdc
Maximum input current	2x 590 Adc
Ripple voltage	<1%
Number of inputs	2
MPPT number	2
D.C. connectors	Bus bar

Output

Operating voltage	20kV
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current (a 20kV)	14,45 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99

System

Maximum efficiency (*)	97,3%
European efficiency (*)	96,7%
Operating temperature	-20°C ÷ 40°C
Humidity	0 ÷ 95% non-condensing

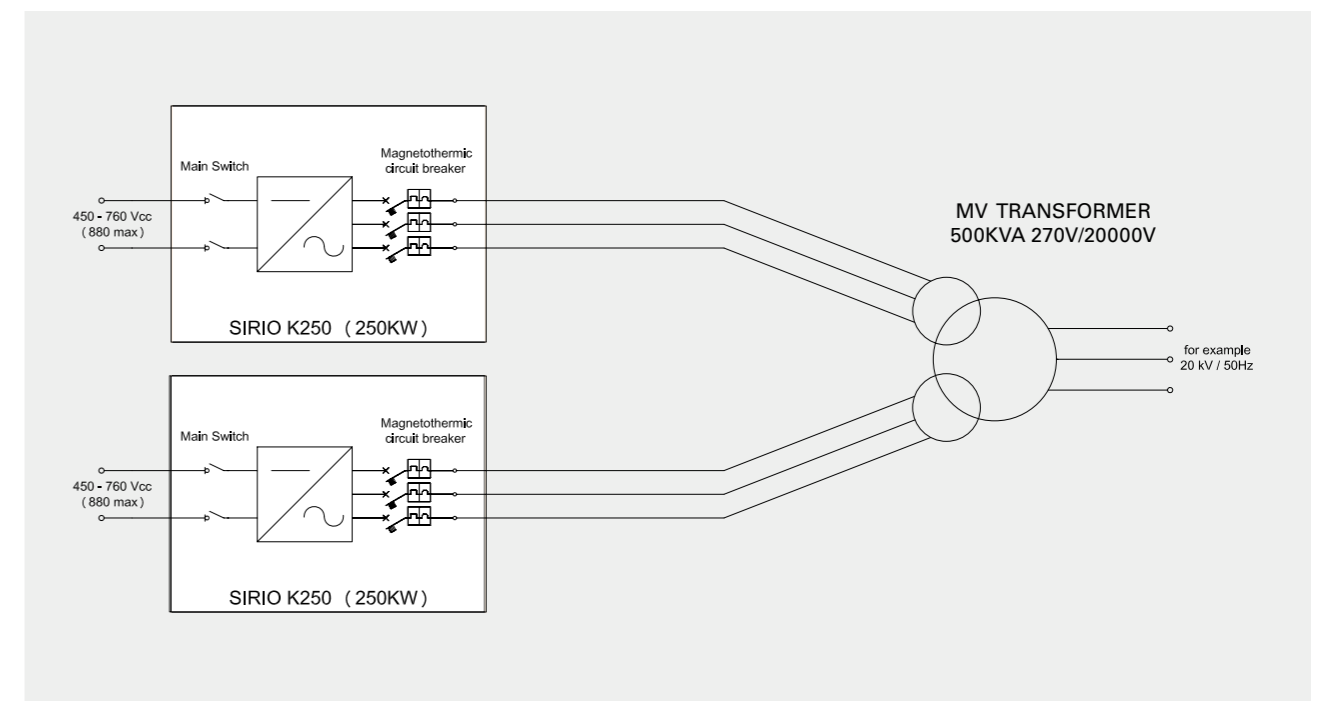
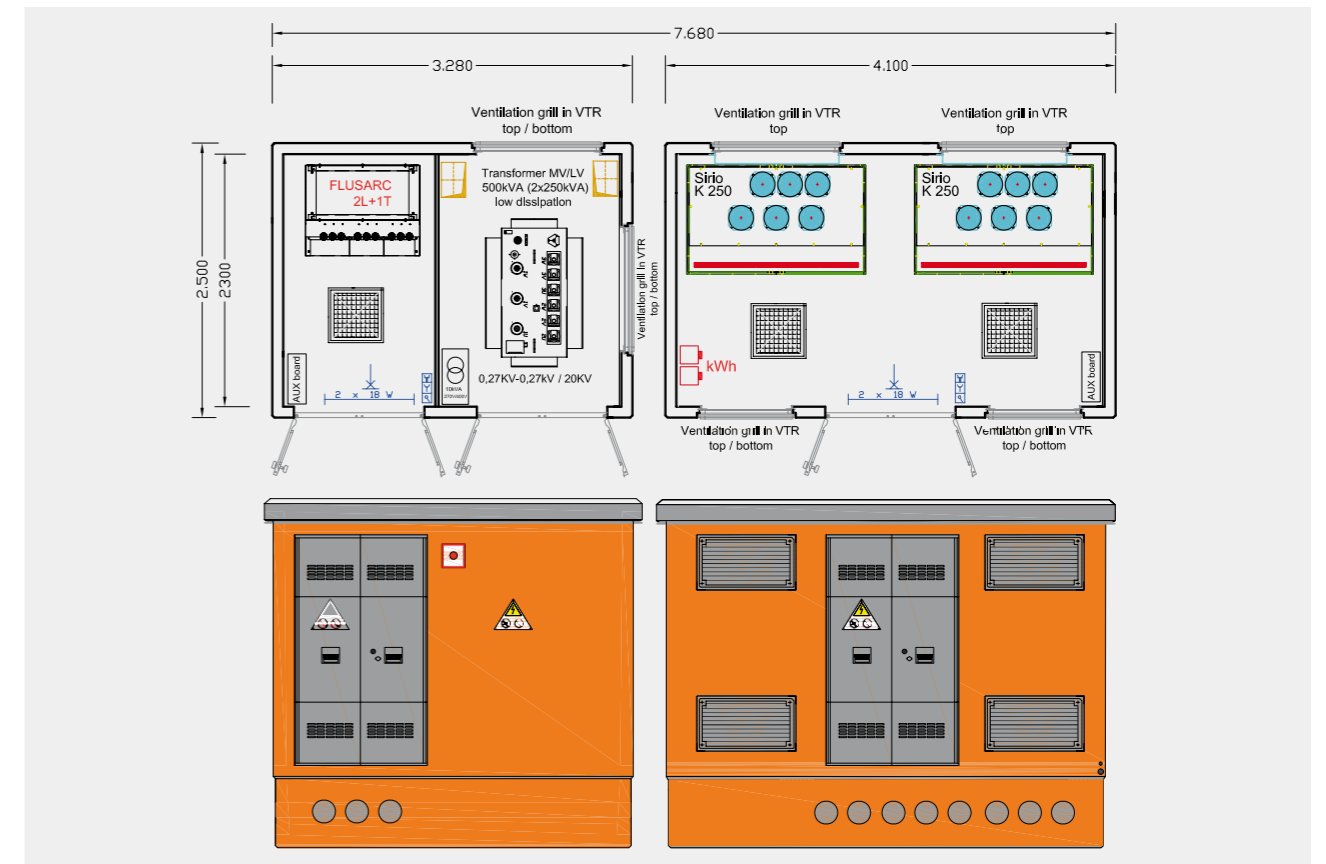
Station features

Materials	Block construction with reinforced concrete, class Rck 250 Kg/sq. cm with superfluidifying and waterproofing additives
Structure	Comprising electro-soldered metal mesh reinforcement and corrugated iron, with improved adherence, both in Feb44k
Walls	Waterproof plastic coating painted with quartz/rubber paint with a textured finish
Cooling	Natural ventilation through metal ducting
Cover	flat cover
Dimensions (WxDxH)	7680x2500x2550 mm
Lighting	2x18W fluorescent lamps, of which 1x18W is for emergency lighting, for each prefabricated structure
Standard features	2 ENEL-approved meters, GSM remote reading system, extinguisher
Conformance to specifications	CEI 0-16 ed. 2 July 2008; ENEL Guide for grid connections ed. 1 December 2008 and Construction Specifications DG 2092 ed. 1 December 2008

Transformer

Construction	Oil bath seal
Primary nominal power	500kVA
Secondary nominal power	2x250kVA
In/Out voltage	2x(270V)/20000V
Cooling	ONAN (Oil Natural Air Natural, without pumps or fans)
Short circuit voltage	6%

(*) Data include the auxiliary inverters



SIRIO CENTRAL STATION - SCS

Approximate power of the photovoltaic field	max 600 kWp min 450 kWp
Rated AC power	500 kW

Input

Maximum DC voltage in an open circuit	880 Vdc
Intervallo MPPT	450 ÷ 760 Vdc
Maximum input current	1180 Acc
Ripple voltage	<1%
Number of inputs	2
MPPT number	1
D.C. connectors	Bus bar

Output

Operating voltage	20kV
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current (a 20kV)	14,45 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99

System

Maximum efficiency (*)	97,3%
European efficiency (*)	96,7%
Operating temperature	-20°C ÷ 40°C
Humidity	0 ÷ 95% non-condensing

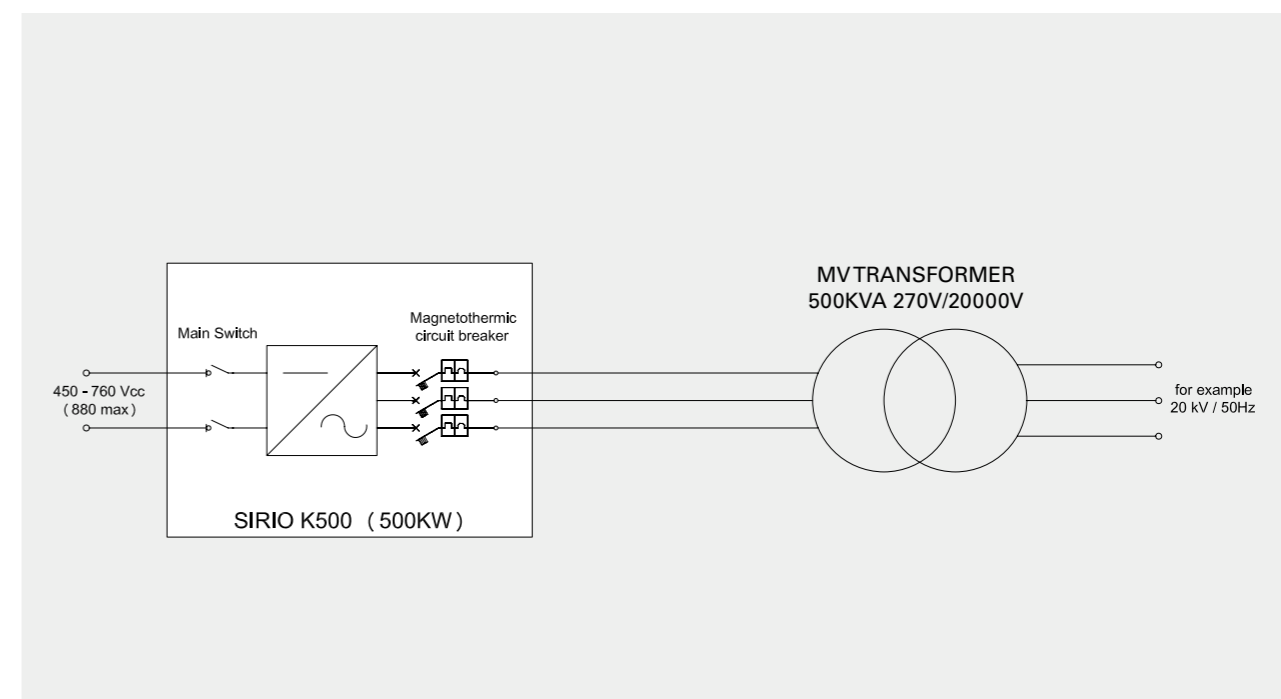
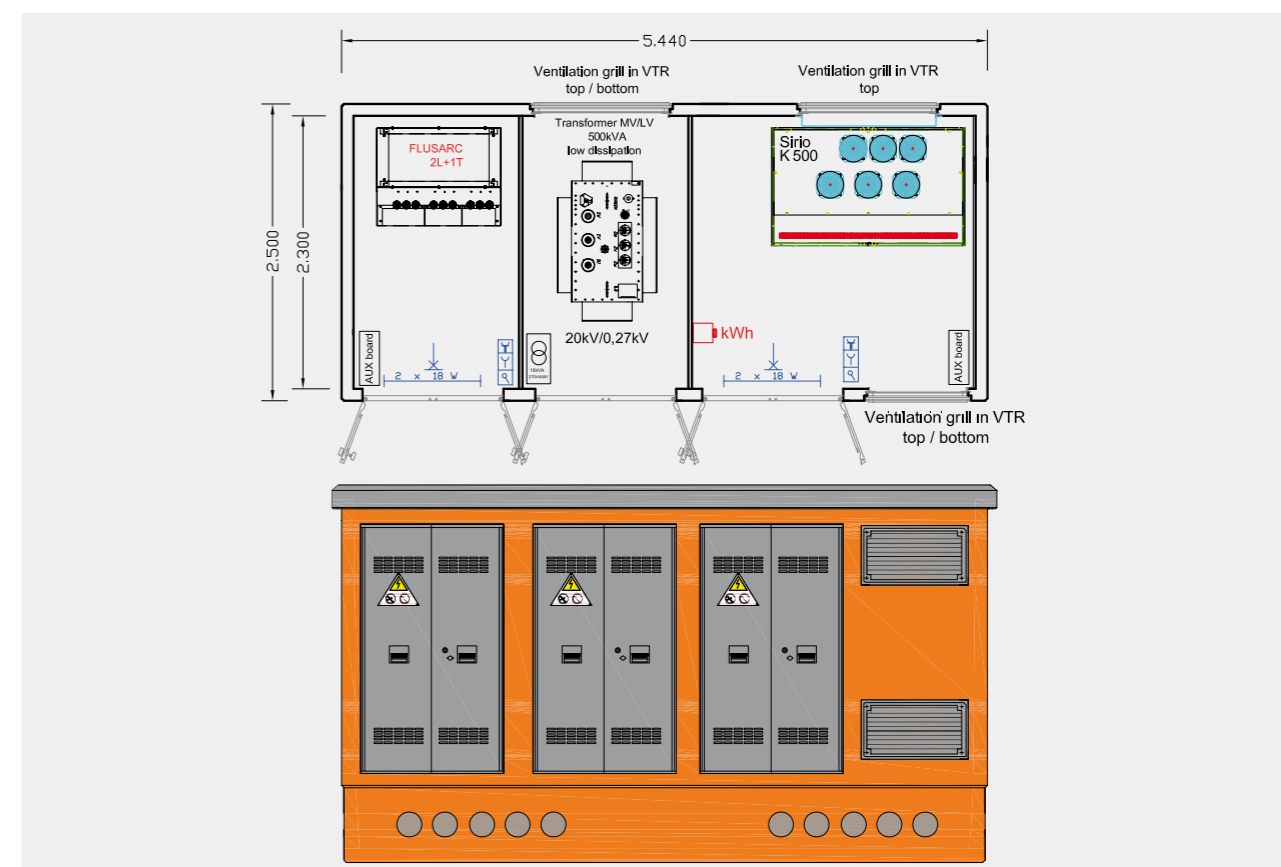
Station features

Materials	Block construction with reinforced concrete, class Rck 250 Kg/sq. cm with superfluidifying and waterproofing additives
Structure	Comprising electro-soldered metal mesh reinforcement and corrugated iron, with improved adherence, both in Feb44k
Walls	Waterproof plastic coating painted with quartz/rubber paint with a textured finish
Cooling	Natural ventilation through metal ducting
Cover	flat cover
Dimensions (WxDxH)	5440x2500x2550 mm
Lighting	2x18W fluorescent lamps, of which 1x18W is for emergency lighting, for each prefabricated structure
Standard features	2 ENEL-approved meters, GSM remote reading system, extinguisher
Conformance to specifications	CEI 0-16 ed. 2 July 2008; ENEL Guide for grid connections ed. 1 December 2008 and Construction Specifications DG 2092 ed. 1 December 2008

Transformer

Construction	Oil bath seal
Primary nominal power	500kVA
Secondary nominal power	500kVA
In/Out voltage	270V/20000V
Cooling	ONAN (Oil Natural Air Natural, without pumps or fans)
Short circuit voltage	6%

(*) Data include the auxiliary inverters



04

SCS 750

SIRIO CENTRAL STATION - SCS

Approximate power of the photovoltaic field	max 880 kWp min 600 kWp
Rated AC power	750 kW

Input	
Maximum DC voltage in an open circuit	880 Vdc
Intervallo MPPT	450÷760 Vdc
Maximum input current	3x 590 Adc
Ripple voltage	<1%
Number of inputs	3
MPPT number	3
D.C. connectors	Bus bar

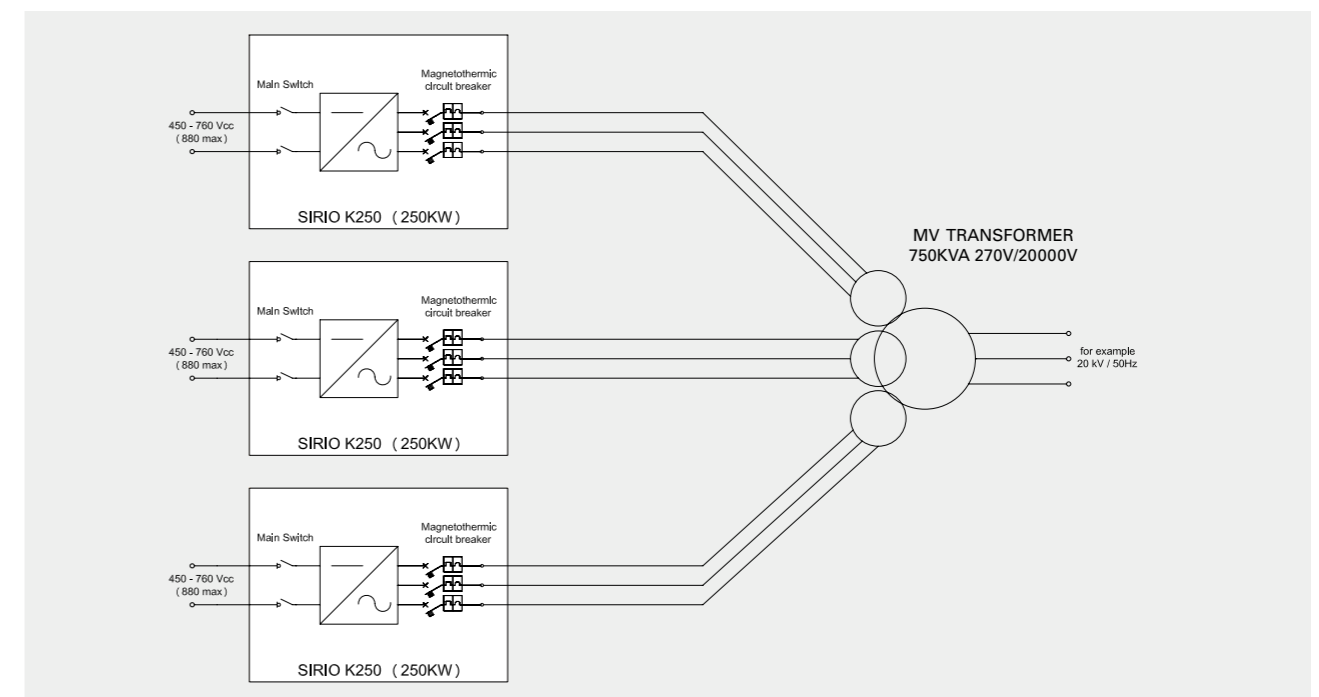
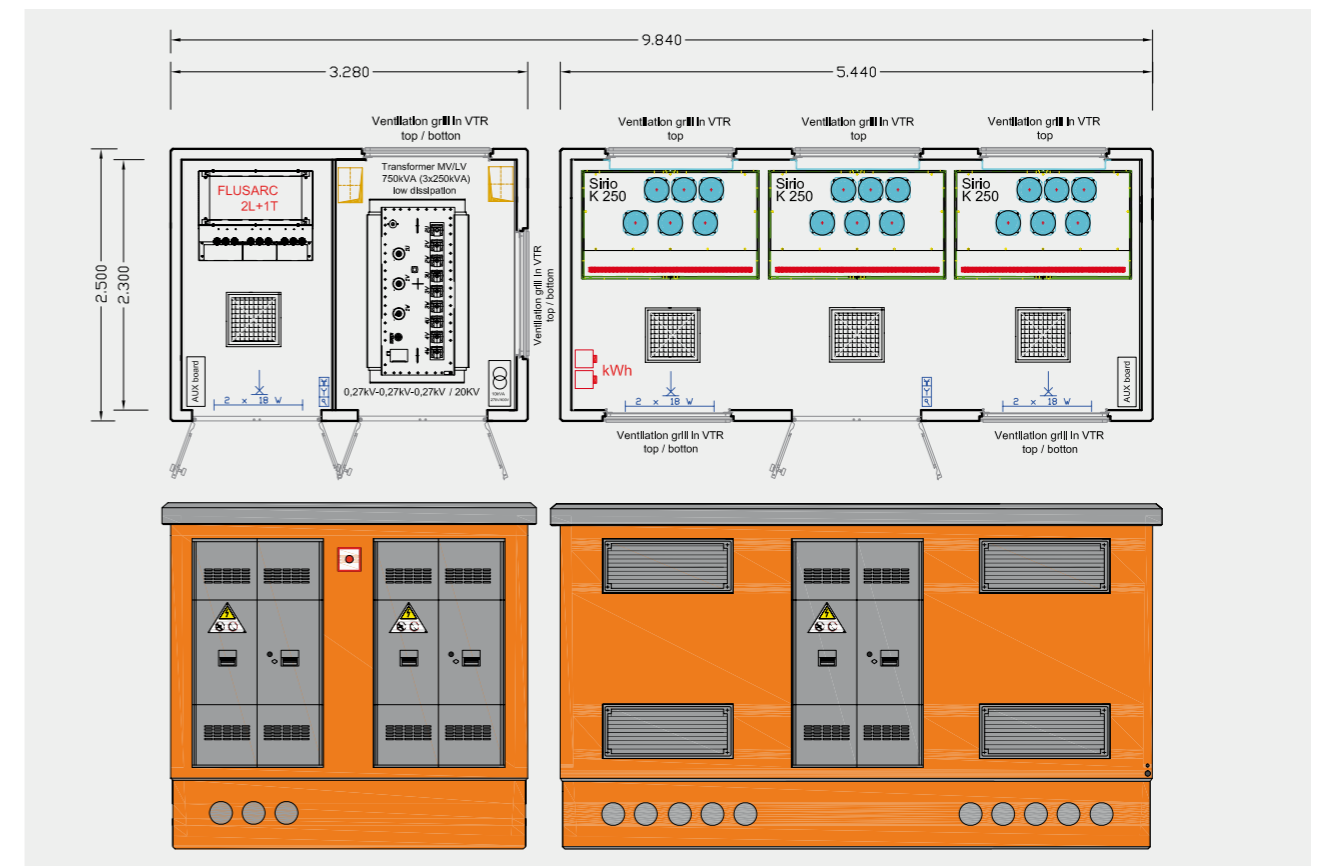
Output	
Operating voltage	20kV
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current (a 20kV)	21,68 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99

System	
Maximum efficiency (*)	97,3%
European efficiency (*)	96,7%
Operating temperature	-20°C ÷ 40°C
Humidity	0 ÷ 95% non-condensing

Station features	
Materials	Block construction with reinforced concrete, class Rck 250 Kg/sq. cm with superfluidifying and waterproofing additives
Structure	Comprising electro-soldered metal mesh reinforcement and corrugated iron, with improved adherence, both in Feb44k
Walls	Waterproof plastic coating painted with quartz/rubber paint with a textured finish
Cooling	Natural ventilation through metal ducting
Cover	flat cover
Dimensions (WxDxH)	9840x2500x2550 mm
Lighting	2x18W fluorescent lamps, of which 1x18W is for emergency lighting, for each prefabricated structure
Standard features	2 ENEL-approved meters, GSM remote reading system, extinguisher
Conformance to specifications	CEI 0-16 ed. 2 July 2008; ENEL Guide for grid connections ed. 1 December 2008 and Construction Specifications DG 2092 ed. 1 December 2008

Transformer	
Construction	Oil bath seal
Primary nominal power	750kVA
Secondary nominal power	3x250kVA
In/Out voltage	3x(270V)/20000V
Cooling	ONAN (Oil Natural Air Natural, without pumps or fans)
Short circuit voltage	6%

(*) Data include the auxiliary inverters



SIRIO CENTRAL STATION - SCS

Approximate power of the photovoltaic field	max 1150 kWp min 880 kWp
Rated AC power	1000 kW

Input

Maximum DC voltage in an open circuit	880 Vdc
Intervallo MPPT	450÷760 Vdc
Maximum input current	2x 1180 Adc
Ripple voltage	<1%
Number of inputs	4
MPPT number	2
D.C. connectors	Bus bar

Output

Operating voltage	20kV
Frequency range	49,7 ÷ 50,3 Hz
Settable frequency range	47 ÷ 52 Hz
Nominal current (a 20kV)	28,90 Aac
Current Harmonic Distorsion (THDi)	<3%
Power factor	>0,99

System

Maximum efficiency (*)	97,4%
European efficiency (*)	96,8%
Operating temperature	-20°C ÷ 40°C
Humidity	0 ÷ 95% non-condensing

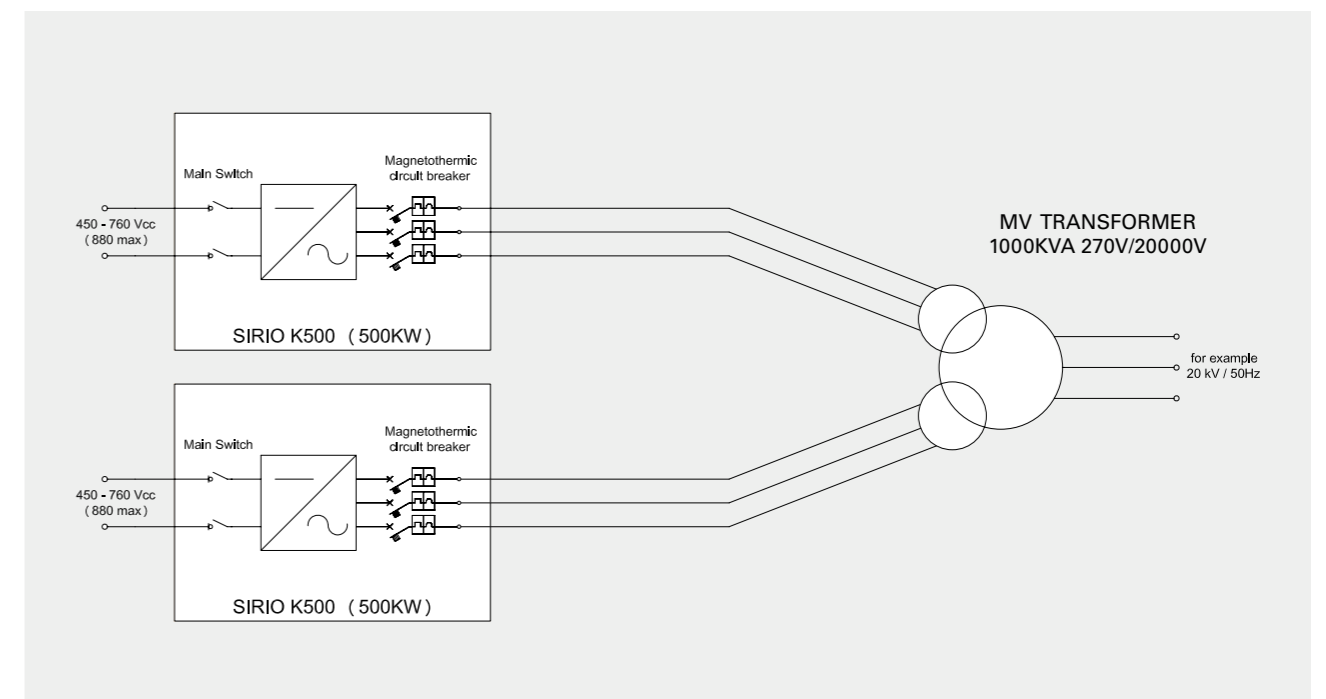
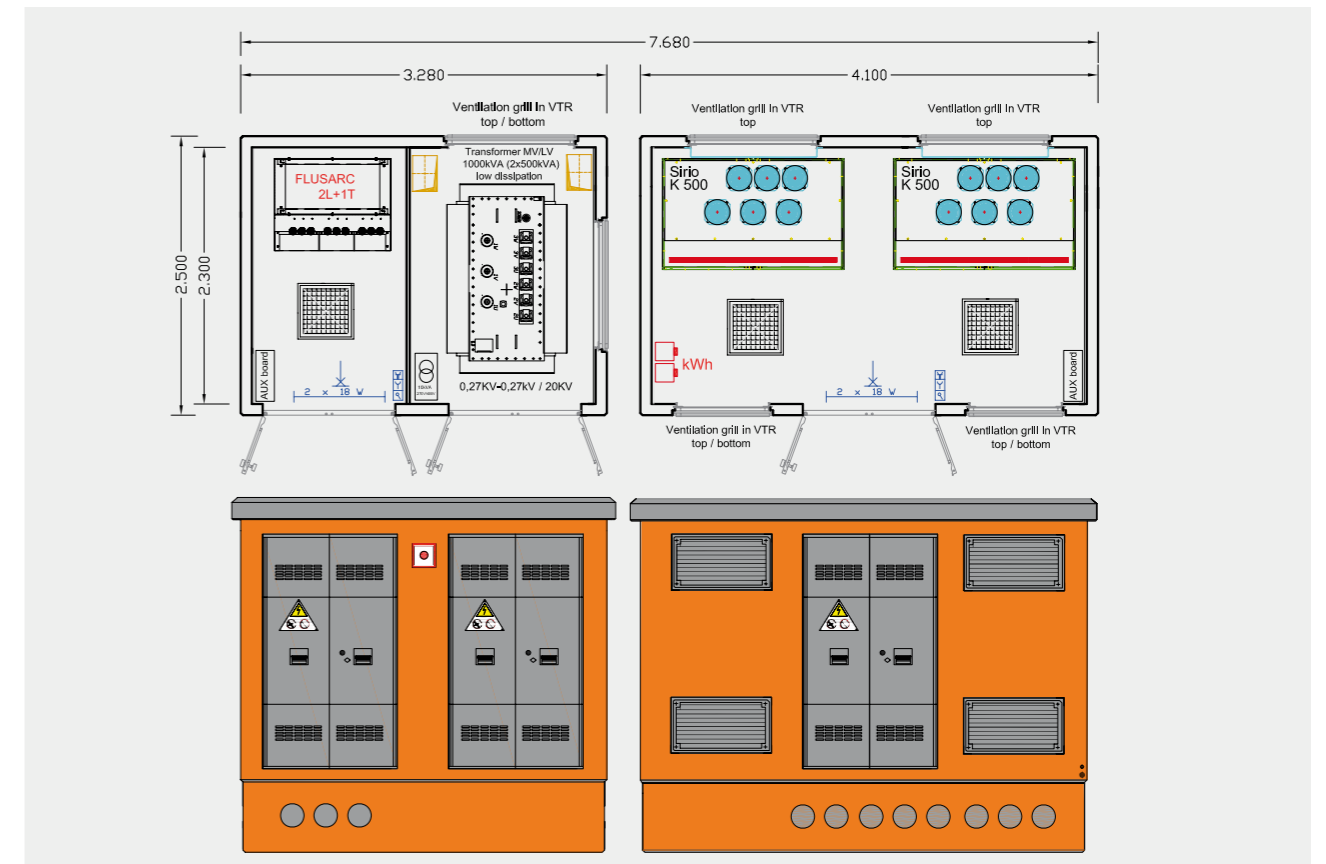
Station features

Materials	Block construction with reinforced concrete, class Rck 250 Kg/sq. cm with superfluidifying and waterproofing additives
Structure	Comprising electro-soldered metal mesh reinforcement and corrugated iron, with improved adherence, both in Feb44k
Walls	Waterproof plastic coating painted with quartz/rubber paint with a textured finish
Cooling	Natural ventilation through metal ducting
Cover	flat cover
Dimensions (WxDxH)	7680x2500x2550 mm
Lighting	2x18W fluorescent lamps, of which 1x18W is for emergency lighting, for each prefabricated structure
Standard features	2 ENEL-approved meters, GSM remote reading system, extinguisher
Conformance to specifications	CEI 0-16 ed. 2 July 2008; ENEL Guide for grid connections ed. 1 December 2008 and Construction Specifications DG 2092 ed. 1 December 2008

Transformer

Construction	Oil bath seal
Primary nominal power	1MVA
Secondary nominal power	2x500kVA
In/Out voltage	2x(270V)/20000V
Cooling	ONAN (Oil Natural Air Natural, without pumps or fans)
Short circuit voltage	6%

(*) Data include the auxiliary inverters





String Box

The String Box monitors the currents in photovoltaic modules and can promptly diagnose faults. The device is made of UV-resistant polyester resin and offers IP65 degree of protection. It has a general circuit breaker, type ABB S804PV from 1200V, to disconnect the photovoltaic field from the inverter and up to 16 strings (with a maximum input current per string of 9A) can be connected. Since it is compatible with the SunVision monitoring software, signals and alarms are sent in the event of current faults according to the thresholds set at configuration. Communication solutions include an RS485 and RS232 ports port (supplied as standard), an optional slot for a NetMan Plus PV Ethernet card and analog inputs for the connection of environmental sensors (temperature, radiation and wind).

MAIN FEATURES

- Parallel connection of (up to) 16 strings by 9A each (8 channels);
- Local and remote indication of status and alarm conditions;
- RS232 and RS485 connections supplied as standard;
- One slot connection for expanding communication (e.g. Ethernet board);
- Proprietary communication protocol and MODBUS RTU, both available on all the communication ports;
- Wide configurability of the monitoring parameters using the available software;
- Local history log of alarms and status;
- Protection fuses for each couple of inputs, 900Vdc on positive and negative;
- For each input is possible to connect wires up to 16mm²;
- Output switch, with optional release coil, used for inverter detachment;
- Monitored discharger, used against over-voltage situations, protected against over-currents, easy to restore thanks to removable cartridges;
- Direct input power from PV field or from auxiliary;
- Insulated digital inputs for local monitoring;
- Insulated analog inputs for environmental sensors (2xPT100, 0-10V, 4-20mA);
- Configurable digital outputs with free contacts;
- IP65 protection degree for external environment.

String Box

Product code 6QPSC001A

General

Max input current	16 x 9A
Max output current	144A
Max voltage	880Vdc
Input screw	16+16 screw terminals
Output screw	2 bar clamps
Protection level	IP65
Operating temperature	-20°C ÷ 45°C
Insulation	2500Vac power/ control

Protection

Overvoltage discharger	type 2 1000V max 40KA (total 8/20µs) 12.5KA (nominal 8/20µs) 25KA (max 8/20µs) 3 varistors configuration Self-protected with fuse monitored
General output switch	4x125A (2 poles in parallel)
String fuse	20A 900Vdc 10x38
Auxiliary power fuse	4A 500Vac 10x38

Output relays

No. of relays	2
Contact	Exchange/potential free max. 2A max. 220Vdc / 250Vac max. 60W /62.5VA resistance < 35 mΩ
Insulation	1000 Vac

Communication

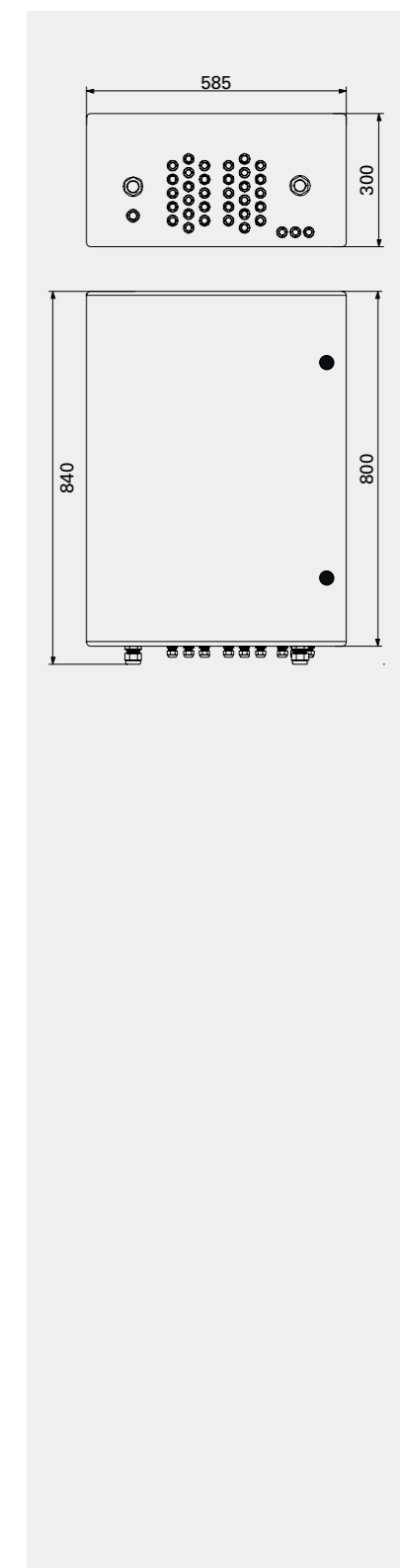
Standard	1 x RS232 (DB9 female) 1 x RS485 (RJ45 + screws) expansion communication slot
Speed	9600 bps
Insulation	2500Vac x 1 minute (232 and 485) Slot not insulated
Addressing	from 1 to 127 (dip-switch selection)

Mechanical data

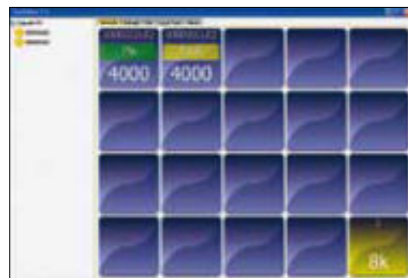
Dimensions (WxDxH)	585x300x840 mm
Weight	27 Kg

Standards

EMC	Directive 2004/108/EC
LV	Directive 2006/95/EC



AROS offers the ideal solution to guarantee a protected, efficient and global system combining Sirio inverters with software designed to ensure the complete control of your plant.



SunVision - Monitoring program

SunVision guarantees efficient and intuitive management of your photovoltaic plant (up to 127 inverters), displaying such essential information as voltage (AC/DC), current (AC/DC), power and temperature. The values of energy produced and the economic returns generated are always available via the indicators, which also calculate the reduction of CO2 emissions. Timely graphic reports allow you to monitor your plant's energy production on a daily, weekly, monthly, and annual basis. The new export routine in text format makes it possible to use data in various software applications. Thanks to the "discovering/ browsing" function, any inverters connected to the RS485 bus or to the Ethernet network are automatically displayed in a directory list, without manual configuration interventions.



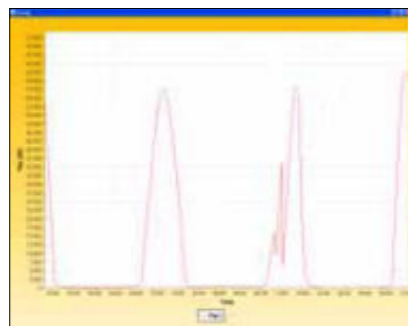
MAIN FEATURES

- Real time graphic monitoring of inverter status
- Detailed display including all values
- Centralized control of PV inverters connected via serial port (RS232 or RS485) or network
- Internal graphic data-log with two levels of detail
- Alarm notification via email and SMS
- HTTP functionality for remote control
- Multilingual support
- Compatible with String Box



SUPPORTED OPERATING SYSTEMS

Windows 7
Windows Server 2008
Windows Vista
Windows 2003
Windows XP
Windows 2000
Linux
Sun Solaris 8,9 and 10



Download the software free of charge from our website: www.aros-solar.com

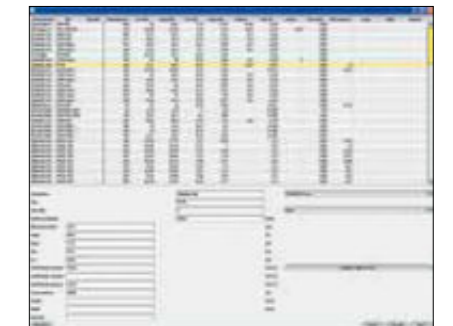
PV Configurator

PV Configurator gives you a complete overview so that you can correctly rate your grid-connected photovoltaic plant. With the optimization of the calculation process, the software is now capable of operating with the entire range of Sirio inverters, with or without transformers.

MAIN FEATURES

- Updated database of photovoltaic modules
- Complete range of SIRIO inverters
- Rapid search for optimal configuration function (according to power or number of panels)
- Creation of reports with the configuration adopted
- Multilingual support

Download the software free of charge from our website: www.aros-solar.com

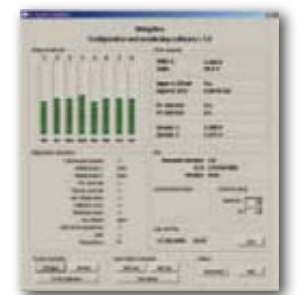


String Box Setup

This application is used to set the String Box depending on the features of the installation and the user's requirements. Items that can be set are the analog inputs, digital inputs and outputs, read channels and alarm thresholds.

MAIN FEATURES

- Via the Time Windows function, time windows can be set for each of the 8 inputs necessary to avoid false alarms (e.g. in case of systematic shading out in certain periods and at certain times of the year)
- Configuration of the relays present on the device depending on status of the alarms
- Configuration of the two inputs 4/20 mA and 0/10 V
- Full management of the minimum alarm threshold parameters
- Management and download of the events log



Software and communication devices



NetMan Plus PV

NetMan Plus PV - Agent Network

Product code

Version for Sirio TL	XPV2RSA3A
Version for Central Sirio	XPV2RSA1A

The NetMan Plus PV network card enables management of an inverter directly connected to a 10/100Mbps LAN using the main network communication protocols (TCP/IP and HTTP).

MAIN FEATURES

- 10/100Mbps Ethernet and IPv4 network compatible
- SunVision compatible
- HTTP for control via web browser
- SMTP for sending alarm emails
- Serial port for communication with inverter
- Event history log management
- Other standards: DHCP, DNS, RARP, FTP, NTP, ICMP, IGMP
- Configurable via multisection Telnet and serial terminal with data import/export
- Firmware upgradable via serial port and server TFTP

NetMan Sensor Interface

Product code

XPV1RSA1A

The device NetMan Sensor Interface enables you to connect to the SNMP the irradiance and temperature sensor (XPV3RS01A and XPV3RS02A). This allows to monitor the measurements through the supervision software SunVision.

MAIN FEATURES

- Analogic/Digital convertor, 4 channels
- Standard measuring range 0-10 V
- Not stabilised 15V power supply capable of supplying a maximum of 20mA (100 mA when connected to an external power supply (12~18V) trough the Jack connector)



NetMan Sensor Interface

RS485 – Communication adapter

Product code

Version for Sirio TL	XPV2RBC1A
Version for Central Sirio	XPV2RBC2A

The RS485 card enables the creation of a bus to connect additional inverters, displaying all parameters via connection to a PC equipped with SunVision software.

MAIN FEATURES

- Plug&Play installation
- Data transfer up to 9.6 Kbaud



RS485

ModCOM PV – Modbus Protocol Converter

Product code

Version for Sirio TL	XPV2RMC3A
Version for Central Sirio	XPV2RMC2A

MODBUS is an open-source and royalty-free serial communication protocol, which has become an industry standard in recent years thanks its ease of use and implementation. The ModCOM PV device makes it possible to monitor Aros photovoltaic inverters via the MODBUS RTU protocol over half-duplex RS-485 serial cable.

MAIN FEATURES

- MODBUS/JBUS port can be configured as RS232 or RS485
- RJ-45 connector for connecting to the MODBUS network
- Can be integrated with the main BMS management programs
- LED signals for communication activity
- Firmware upgradeable through serial port



ModCOM PV



Solar View

Solar View

Product code	XPV1RD13A
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This remote data acquisition device is capable of providing the main electric parameter information for a photovoltaic generator via an RS485 connection. By simple touch on the touch screen display, you can recall such values as panel voltage, power generated by the plant, line voltage and line current, energy produced and the amount of CO2 unemitted. In addition, an intuitive horizontal bar indicates the percentage of instant power. Touch screen technology makes it possible to scroll through and zoom in on graphics created by the device directly on the display. Compatible with installations of up to 5 inverters, it does not require special configurations since it is capable of automatically detecting the model and related characteristics of the inverters.

MAIN FEATURES

System:

- B/W 240x128 pixel LCD touch screen with LED backlight
- RS485 and USB communication ports
- Multimedia graphic interface
- 12Vdc power supply

Graphics:

- 5 display settings: 6-hour, 12-hour, 24-hour, weekly, and monthly
- The ability to display averages or individual readings

Modem RTG 100

Product code	XGSMR002A
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RTG 100 is a GSM/GPRS modem designed for the purpose of controlling solar inverters. It sends out text messages (SMS) if the devices it is connected to fail and/or change status. The RTG 100 may also be used for remote supervision, as it has the ability to acquire, store and transmit the inverter production data to a customer monitoring station. This function is managed by TeleNETGuard, software installed on a PC provided with a static IP address which is necessary for the inverter to send the data it has stored via GPRS. This software can also send out a call via the GPRS modem to force a transmission of the monitored device's data.

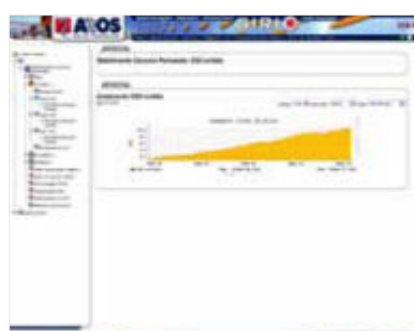
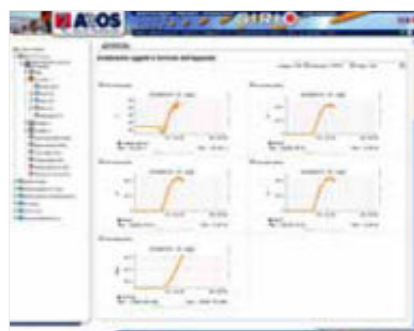
Note: The client is responsible for fitting a Data SIM of the telephone operator of his choice in the device – this is required for its correct operation.

MAIN FEATURES

- Dual band GSM 850/900/1800/1900 MHz
- Multi-slot class 12,CS-1, CS-2, CS-3, CS-4
- Transmission higher than 56.3Kb/s



RTG 100



Everyday more and more photovoltaic systems, both civil and industrial, are installed without providing for adequate maintenance. Technological systems, above all when undergoing significant development, require routine and special maintenance operations to be carried out by specialised technicians. This, however, does not guarantee the complete and constant efficiency of the photovoltaic system and, even less, preventive interventions in the case of imminent energy loss or malfunction due to exogenous and/or endogenous causes. That's why SunGuard has been developed.

A professional system that closely monitors every type of photovoltaic system, as well as the environment in which it is installed. Useful for smaller installations, necessary for medium to large sized installations. SunGuard communicates data and information in real time to both the operators who perform the monitoring, as well as to the specialised technicians, thereby allowing for targeted, timely and preventive interventions. SunGuard provides for the real time monitoring of the systems' performance and, through the SunGuard Box interface, sends the data to the central calculation unit over an SNMP Protocol. The elaboration of this data, in addition to that which is received from weather stations, pyranometers, toroids and video cameras positioned upon the system, provides for the constant supervision of our systems and allows us to offer a service which is even more oriented towards maximum customer satisfaction.

TECHNICAL CHARACTERISTICS SUMMARY

- Remote web-based management through UMTS, GPRS, LAN network and Wi-Fi connectivity;
- Monitoring of each individual inverter;
- Connection to every type of environmental sensor;
- Numerical and graphical display of the periodic data and reports regarding the system's productivity;
- Notifications sent by email and SMS;
- Pro-active management of maintenance interventions;
- Web-based system management for the installers, maintenance personnel, technical assistance, help desk and final customer, through dedicated administration panels.

MAIN FUNCTIONS

- Centralised multi-system management
- Multi-user functionality with various access levels
- Data storage in SQL databases
- Advanced formula editor
- Events and actions management
- Reporting system
- Performance analysis
- Graphics management
- Integrated video camera management

SunGuard Box Family – datalogger for up to 6KWp

Product code

SGB Family XSOL001A

MAIN FEATURES

- System compatibility: 0~6kWp
- Number of monitorable inverters: 2
- Power adaptor: 24VDC/20W DIN included
- Operating range: 0~60°C
- RAM: 128Mb
- Memory: 2Gb
- Communication ports: 2 RS232, 1 RJ45 Ethernet and 3 USB



SunGuard Box Family

SunGuard Box Small – datalogger for up to 19KWp

Product code

SGB Small XSOL002A

MAIN FEATURES

- System compatibility: 0~19kWp
- Number of monitorable inverters: 5
- Power adaptor: 24VDC/60W DIN included
- Terminal board: MOXA type for DB9 connectors (RS485) included
- Operating range: -20~60°C
- RAM: 128Mb
- Memory: 2Gb
- Communication ports: 1 RS232, 2 RS485, 1 RS422, 2 RJ45 Ethernet and 2 USB



SunGuard Box Small



SunGuard Professional

SunGuard Box Professional – datalogger for up to 200KWp**Product code**

SGB Professional	XSOL003A
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MAIN FEATURES

- System compatibility: 0~200kWp
- Number of monitorable inverters: 50
- Power adaptor: 24VDC/60W DIN included
- Terminal board: MOXA type for DB9 connectors (RS485) included
- Operating range: -20~60°C
- RAM: 256Mb
- Memory: 1Gb
- Communication ports: 1 RS232, 2 RS485 (or 1 RS422), 1 RJ45 Ethernet and 4 USB

SunGuard Box Business – datalogger for over 200KWp**Product code**

SGB Business	XSOL004A
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MAIN FEATURES

- System compatibility: >200kWp
- Number of monitorable inverters: 100
- Power adaptor: 24VDC/60W DIN included
- Terminal board: MOXA type for DB9 connectors (RS485) included
- Operating range: -20~60°C
- RAM: 1Gb
- Memory: 2Gb
- Communication ports: 1 RS232, 3 configurable (RS232, RS422, RS485), 2 configurable (RS422/485), 3 RJ45 Ethernet and 6 USB ports



SunGuard Box Business

String Control – current sensor**Product code**

SG4 (for 4 strings)	XSOL007A
SG3 (for 3 strings)	XSOL008A
SG2 (for 2 strings)	XSOL009A
SG1 (for 1 string)	XSOL010A

MAIN FEATURES

- Monitoring of the individual photovoltaic string
- Notifications in the event of malfunction and/or loss of efficiency
- Checking of 1 to 1016 strings
- From 0 to 25 Amperes per string
- ModBUS communication
- RS485 connection
- 24VDC power supply
- Precision: ±1%



String Control

Sensor Kit – environmental sensors**Product code**

SensorKit-A	XSOL005A
SensorKit-B	XSOL006A

CARATTERISTICHE PRINCIPALI

- Sensors: irradiation, module temperature, environment temperature (Kit-B) and anemometer (Kit-B)
- Power Supply: 24VDC from SunGuard Box
- ModBUS communication
- RS485 connection



Sensor Kit



AROS Solar Management

Supervision web portal:

Through solar management solutions, Aros guarantees its clients the most complete and advanced monitoring system available today.

At the heart of the system is the WEB'log device enabling the centralization of information produced by:

- the photovoltaic generator
- the inverter
- the temperature and irradiance sensors, the anemometer
- the iChecker sensors.

WEB'log sends stored data via an internal modem that is either analog or ISDN, GPRS, ADSL modem or ethernet to the control server interfaced with a meteorological satellite system that analyzes the production data and highlights any problems at plant level. Sending data to the server can be programmed by the user in an automatic manner or can be remotely "forced" at any time of the day. In the event of faults the WEB'log picks up alarm signals connected to clean contacts and immediately sends alarm signals via fax, mail or SMS.

Solar Management enables you to monitor the production data of several systems simply and quickly from a remote location, comparing the production values with those of the local satellite weather forecasting system and revealing any system engineering problems. In addition, complete management of statistics, with large volumes of energy production data and graphs, electrical parameters, system efficiency and income, is guaranteed for 20 years.

Main system features :

- complete alarm criteria management;
- in-depth analysis of system performance and energy production;
- graphs on all parameters of the PV field and inverters;
- possibility of making reports on all the information stored;
- history file of over 20 years.

The portal is accessed directly from the www.aros-solar.com site, by entering your username and password.

The screens that follow are just a taste of the potential of this tool, which is capable of handling several systems under a single access profile, drawing up in-depth reports on each parameter concerned and setting all fault and/or alarm conditions to suit your needs.

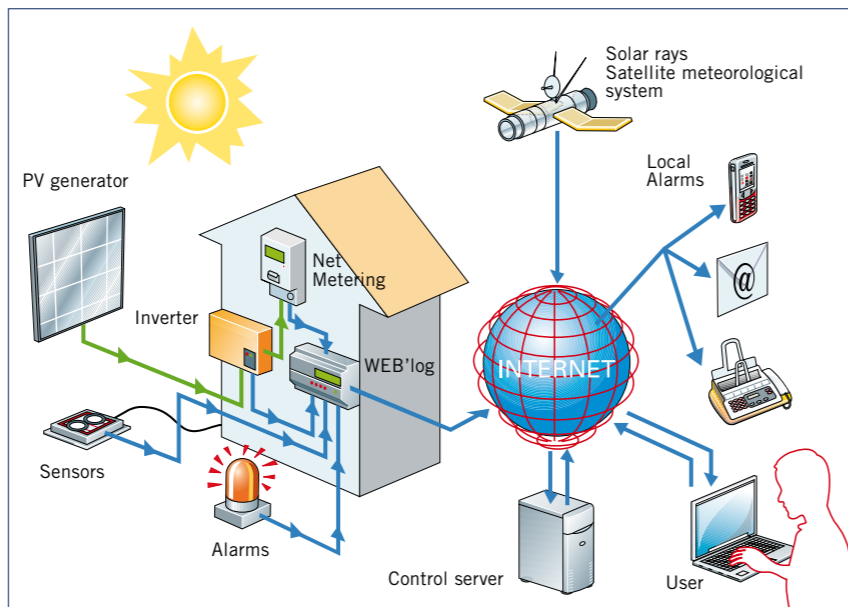


Fig. 1
PV plant technical data

Fig. 2
Energy generation



Fig. 3
Comparison energy generated/nominal

Fig. 4
Performance index



Fig. 5
Inverter - energy generated

Fig. 6
Inverter - power in grid



Fig. 7
Net metering counter

Fig. 8
Pay-Back Time visualization



WEB'log LIGHT + Solar management control center

Product code

WEB'log LIGHT + Analogic	XPV1RD01A
WEB'log LIGHT + Ethernet	XPV1RD02A
WEB'log LIGHT + DSL	XPV1RD03A

MAIN FEATURES

- "Ready to Go" – simply plug in and it will automatically dial-in and start operation
- Automatic transfer of recorded data to the portal
- Integrated telephone, DSL or Ethernet modem
- Two measurement inputs (for example, the energy meter, status information, analog or temperature sensors)
- Data management per single device for up to a maximum of 20kWp
- Communication via RS485 for up to 5 inverters
- Signal LEDs

WEB'log PRO Solar management control center

Product code

WEB'log PRO Analogic	XPV1RD08A
WEB'log PRO Ethernet + DSL	XPV1RD11A
WEB'log PRO GSM	XPV1RD10A
WEB'log PRO ISDN	XPV1RD09A

MAIN FEATURES

- Integrated power supply
- Integrated modem (see available versions)
- 4 analog inputs (10V, 20mA)
- 4 digital inputs (counters, measurements, etc.)
- RS485 bus interface for up to 30 inverters and Ethernet interface internal 32Mb memory
- LCD display
- Output for large display or local alarm

RS485 Repeater

Product code

XPV3R004A

The signal repeater for RS485 is indispensable for plants containing more than 20 inverters.



i'Checker - Current monitor

Product code

i'Checker 14A	XPV3R001A
i'Checker 35A	XPV3R002A
i'Checker 70A	XPV3R003A

MAIN FEATURES

- Ideal for measuring direct and alternating currents
- Non-contact current measurement
- Up to 100 i'Checkers can be installed per WEB'log
- Data is transferred by protocol
- Integrated audible and visual indicators
- Standard cable connections
- Output for local alarms
- DIN rail mounting



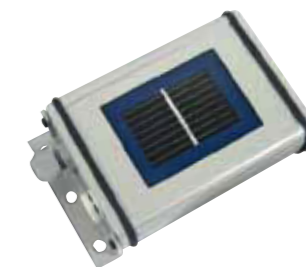
Irradiance and temperature sensor

Product code

Si-12TC Irradiance sensor	XPV3RS01A
<i>Compatible with String Box and NetMan Sensor Interface too</i>	
Si12TC-T Irradiance and temperature sensor	XPV3RS02A
<i>Comaptible with NetMan Sensor Interface too</i>	

MAIN FEATURES

- Temperature-compensated solar irradiance measurement
- Measurement range up to 1200W/ m²
- Module temperature measurement
- Each sensor is calibrated through pyranometers certified by the German Meteorological Insitute
- Ease of installation
- Supplied with 3 meter-cable (UV resistant)



**Anemometer**

Product code **XPV3RS05A**

Compatible with String Box too

The anemometer connected to the WEB'log control center enables detection of wind velocity for a complete analysis of environmental data.

MAIN FEATURES

- Power supply: 13 – 30 VDC
- Heating supply: 24 V AC/DC
- Heating: 20 W
- Output: 0 –10V
- Range of detection: 0.5 – 50 m/s
- Tolerance: +/- 3%
- Length of supplied cable: 12 meters

**PT100 temperature sensor**

Product code **XPV3RS06A**

Compatible with String Box too

Suitable for detecting the temperature of PV modules. Can be directly connected to the WEB'log control center through the PT100 signal convertor.

MAIN FEATURES

- Range of use: -50.. +50 o C
- Output: PT 100
- Length of supplied cable: 2 metersi

PT100 signal convertor

Product code **XPV3R006A**

Indispensable device for transmitting signals of the XPV3RS06A sensor.

MAIN FEATURES

- Power supply: 230VAC
- Input signal: PT 100 (3 wire)
- Output: 0-10 V

**PT1000 temperature sensor**

Product code **XPV3RS04A**

Suitable for measuring the ambient temperature. Can be directly connected to the WEB'log control center. Version equipped with integrated signal convertor and with IP65 protection.

MAIN FEATURES

- Power supply: 15—24 VDC
- Power consumption: 12 mA @ 24 V
- Tolerance: 1%
- Output: 0 –10V
- Temperature range: -50°C...+ 50°C

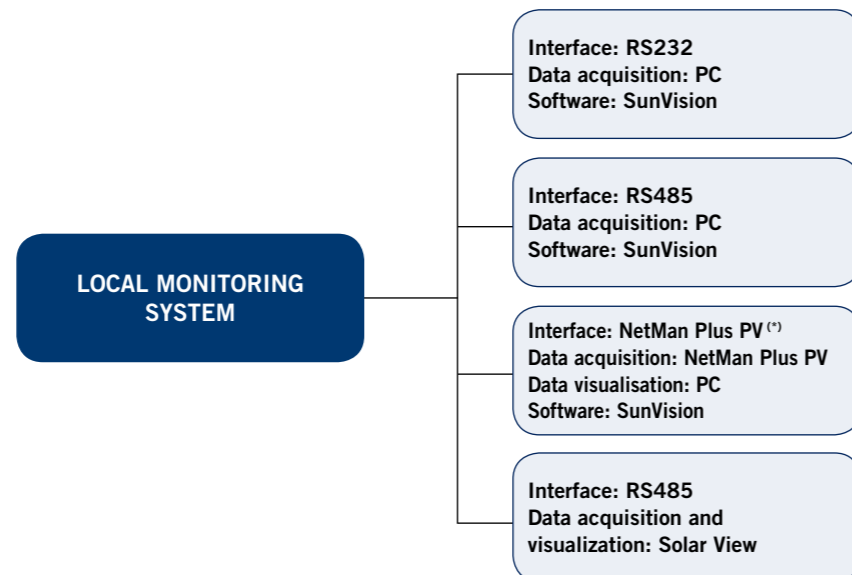


In the current global economic situation, where energy costs have risen significantly due to the ever-increasing price of fossil fuels, renewable energy offers an obvious alternative for those countries whose dependence on energy is vital for the development of the economy.

Photovoltaic power stations play an essential role in this scenario: however, these installations, whether they are large photovoltaic farms or individual private plants, must work constantly at their maximum efficiency if they are to guarantee the profitability estimated in their investment plans. It is no mere coincidence that the CEI 82-25 Guide recommends the "constant monitoring" of the system in order to identify and immediately eliminate any faults or failures that may affect the efficiency of the plant.

AROS offers a number of solutions for photovoltaic plant monitoring which can be implemented at various levels in order to have an efficient control system according to customer requirements.

LOCAL MONITORING (POINT – POINT)



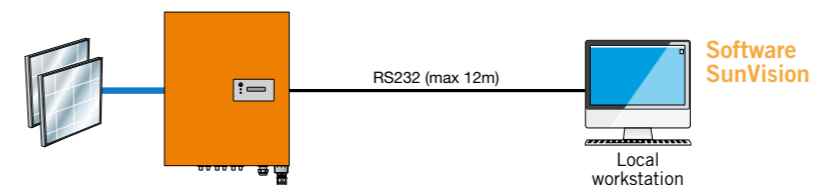
^(*) Only for Central Inverters

INVERTER - PC Connection with SunVision monitoring and management software installed

Single connection < 12m from the PC

For a single connection, with just one inverter located at a distance of less than 12 metres from the PC, connection must be made via the RS232 interface supplied as a standard accessory with the whole range of inverters. In this way users can connect a PC and use SunVision software to monitor the inverter. Data storage and event history logs are performed directly by the Personal Computer connected to the system.

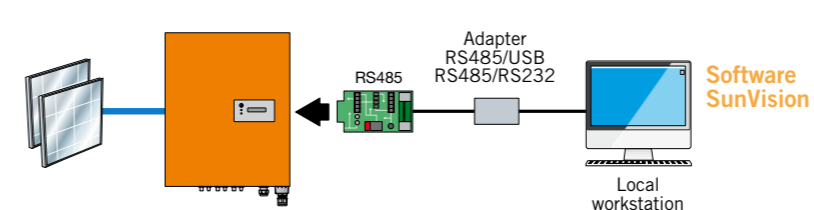
Diagram of point-point connection with RS232



Single connection > 12m from the PC

For a single connection, with just one inverter located at a distance of more than 12 metres from the PC, a BUS must be constructed by installing the RS485 card in the appropriate inverter slot; this will create a connection to inverters, and all the parameters can be displayed via connection to a PC equipped with SunVision software. Data storage and event history logs are performed directly by the Personal Computer connected to the system.

Diagram of point-point connection with RS485



An RS485/USB or RS485/RS232 converter, NOT provided by AROS, (such as the "Distrelec" model, item 688257, see www.distrelec.it) is required to complete the connection to the relevant PC.

Multi inverter connection up to 127 inverters

For a multi-inverter connection (up to 127 inverters) up to a distance of 1200m, it is possible to construct a BUS, installing the RS485 card in the appropriate inverter slot, connecting one or more inverters from a PC station equipped with SunVision software. Data storage and event history logs are performed directly by the Personal Computer connected to the system.

The following accessories are needed for this solution:

- RS232 serial cable;
- Personal Computer with SunVision software installed (downloadable from www.aros-solar.com).



RS485

The following accessories are needed for this solution:

- RS485 card (codes: for TL inverters, XPV2RBC1A; for Central inverters, XPV2RBC2A);
- 485 BUS serial cable;
- Adapter RS485/USB;
- Personal Computer with SunVision software installed (downloadable from www.aros-solar.com).

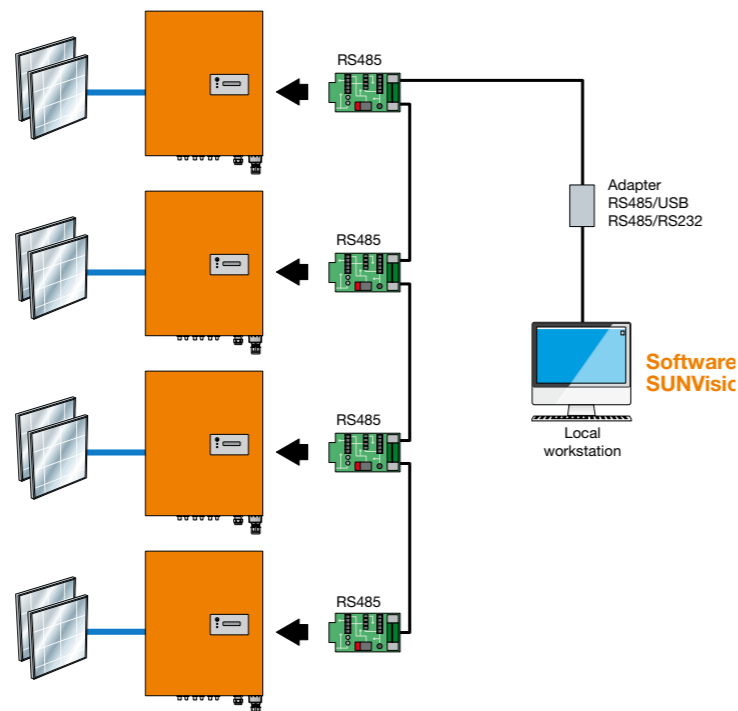


RS485

The following accessories are needed for this solution:

- RS485 card for each inverter (codes: for TL inverters, XPV2RBC1A; for Central inverters, XPV2RBC2A);
- 485 BUS serial cable;
- Adapter RS485/USB;
- Personal Computer with SunVision software installed (downloadable from www.aros-solar.com).

Diagram of Multinverter point-point connection with RS485



An RS485/USB or RS485/RS232 converter, NOT provided by AROS, (such as the "Distrelec" model, item 688257, see www.distrelec.it) is required to complete the connection to the relevant PC.

Single or multi inverter connection

For a single or multi inverter connection, a NetMan Plus PV interface can also be used; this expansion card is inserted in the inverter slot and will record the inverter measurements and events in the log file. This uses the capability of the NetMan Plus PV device to store the data relating to events and make them available in a "log" file, which can be downloaded directly from the SunVision software and with which the information can be processed in the form of graphs.

An UPDATE of the data files can be carried out via the Log & Tools menu (password required = password). At this point the parameters can be displayed in the form of graphs, or exported for reading in a text file or Excel spreadsheet (for more information please refer to the SunVision manual). The interval of time between one log and the next (Log frequency) can be configured by the user in the NetMan Plus PV card. The data are saved in a circular list procedure whereby the most recent data are saved by overwriting the older data; data relating to up to 1,024 different instants can be logged. With this local monitoring solution, it is no longer necessary for the display computer to be kept in constant operation in order to have the data log file.



NetMan Plus PV



Diagram of SINGLE INVERTER point-point connection with NetMan Plus PV

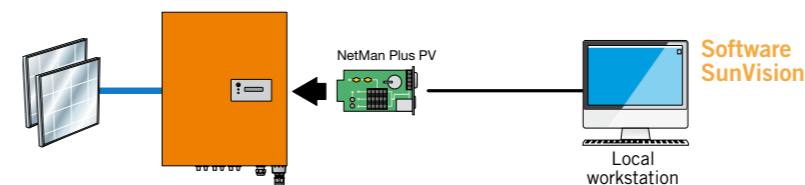
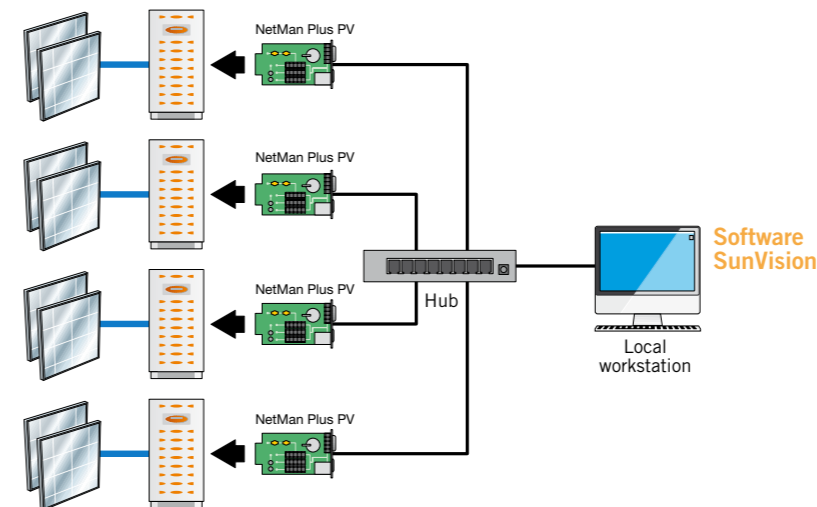


Diagram of MULTINVERTER point-point connection with NetMan Plus PV



The following accessories are needed for this solution

- NetMan card (codes: for TL inverters, XPV2RSA2A; for Central inverters, XPV2RSA1A);
- Ethernet or crossover cable: this is a kind of network cable used for the direct connection of the PC and other devices equipped with a network card without the aid of a network switch, hub or router;
- Personal Computer with SunVision software installed (downloadable from www.aros-solar.com).

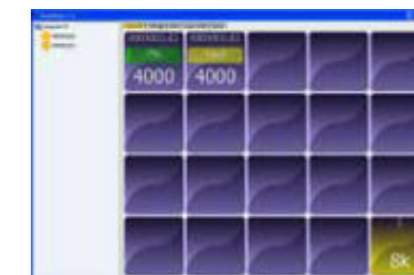
The following accessories are needed for this solution

- NetMan card (codes: for TL inverters, XPV2RSA2A; for Central inverters, XPV2RSA1A);
- Network cable to connect each inverter to a hub or network switch;
- Personal Computer with SunVision software installed (downloadable from www.aros-solar.com).

SunVision local monitoring software

SunVision, a utility program for the configuration and monitoring of solar inverters, is the monitoring interface software for all connections. SunVision can provide a wealth of information, such as inverter status and the power fed into the grid, as well as allowing some machine parameters to be configured. The software ensures the efficient and intuitive management of the photovoltaic plant (up to 127 inverters), displaying all the electrical parameters subdivided into different access menus, the most important being:

- graphic monitoring of inverter status in instantaneous operating conditions;
- detailed display with all values;
- centralized control of the PV inverters connected via serial port (RS232 or RS485), or via network;
- internal graphic data log, with two levels of detail;
- alarm notification via e-mail and SMS;
- http functionality for remote control.



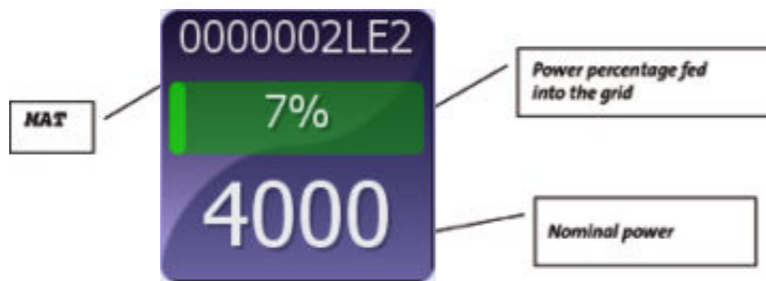
View of the main SunVision window

System capacity subdivided into the various menus

“General” tab

Each square, except for the last square in the bottom right-hand corner, represents a photovoltaic inverter connected to the BUS and contains information on the associated inverter. This information includes the MAT code, the nominal power and the fraction of nominal power, expressed as a percentage, that the inverter is feeding into the grid, as shown in Figure 1.

Figure 1: Detail of general tab



The sum of the nominal powers of all inverters detected is displayed in the last square in the bottom right-hand corner, as shown in Figure 2.

Figure 2: General tab - sum



“Details” tab

The Details tab (Figure 3) has the same structure as the “General” tab, except that each square shows the instantaneous output parameters and the internal temperature of each PV inverter.

Figure 3: Details tab



The following information is provided:

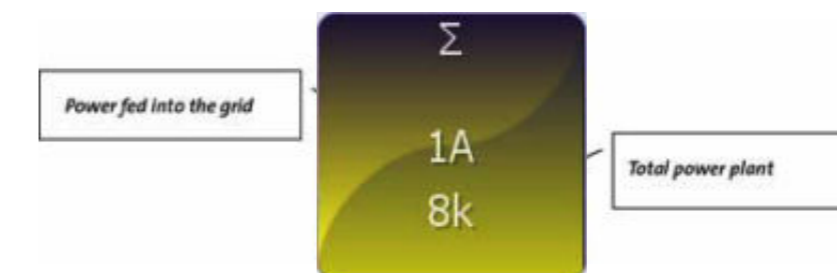
- Vac = phase-neutral voltage (L1-N for a three-phase inverter) of the AC electricity grid;
- Iac = inverter AC output current (from L1 for a three-phase inverter);
- Temp = inverter temperature;
- Fac = frequency of the grid voltage;
- Pac = power fed into the grid by the inverter;
- Zac = grid impedance (only for versions that support this feature).

Figure 4: Detail of the “Details” tab



The bottom right-hand square shown in Figure 3 displays the sum of the nominal powers and the powers fed into the grid shown in the squares of Figure 4 for the inverters connected to the BUS at that time, as shown in Figure 5.

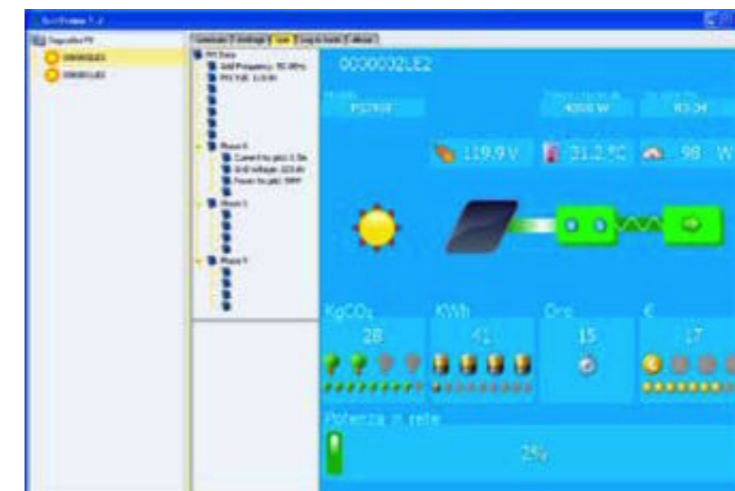
Figure 5: Details sum square



“Sun” tab

The “Sun” tab (Figure 6) provides an immediate view of all the parameters of the photovoltaic power plant.

Figure 6: Sun tab

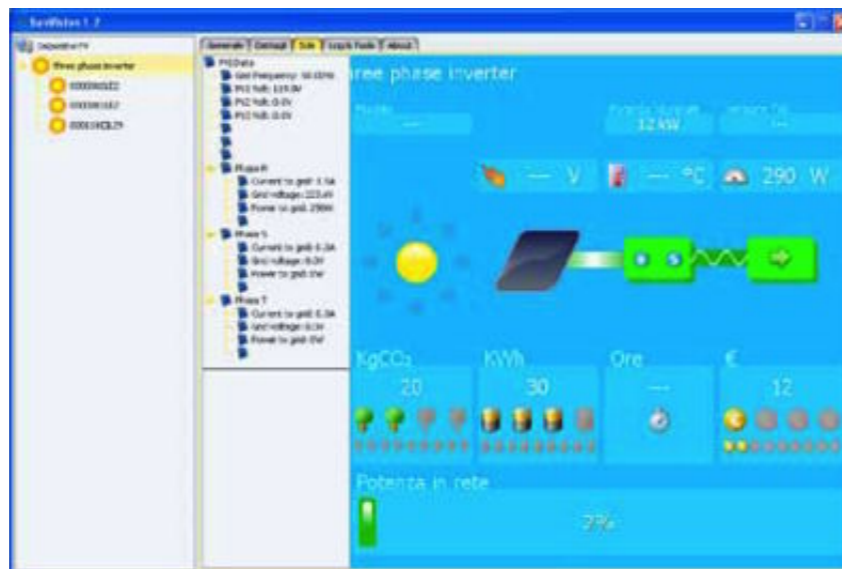


The “Sun” tab is divided into two parts, as can be seen in Figure 6. The instantaneous electrical input parameters for each tracker (PV generator voltage, input current for the models that support this feature) and output parameters for each phase (grid voltage, current and power fed into the grid) are shown on the left-hand side, while the right-hand side displays the information identifying the inverter, some instantaneous parameters and the cumulative parameters, such as the counters measuring the amount of energy produced and the total hours of operation, in graphic/digital format. These cumulative parameters are used to calculate the gain and the equivalent mass of CO₂, expressed in kg, that has not been emitted into the atmosphere by using solar energy rather than fossil fuels.

The “Sun” tab displays the following parameters, shown in Figure 7:

- 1) MAT code;
- 2) inverter model;
- 3) nominal power;
- 4) FW version;
- 5) input voltage of the first inverter MPPT tracker;
- 6) inverter temperature;
- 7) power supplied by the inverter;
- 8) presence of solar radiation;
- 9) inverter status;
- 10) grid status;
- 11) kgCO₂ saved;
- 12) kWh produced;
- 13) hours of operation;
- 14) gain;
- 15) percentage of instantaneous power fed into the grid.

Figure 7: “Sun” tab in detail



“Log & Tools” tab

The “Log & Tools” tab, shown in Figure 8, displays, in the form of graphs, the data read by the inverter selected on the left and stored in the internal program data log; configuration operations can also be carried out for the reception and processing of the data.

The “Log & Tools” tab is divided into four submenus:

- Log;
- Load files;
- Load parameters;
- Tools.

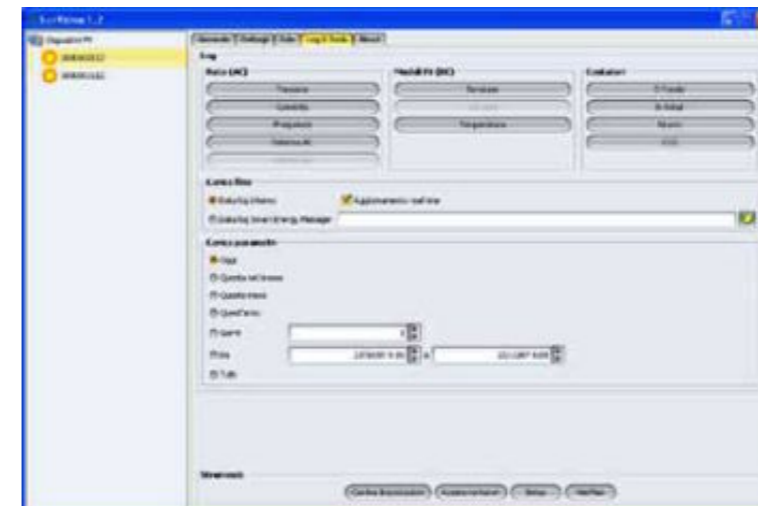


Figure 8: “Log & Tools” tab

“Log” menu

The “Log” menu (Figure 9) provides a graphic display of the parameters for a specific photovoltaic inverter, divided into three subgroups:

- 1) Grid (AC): corresponds to the inverter output and therefore provides the parameters associated with the alternating current grid. Press the relevant button shown in Figure 9 to display the following graphs:

- voltage;
- current;
- frequency;
- AC power;
- impedance (only for versions that support this feature).

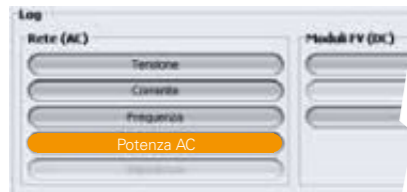
The graphs show the state of the above parameters in relation to the time expressed in hours.



Figure 9: “Log” menu

08

Communication and Monitoring Systems



Example: Press the "AC Power" button to display the graph of the power fed into the grid over time



2) PV modules (DC): corresponds to the output of the photovoltaic panels and, therefore, to the inverter input. The following graphs can be displayed by pressing the relevant button shown in Figure 9:

- input voltage;
- input current (for the PV inverter models that provide this measurement).

3) Inverter: corresponds to internal inverter readings. The following graph can be displayed by pressing the relevant button shown in Figure 9:

- inverter temperature.

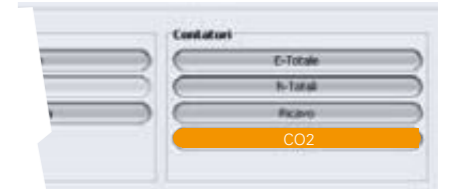
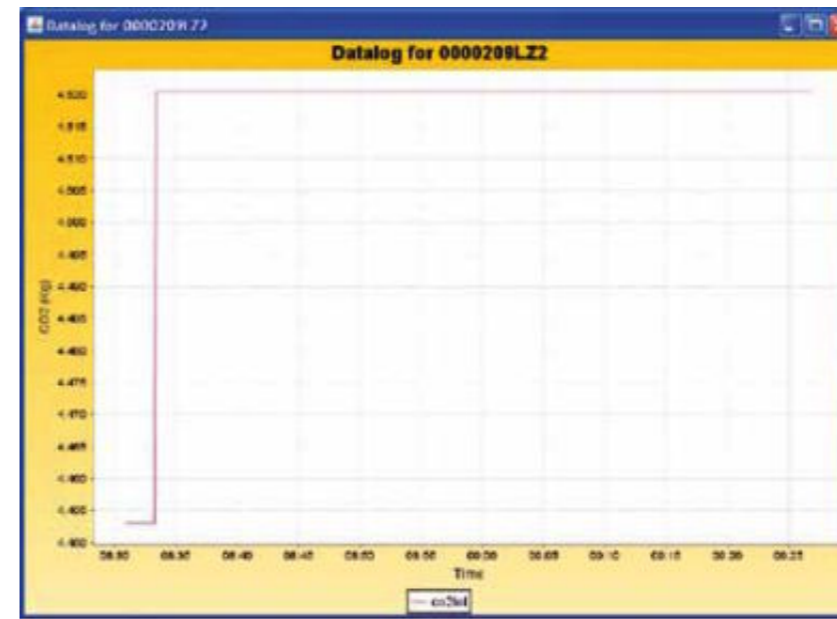


Example: Press the "Temperature" button to display the graph of the inverter temperature over time.



4) Counters: SunVision counters can provide a graphic display of the following values:

- Total E;
- Total h;
- Revenew;
- CO2.



Example: Press the "CO2", button to display the graph of the kg of CO2 saved up to that time.

The daily/monthly energy graph provides a graphic representation of the energy produced in the previous days or months.

For more information and specific details, reference should be made to the SUN VISION manual, which can be downloaded from the site: www.aros.it/sirio



Connection with SOLAR VIEW data logger (up to a maximum of 5 inverters)

This data acquisition device can provide all the information on the main electrical parameters of the photovoltaic generator, by means of the RS485 connection. A 485 BUS must be constructed between the inverters by installing an RS485 card in the relevant slot of each device (up to a maximum of 5 inverters).

A simple touch of the touch screen display is sufficient to show the following values:

- DC side voltage;
- power generated by the plant;
- AC side voltage;
- AC side current;
- energy produced;
- CO2 value avoided;
- remuneration in euros for each kWh produced.

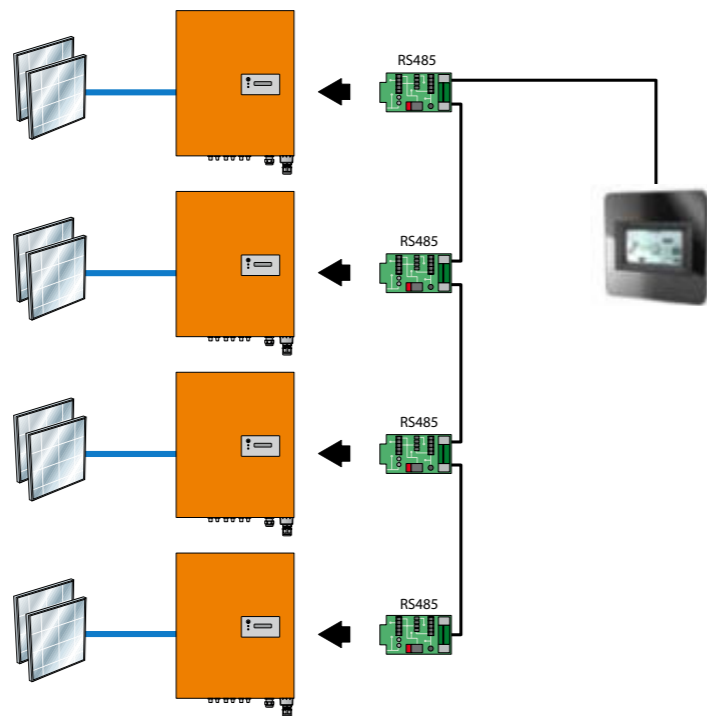
All the parameters are also displayed in the form of graphs.

The data logger also logs a series of events relating to the status of the devices and of the plant in general, as well as operating faults (grid power outage, exceeding the overvoltage thresholds, electric grid parameters that do not comply with regulations).

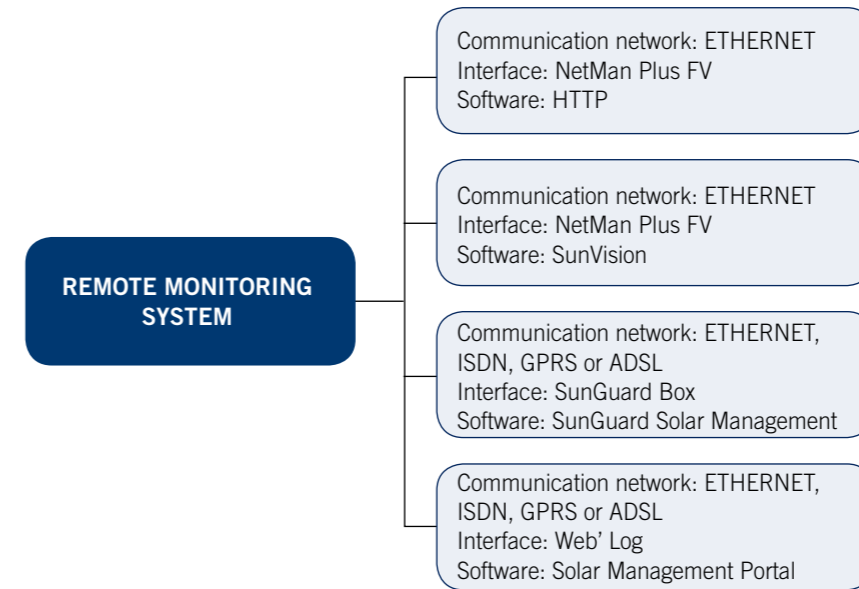
Lastly, the data logger stores the history log of the last 30 days.

The following accessories are needed for this solution:

- RS485 card (codes: for TL inverters, XPV2RBC1A; for Central inverters, XPV2RBC2A);
- 485 BUS serial cable;
- Data logger, Solar View model.



Remote monitoring



Connection from INVERTER to PC installed on a LAN network with NetMan Plus PV

Connection via the NetMan Plus PV network card, a device which can be used to manage the inverter via the LAN (Local Area Network); this accessory supports all the main network protocols (TCP/IP, HTTP, etc.) and is compatible with Ethernet 10/100Mbps IPv4 networks, so all inverters can be easily integrated into medium and large sized networks.

The device also records the inverter measurements and events in log files.

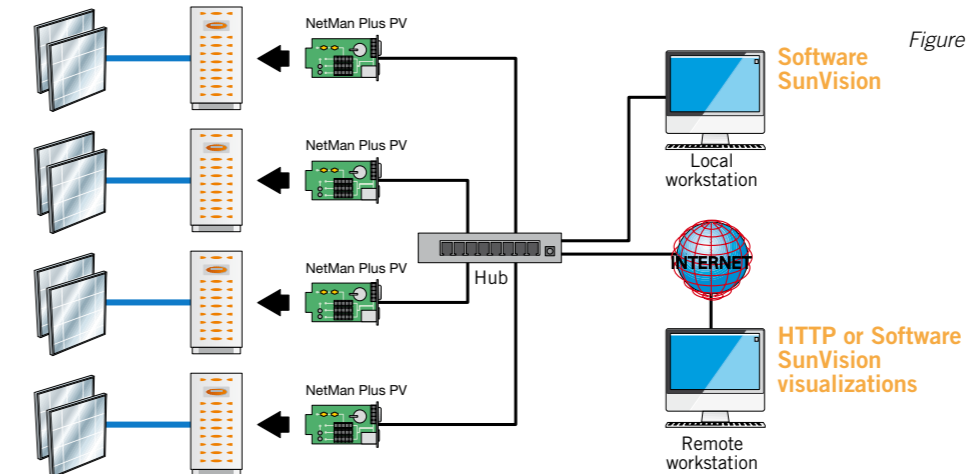
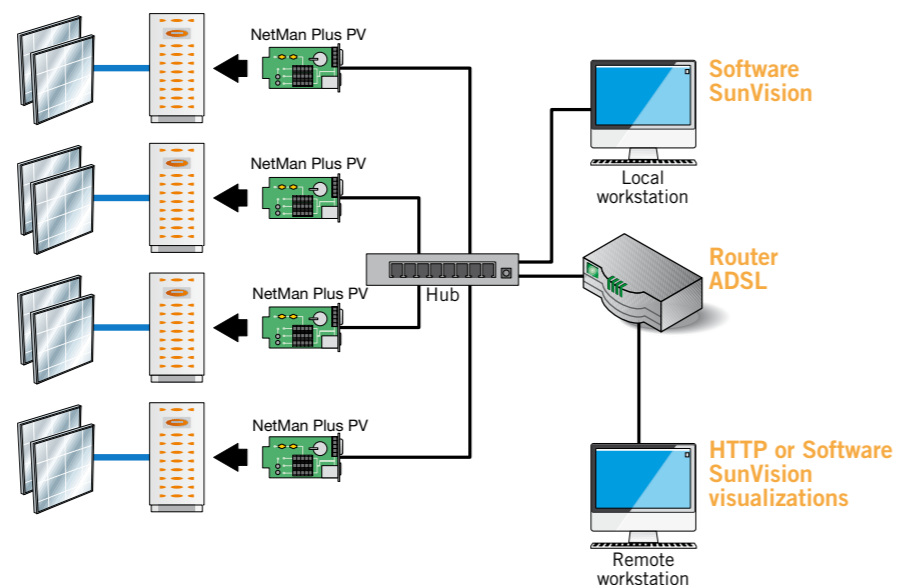


Figure 10: Monitoring LAN networks

The following accessories are needed for this solution:

- NetMan card for each inverter (codes: for TL inverters, XPV2RSA2A; for Central inverters, XPV2RSA1A);
- LAN line;
- Ethernet cable;
- HUB (see description above);
- Personal Computer with SunVision software installed (downloadable from www.aros-solar.com).



N.B.

The HUB is a concentrator, a network device that acts as a switching node in a data communication network. In the case of the widespread Ethernet networks, a hub is a device that forwards data coming from any of its ports onto all the other ports. For this reason it can also be defined as a "multiport repeater". This device is NOT supplied by AROS; it can be purchased from any retailer dealing in data processing equipment.

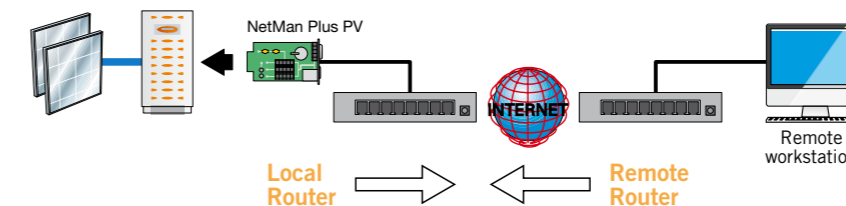
Remote access

A VPN connection with the network where the photovoltaic plant is connected is required in order to display data from a remote location. There are two possible ways to do this:

- by acquiring a STATIC IP address associated with the relevant router from the telephone network operator (at a cost of around 20 euros a year);
- by using DNS services to obtain a DYNAMIC IP domain. This service is used to create a dynamic DNS that associates the IP, which changes at each new connection, with the domain name.

As far as Italy is concerned, the only free dynamic DNS service is provided by Dyndns.it. It should be noted that the services are independent of the operating system used. For example: www.impianto1.noip.com

Monitoring with SunVision with PC in a remote location



The following accessories are needed for this solution:

- NetMan card for each inverter (codes: for TL inverters, XPV2RSA2A; for Central inverters, XPV2RSA1A);
- network cable and router with enough inputs to connect all the inverters, or an additional hub or network switch;
- Personal Computer with SunVision software installed (downloadable from www.aros-solar.com).

Remote monitoring software: HTTP display; NetMan Plus PV network agent capabilities

The capabilities of the NetMan Plus PV network card can be used for the remote control of the system; besides interfacing with the system, NetMan Plus PV also allows data logging, in particular:

HTTP

The inverter status can be monitored via a WEB browser without having to install any additional software, by means of the HTTP protocol (Hyper Text Transfer Protocol). All the most popular WEB browsers (Internet Explorer, Safari, Firefox, Netscape Navigator, Konqueror, Opera) are supported. Enter the hostname or the NetMan Plus PV IP address on your WEB browser to display a screen similar to the one shown in Figure 12, containing the main operating data of the inverter.

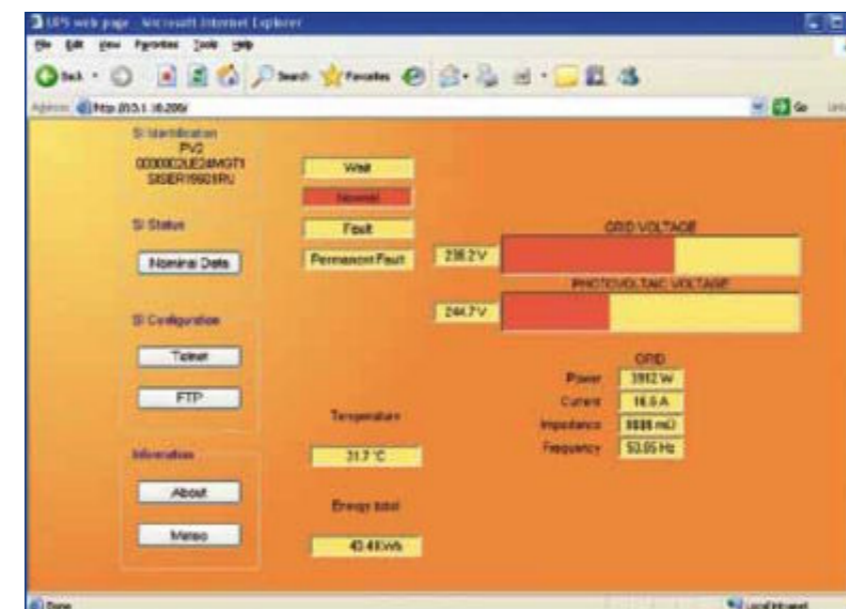
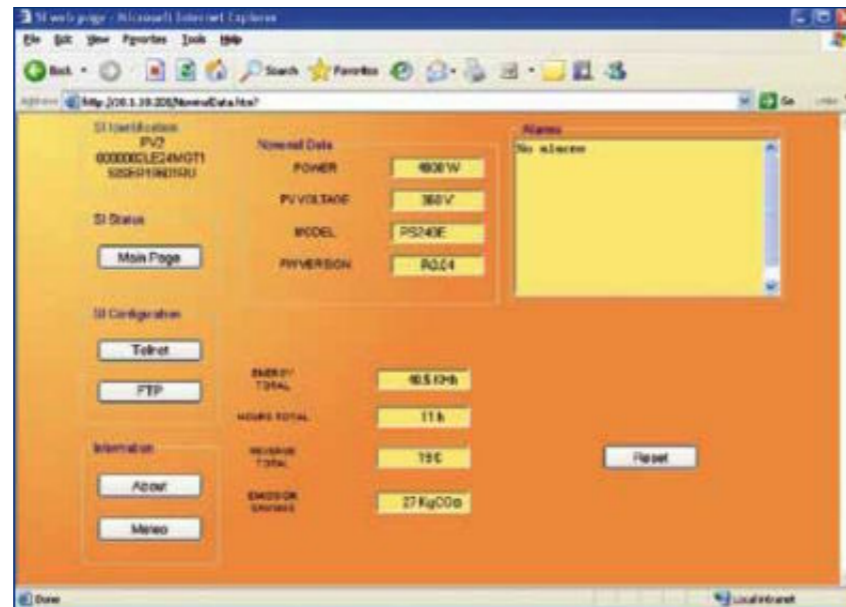


Figure 12: Example of a display via HTTP

The following buttons are shown on the left-hand side of the page:

- Nominal Data: opens a page that displays the nominal values of the inverter, the list of active alarms and the counters (see Figure 13);
- Telnet: opens a Telnet session (see section on "Telnet");
- FTP: opens an FTP session (see section on "FTP");
- About: opens a page with information on copyright;
- Weather: opens a weather forecast web page (see section on "Feeding config").

Figure 13:
Example of the "Nominal Data" window



UDP

UDP (User Datagram Protocol) is a low-level network protocol that guarantees speed in data exchanges and low network congestion. It is the protocol used by SunVision software for the monitoring and control of the inverter. The UDP connection uses the UDP 33000 port by default, but can be configured on other ports if necessary.

FTP

FTP (File Transfer Protocol) is a network protocol used to exchange files. NetMan Plus uses this protocol for two purposes:

- to download files from the inverter measurements and events log file (Datalog and Eventlog);
- to download and upload configuration files.

Both cases require an FTP client configured with the following parameters:

- Host: hostname or NetMan Plus PV IP address;
- User: "root";
- Password: current password (default configuration: "password").

The connection can also be established by using a WEB browser (all the most popular WEB browsers are supported), by entering the following address: ftp://root@<indirizzo.NetMan Plus>, where <indirizzo.NetMan Plus> is replaced with the actual address of the device. In this case a screen similar to the one shown in Figure 14 will be displayed.

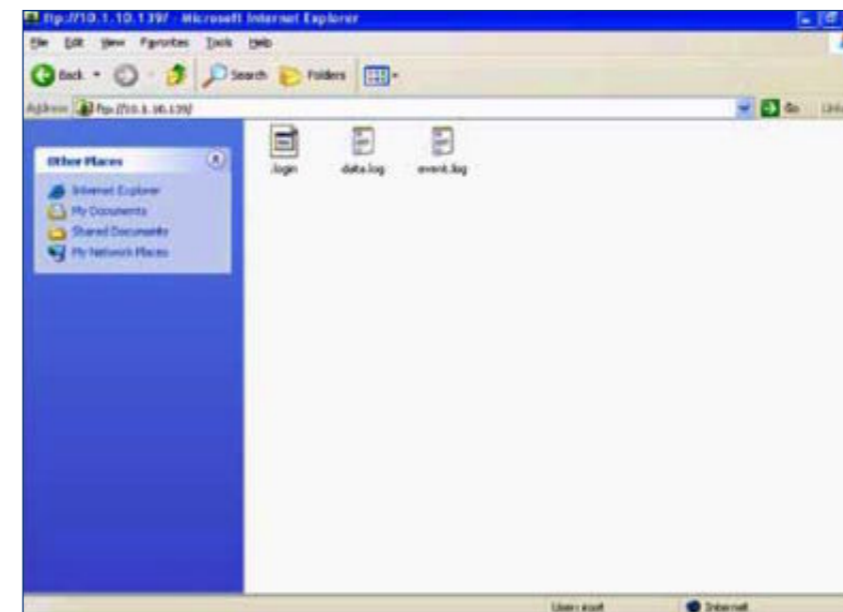


Figure 14:
Example of FTP connection

Emails

NetMan Plus PV can send notification e-mails when one or more alarm conditions occur. The e-mails can be sent to up to three recipients and can be sent for three different levels of alarm.

SMTP (Simple Mail Transfer Protocol) is the protocol used to send the e-mails, which are sent to an SMTP server on port 25.

Report

NetMan Plus PV can send periodic e-mails with an attachment containing the inverter measurements and events log file.

This service can be used to save the log files periodically.

The "Email" service has to be enabled in order to send reports; reports are sent to all the addresses configured for this service.

Eventlog

The Eventlog service is always active; it records all the significant inverter events in the "event.log" file. This file can be downloaded via FTP or sent via e-mail by using the "Email report" service. The data are saved in a circular list procedure whereby the most recent data are saved by overwriting the older data.

Datalog

The Datalog service records the most important inverter data in the "data.snv" file. This file can be downloaded via FTP or sent via e-mail, using the "Email report" service. The following data are monitored:

- Temp: inverter temperature;
- lac1: line 1 current;
- lac2: line 2 current;
- lac3: line 3 current;
- Vac1: line 1 voltage;
- Vac2: line 2 voltage;
- Vac3: line 3 voltage;
- Fac: line frequency;
- Pac: output power;
- Zac: line impedance (only for models that support this feature);
- Etot: total energy produced;
- Htot: total hours of operation;
- Vpv1: MPPT1 input voltage;
- Vpv2: MPPT2 input voltage (if present);
- Vpv3: MPPT3 input voltage (if present);
- Ipv1: MPPT1 current in input;
- Ipv2: MPPT2 current in input;
- Ipv3: MPPT3 current in input.

SunVision remote monitoring software

SunVision is a utility program for the configuration and monitoring of solar inverters. SunVision can provide a wealth of information, such as inverter status and the power fed into the grid, as well as allowing some machine parameters to be configured. The software ensures efficient and intuitive management of the photovoltaic plant (up to 127 inverters), displaying all the electrical parameters subdivided into different access menus, the most important being:

- graphic monitoring of inverter status in instantaneous operating conditions;
- detailed display with all measurements;
- centralized control of PV inverters connected via serial port (RS232 or RS485), or via network;
- internal graphic data log, with two levels of detail;
- alarm notifications via e-mail and SMS;
- http functionality for remote control.

For more details on the capabilities of the software please turn to page 94. Different configurations are required according to the network connection:

On the local network

In order to connect to SunVision from the same local network, it is sufficient to connect to the IP address of the computer running SunVision via a WEB browser. If the default port is changed, the port must be entered at the end of the IP address.

Via Internet:

- if SunVision is running on a PC connected to a local network.

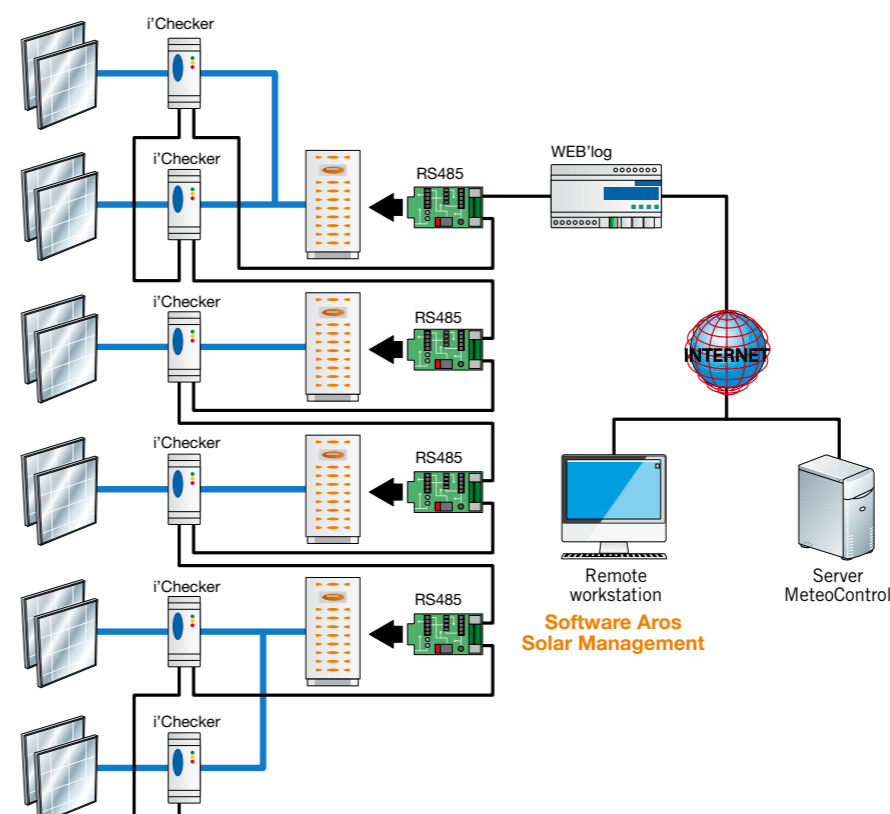
The gateway, that is the device sharing the Internet connection (usually a router) must be configured to provide port-forwarding, so that the IP address of the PC running SunVision is associated in input with TCP ports 1098 and 1099 and with the default TCP port. It is recommended to use a static local IP address for this PC. Remote PCs must open the IP address of the gateway where the PC running SunVision is connected and the default TCP port. The gateway IP address may be replaced by a symbolic name if a dynamic DNS service is used or if an internet domain is owned.

- if the PC running SunVision is connected to the internet via a modem.

In this case TCP ports 1098, 1099 and the default TCP port must be opened in any firewall that may be installed on the PC. In this case too, the PC can be addressed directly through the public IP address or via a symbolic name if a dynamic DNS service is used or if an internet domain is owned.

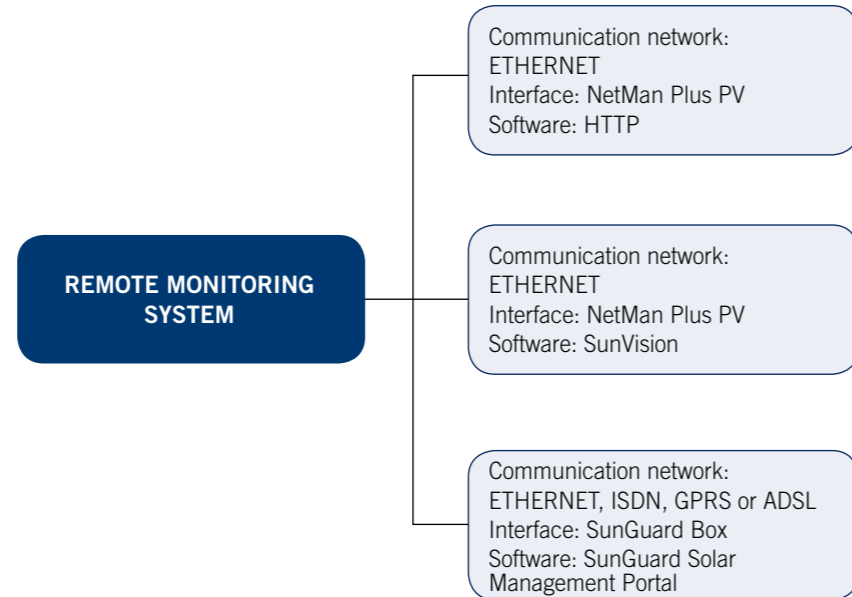
AROS Solar Management Portal

For more information about this service please refer to pag. 104.



AROS Solar Management

Monitoring with String Box

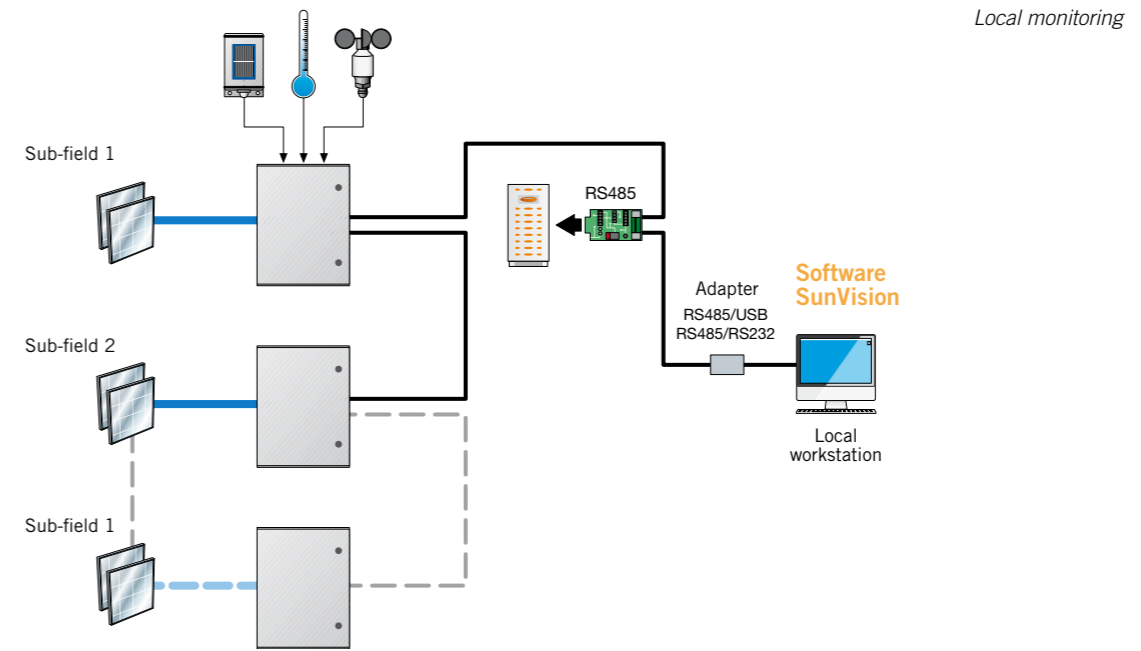


The device monitors the currents in photovoltaic modules and can promptly diagnose faults. Up to 16 strings (with a maximum input current per string of 9A) can be connected.

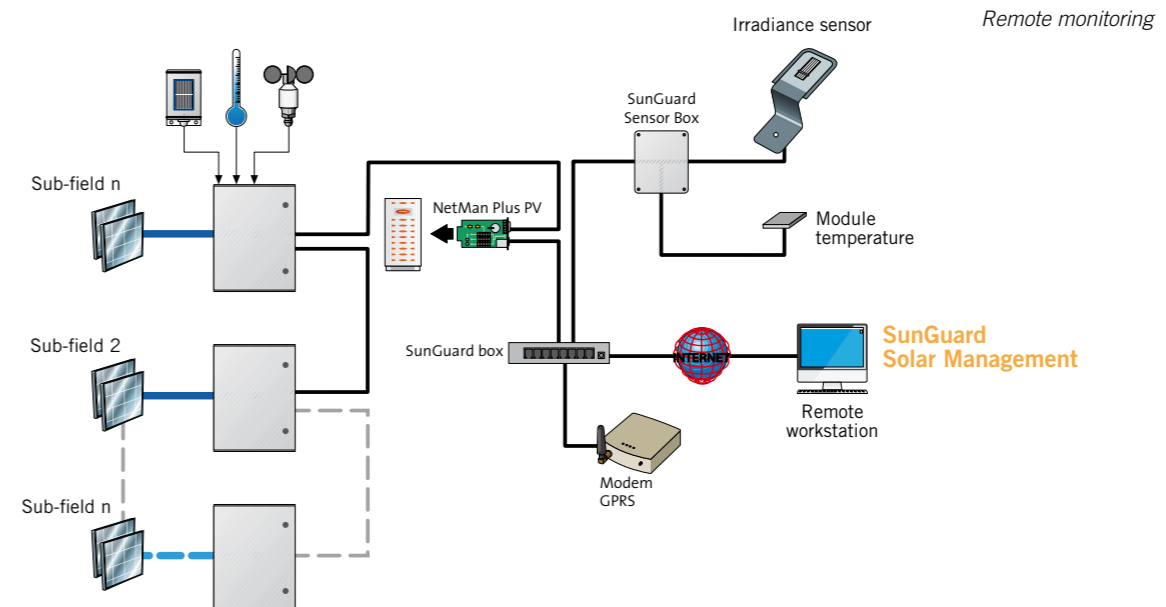
From the software point of view, the device is compatible with SunVision, which can display the status of the string current measurements and any alarms. It has 3 communication ports that are compatible with SunVision and ModBus.

The following environment sensors, which have already been described on pages 108 and 109, can be connected to the device:

- environment temperature and photovoltaic modules (PT100);
- irradiation device;
- wind sensor (anemometer).



Local monitoring



Remote monitoring

Glossary

alternating current - Electric current in which the direction of flow is reversed at frequent intervals--usually 100 or 120 times per second (50 or 60 cycles per second or 50/60 Hz).

amorphous semiconductor - A non-crystalline semiconductor material. Easier and cheaper to make than crystalline, but less efficient and slowly degrades over time. Also called thin film.

ampere (A) or amp - The unit for the electric current; the flow of electrons. One amp is 1 coulomb passing in one second. One amp is produced by an electric force of 1 volt acting across a resistance of 1 ohm.

ampere-hour (AH) - Quantity of electricity or measure of charge. How many amps flow or can be provided over a one hour period. Most batteries are rated in AH.

array - Any number of photovoltaic modules connected together to provide a single electrical output. Arrays are often designed to produce significant amounts of electricity.

cell - The basic unit of a photovoltaic panel or battery

charge controller - An electronic device which regulates the voltage applied to the battery system from the PV array. Essential for ensuring that batteries obtain maximum state of charge and longest life.

combined collector - A photovoltaic device or module that provides useful heat energy in addition to electricity.

concentrator (module, array, or collector) - An arrangement of photovoltaic cells that includes a lens to concentrate sunlight onto small-area cells. Concentrators can increase the power flux of sunlight hundreds of times.

conversion efficiency (cell or module) - The ratio of the electric energy produced by a photovoltaic device (under one-sun conditions) to the energy from sunlight incident upon the cell.

current at maximum power (Imp) - The current at which maximum power is available from a module.

dc to dc converter - Electronic circuit to convert dc voltages (e.g., PV module voltage) into other levels (e.g., load voltage). Can be part of a maximum power point tracker (MPPT).

deep discharge - Discharging a battery to 20-percent or less of its full charge.

diffuse insolation - Sunlight received indirectly as a result of scattering due to clouds, fog, haze, dust, or other obstructions in the atmosphere. Opposite of direct insolation.

direct current (dc) - Electric current in which electrons flow in one direction only. Opposite of alternating current.

direct insolation - Sunlight falling directly upon a collector. Opposite of diffuse insolation.

discharge rate - The rate, usually expressed in amperes or time, at which electrical current is taken from the battery.

electric circuit - Path followed by electrons from a power source (generator or battery) through an external line (including devices that use the electricity) and returning through another line to the source.

electric current - A flow of electrons; electricity, amps.

electrical grid - An integrated system of electricity distribution, usually covering a large area. As in "off the grid".

grid-connected (PV system) - A PV system in which the PV array acts like a central generating plant, supplying power to the grid.

incident light - Light that shines onto the face of a solar cell or module.

inverters - Devices that convert dc electricity into ac electricity (single or multiphase), either for stand-alone systems (not connected to the grid) or for utility-interactive systems.

junction box - A PV generator junction box is an enclosure on the module where PV strings are electrically connected and where protection devices can be located, if necessary.

junction diode - A semiconductor device with a junction and a built-in potential that passes current better in one direction than the other. All solar cells are junction diodes.

kilowatt (kW) - 1000 watts.

kilowatt-hour (kWh) - One thousand watts acting over a period of 1 hour. The kWh is a unit of energy. 1 kWh=3600 kJ.

load - Anything in an electrical circuit that, when the circuit is turned on, draws power from that circuit.

maximum power point tracker (MPPT) - A power conditioning unit that automatically operates the PV-generator at its maximum power point under all conditions. An MPPT will typically increase power delivered to the system by 10% to 40%, depending on climate conditions and battery state of charge. You usually get more gain in winter and in colder weather due to the higher panel output. Most MPPT controllers are down converters - from a higher voltage to a lower one.

microgroove - A small groove scribed into the surface of a cell which is filled with metal for contacts.

module - A number of PV cells connected together, sealed with an encapsulant, and having a standard size and output power; the smallest building block of the power generating part of a PV array. Also called panel.

monolithic - Fabricated as a single structure.

multicrystalline - Material that is solidified at such as rate that many small crystals (crystallites) form. The atoms within a single crystallite are symmetrically arranged, whereas crystallites are umbled together. These numerous grain boundaries reduce the device efficiency. A material composed of variously oriented, small individual crystals. (Sometimes referred to as polycrystalline or semi-crystalline).

multijunction device - A photovoltaic device containing two or more cell junctions, each of which is optimized for a particular part of the solar spectrum, to achieve greater overall efficiency.

n-type semiconductor - A semiconductor produced by doping an intrinsic semiconductor with an electron-donor impurity (e.g., phosphorous in silicon).

ohm - The unit of resistance to the flow of an electric current. peak load; peak demand--The maximum load, or usage, of electrical power occurring in a given period of time, typically a day.

peak watts (Wp) - See 'Photovoltaic peak watt.'

photon - A particle of light that acts as an individual unit of energy.

photovoltaic (PV) - Pertaining to the direct conversion of light into electricity.

photovoltaic (PV) array - An interconnected system of PV modules that function as a single electricity-producing unit. The modules are assembled as a discrete structure, with common support or mounting. In smaller systems, an array can consist of a single module.

photovoltaic (PV) cell - The smallest semiconductor element within a PV module to perform the immediate conversion of light into electrical energy (dc voltage and current).

photovoltaic (PV) conversion efficiency - The ratio of the electric power produced by a photovoltaic device to the power of the sunlight incident on the device.

photovoltaic (PV) efficiency - The ratio of electric power produced by a cell at any instant to the power of the sunlight striking the cell. This is typically about 9% to 14% for commercially available cells.

photovoltaic (PV) generator - The total of all PV strings of a PV power supply system, which are electrically interconnected.

photovoltaic (PV) module - The smallest environmentally protected, essentially planar assembly of solar cells and ancillary parts, such as interconnections, terminals, [and protective devices such as diodes] intended to generate DC power under un-concentrated sunlight. The structural (load carrying) member of a module can either be the top layer (superstrate) or the back layer (substrate). [UL 1703]

photovoltaic (PV) panel - often used interchangeably with PV module (especially in one-module systems), but more accurately used to refer to a physically connected collection of modules (i.e., a laminate string of modules used to achieve a required voltage and current).

photovoltaic (PV) peak watt - Maximum "rated" output of a cell, module, or system. Typical rating conditions are 0.645 watts per square inch (1000 watts per square meter) of sunlight, 68 degrees F (20 degrees C) ambient air temperature and 6.2 x 10⁻³ mi/s (1 m/s) wind speed.

photovoltaic (PV) system - A complete set of components for converting sunlight into electricity by the photovoltaic process, in-

cluding the array and balance of system components.

polycrystalline - See 'Multicrystalline.'

power conditioning equipment - Electrical equipment, or power electronics, used to convert power from a photovoltaic array into a form suitable for subsequent use. A collective term for inverter, converter, battery charge regulator, and blocking diode.

power factor - The ratio of the average power and the apparent volt-amperes. Affected by the inductance and capacitance of the load. A pure resistance, such as an electric heater would have a power factor of 1.00.

pulse-width-modulated (PWM) - A function of many of the newer charge controllers and battery chargers which instead of applying a steady DC voltage to the battery, sends out short pulses. The width of the pulses varies with the battery state of charge.

PV - Abbreviation for photovoltaic(s).

pyranometer - An instrument for measuring total hemispherical solar irradiance on a flat surface, or "global" irradiance; thermopile sensors have been generally identified as pyranometers, however, silicon sensors are also referred to as pyranometers.

rectifier - A device that converts ac to dc, as in a battery charger or converter. See inverter and diode.

semiconductor - Any material that has a limited capacity for conducting an electric current. Generally falls between a metal and an insulator in conductivity. Certain semiconductors, including silicon, gallium arsenide, copper indium diselenide, and cadmium telluride, are uniquely suited to the photovoltaic conversion process.

semicrystalline - See 'Multicrystalline.'

short-circuit current (Isc) - The current flowing freely from a photovoltaic cell through an external circuit that has no load or resistance; the maximum current possible.

silicon (Si) - A chemical element, atomic number 14, semi-metallic in nature, dark gray, an excellent semiconductor material. A common constituent of sand and quartz (as the oxide). Crystallizes in facecentered cubic lattice like a diamond. The most com-

mon semiconductor material used in making photovoltaic devices.

single-crystal material - A material that is composed of a single crystal or a few large crystals.

solar cell - See 'Photovoltaic cell.'

solar energy - Energy from the sun. The heat that builds up in your car when it is parked in the sun is an example of solar energy.

stand-alone (PV system) - An autonomous or hybrid photovoltaic system not connected to a grid. May or may not have storage, but most stand-alone systems require batteries or some other form of storage.

substrate - The physical material upon which a photovoltaic cell is made.

thin film - A layer of semiconductor material, such as copper indium diselenide, cadmium telluride, gallium arsenide, or amorphous silicon, a few microns or less in thickness, used to make photovoltaic cells. Commonly called amorphous.

transformer - Steps AC voltage up or down, depending on the application.

VAC - Volts ac

VDC - Volts dc

volt (V) - A unit of measure of the force, or 'push,' given the electrons in an electric circuit. One volt produces one ampere of current when acting a resistance of one ohm.

wafer - A thin sheet of semiconductor material made by mechanically sawing it from a single-crystal or multicrystal ingot or casting.

watt (W) - The unit of electric power, or amount of work (J), done in a unit of time. One ampere of current flowing at a potential of one volt produces one watt of power.

watt-hour (Wh) - See 'Kilowatt-hour.'

waveform - The shape of the curve graphically representing the change in the ac signal voltage and current amplitude, with respect to time.

