



Beghelli

**PlanetSun Beghelli
Photovoltaic Systems**

2011 Catalogue

**SOLAR
DATA·Gate**  **Beghelli**

**FH-DSSS radio transmission
for GSM anti-theft system,
remote management and
intelligent self-supervision**



PianetaSole project is part of



“The human species has a remarkable record of ingenuity and problem solving. The same spirit that took man to the moon must now be harnessed to free future generations from crippling ecological debt.”

James P. Leape
Director General, WWF International

Photovoltaic systems

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The photovoltaic market

The growing awareness regarding a possible ecological catastrophe has finally led to widespread agreement on the need to tackle the energy problem in a new way. The second half of the twentieth century saw an exponential growth in global energy consumption. Overall energy consumption increased some 1.5 times, while greenhouse gas emissions spiked 1.4 times. The need to create renewable energy sources to gradually replace plants powered with fossil fuels has generated support from the institutions and energy sector regulatory bodies.

In Italy, in order to obtain the Building Permit, since 1st January 2011 it is mandatory to install at least 1 kWp of renewable energy for each housing unit. Moreover, Italian Legislative Decree no. 311/2006 (Energy Performance Decree) establishes that 50% of domestic hot water requirements must be covered by renewable energy sources.

The study conducted by the European Photovoltaic Industry Association

The "SET for 2020" study, conducted by EPIA in cooperation with strategic management consulting firm A.T. Kearney, is based on interviews released by approximately 100 key figures operating in the industrial sector, research institutes, utilities companies, regulatory bodies and public administration bodies throughout Europe and in other parts of the world, with the aid of the company's global experts network. The study constitutes a more in-depth analysis and is far more comprehensive compared to several other studies regarding photovoltaic technology currently available in Europe.

The time has come for photovoltaic energy

Economic, financial and energy sectors are currently evolving and such a fluid situation offers the perfect backdrop for laying the foundations of the Paradigm Shift Scenario: "within 2020 photovoltaic energy will cover 12% of the European Union's electrical energy needs". In Europe, photovoltaic technology already constitutes an advantageous and responsible investment for many home owners, farmers and communities.

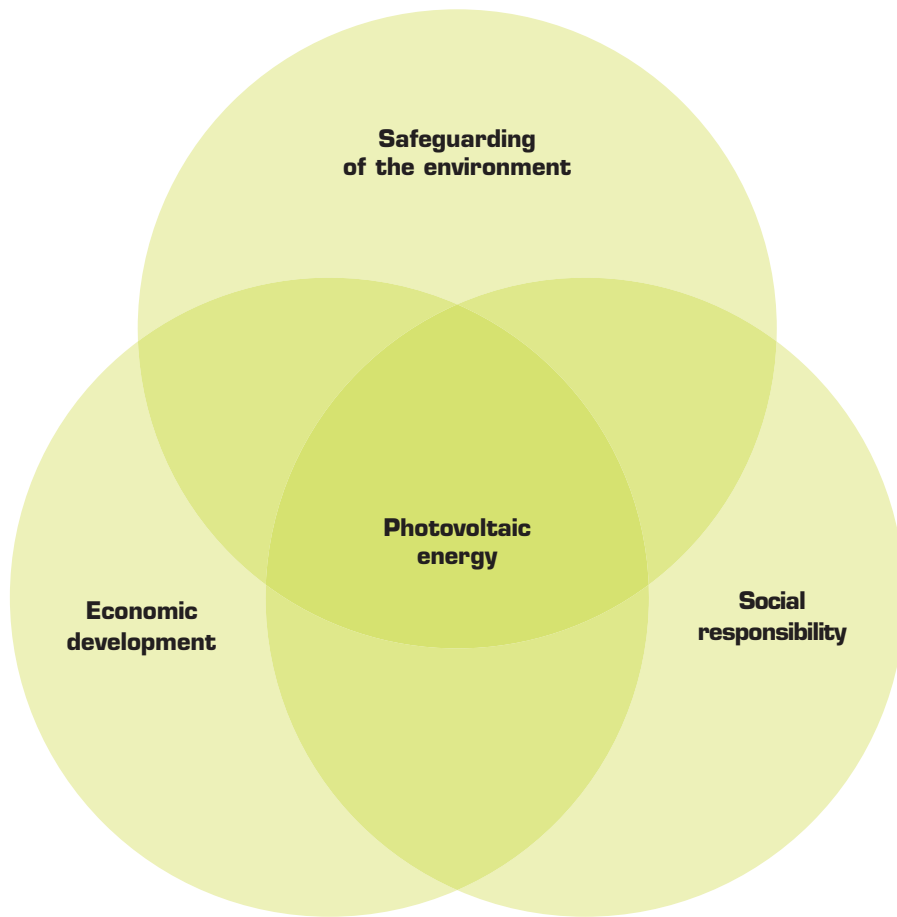
By providing society with safe and renewable energy in a decentralised manner, photovoltaic technology constitutes a practical solution for building a safe, prosperous and sustainable European society.

As photovoltaic energy can be produced virtually anywhere and does not require large-scale installations, it contributes towards achieving energy independence at a national, national, regional, local and individual level, and helps local communities and households to become self-sufficient with regard to energy.

What the study proves

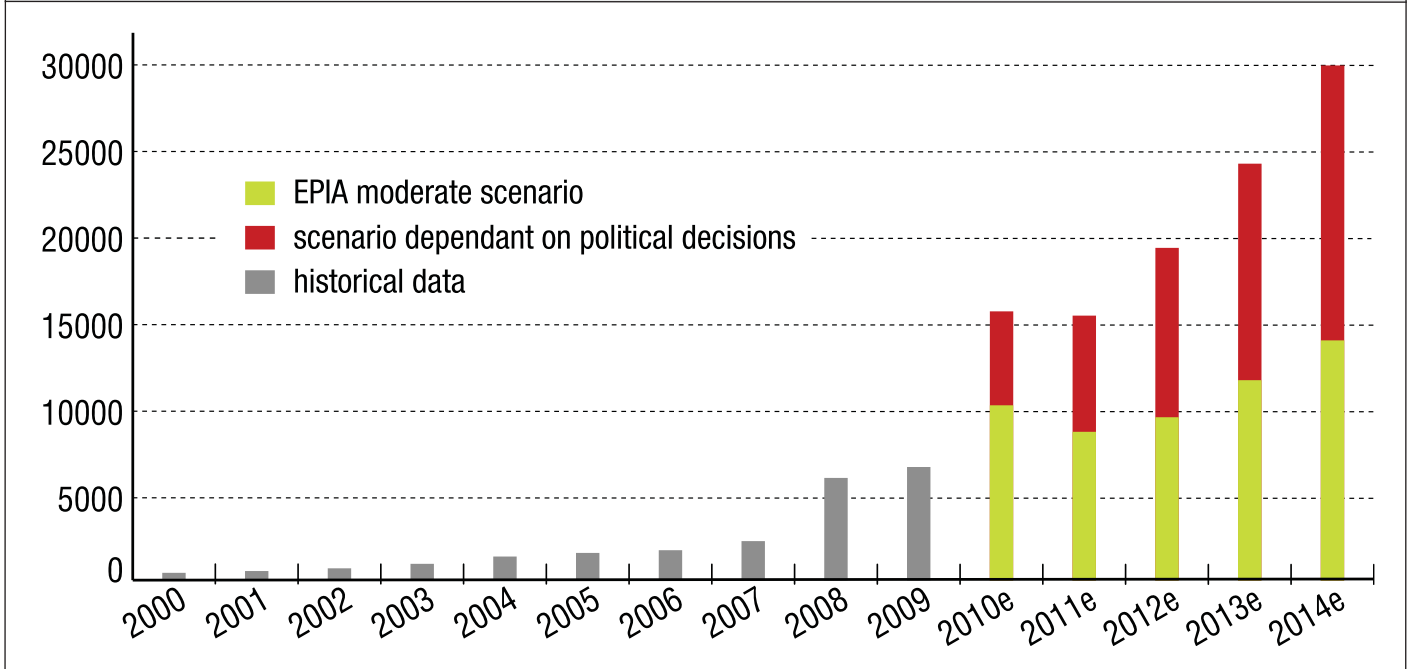
The SET For 2020 study analyses several photovoltaic energy distribution scenarios in Europe, and proves that the most ambitious scenario is not only achievable, but is also the most desirable. The study demonstrates that photovoltaic energy will be able to cover 12% of the European Union's electrical energy needs by 2020, compared to the current 1%.

A 12% market share is an ambitious, yet achievable target



Photovoltaic solar energy is set to become a significant and competitive energy source in the European electrical energy market, and will generate important advantages for society and the economy.

Possible photovoltaic energy distribution scenarios for Europe



Remote management system and intelligent self-supervision

Beghelli PianetaSole Control Panel constitutes the intelligent core of the entire photovoltaic system. Besides the unit that controls and elaborates the system's parameters, the control panel houses the Beghelli Solar DATA Gate radio transmission system and a GSM interface, for

communicating with the outside world with the maximum safety and in conformity to the regulations in force.



Interface protection system (IPS), approved according to the "Guide for Connections to the Enel Distribuzione electricity network". Through the Interface Device (ID), it controls the entire system's connection to the electricity network and ensures cut-off in the event of any possible anomaly.

Interface Device (ID) with Remote Control Switch.

Not included in the PianetaSole Control Panel model code 15310 for loads ranging from 20 to 400 kW.

Amperometric current transformers for measuring the power generated before it enters the public grid. To be ordered separately for PianetaSole Control Panel model code 15310 for loads ranging from 20 to 400 kW. 15310 per carichi da 20 a 400 kW

GSM interface for remote connection to a PC equipped with FotoVisual software and an additional GSM interface. Also allows for sending text messages with the diagnostics and anti-theft alarm data. Not included in the Compact RS485 Control Panel.

PianetaSole Control Panel for controlling all the system's functions: it receives – via radio – the energy production data from all the PV circuit inverters, in addition to anomaly signals and burglary attempts. Not included in the Compact RS485 Control Panel.



INVERTER PERFORMANCE SELF-SUPERVISION WITH SMS NOTIFICATION

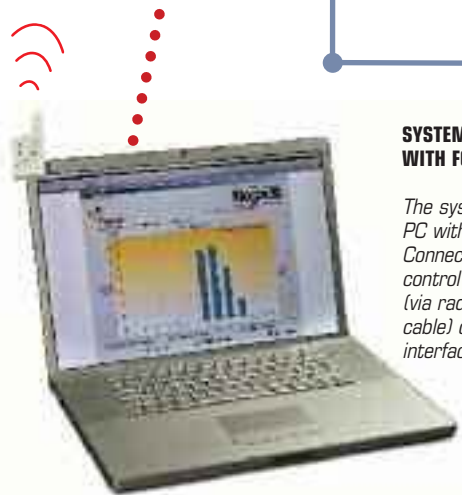
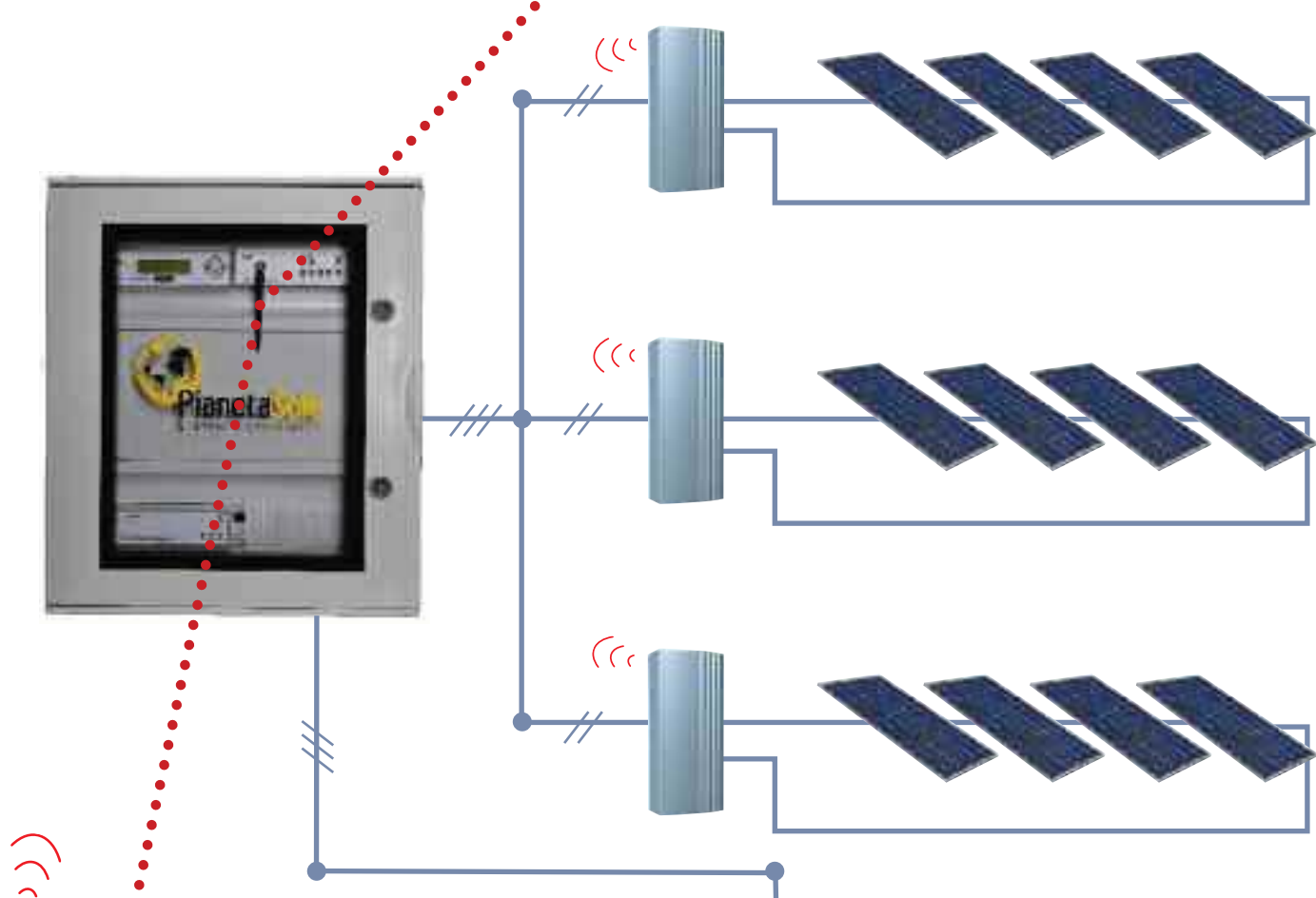
In order to monitor and control the mismatching effect, the PlanetaSole control panel compares the energy production of each single inverter. Should substantial differences emerge, the system will automatically send an SMS text message signalling the anomaly. The same message is visualised through the FotoVisual software.



ANTI-THEFT SYSTEM WITH INSTANT SMS NOTIFICATION

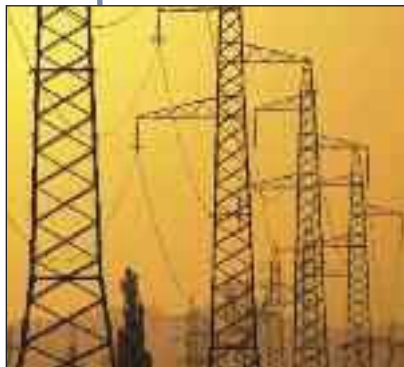
Where necessary, the GSM interface integrated into the control panel is able to send SMS text messages to signal any malfunctions, theft attempts or improper interference with the photovoltaic panels.

))) Beghelli Solar DATA Gate FH-DSSS Radio Transmission
 ... GSM Transmission



SYSTEM MONITORING VIA PC WITH FOTOVISUAL

The system can be monitored via PC with the aid of FotoVisual. Connection to the PlanetaSole control panel can be either local (via radio transmission or RS485 cable) or remote, through GSM interface connected to the PC.



SAFE CONNECTION TO THE PUBLIC NETWORK

The interface protection system (IPS) performs the following functions: line monitoring with checks on minimum and maximum voltage, minimum and maximum frequency and frequency creep. In case of malfunctions or anomalies in the public network, the IPS intervenes on the ID by disconnecting the photovoltaic system.



Control panels

Supervision unit for up to 3 TL inverters

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Single-phase RS485 compact control panel up to 6 kWp

page 12

Single-phase/three-phase control panel for up to 20 kWp

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Three-phase control panel from 20 to 400 kWp

page 16

Supervision unit for up to 3 TL inverters



Device installable on DIN rail, for radio transmission with the system's inverters. The unit visualises the system's energy production data and carries out diagnostics.

It houses a GSM modem for sending SMS alarm messages and for remote management of the system from the Beghelli Service Operational Centre, so as to monitor the power generated and verify the correct operation of each module.

The supervision unit includes the following elements:

- **GSM communication device:**
manages transmission of SMS malfunction messages directly to the system owner and communicates with the Beghelli Service Operational Centre.
- **Solar DATA Gate radio transmission system:**
manages communication between the unit and the inverters via FH-DSSS 2.4 GHz radio waves.
- **Colour LCD:** allows for visualising data relative to the system and energy production, and controlling or setting the diagnostics parameters.

REGULATORY CONSTRAINTS

The supervision unit does not include the interface protection system: all inverters without a Beghelli transformer are equipped with this device and can thus be managed by simply integrating the supervision unit. The system thus configured offers considerable advantages, in terms of both cost-efficiency and ease of installation; however, it is important to stress that

ENEL regulations expressly require systems of this type to be configured for maximum 20 kW power and 3 interconnected inverters at the most. In all other cases, a centralised interface protection system (IPS) is required, such as that featured on the other Beghelli control panels.

UNIT ACCESSORIES CODE 15321 - to be ordered separately (necessary for installation)

Order Code	Description	Notes
15600	RADIO/USB/RS485 FOTOVISUAL SOFTWARE	Includes USB antenna, USB/RS485 cable, configuration software for compact control panel
Order Code	Description	Notes
15321	GSM supervision unit	Anti-burglary system and energy production data monitoring



INVERTER PERFORMANCE SELF-SUPERVISION WITH SMS NOTIFICATION

In order to monitor and control the mismatching effect, the supervision unit compares the energy production of each single inverter. Should substantial differences emerge, the system will automatically send an SMS text message signalling the anomaly. The same message is visualised through the FotoVisual software.

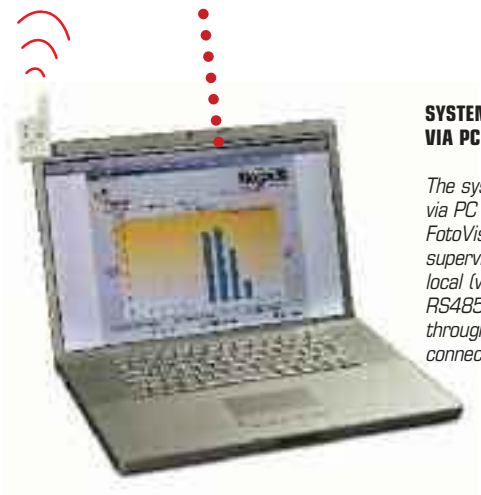
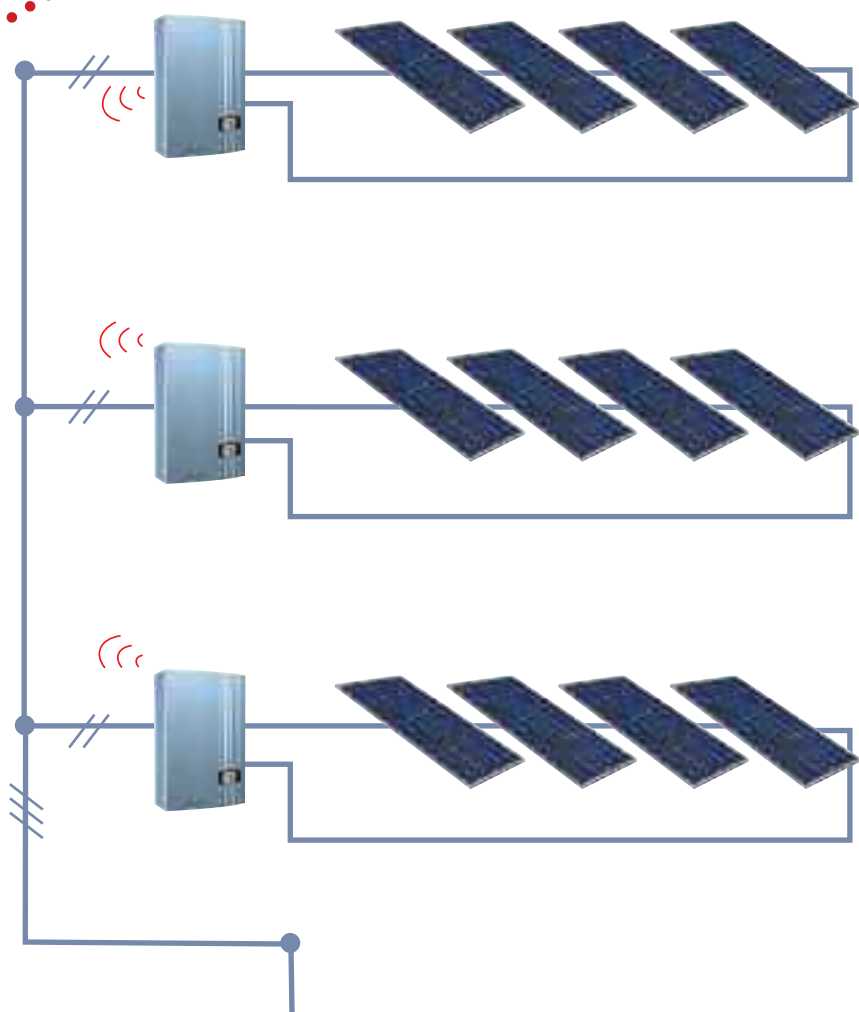
ANTI-THEFT

VIA SMS

ANTI-THEFT SYSTEM WITH INSTANT SMS NOTIFICATION

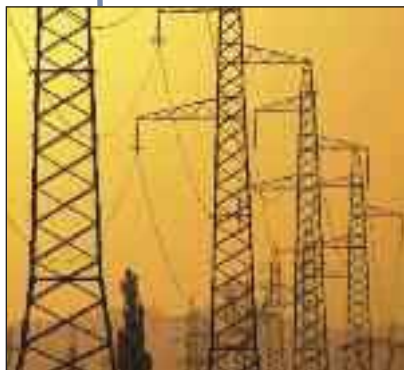
Where necessary, the GSM interface integrated into the supervision unit is able to send SMS messages to signal any malfunctions, theft attempts or improper interference with the photovoltaic panels.

-))) Beghelli Solar DATA Gate FH-DSSS Radio Transmission
- GSM Transmission



SYSTEM MONITORING VIA PC WITH FOTOVISUAL

The system can be monitored via PC with the aid of FotoVisual. Connection to the supervision unit can be either local (via radio transmission or RS485 cable) or remote, through GSM interface connected to the PC.



SAFE CONNECTION TO THE PUBLIC NETWORK

The interface protection system (IPS) performs the following functions: monitoring of the line with minimum and maximum voltage, minimum and maximum frequency and frequency creep checks. In case of malfunctions or anomalies in the public network, the IPS intervenes on the ID by disconnecting the photovoltaic system.



Compact RS485 control panel for up to 6 kWp

By connecting the control panel to a PC equipped with configuration software (included in the Fotovisual package), it is possible to set up the interface protection and perform instant reading of energy production data. The RS485 Compact Control Panel includes the following elements:

- **Interface Protection System (IPS):**
manages disconnection from the public network in the relevant cases; moreover, it incorporates a meter for measuring the energy generated. TÜV Rheinland Certificate no. AK60022168 according to the "Guide for connections to the ENEL Distribuzione electricity network".
- **Interface Device (ID):**
manages disconnection of the generators from the public network in the event of anomalies or malfunctions.
- **RS485 Interface:** allows for connection to a USB port of a PC dedicated to the IPS configuration and the visualisation of energy production data. The FotoVisual software - equipped with USB/RS485 cable (to be ordered separately) - is required for the configuration



Local supervision system
with RS485 wired connection

Code 15307	
Input parameters	
Power supply voltage	230 Vac
Voltage input	230 Vac internally pre-wired
Current input	1 for the 60/5A CT included
Absorbed power	< 10 VA
Other features	
Dimensions	419 x 314 x 142 mm

CONTROL PANEL ACCESSORIES CODE 153077 - to be ordered separately (necessary for installation)		
Order Code	Description	Notes
15600	RADIO/USB/RS485 FOTOVISUAL SOFTWARE	Includes USB antenna, USB/RS485 cable, configuration software for compact control panel.
Order Code	Description	Notes
15307	RS485 PIANETASOLE CONTROL PANEL	Single-phase control panel for up to 6 kWp. Does not include remote management and supervision system.

Solutions allowed according to the “Guide for connections to the ENEL Distribuzione electricity network” regarding the interface device (ID).

SYSTEM	Single-phase		Three-phase	
	up to 6 kW		up to 20 kW	over 20 kW
Generators connected through conversion system	Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch. Commutator (i.e. CEI EN 60947-3 approved circuit breaker with no-voltage tripping coil coupled with fuse or automatic switch). Also inside the conversion system.		up to 20 kW	Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch. Outside the conversion system.
Asynchronous rotary generators directly connected to the public network.	Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch.			

Interface Protection System (IPS)

The Interface Protection System (IPS) intervenes on the Interface Device (ID) in order to separate the public network from the network powered by the photovoltaic generators, in the event of malfunctions or anomalies in the public network.

The IPS, which can be mounted on a DIN rail and is included on all PianetaSole control panel models, intervenes on the ID to disconnect the production system from the ENEL electricity network in the following cases: minimum voltage protection, maximum voltage protection, minimum frequency protection, maximum frequency protection and frequency creep protection.



DIN interface protection, order code 15320

Specifications

Single-phase / three-phase Interface Protection System	
Double relay output for interface device (ID)	
Device included in the “devices that can be connected to the ENEL Distribuzione low-voltage network” list	
current inputs for energy meter	
Relay output drive power	230V 8A;
Maximum switching power	dependent on the external interface device (ID) used
Maximum measurable power	dependent on the CTs connected to the current input
Own consumption	<10VA
Housing	plastic case on 9-module DIN rail
Dimensions	160 x 90 x 74mm
Operating conditions	-10°C ÷ 55°C, 10% ÷ 90% R.H.
Power supply	230V~50Hz
Protection rating	IP20
Insulation class	class II

Protection	Execution	Threshold level	Intervention time	Recovery threshold	Recovery time
Minimum voltage	Single-pole	189V	200ms	194V	100ms
Maximum voltage	Single-pole	271V	100ms	263V	100ms
Minimum frequency	Single-pole	49.70Hz	100ms	49.80Hz	100ms
Maximum frequency	Single-pole	50.30Hz	100ms	50.23Hz	100ms
Frequency creep (if requested)	Single-pole	0.5Hz/s	200ms	0.5Hz/s	200ms



Single-phase/three-phase control panel up to 20 kWp

The control panel includes all the elements for managing, monitoring and transmitting data related to the system's parameters:

- **Beghelli Solar DATA Gate system:**
radio transmission system for intelligent supervision of the system (Spread Spectrum FH-DSSS).
- **Interface Protection System (IPS):**
this device manages disconnection from the public network in the relevant cases; moreover, it incorporates a meter for measuring the energy generated. TÜV Rheinland Certificate no. AK60022168 according to the "Guide for connections to the ENEL Distribuzione electricity network".
- **Interface Device (ID):**
manages disconnection of the generators from the public network in the event of anomalies or malfunctions.
- **Supervision module:** processing unit that coordinates the various parts of the system and collects diagnostics and generated power data.
- **GSM module:** incorporates a GSM modem for remote management of the system from the Beghelli Service operational centre, for monitoring the power generated, analysing the correct operation of each module and managing diagnostics.

Code 15300

Input parameters

Power supply voltage	230 Vac
Voltage inputs	3x230 VAC internally pre-wired
Current inputs	3 for the 60/5A CTs included
Absorbed power	< 15VA
Backup battery incorporated	Yes

Other features

Dimensions	430 x 500 x 210
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CONTROL PANEL ACCESSORIES CODE 15300 - to be ordered separately (necessary for installation)

Order Code	Description	Notes
15600	RADIO/USB/RS485 FOTOVISUAL SOFTWARE	Includes USB antenna, USB/RS485 cable, configuration software for compact control panel.

Order Code	Description	Notes
15300	Single-phase/three-phase PIANETASOLE CONTROL PANEL for up to 20 kWp	Single-phase and three-phase control panel for up to 20 kWp (includes the disconnect contactors)

Solutions allowed according to the “Guide for connections to the ENEL Distribuzione electricity network” regarding the interface device (ID).

SYSTEM	Single-phase		Three-phase	
	up to 6 kW		up to 20 kW	over 20 kW
Type of generator				
Generators connected through conversion system	Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch. Commutator (i.e. CEI EN 60947-3 approved circuit breaker with no-voltage tripping coil coupled with fuse or automatic switch). Also inside the conversion system.		Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch.	Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch. Outside the conversion system.
Asynchronous rotary generators directly connected to the public network.	Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch.			

Interface Protection System (IPS)

The Interface Protection System (IPS) intervenes on the Interface Device (ID) in order to separate the public network from the network powered by the photovoltaic generators, in the event of malfunctions or anomalies in the public network.

The IPS, which can be mounted on a DIN rail and is included on all PianetaSole control panel models, intervenes on the ID to disconnect the production system from the ENEL electricity network in the following cases: minimum voltage protection, maximum voltage protection, minimum frequency protection, maximum frequency protection and frequency creep protection.



DIN interface protection, order code 15320

Specifications

Single-phase / three-phase Interface Protection System	
Double relay output for interface device (ID)	
Device included in the “devices that can be connected to the ENEL Distribuzione low-voltage network” list	
current inputs for energy meter	
Relay output drive power	230V 8A;
Maximum switching power	dependent on the external interface device (ID) used
Maximum measurable power	dependent on the CTs connected to the current input
Own consumption	<10VA
Housing	plastic case on 9-module DIN rail
Dimensions	160 x 90 x 74mm
Operating conditions	-10°C ÷ 55°C, 10% ÷ 90% R.H.
Power supply	230V~50Hz
Protection rating	IP20
Insulation class	class II

Protection	Execution	Threshold level	Intervention time	Recovery threshold	Recovery time
Minimum voltage	Single-pole	189V	200ms	194V	100ms
Maximum voltage	Single-pole	271V	100ms	263V	100ms
Minimum frequency	Single-pole	49.70Hz	100ms	49.80Hz	100ms
Maximum frequency	Single-pole	50.30Hz	100ms	50.23Hz	100ms
Frequency creep (if requested)	Single-pole	0.5Hz/s	200ms	0.5Hz/s	200ms



Three-phase control panel from 20 to 400 kWp

The control panel includes all the elements for managing, monitoring and transmitting data relative to the system's parameters:

- **Beghelli Solar DATA Gate system:**
radio transmission system for intelligent supervision of the system (Spread Spectrum FH-DSSS).
- **Interface Protection System (IPS):**
this device manages disconnection from the public network in the relevant cases; moreover, it incorporates a meter for measuring the energy generated. TÜV Rheinland Certificate no. AK60022168 according to the "Guide for connections to the ENEL Distribuzione electricity network".
- **Contactor for connection to an ID:**
single-phase 230V 16A device, for managing an external interface device (ID).
- **Supervision module:** processing unit that coordinates the various parts of the system and collects diagnostics and generated power data.
- **GSM module:** incorporates a GSM modem for remote management of the system from the Beghelli Service operational centre, for monitoring the power generated, analysing the correct operation of each module and managing diagnostics.

Code 15310

Input parameters

Power supply voltage	230 Vac
Voltage inputs	3x230 Vac internally pre-wired
Current inputs	3 for CTs with 5A output outside of the control panel (to be ordered separately)
Absorbed power	< 15VA
Backup battery incorporated	Yes

Other features

Dimensions	426 x 657 x 168
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CONTROL PANEL ACCESSORIES code 15310 - to be ordered separately

Order Code	Description	Notes
15700	3CT 20-100 kWp KIT	Three-phase current transformer 20-100 kW peak
15701	3CT 100-200 kWp KIT	Three-phase current transformer 100-200 kW peak
15702	3CT 200-400 kWp KIT	Three-phase current transformer 200-400 kW peak
15600	RADIO/USB/RS485 FOTOVISUAL SOFTWARE	Includes USB antenna, USB/RS485 cable, configuration software for compact control panel.
Order Code	Description	Notes
15310	Three-phase PIANETASOLE CONTROL PANEL 20-400 kWp	Three-phase control panel for up to 20-400 kWp. Does not include the disconnect contactor (as per designer's decision) and the current transformers

Solutions allowed according to the “Guide for connections to the ENEL Distribuzione electricity network” regarding the interface device (ID). Not included in the control panel

SYSTEM	Single-phase		Three-phase	
	up to 6 kW		up to 20 kW	over 20 kW
Type of generator				
Generators connected through conversion system	Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch. Commutator (i.e. CEI EN 60947-3 approved circuit breaker with no-voltage tripping coil coupled with fuse or automatic switch). Also inside the conversion system.		Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch.	Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch. Outside the conversion system.
Asynchronous rotary generators directly connected to the public network.	Automatic switch with no-voltage tripping coil. Contactor with no-voltage tripping coil coupled with fuse or automatic switch.			

Interface Protection System (IPS)

The Interface Protection System (IPS) intervenes on the Interface Device (ID) in order to separate the public network from the network powered by the photovoltaic generators, in the event of malfunctions or anomalies in the public network.

The IPS, which can be mounted on a DIN rail and is included on all PianetaSole Control Panel models, intervenes on the ID to disconnect the production system from the ENEL electricity network in the following cases: minimum voltage protection, maximum voltage protection, minimum frequency protection, maximum frequency protection and frequency creep protection.



DIN interface protection, order code 15320

Specifications

Single-phase / three-phase Interface Protection System	
Double relay output for interface device (ID)	
Device included in the “devices that can be connected to the ENEL Distribuzione low-voltage network” list	
current inputs for energy meter	
Relay output drive power	230V 8A;
Maximum switching power	dependent on the external interface device (ID) used
Maximum measurable power	dependent on the CTs connected to the current input
Own consumption	<10VA
Housing	plastic case on 9-module DIN rail
Dimensions	160 x 90 x 74mm
Operating conditions	-10°C ÷ 55°C, 10% ÷ 90% R.H.
Power supply	230V~50Hz
Protection rating	IP20
Insulation class	class II

Protection	Execution	Threshold level	Intervention time	Recovery threshold	Recovery time
Minimum voltage	Single-pole	189V	200ms	194V	100ms
Maximum voltage	Single-pole	271V	100ms	263V	100ms
Minimum frequency	Single-pole	49.70Hz	100ms	49.80Hz	100ms
Maximum frequency	Single-pole	50.30Hz	100ms	50.23Hz	100ms
Frequency creep (if requested)	Single-pole	0.5Hz/s	200ms	0.5Hz/s	200ms

FotoVisual software



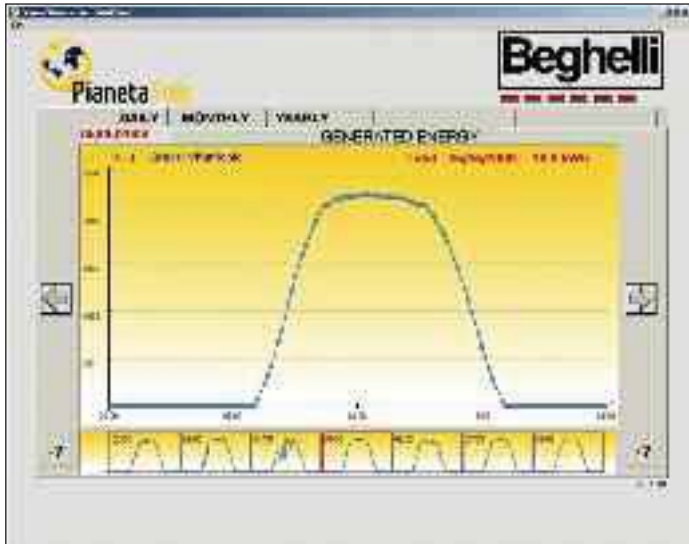
Monitoring, supervision and remote management software for one or more photovoltaic systems. The radio connection with the system is guaranteed by the Solar DATA Gate transmission system that allows for connecting a remote PC to all the PianetaSole control panels. Data is received through an antenna that can be connected to the USB port of a computer which must be located within the radio range of the control panel or inverters.

The Solar DATA Gate – used for transferring data – is particularly safe, as the frequencies it uses do not generate electromagnetic pollution.

The kit supplied with FotoVisual includes the radio antenna with USB port and the cable for connection to the compact control panel, for which a specific configuration software is supplied.



Connection radio antenna, for transmitting data through the Beghelli Solar DATA Gate system. The radio device is connected to the PC through USB interface.



Daily report of the power supplied and energy produced

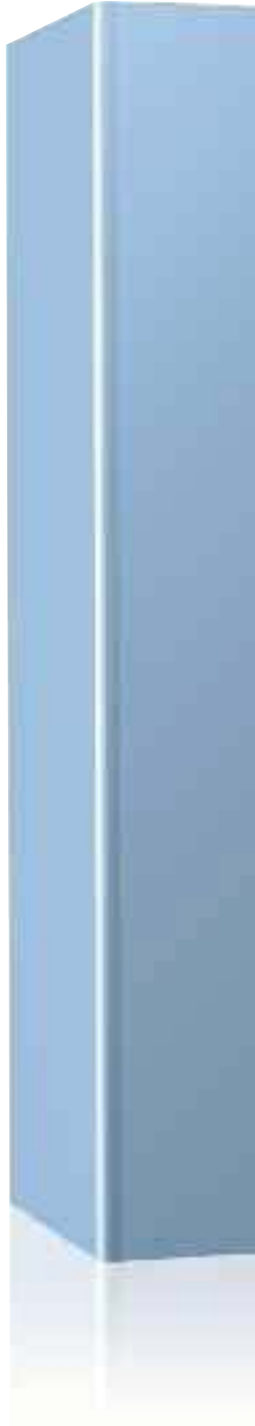


Monthly report of the energy produced



Annual report of the energy produced

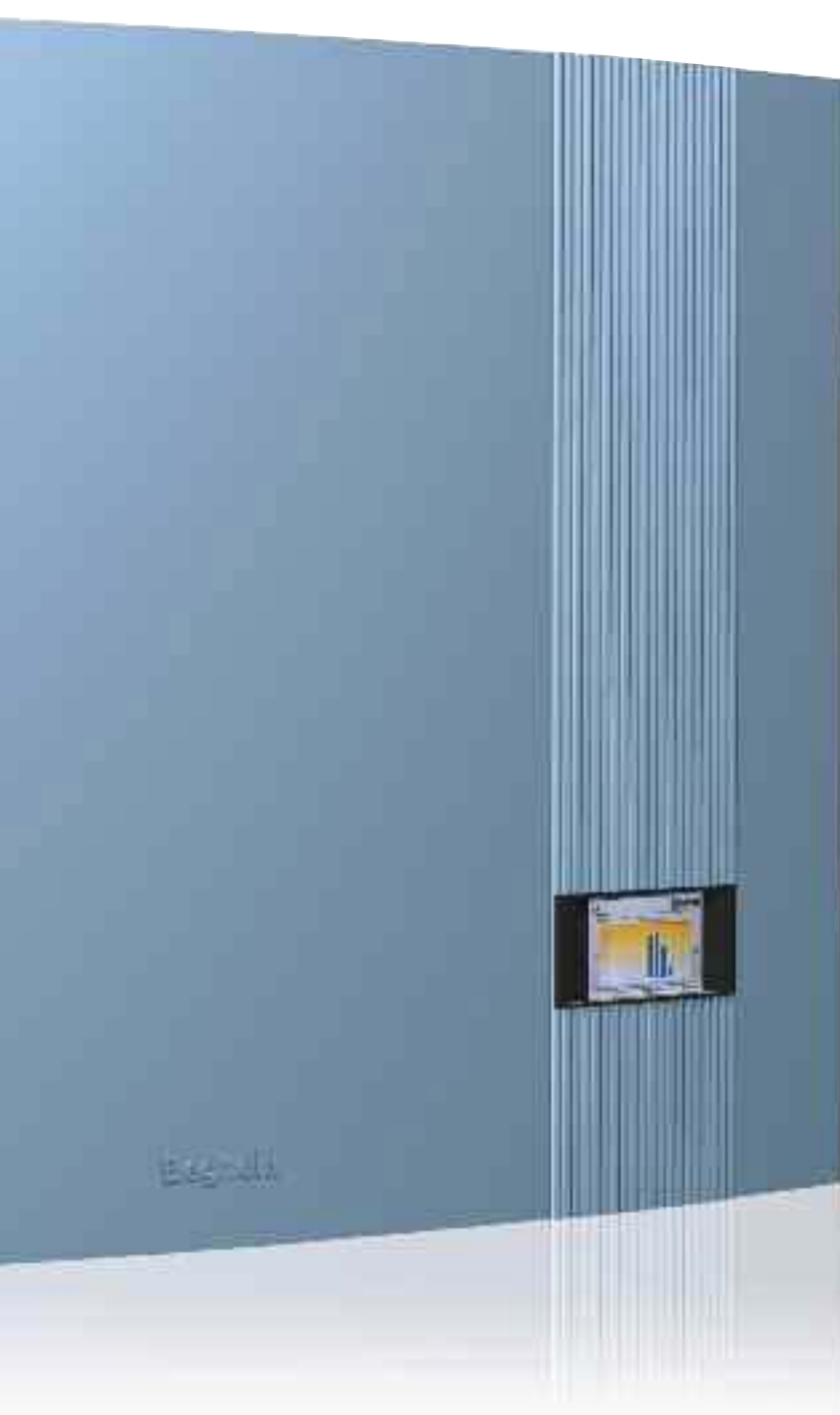
Order Code	Description	Notes
15600	RADIO/USB/RS485 FOTOVISUAL SOFTWARE	Includes USB antenna, USB/RS485 cable, configuration software for compact control panel



Transformerless inverters

Single-phase 2,1 - 3 - 4,5 - 6 Kw

page 22



Three-phase 9 - 12 - 18 Kw

page 24



Single-phase transformerless inverter 2,1 - 3 - 4,5 - 6 Kw

Beghelli Solar DATA Gate FH-DSSS radio transmission system

Integrated interface protection system (IPS)

Complies with the "Guide for connections to the ENEL Distribuzione electricity network"

Anti-islanding devices and integrated protection devices sensitive to output DC (CEI 64-8 conforming)

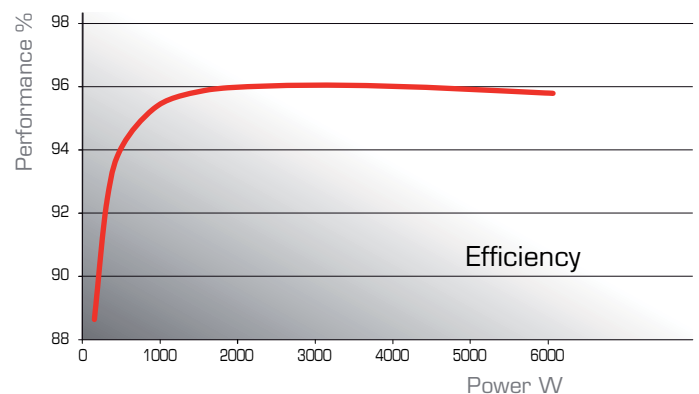
MPPT algorithm optimised for continuous maximum power point tracking

Colour touchscreen display

3 - 4.5 - 6 kW versions: Up to two inputs with independent MPPT to reduce the mismatching effect

High conversion efficiency

Single-phase inverter, without isolation transformer (transformerless), suitable for grid connection, with Beghelli Solar DATA Gate FH-DSSS radio transmission system for connection to PianetaSole control panels, with integrated output protection devices. The Beghelli transformerless inverters are equipped with the interface protection system (IPS) that intervenes directly on the interface device (ID) to disconnect the production system from the ENEL electricity network. Monitoring and remote management are possible with the addition of the GSM module, without the aid of dedicated control panels. According to the instructions of the network manager, the interface protection integrated in the inverter can be used in photovoltaic fields with maximum 3 inverters connected on a single network entry point.



INPUT MODULES CONFIGURATION FOR SINGLE INVERTER

	2.100 W TL	3.000 W TL - 2MPPT	4.500 W TL - 2MPPT	6.000 W TL - 2MPPT
Total number of strips	1	2	2	2
280Wp modules for each strip	5 ÷ 8	4 ÷ 6	6 ÷ 9	7 ÷ 12
Maximum number of installable modules	8	12	18	24

Order Code	Description	Notes
15760	2100 W TL inverter	Anti-theft system and energy production data monitoring
15761	3000 W TL 2MPPT inverter	Anti-theft system and energy production data monitoring
15762	4500 W TL 2MPPT inverter	Anti-theft system and energy production data monitoring
15763	6000 W TL 2MPPT inverter	Anti-theft system and energy production data monitoring

	2.100 W TL	3.000 W TL - 2MPPT	4.500 W TL - 2MPPT	6.000 W TL - 2MPPT
Input parameters				
Maximum DC power	2.3 kW	3,45 kW	5,15 kW	6.72 kW
MPPT voltage interval	125-530 (rated 290)	125-530 (rated 290)	125-530 (rated 330)	125-530 (rated 420)
Maximum DC voltage	600 V	600 V	600 V	600
Activation voltage	150 V	150 V	150 V	200
Independent MPPTs	1	2	2	2
Maximum power per MPPT	2.3 kW	1.725 kW	2.575 kW	3.36 kW
No. of DC inputs	1	2	2	2
Maximum current per MPPT	10 A (12 short-circuit)	10 A (12 short-circuit)	10 A (12 short-circuit)	10 A (12 short-circuit)
Input protections				
Polarity inversion	Yes	Yes	Yes	Yes
DC-side varistors	2 + gas arrester to earth	4 + gas arrester to earth		2 + gas arrester to earth
Output parameters				
Rated power up to 50°C	2 kW	3 kW	4.5 kW	6 kW
Maximum power	2.2 kW	3.3 kW	4.9 kW	6.3 kW
	Single-phase 230 VAC 50 Hz PE			
Rated voltage between phase and neutral	230 V	230 V	230 V	230 V
Rated network frequency	50 Hz	50 Hz	50 Hz	50 Hz
Rated current per phase	8.7 A	13 A	19.6 A	26 A
Maximum current per phase	10.5 A	15.6 A	23.5 A	30 A
AC connection	Bayonet connector; for 4 mm ² cable, Ø 16-18 mm		Bayonet connector; for 6 mm ² cable, Ø 16-18 mm	
Power factor	1	1	1	1
Total harmonic distortion (THD%) - AC	< 4.0% at rated power, with sinusoidal mains voltage			
Output protections				
AC-side varistors per phase	2 + gas arrester to earth			
Earth leakage measurement	Conforms to VDE 0126-1-1 and CEI 64-8 regulation (type-B RCD as per IEC 60755/A2)			
Conversion efficiency				
Maximum efficiency	96 %	96 %	96 %	96 %
European efficiency	95 %	95 %	95 %	95 %
Environmental parameters				
	Forced with dedicated fan			
	-20 / +60 (power derating above 50°)			
Acoustic noise (dBA)	<50 with fan activated			
Protection rating	IP65	IP65	IP65	IP65
Mechanical parameters				
Dimensions	380 x 580 x 180 mm	380 x 580 x 180 mm	380 x 580 x 180 mm	550 x 580 x 200
Weight	15 kg	18 kg	22 kg	30 kg
Other information				
Night-time consumption	0,3 W	0,3 W	0,3 W	0,3 W
Stand-by mode consumption	8 W	8 W	8 W	8 W
Insulation	Not insulated, transformerless	Not insulated, transformerless	Not insulated, transformerless	Not insulated, transformerless
Display	Yes	Yes	Yes	Yes
Transmission	RS485; Radio FH-DSSS			
	See calibrations table			
	Static converter unsuitable for withstanding the voltage and frequency within the rated range (static conversion device that behaves like a current generator)			
Firmware version	1.0	1.0	1.0	1.0
Contribution to the short-circuit current	15 A	23 A	35 A	45 A
	Integrated protection device against entry of DC component in the network. Limitation of the DC component entering the network through a dedicated control algorithm. Monitoring of the value and variation speed of the DC component introduced into the network, through DC-sensitive sensors.			

Three-phase transformerless inverter 9 - 12 - 18 Kw



Beghelli Solar DATA Gate
FH-DSSS radio transmission
system

Integrated interface
protection system (IPS)

Complies with the
"Guide for connections to the ENEL
Distribuzione electricity network"

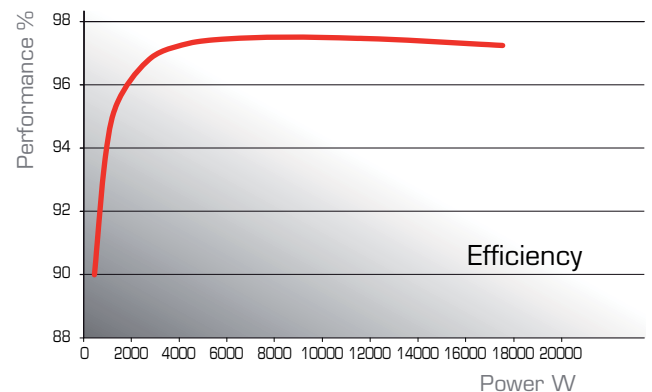
Anti-islanding devices and integrated
protection devices sensitive to output
DC (CEI 64-8 conforming)

MPPT algorithm optimised
for continuous maximum
power point tracking

Colour touchscreen display

High conversion efficiency

Three-phase inverter, without isolation transformer (transformerless), suitable for grid connection, with Beghelli Solar DATA Gate FH-DSSS radio transmission system for connection to PianetaSole control panels, with integrated output protection devices. The Beghelli transformerless inverters are equipped with the interface protection system (IPS) that intervenes directly on the interface device (ID) to disconnect the production plant from the ENEL electricity network. Monitoring and remote management are possible with the addition of the GSM module, without requiring any dedicated control panels. According to the instructions of the network manager, the interface protection integrated in the inverter can be used in photovoltaic fields with maximum 3 inverters connected on a single network entry point.

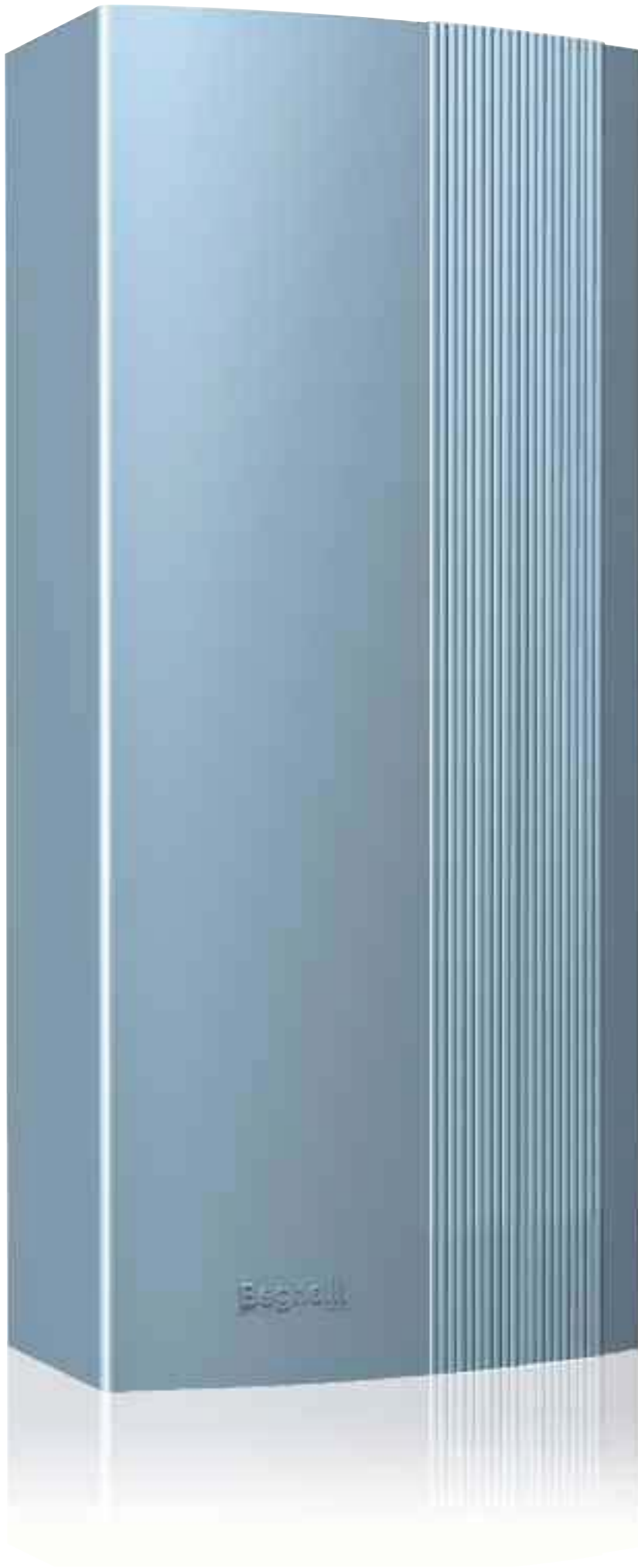


INPUT MODULES CONFIGURATION FOR SINGLE INVERTER

	9.000 W TL - 2MPPT	12.000 W TL - 2MPPT	18.000 W TL - 2MPPT
Total number of strips	2	4	4
280Wp modules for each strip	12 ÷ 19	12 ÷ 19	12 ÷ 19
Maximum number of installable modules	37	49	73

Order Code	Description	Notes
15764	9000 W TL inverter	Anti-theft system and energy production data monitoring
15765	12000 W TL inverter	Anti-theft system and energy production data monitoring
15766	18000 W TL inverter	Anti-theft system and energy production data monitoring

	9.000 W TL - 2MPPT	12.000 W TL - 2MPPT	18.000 W TL - 2MPPT
Input parameters			
Maximum DC power	10.3 kW	13.8 kW	20.6 kW
MPPT voltage interval	335-530 V (rated 420)	335-530 V (rated 420)	335-530 V (rated 420)
Maximum DC voltage	1.000 V	1.000 V	1.000 V
Activation voltage	360 V	360 V	360 V
Independent MPPTs	2	2	2
Maximum power per MPPT	5.15 kW	6.9 kW	10.3 kW
No. of DC inputs	2 (for each MPPT)	4 (2 for each MPPT)	4 (2 for each MPPT)
Maximum current per MPPT	10 A (12 short-circuit)	20 A (24 short-circuit)	20 A (24 short-circuit)
Input protections			
Inversione polarità	Yes	Yes	Yes
Varistori lato DC	2 + gas arrester to earth	2 + gas arrester to earth	2 + gas arrester to earth
Output parameters			
Rated power up to 50°C	9 kW	12 kW	18 kW
Maximum power	9.9 kW	13.2 kW	19 kW
Connection to the AC network	Three-phase 230VAC 50Hz + PE + N	Three-phase 230VAC 50Hz + PE + N	Three-phase 230VAC 50Hz + PE + N
Rated voltage between phase and neutral	230 V	230 V	230 V
Rated network frequency	50 Hz	50 Hz	50 Hz
Rated current per phase	13 A	17.4 A	26 A
Maximum current per phase	15.6 A	19.1 A	30 A
AC connection	Three-phase terminal board for 4 mm ² cables, Ø 16-18 mm	Three-phase terminal board for 6 mm ² cables, Ø 16-18 mm	
Power factor	1	1	1
Total harmonic distortion (THD%) - AC	< 4.0% at rated power, with sinusoidal mains voltage		
Output protections			
AC-side varistors per phase	2 + gas arrester to earth	2 + gas arrester to earth	2 + gas arrester to earth
Earth leakage measurement	Conforms to VDE 0126-1-1 and CEI 64-8 regulation (type-F RCD as per IEC 60755/A2)		
Conversion efficiency			
Maximum efficiency	97.5 %	97.5 %	97.5 %
European efficiency	97 %	97 %	97 %
Environmental parameters			
Cooling	Forced with dedicated fan	Forced with dedicated fan	Forced with dedicated fan
	-20 / +60 (power derating above 50°)		
Acoustic noise (dBA)	<50 with fan activated	<50 with fan activated	<50 with fan activated
Protection rating	IP65	IP65	IP65
Mechanical parameters			
Dimensions	550 x 580 x 200 mm	550 x 580 x 200 mm	550 x 580 x 200 mm
Weight	45 kg	48 kg	50 kg
Other information			
Night-time consumption	0,3 W	0,3 W	0,3 W
Stand-by mode consumption	8 W	8 W	8 W
Insulation	Not insulated, transformerless	Not insulated, transformerless	Not insulated, transformerless
Display	Yes	Yes	Yes
Transmission	RS485; Radio FH-DSSS	RS485; Radio FH-DSSS	RS485; Radio FH-DSSS
Integrated protection and interface device	See calibrations table	See calibrations table	See calibrations table
Type of converter	Static converter unsuitable for withstanding the voltage and frequency within the rated range (static conversion device that behaves like a current generator)		
Firmware version	1.0	1.0	1.0
Contribution to the short-circuit current	23 A per phase	28.7 A per phase	45 A per phase
Limitation of the DC component entering the network	Integrated protection device against entry of DC component in the network. Limitation of the DC component entering the network through a dedicated control algorithm. Monitoring of the value and variation speed of the DC component introduced into the network, through DC-sensitive sensors.		



Inverter with transformer



0,93 - 1.1 kW

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3 - 3.3 kW

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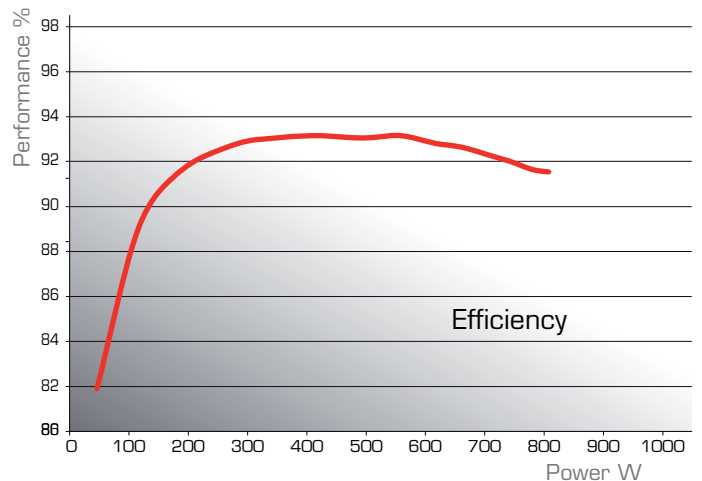
Inverters with transformer 0,93 - 1,1 Kw

Beghelli Solar DATA Gate FH-DSSS radio transmission system

Complies with the "Guide for connections to the ENEL Distribuzione electricity network"

Optimised MPPT algorithm for continuous maximum power point tracking

Single-phase inverter, with isolation transformer configured for 50 Hz network frequency, suitable for grid connection also in three-phase systems, with Beghelli Solar DATA Gate FH-DSSS radio transmission for connection to the PianetaSole control panels.
TÜV Rheinland Certificate no. AK60028630 according to the "Guide for connections to the ENEL Distribuzione electricity network".



INPUT MODULES CONFIGURATION FOR SINGLE INVERTER

	930 W	1.100 W
Total number of strips	1	1
280Wp modules for each strip	3	4
Maximum number of installable modules	3	4

Order Code	Description	notes
15730	930 W Beghelli inverter	Integrated anti-theft system
15731	1100 W Beghelli inverter	Integrated anti-theft system

	930 W	1100 W
Input parameters		
Maximum DC power	965W	1150W
MPPT voltage interval	85÷185V (rated 110)	115÷200V (rated 145)
Maximum DC voltage	200V	250V
Activation voltage	110V	150V
Independent MPPTs	1	1
Maximum power per MPPT	965W	1150W
No. of DC inputs	1	1
Maximum current per MPPT	9.0A	8.25A
Input protections and connections		
DC-side disconnection	External bi-polar disconnect switch in IP66 casing	External bi-polar disconnect switch in IP66 casing
Polarity inversion	Yes	Yes
DC-side varistors	2 + gas arrester to earth	2 + gas arrester to earth
DC Input	1 input with 2 MC4-type snap-in plugs	
Output parameters		
Rated output power	840W	1000W
Maximum output power	930W	1100W
Connection to the AC network	Single-phase 230 VAC 50 Hz + PE	Single-phase 230 VAC 50 Hz + PE
Rated output voltage	230Vac	230Vac
Rated output current	3.48A	4,35A
Maximum output current	4A	4,80A
Maximum short-circuit output current	7A	8,70A
Rated frequency	50 +/- 2% Hz	50 +/- 2% Hz
Power factor	0.997	0.997
Output protections and connections		
AC-side disconnection	Bi-polar rotating disconnect switch on the inverter	
AC-side varistors	2 + gas arrester to earth	
Measuring device for leakage currents following earth malfunctions (AC/DC-sensitive type A and F RCD)	Conforms to VDE 0126-1-1 and CEI 64-8 regulation (type-F RCD as per IEC 60755/A2)	Conforms to VDE 0126-1-1 and CEI 64-8 regulation (type-F RCD as per IEC 60755/A2)
AC Output	1 connector with locking nut, IP68, with terminals, suitable for clamping a sheathed three-pole cable 3 x 2.5 mm ² (Neutral, Live and Earth)	
Motor Output	1 IP68 connector with locking nut for connecting the linear actuator provided, with the appropriate power supply connections (36 VDC) and control connections	
Isolation	Incorporated isolation transformer configured for mains voltage, with class II insulation.	Incorporated isolation transformer configured for mains voltage, with class II insulation.
Conversion efficiency		
Maximum efficiency	93%	93%
European efficiency	91%	91%
Environmental parameters		
Operating temperature range	-20 ÷ +60 °C	-20 ÷ +60 °C
Protection rating	IP66	IP66
Cooling	Natural aeration, without fans	Natural aeration, without fans
Mechanical parameters		
Dimensions	400x200x130 mm	400x200x130 mm
Weight	10 Kg	10 Kg
Other information		
Stand-by mode absorption	1,2W	1,2W
MTBF (mean time between failures)	153000 hours (at 20°C)	153000 hours (at 20°C)
Transmission	Radio FH-DSSS	Radio FH-DSSS
Firmware version as at 10-12-2008 (Annex F DK5940)	V1.14	V1.25
Type of converter	Static converter unsuitable for withstanding the voltage and frequency within the rated range (static conversion device that behaves like a current generator)	
Contribution to the short-circuit current	6A	7.2A
Make	Beghelli S.p.A.	Beghelli S.p.A.
Model	291.005.001	291.005.003



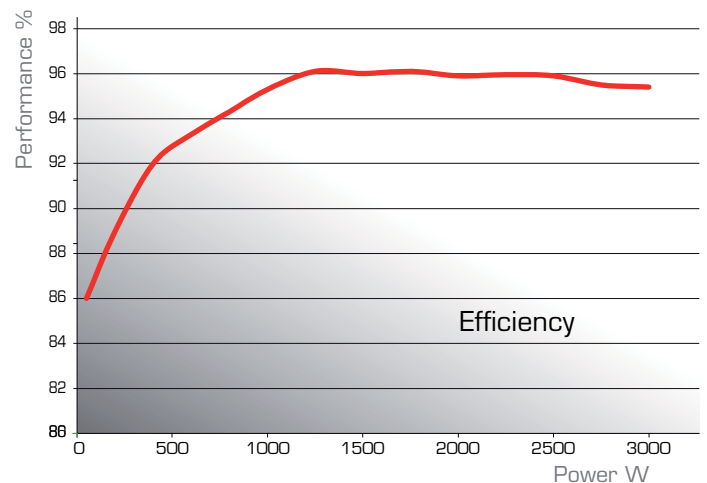
Inverters with transformer 3 - 3,3 Kw

**Beghelli Solar DATA Gate FH-DSSS
radio transmission system**

**Complies with the
"Guide for connections
to the ENEL Distribuzione
electricity network"**

**MPPT algorithm optimised
for continuous maximum
power point tracking**

Single-phase inverter, with isolation transformer configured for 50 Hz network frequency, suitable for grid connection also in three-phase systems, with Beghelli Solar DATA Gate FH-DSSS radio transmission for connection to the PianetaSole control panels.



INPUT MODULES CONFIGURATION FOR SINGLE INVERTE

	3.000 W TL	3.300 W TL
Total number of strips	1	1
280Wp modules for each strip	10 ÷ 11	11 ÷ 12
Maximum number of installable modules	11	12

Order Code	Description	Notes
15732	3000 W Beghelli inverter	Integrated anti-theft system
15733	3300 W Beghelli inverter	Integrated anti-theft system

	3000 W	3300 W
Input parameters		
Maximum DC power	3300W	3600W
MPPT voltage interval	260÷490v (rated 400)	300÷530v (rated 430)
Maximum DC voltage	600V	650V
Activation voltage	360V	400V
Independent MPPTs	1	1
Maximum power per MPPT	3300W	3600W
No. of DC inputs	1	1
Maximum current per MPPT	10A	10A
Input protections and connections		
DC-side disconnection	External bi-polar disconnect switch in IP66 casing	External bi-polar disconnect switch in IP66 casing
Polarity inversion	Yes	Yes
DC-side varistors	2 + gas arrester to earth	2 + gas arrester to earth
DC Input	1 input with 2 MC4-type snap-in plugs	1 input with 2 MC4-type snap-in plugs
Output parameters		
Rated output power	2800W	3000W
Maximum output power	3000W	3300W
Connection to the AC network	Single-phase 230 VAC 50 Hz + PE	Single-phase 230 VAC 50 Hz + PE
Rated output voltage	230Vac	230Vac
Rated output current	12.17A	13A
Maximum output current	15A	16A
Maximum short-circuit output current	27A	29A
Rated frequency	50 +/- 2% Hz	50 +/- 2% Hz
Power factor	0.99	0.99
Output protections and connections		
AC-side disconnection	Bi-polar rotating disconnect switch on the inverter	Bi-polar rotating disconnect switch on the inverter
AC-side varistors	2 + gas arrester to earth	2 + gas arrester to earth
Measuring device for leakage currents following earth malfunctions (AC/DC-sensitive type A and F RCD)	Conforms to VDE 0126-1-1 and CEI 64-8 regulation (type-F RCD as per IEC 60755/A2)	Conforms to VDE 0126-1-1 and CEI 64-8 regulation (type-F RCD as per IEC 60755/A2)
AC Output	1 connector with locking nut, IP68, with terminals, suitable for clamping a sheathed three-pole cable 3 x 2.5 mm ² (Neutral, Live and Earth)	1 connector with locking nut, IP68, with terminals, suitable for clamping a sheathed three-pole cable 3 x 2.5 mm ² (Neutral, Live and Earth)
Isolation	Incorporated isolation transformer configured for mains voltage, with class II insulation.	Incorporated isolation transformer configured for mains voltage, with class II insulation.
Conversion efficiency		
Maximum efficiency	96%	96%
European efficiency	94%	94%
Environmental parameters		
Operating temperature range	-20 ÷ +60 °C	-20 ÷ +60 °C
Protection rating	IP66	IP66
Cooling	Natural aeration, without fans	Natural aeration, without fans
Mechanical parameters		
Dimensions	797x359x223 mm30 kg	797x359x223 mm
Weight	30 kg	30 Kg
Other information		
Stand-by mode absorption	2W	2W
MTBF (mean time between failures)	153000 hours (at 20°C)	153000 hours (at 20°C)
Transmission	Radio FH-DSSS	Radio FH-DSSS
Firmware version	V3.1	V4.1
Type of converter	Static converter unsuitable for withstanding the voltage and frequency within the rated range (static conversion device that behaves like a current generator)	Static converter unsuitable for withstanding the voltage and frequency within the rated range (static conversion device that behaves like a current generator)
Contribution to the short-circuit current	24A	27A
Make	Beghelli S.p.A.	Beghelli S.p.A.
Model	291.005.015	291.005.014

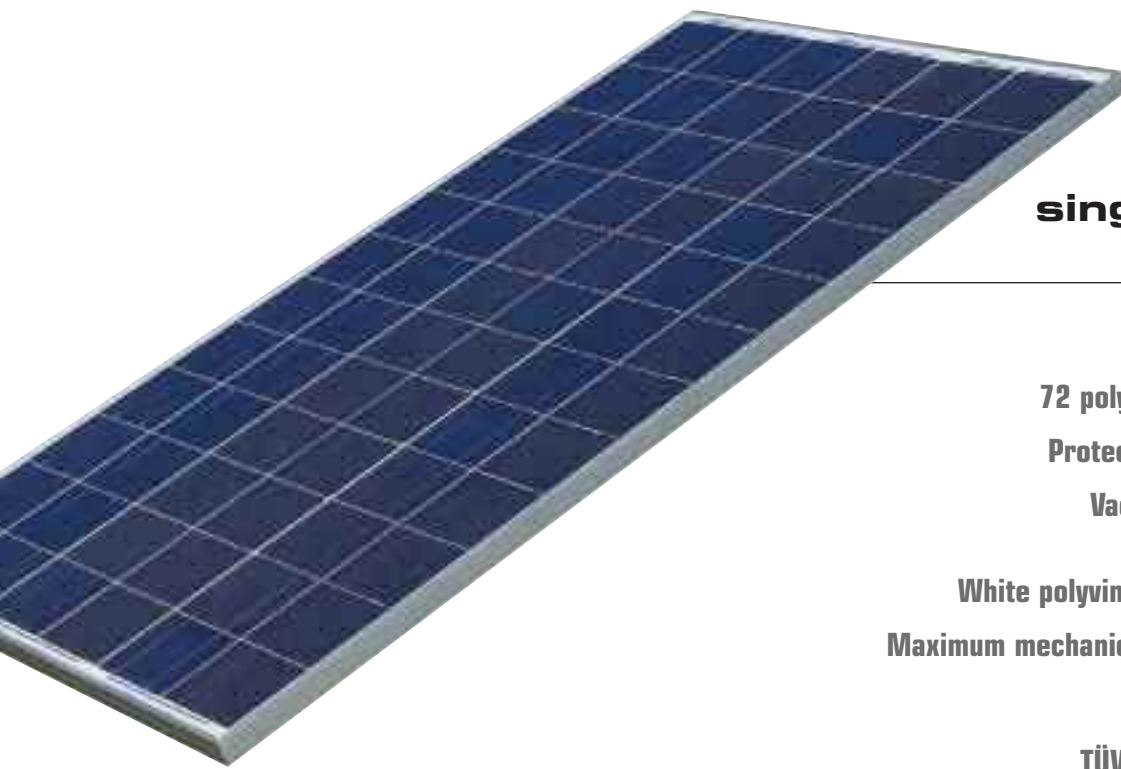


Photovoltaic modules



280 Wp photovoltaic module

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280 Wp single photovoltaic module

72 polycrystalline silicon cells module

Protected by high-transparency glass

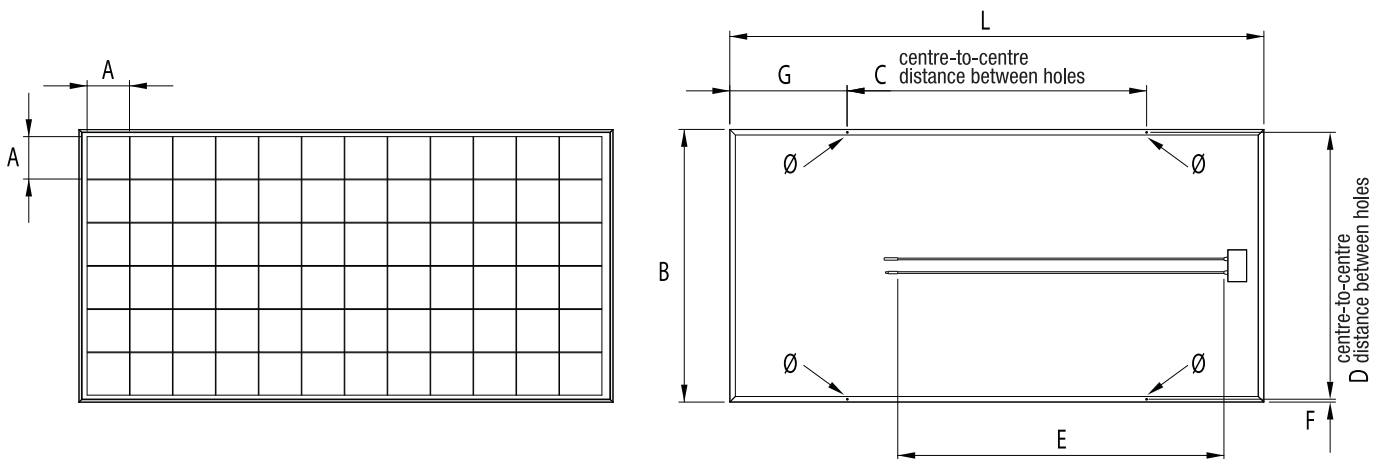
Vacuum-encapsulation of the cells
between 2 sheets of EVA

White polyvinyl fluoride back-side protection

Maximum mechanical load capacity = 5,400 N/m².

Compliant with:
CEI-EN 61215 - CEI-EN 61730
TÜV Rheinland no. AK38700010/11

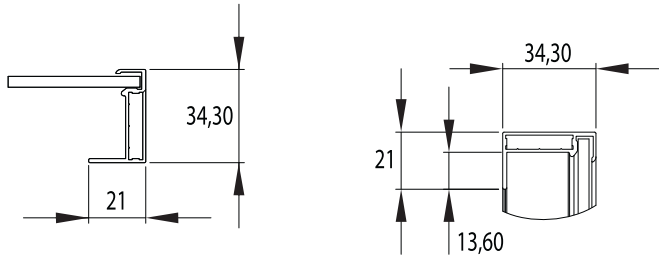
Module made of 72 polycrystalline silicon cells. The single cell measures 156 mm x 156 mm. High-transparency protective glass; the photovoltaic cells are vacuum-encapsulated between 2 sheets of EVA (ethylene vinyl acetate). The back-side of the module is protected with backing material specially designed for photovoltaic applications that combines high resistance and durability. Maximum mechanical load capacity = 5,400 N/m². The module is bordered by an aluminium frame.



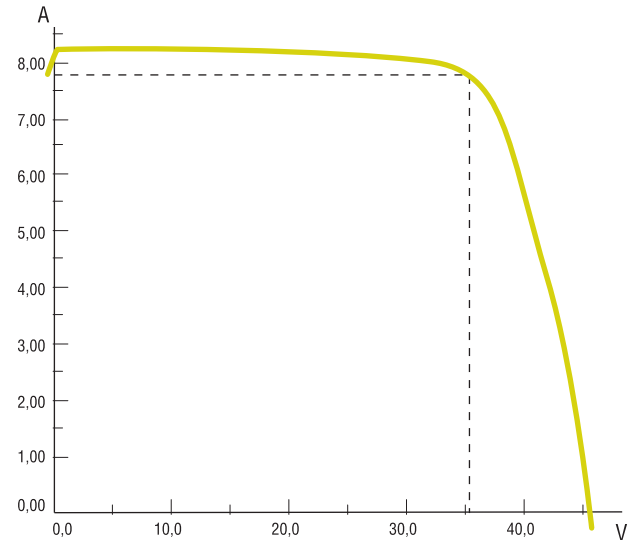
Power Wp	L	B	H	• Dimensions (mm) •			E	F	G	Ø	Weight kg
				A	C	D					
280	1965	1003	36 max	156	1102	975	1200	14	431,5	6,50	25

Order Code	Description
15744	280 Wp single module - polycrystalline silicon cell

Dimensional details



Characteristic curve of the module (Voltage – Current)



MC4-type connection

Mechanical data

Cell	Polycrystalline silicon 156 x 156 mm
No. of cells and connection	72 cells connected in series
Type of connection	pin-type compatible with MC4 IP67

Threshold values

Maximum humidity tolerated	90%
Operating temperature range	-40°÷+85°
Maximum voltage of the system	1000 V _{cc}
Maximum load capacity	5400 N/mq

Mechanical data

Peak power (P _{max})	280 Wp
MPP voltage	35,54 V
Open-circuit voltage	45,64 V
MPP current	7,88 A
Short-circuit current	8,42 A
Module performance	14,20 %
Maximum isolation voltage	1.000 V _{dc}
Temperature coefficient of short-circuit current (I _{sc})	4,2 mA/°C (0,05%/°C)
Temperature coefficient of the open-circuit voltage	-0,168 V/°C (-0,37%/°C)
Temperature coefficient of the maximum power	-1,260 W/°C (-0,45%/°C)
Module surface area	1,971 m ²
Bypass diode	presente (n° 3)
NOCT	45 ± 2 °C



PVT Hybrid module

Hybrid photovoltaic + solar thermal module (PVT)

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**Hydronic DHW unit - up to 12 modules
accumulation tank with heat exchanger and Radio Controller**

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**Hydronic DHW unit - up to 6 modules
accumulation tank with heat exchanger and Radio Controller**

page 42

Hybrid photovoltaic + thermal module (PVT)



front and back view of the PVT hybrid module

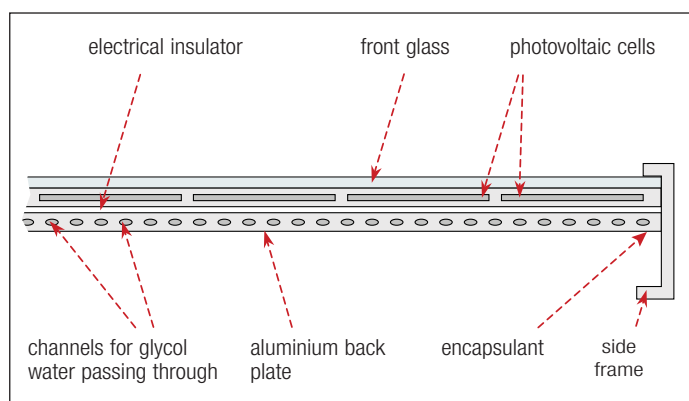
Production of electrical energy and domestic hot water

The energy independence of buildings has now become a reality. The possibility of installing hybrid modules capable of simultaneously generating electrical energy and domestic hot water constitutes a further step towards achieving this ideal model. The combination of the two systems is both synergic and winning due to at least three physics-related reasons, namely:

- **Heat is generated during the photovoltaic process.**
- **Keeping the PV cells at low temperatures improves performance by up to 20%.**
- **Combining thermal and photovoltaic systems doubles the area available for renewable energy sources.**

The Beghelli project takes full advantage of these principles thanks to the PVT hybrid modules, the front side of which carries 72 photovoltaic modules while the back-side has a high thermal conductivity aluminium absorber lined with a coil for the circulation of the heat-carrier fluid. The heat generated from the production of photovoltaic energy is transmitted to the cooling fluid that, in turn, becomes a heat carrier for the heat accumulated in a domestic hot water (DHW) production system. During the warmer months, the temperature of the "solar water" will not cause the boiler to turn on: the production of DHW will more than fully cover the home's hot water needs. During the colder winter months, the temperature of the "solar water" will help to significantly reduce the thermal gradient between the input and output water of the boiler, which greatly reduces energy consumption and the time required for producing DHW. Coverage of annual DHW needs varies between 80% and 90%. **Improved energy performance from photovoltaic sources with cooling of the heat-carrier fluid by up to 20%.**

CROSS-SECTION OF THE PVT MODULE



PianetaSole control panel is able to analyse all the system's parameters by constantly monitoring the temperature of the various system sensors and measuring solar irradiation, which is indirectly recorded by the photovoltaic inverter.



Order Code

15754

Description

Hybrid PVT module - polycrystalline silicon cell - coiled aluminium heat exchanger

Module made up of 72 polycrystalline silicon cells

Protected by high-transparency glass

Vacuum-encapsulation of the photovoltaic cells between 2 sheets of EVA

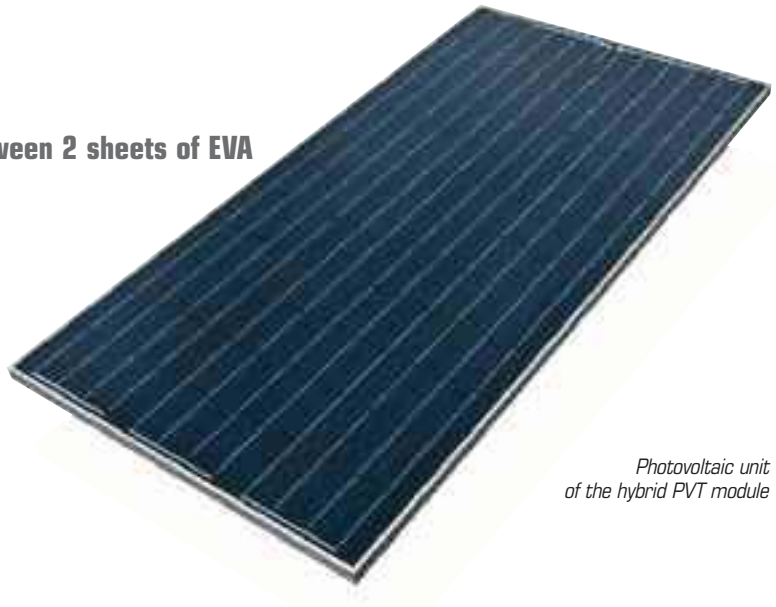
White polyvinyl fluoride back-side protection

Maximum mechanical load capacity 5,400 N/m²

Compliant with:

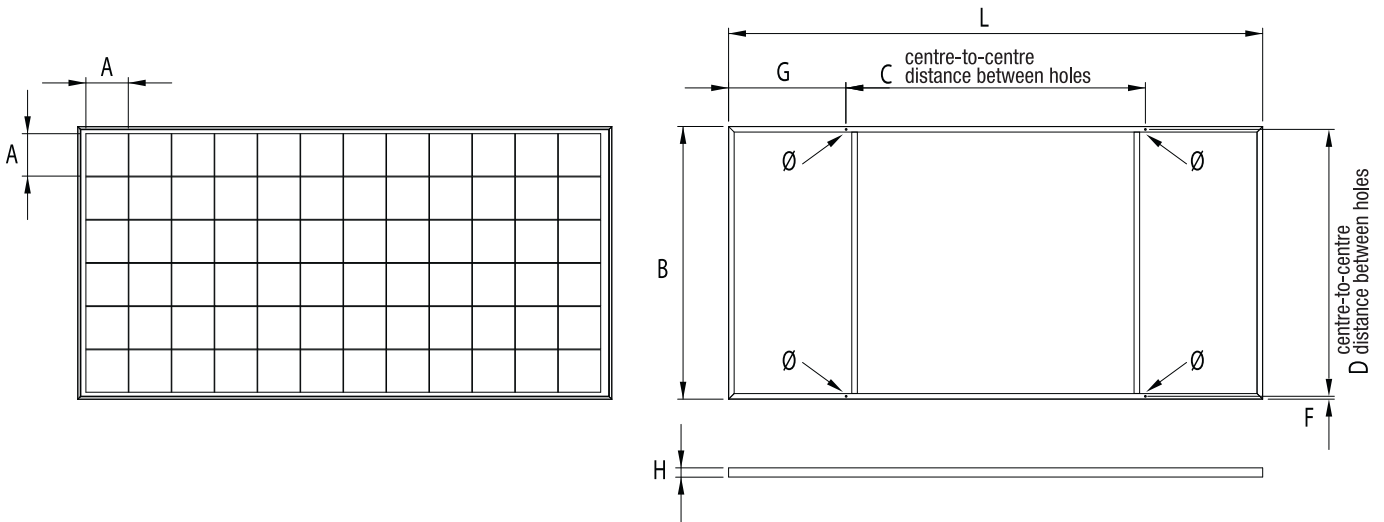
CEI-EN 61215 - CEI-EN 61730

TÜV Rheinland no. AK38700010/11



Photovoltaic unit of the hybrid PVT module

Module made up of 72 polycrystalline silicon cells. Dimensions of the single cell: 156 mm x 156 mm. High-transparency protective glass; the photovoltaic cells are vacuum-encapsulated between 2 sheets of EVA (ethylene vinyl acetate). The back-side of the module is protected with backing material specially designed for photovoltaic applications that combines high resistance and durability. Maximum mechanical load capacity = 5,400 N/m². The module is bordered by an aluminium frame.



Power Wp	• Dimensions (mm) •										Weight kg
	L	B	H	A	C	D	F	G	Ø		
280	1965	1003	36 max	156	1102	975	14	431,5	6,50	40	

Specifications

Peak power (Pmax)	280 Wp
MPP voltage	35,54 V
Open-circuit voltage	45,64 V
MPP current	7,88 A
Short-circuit current	8,42 A
Module performance	14,20 %
Maximum isolation voltage	1.000 Vdc
Temperature coefficient of short-circuit current (Isc)	4,2 mA/°C (0,05%/°C)
Temperature coefficient of the maximum power	-0,168 V/°C (-0,37%/°C)
Temperature coefficient of the open-circuit voltage	-1,260 W/°C (-0,45%/°C)
Module surface area	1,971 m²
Bypass diode	included (n° 3)
NOCT	45 ± 2 °C

Mechanical data

Cell	Polycrystalline silicon 156 x 156 mm
No. of cells and connection	72 cells connected in series
Type of connection	pin-type compatible with MC4 IP67

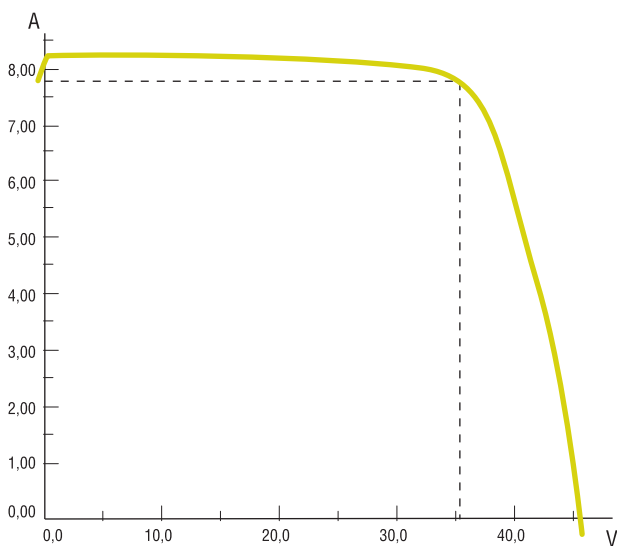
Threshold values

Maximum humidity tolerated	90%
Operating temperature range	-40° ÷ +85°
Maximum voltage of the system	1000 Vcc
Maximum load capacity	5400 N/mq



MC4-type connection

Characteristic curve of the module (Voltage – Current)



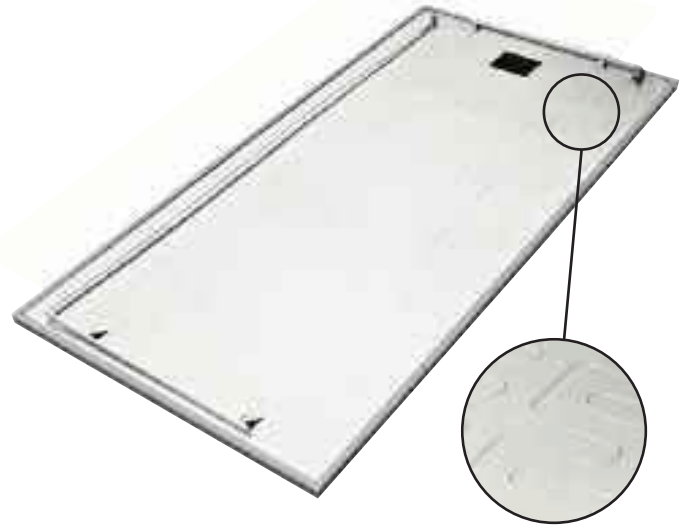
A correctly-sized system is able to guarantee total independence regarding domestic hot water production, by satisfying up to 90% of the total need.

The pvt module, in its back side, houses an aluminium thermal absorber with a built in thermal media fluid radiator.

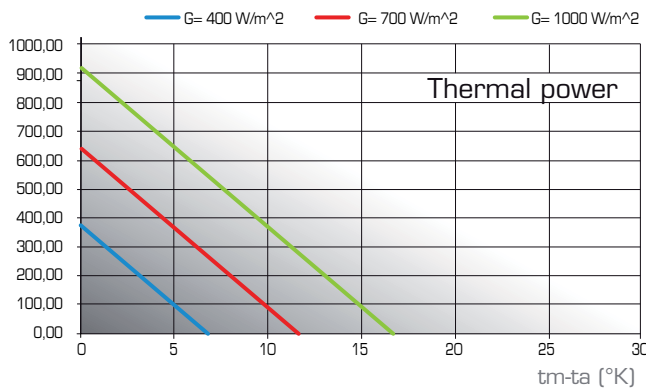
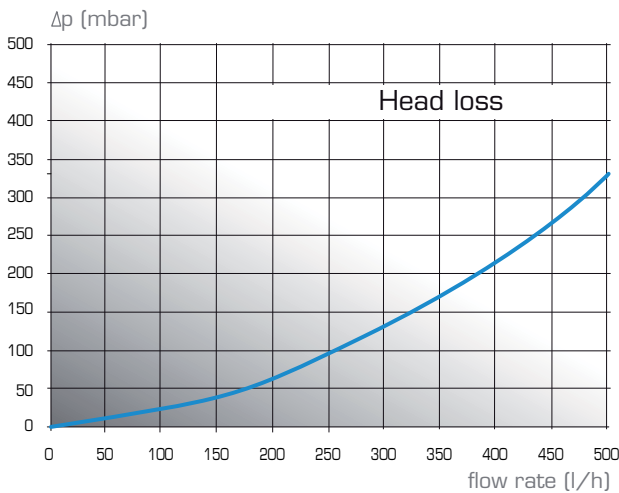
This positioning, right behind the photovoltaic cells, allows a better PV cells cooling increasing their efficiency further than producing domestic hot water.

Cooling of the photovoltaic cells improves performance by up to 20%

The energy performance of silicon-based photovoltaic systems drops down sharply when certain temperatures are exceeded. Naturally, this effect occurs during the hottest months of the year, when solar irradiation and thus energy production are at their peak. The cooling system whereby the fluid circulates inside the thermal absorber improves the energy performance during the warmer months, especially when combined with an air-to-water heat exchanger or when connected to a pool - the latter case offers the added advantage of having a heated pool.

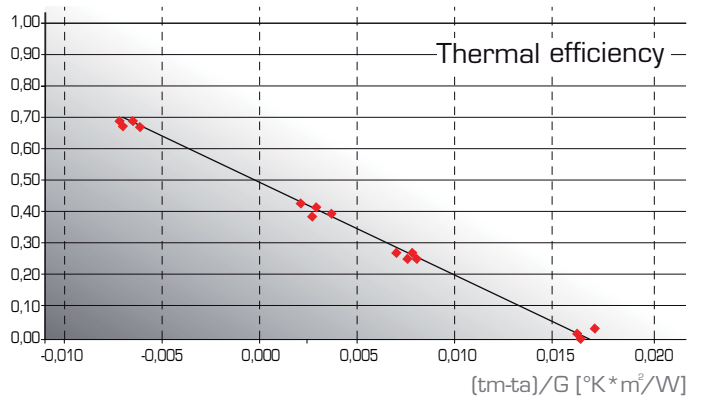


Thermal absorber for hybrid PVT module, including detail of the aluminium coil



Thermal specifications

Peak thermal power	950 Wt
Thermal efficiency	0.5 (@ $t_m - t_a = 0.1000 \text{ W/m}^2$)
Internal water volume	400 ml
Operating pressure	2 bar
Max. pressure	6 bar
Rated flow rate	2 litres/min
Empty weight	35 kg
Stagnation temperature	< 90°C
Hydraulic fittings	3/8" male
Cooling fluid	water-glycol mixture (30% Antifrogen SOL VP1981, 70% water)



Δp = difference of pressure **tm** = average "solar water" temperature **ta** = ambient temperature **G** = radiation

Installation scenarios and use of the thermal component of a system containing hybrid PVT modules

- Coverage: 80%-90% (as pre-heating occurs, the boiler must nevertheless intervene for a small amount of time)
- Average per capita consumption of DHW between 800 and 1,000 kWh/year
- South-facing modules with typical photovoltaic inclination (30°)

	Northern Italy	Central Italy	Southern Italy
4-person household (hydraulic unit code 15830 with 200 l accumulation tank)	6 PVT modules	5 PVT modules	4 PVT modules
6-8 person household (hydraulic unit code 15831 with 400 l accumulation tank)	12 PVT modules	10 PVT modules	8 PVT modules

indicative values for coverage of domestic hot water needs

Hydronic DHW unit with PVT Radio Controller



Accumulation tank with incorporated heat exchanger

Thermal system with accumulation tank and radio control interface

The DHW hydronic unit connected to the hybrid PVT modules pre-heats – with the aid of solar energy – the low-temperature mains water, before the latter is supplied to the system’s boiler. The heat accumulated by the “solar water” is transferred - through a stainless steel heat exchanger incorporated in the tank - to the mains water the moment the system requires DHW.

The traditional boiler connected downstream of the solar pre-heater is filled by heated-up water and thus only intervenes when the temperature of the pre-heated water is too low, due to the lack of sunlight. Moreover, the heat exchange system between the heat-carrier fluid and the domestic water protects the system against possible bacterial contamination, as heating occurs through heat exchange within a sealed chamber thanks to a stainless steel coil.

Intelligent control of all the functions linked to the heat exchange between different fluids is managed by the PVT Radio Controller, a device capable of simultaneously managing a series of temperature sensors, power output ports and diverter valve ports. The device is powered at 230 VAC and is controlled by the system’s control panel via the Beghelli Solar DATA Gate radio connection.

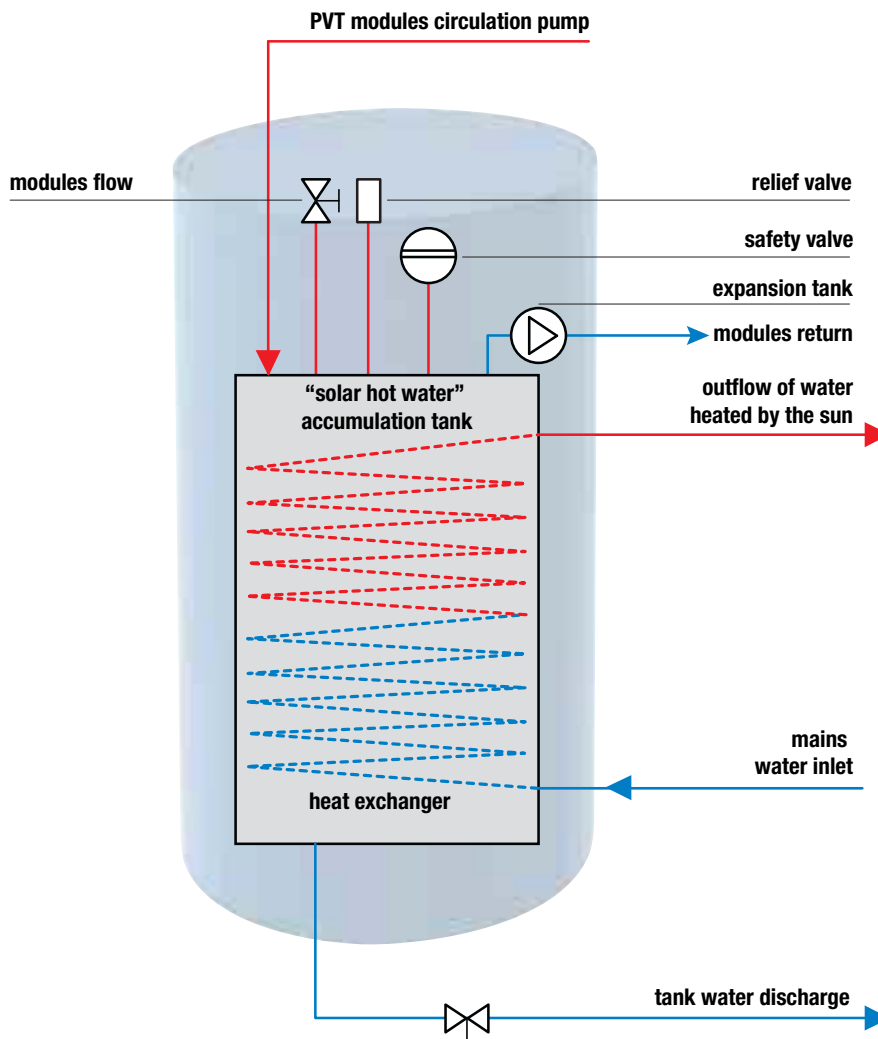
The DHW hydronic unit includes the following main components:

- PVT Radio Controller system
- Heat exchanger for the production of DHW
- Accumulation tank for water heated by the sun
- Recirculation pumps for water heated by the sun
- Diverter valves
- Safety valves
- Bleed valves
- Temperature sensors

• Dimensions (mm) •		Internal water volume (litres)	Empty weight (kg)
Ø	H		
550	1500	200	75
700	1750	400	110

PVT Radio Controller control unit





Specifications

Operating pressure	6 bar
Insulation	Polystyrene - thickness 50 mm
Technical water fittings (PVT modules side)	1 ½ " ring nuts
Fittings – water mains side	1" ring nuts
Incorporated expansion tank – PVT modules circuit side	8 litres
Incorporated safety valve	Pmax 6 bar
Incorporated relief valve – PVT circuit side	½"
Tank discharge tap	½"
Incorporated high-efficiency circulation pump	Max. 2 litres/hour

Order Code	Description
15830	Hydronic kit up to 6 PVT modules includes PVT Radio Controller, temperature sensors and power outputs for valve control
15831	Hydronic kit up to 12 PVT modules includes PVT Radio Controller, temperature sensors and power outputs for valve control

1. HYBRID PVT DHW SYSTEM

For high-performance photovoltaic electricity production and for pre-heating of domestic hot water (DHW)

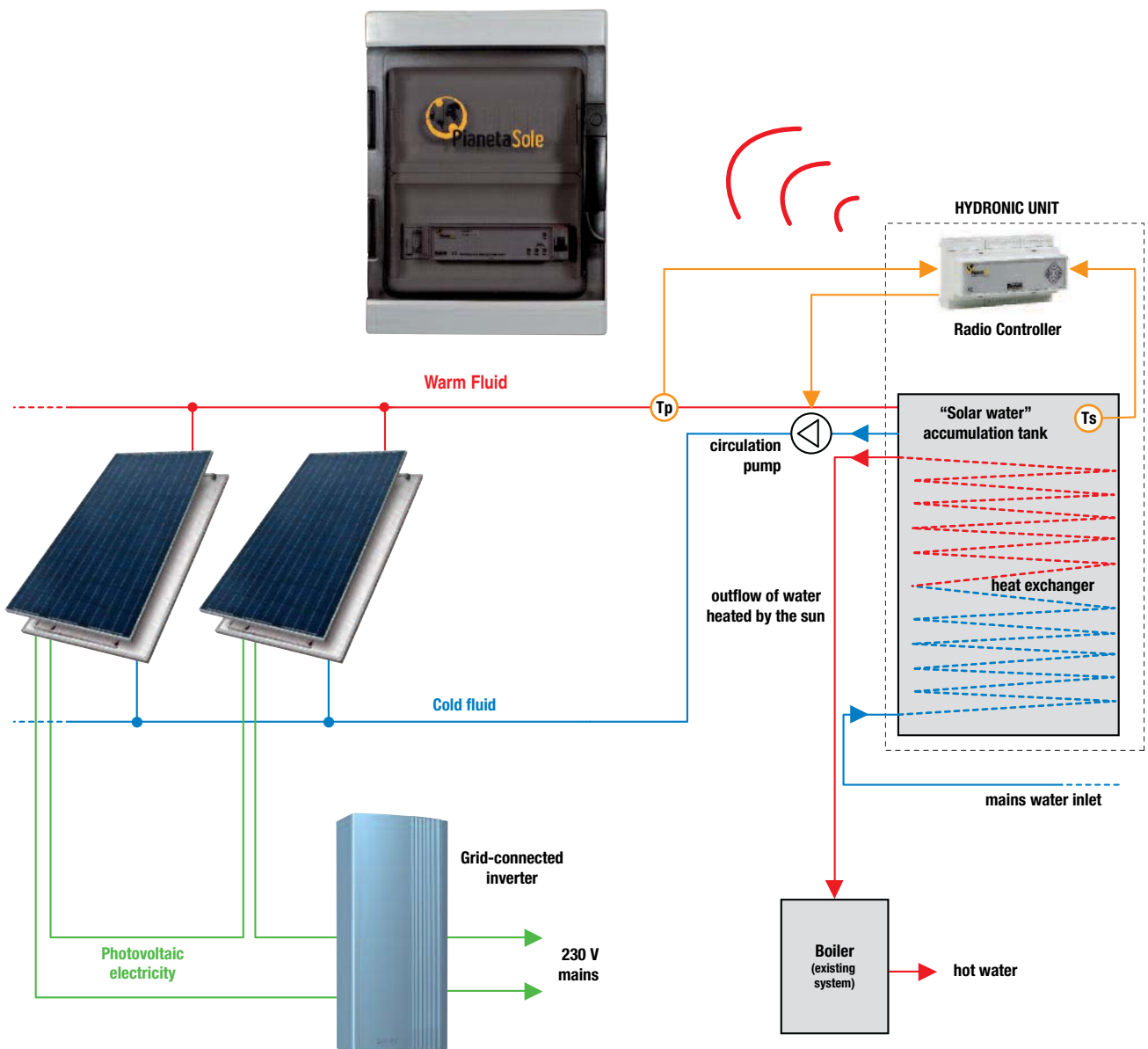
The water heating applications of Beghelli hybrid PVT module can either integrate existing heating systems for producing domestic hot water (DHW), or enhance new water heating projects without modifying the overall system dimensions.

With this scheme, the production of "solar hot water" is used to heat the mains water in real time before it is introduced into the boiler. The heat exchange process occurs while the mains water flows through the heat exchanger coil, without accumulation of DHW in the heat exchanger, but by

instantly producing domestic hot water according to the system's

needs. The entire transfer and heat exchange process is governed by the PVT Radio Controller, which measures the temperature of the flow "solar water" of the hybrid PVT modules (T_p) and the temperature of the "solar water" in the accumulation tank (T_s), while it also controls the circulation pump.

The circulation pump automatically turns on when $T_p > T_s$, so that the maximum amount of heat can accumulate in the tank, depending on the availability of solar thermal energy.



2. HYBRID PVT DHW SYSTEM WITH COOLING OF PV MODULES

For high-performance (up to 20% more) photovoltaic electricity generation and for pre-heating of domestic hot water (DHW)

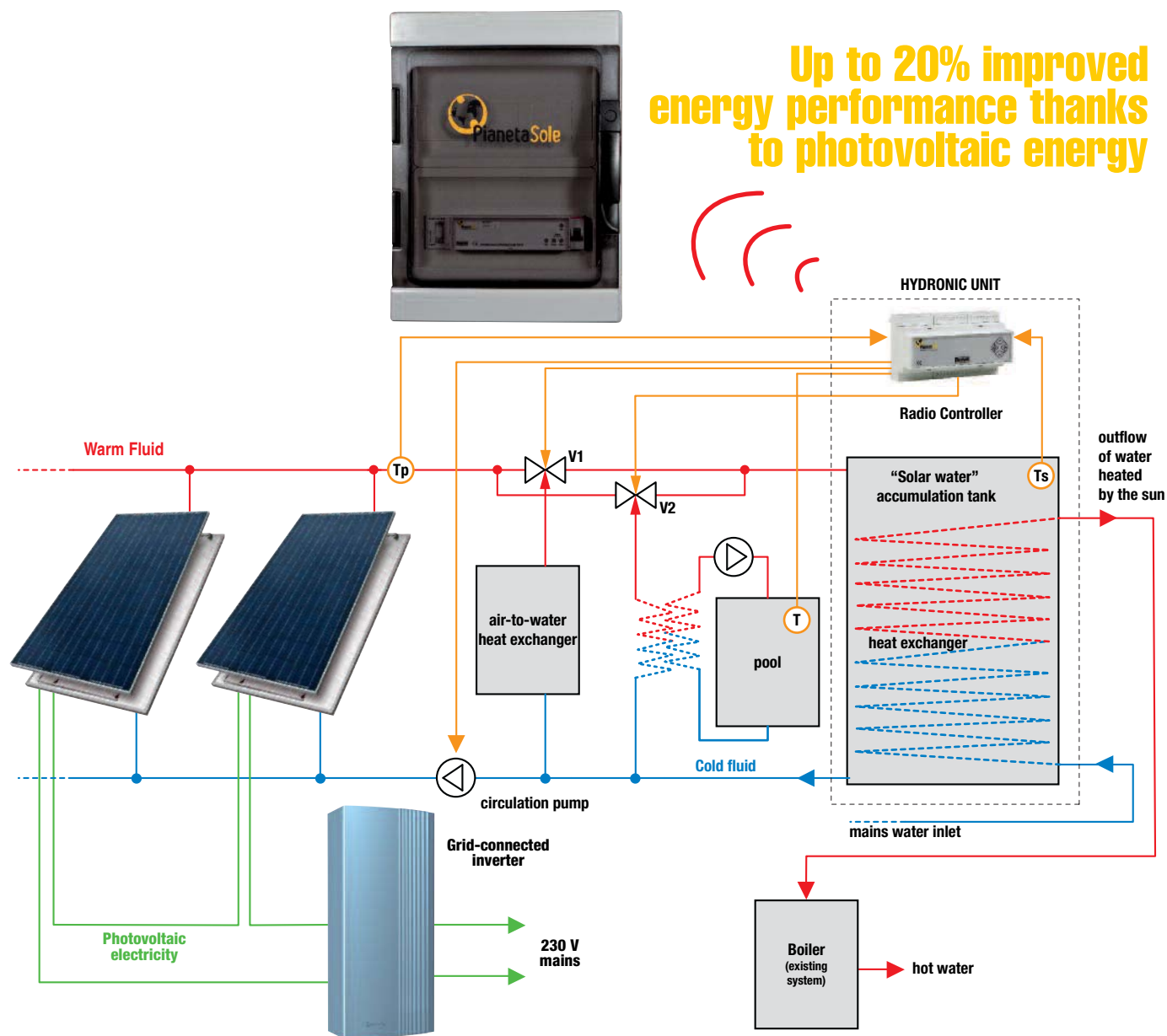
The innovative aspect of this type of installation lies in the cooling of the PVT modules, which occurs thanks to a water-to-air heat exchanger, or by connecting the circuit to a pool that is heated with solar thermal energy.

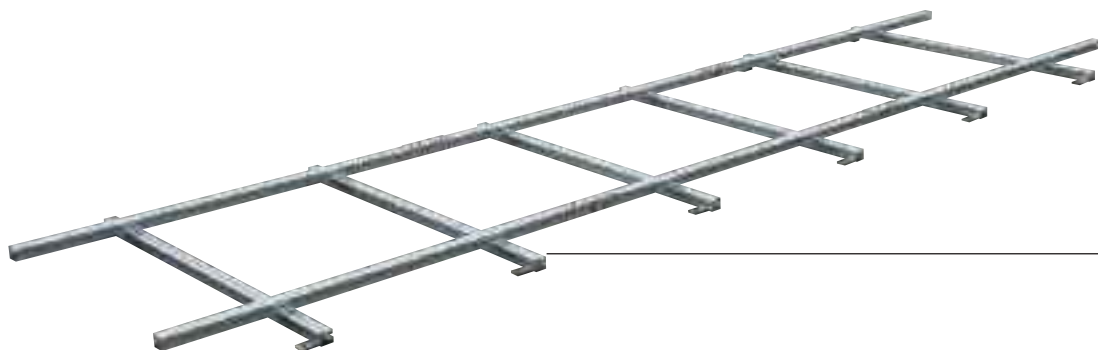
Also in this case, the thermal system is monitored by the PVT Radio Controller that measures the temperature of the flow water of the hybrid PVT modules (T_p), of the water in the accumulation tank (T_s) and, if required, the pool water. Besides the circulation pump (P_c), the system controls the diverter valves (V_1 and V_2) and the water-to-air heat exchanger fan. The circulation pump automatically turns on when $T_p > T_s$, so that the maximum amount of heat can accumulate in the tank, depending on the availability of solar thermal energy. In this case, the diverter valves are appropriately controlled to ensure that the entire flow

circulates in the tank.

Should the hot water in the tank reach the maximum temperature, the Radio Controller intervenes on the pool diverter valves (or those of the water-to-air heat exchanger if there is no pool) to cool the photovoltaic panels.

Also during the summer months, the photovoltaic modules always work at the minimum temperature possible, thereby increasing electrical conversion performance by 15 to 20%, depending on the average temperature of the modules and the temperature of the cooling water.





Systems and solutions for renewable energy

**Solar tracking photovoltaic string
12 modules - 880 Wp**

page 48

**30° inclined fixing and orientation structure
for roof or ground installation**

page 52

**Anodised aluminium aligned fixing
and orientation structure- 2640 Wp**

page 54



Photovoltaic string 12 modules - 880 Wp

Photovoltaic string comprising 12 photovoltaic modules, motorised movement, inverter and field disconnect switch. The integrated inverter transforms direct current – supplied by the photovoltaic cells – into alternating current at 50Hz 230V, which can be used by the single-phase low-voltage electricity network. The inverter hooks onto the metal support structure (optional) of the modules and has a sealed output pin connector for connection to the electricity network. The inverter incorporates an FH-DSSS radio module that ensures contact between the various photovoltaic strings and the control panel, and also includes a special MPPT function. The electronic control unit of the motor that drives the photovoltaic string, to which it is connected through a sealed pin connector, is also housed in the inverter. The motor drives the photovoltaic string through a patented device - incorporated in the control panel - that identifies the optimal position based on the astronomical time. The single modules are connected in series and the string is connected to the inverter input.

**High reliability for an output power
after 20 years at least equal to
80% of the initial output**

Insulation class II

Protection rating IP66

**IMQ-approved motorised
support compliant with the
Machinery Directive**

**CEI-EN 61215 TÜV Rheinland
Certificate No. AK38700016/17
as per EN 61215 - EN 61730**

Intelligent solar tracking system

The micro-motion system is able to track the sun throughout the day. In order to optimally absorb solar energy, the sun's rays impact the cell at an angle that varies according to the panel's orientation: energy efficiency increases the more the impact tends to be perpendicular. In order to fully exploit the potential of this new technology, Beghelli has designed a series of positioning brackets that optimise use of the solar tracking system, while also offering several options for achieving the highest possible degree of architectural integration.

Up to 25% improved energy performance



Representation of a micro-motion solar tracking system

Kit contents



12 PV modules



Field disconnect switch



Inverter 930 Wp

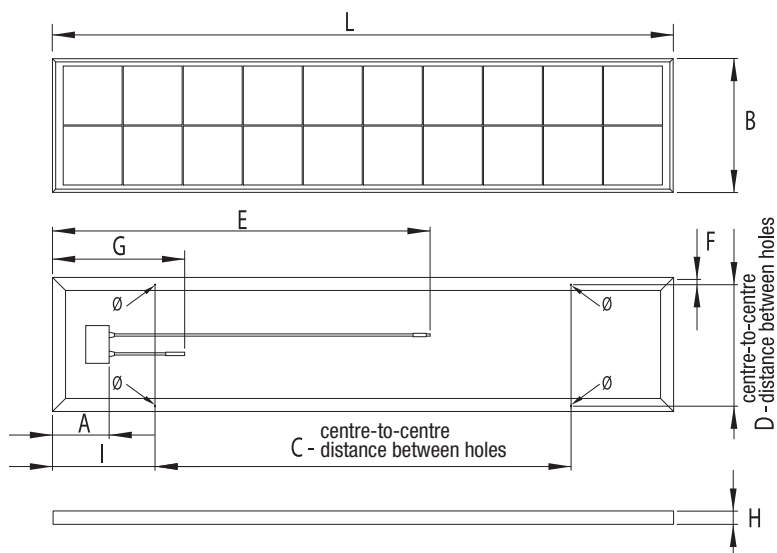


Micro-motion device

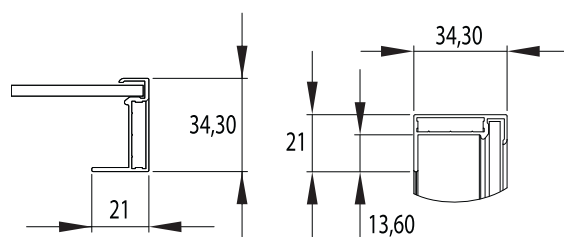
Order Code	Description	Notes	Total weight kg
15442	KIT with 12 solar tracking modules - 880 Wp	includes 12 modules, inverter, motor, field disconnect switch	160

STRUCTURES - to be ordered separately (pages 46-47)

Order Code	Description	Notes
15450	30° inclined structure for flat roof – ground installation	
15460	Aligned structure for flat roofs / sheds / pitched roofs	for 12 modules installed level with the roof, 12 fixing plates are required



Dimensional details

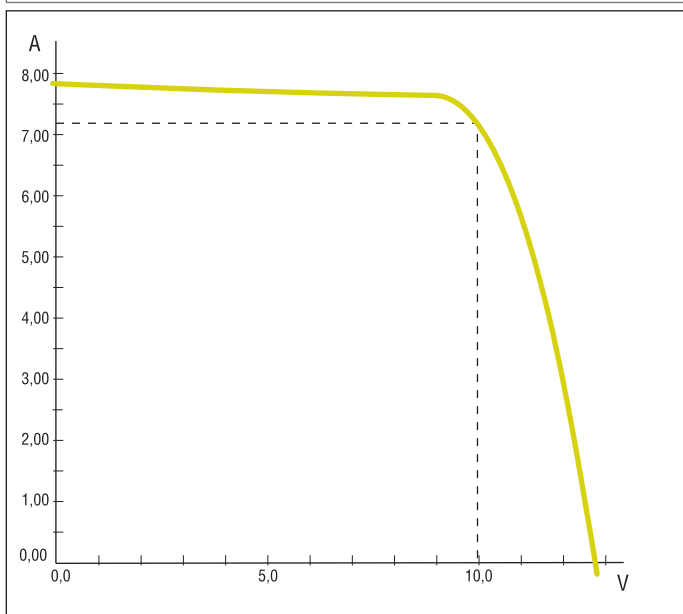


Power Wp	L	B	H	• Dimensions (mm) •			D	E	F	Ø	Weight kg
				A	G	C					
73,30	1645	355	36 max	135	335	1102	327	1000	14	6,50	12



MC4-type connection

Characteristic curve of the module (Voltage - Current)



Mechanical data

Cell	Polycrystalline silicon 156 mm ²
No. of cells and connection	20 cells connected in series
Type of connection	pin-type compatible with MC4 IP67

Threshold values

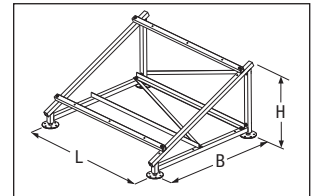
Maximum humidity tolerated	90%
Operating temperature range	-40° ÷ +85°
Maximum voltage of the system	750 Vcc
Maximum load capacity	5400 N/m ²

Electrical specifications of the single panel (291 000 003)

Peak power	73,3 Wp
MPP voltage	10,0 V
Open-circuit voltage (Voc)	12,75 V
MPP current	7,33 A
Short-circuit current (Isc)	7,87 A
Module performance	12,5%
Temperature coefficient of short-circuit current (Isc)	5 mA/°C
Temperature coefficient of the open-circuit voltage	0,045 V/°C
Temperature coefficient of the maximum power	0,37 W/°C
Module surface area	0,584 m ²
Bypass diode	included
NOCT	40,88 °C

30° inclined fixing and orientation structure for roof or ground installation

Accessory for 12-module photovoltaic string



Regulatory framework

Struttura di fissaggio del kit di pannelli Fotovoltaici composta da elementi in alluminio anodizzato.

This structure is suitable for the following applications:

- flat roof with inclination not exceeding 3° or 5% pitch
- ground with inclination up to 5°

All the components used are of extremely high quality (galvanised aluminium and stainless steel). The detailed assembly instructions enable the installer to save precious time and avoid errors. Thanks to its high structural resistance, the product can be installed in areas with maximum 230 kg/m² snow-load and 29 m/sec wind-speed (not simultaneous). The structure must be anchored with M8 bolts on a plinth or ballasted with 50x50 cement tiles (max. 65 kg per linear metre). The calculations to determine the plinth dimensions or the ballast weight must be made by qualified designers in relation to the place of installation of the photovoltaic generator.

The following regulatory framework was taken into account during the calculations and design phase:

- 1 Regulations governing conglomerated reinforced, normal and pre-compressed concrete works, and metal structures (Italian Law no. 1086 of 05/11/1971 and Italian Ministerial Decrees of 14/02/1992 and 09/01/1996).
- 2 Legislation regarding buildings with special provisions for seismic zones (Italian Law no. 64 of 02/02/1974 and Italian Ministerial Decree of 16/01/1996).
- 3 General criteria for verifying the safety of buildings and of loads and overloads (Italian Ministerial Decree of 16/01/1996).
- 4) UNI EN 1991 – Eurocode 1 – Actions on structures.

	• Dimensions (cm) •				Total weight kg
	total L	L	B	H	
structure only	525	131	121	67	96
structure with panels	525	131	151	102	256

Types of surfaces on which the 30° inclined structure can be mounted



GROUND



FLAT ROOF

Order Code	Description
15450	30° inclined structure for flat roof – ground installation

Anodised aluminium aligned fixing and orientation structure

Accessory for 12-module photovoltaic string



Fixing structure for the photovoltaic panels kit comprising standard anodised aluminium profiles for aligned installation on the following types of roofs: roofs with shed, pitched roof, roof with inclination exceeding 3° (5% pitch) or flat roof. All the components used are of extremely high quality (anodised aluminium and stainless steel). The detailed assembly instructions

enable the installer to save precious time and avoid errors. Thanks to its high structural resistance, the product can be installed in areas with maximum 300 kg/m² snow-load and 29 m/sec wind-speed (not simultaneous), and with inclination up to 30°.

Types of roofs on which the aligned structure can be mounted



SHED ROOF



PITCHED ROOF



FLAT ROOF

Regulatory framework

The following regulatory framework was taken into account during the calculations and design phase:

- 1 Regulations governing conglomerated reinforced, normal and pre-compressed concrete works, and metal structures (Italian Law no. 1086 of 05/11/1971 and Italian Ministerial Decrees of 14/02/1992 and 09/01/1996).
- 2 Legislation regarding buildings with special provisions for seismic zones (Italian Law no. 64 of 02/02/1974 and Italian Ministerial Decree of 16/01/1996).
- 3 General criteria for verifying the safety of buildings and of loads and overloads (Italian Ministerial Decree of 16/01/1996).
4. UNI EN 1991 - Eurocode 1 – Actions on structures.

	• Dimensioni (cm) •			Weight kg
	L	B	H	
structure only	510	140	12	36
structure with panels	510	164	39	196

Areas with maximum 300 kg/m² snow-load and 29 m/sec wind-speed (not simultaneous).

Centre-to-centre distances for fixing	A	B
inclined roof up to 30°	between 750 and 1,000 mm	between 1,000 and 1,250 mm

INSTALLATION ACCESSORIES

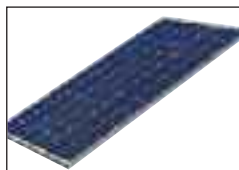
Order Code	Description
15461	Universal mounting jig

Order Code	Description	Notes
15460	Aligned structure for flat roofs / sheds / pitched roofs	for 12 modules installed level with the roof, 12 fixing plates are required

Solar tracking photovoltaic string 4 modules - 1120 Wp



Composizione



4 PV modules



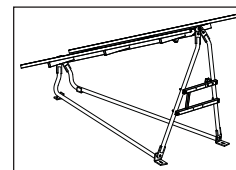
Field disconnect switch



Inverter 1100 Wp



Micro-motion device



Support structure

Intelligent solar tracking system

Photovoltaic string made of 4 photovoltaic modules, single-axis tracker, inverter and field disconnect switch. The inverter hooks onto the metal support structure of the modules and has a sealed output pin connector for connection to the electricity network; moreover, it houses the electronic control unit of the motor that drives the photovoltaic array. The motor drives the photovoltaic array through a patented device - incorporated in the control panel - that identifies the optimal position based on the astronomical time. The single modules are connected in series and the string is connected to the inverter input. Motion control occurs through the astronomical clock and backtracking.

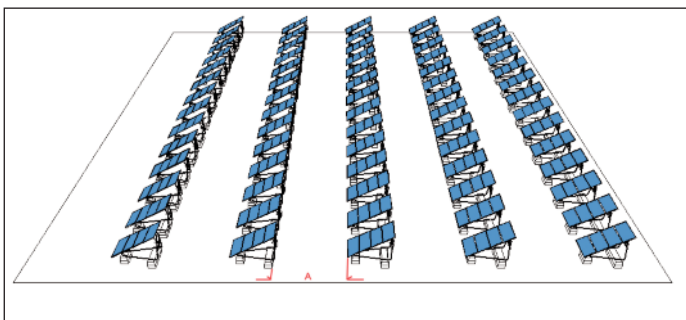
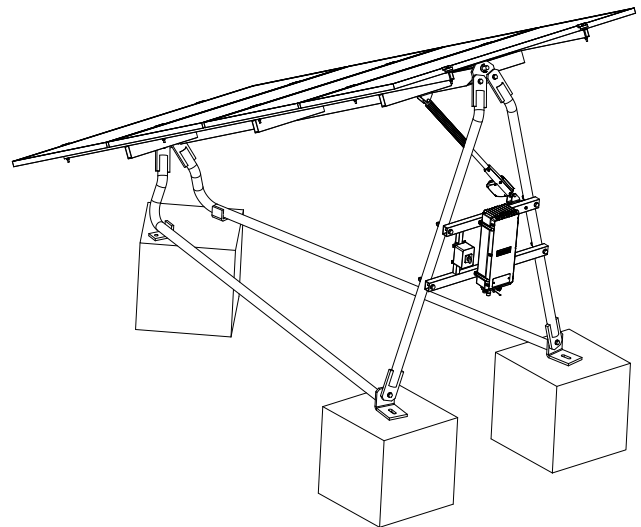
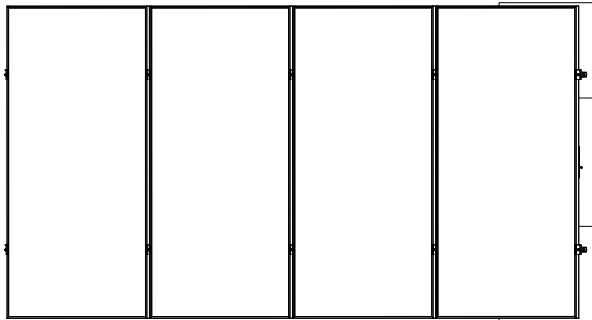
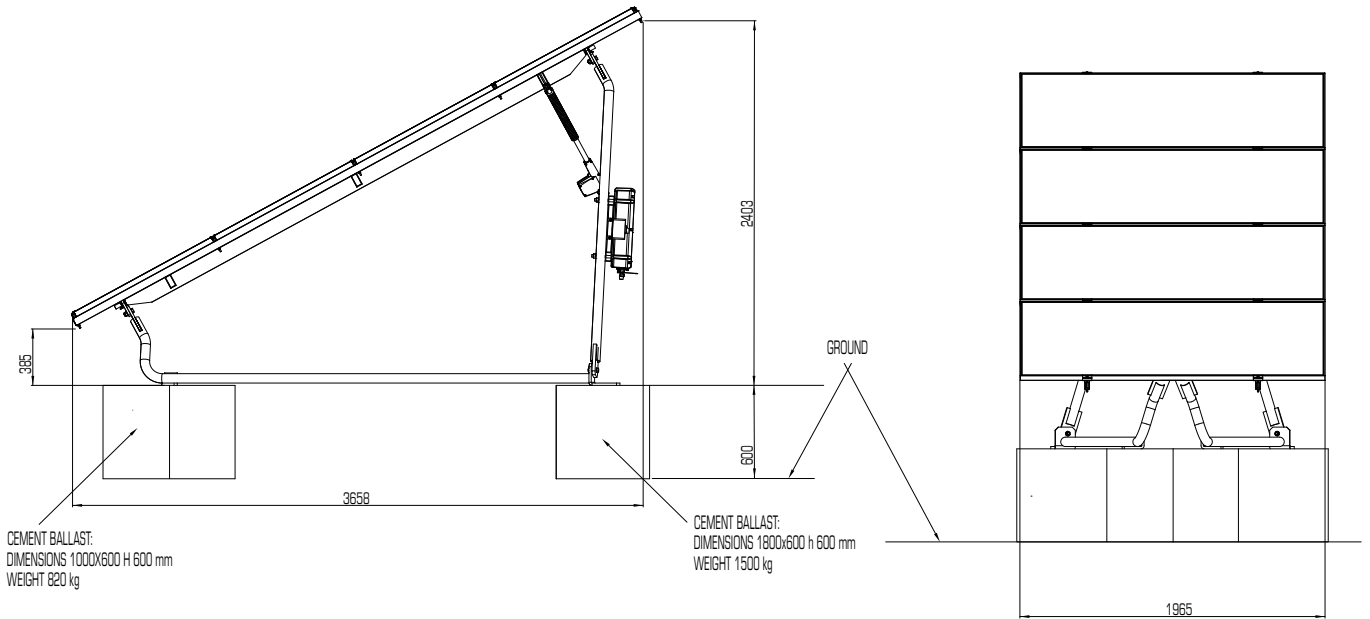
The micro-motion system is able to track the sun throughout the day. In order to optimally absorb solar energy, the sun's rays impact the cell at an angle that varies according to the panel's orientation: energy efficiency increases the more the impact tends to be perpendicular. In order to fully exploit the potential of this new technology, Beghelli has designed a series of positioning brackets that optimise use of the solar tracking system, while also offering several options for achieving the highest possible degree of architectural integration.

Specifications

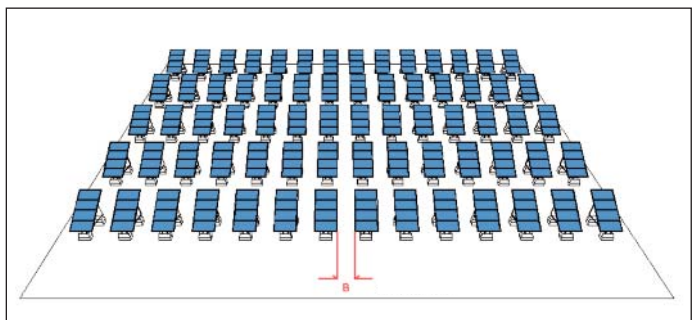
Peak power	1120 Wp
Weight	315 kg

Up to 30% improved energy performance

Order Code	Description	Notes
15541	KIT with 4 solar tracking modules - 1120 Wp	Motorised structure that moves around 1 axis



A is the distance between rows and can vary between 4.5 and 5.2 m depending on the relevant latitude



B is the distance between kits and can vary between 0.4 m and 2 m (recommended distance: 1 m)



The Energy Tree 36 modules - 2640 Wp



Solar module photovoltaic system with micro-movement for intelligent solar tracking. The system consists of three 12-module photovoltaic strings each incorporating an inverter.

The support structure is made of class-GL24 laminate wood, while the lower fixing system is configured for installation on a reinforced concrete plinth.

Intelligent solar tracking system

Up to 25% improved energy performance

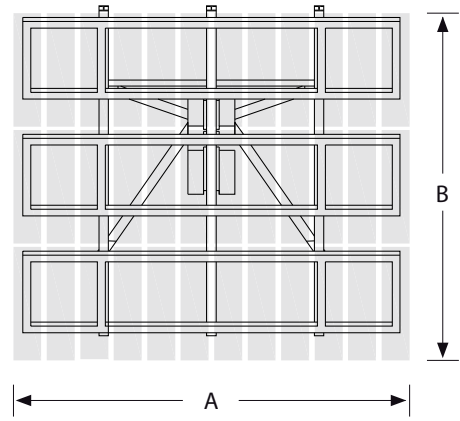
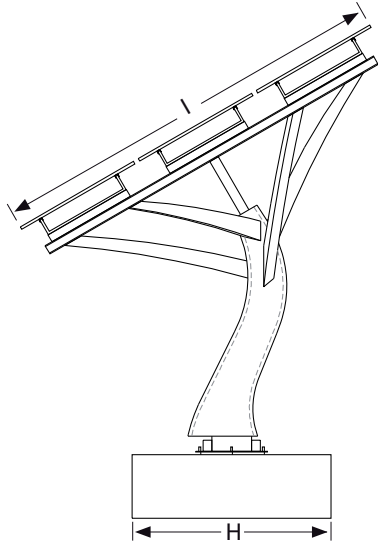
The micro-motion system is able to track the sun throughout the course of the day. In order to optimally absorb solar energy, the sun's rays impact the cell at an angle that varies according to the panel's orientation: energy efficiency increases the more the impact tends to be perpendicular.

Specifications

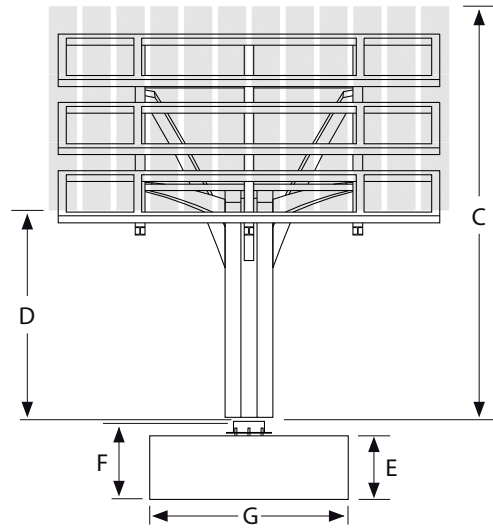
Peak power	2640 Wp
Weight	1900 kg

Order Code	Description
15800	Energy Tree kit comprising 36 solar tracking modules

Notes
Motorised structure that moves around 1 axis



View from above of the photovoltaic panels



• Dimensions (cm) •								
A	B	C	D	E	F	G	H	I
504	441	522	265	80	100	250	250	508



Notes

A series of horizontal dotted lines for writing notes, spanning the width of the page.



PianetaSole project is part of





Beghelli

www.beghelli.com

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