



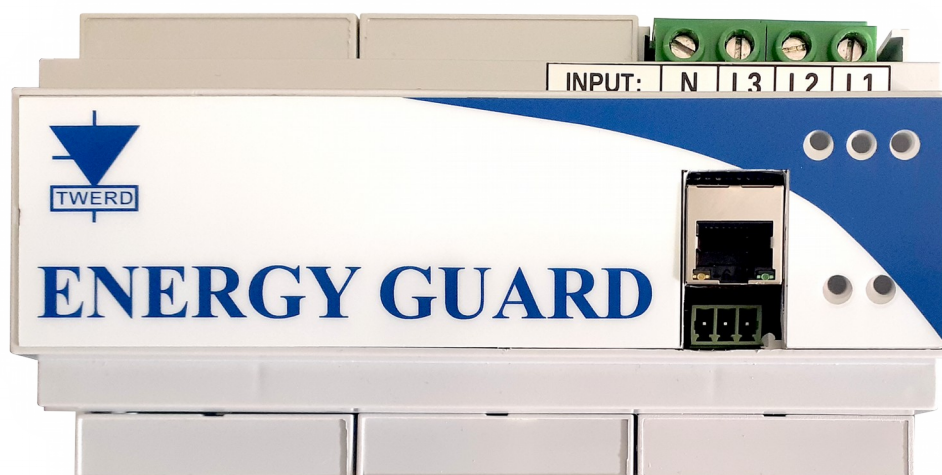
Renewable Energy Sources

Energy meter module
for PS100 and PS300
Inverter Series

PS Energy Guard

User manual

Version 1.0



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1. Device description

Energy meter module **PS Energy Guard** is included in the integrated power control system of the PS100 and PS300 family inverters manufactured by Twerd Power Electronics Limited.

PS Energy Guard measures the flow of electric energy and in cooperation with the PS100 and ps300 inverters, it allows control of the energy flow between the power supply network and the inverter and connected loads.

PS Energy Guard measures active power, reactive power and apparent power of a single-phase or three-phase network and sends current values to inverters connected to devices for regulating energy flow.

PS Energy Guard can be equipped with internal current sensors (marked W in the name) or external.

! Please note that the PS Energy Guard is not a measure of electricity consumption and its indications cannot be used for billing electricity consumption!

2. Conditions of safe operation

Before start to work with the PS Energy Guard read carefully this User's manual. Not knowing or ignorance of the information contained in it can cause physical injury, death or damage to the devices.

In the further part of this User manual, the PS Energy Guard, to which this instruction applies, will also be referred to as the "device".



RISK OF ELECTRIC SHOCK



HOT SURFACE

2.1. Warnings

- Incorrect installation, using, and maintenance of the device can cause physical injury or death, or damage to the device and connected equipment.
- Some housing components, including a heat sink, can get hotter than 80°C during normal operation - there is a risk of burns.
- Installation, using, and maintenance of the device must be performed only by qualified personnel.
- Before switching on the voltage, make sure the device has been correctly installed and all housing elements have been properly assembled.
- Don't make any connections changes when the device is connected to the power supply.

2.2. Basic rules

- Do not make any connections when the electrical voltage is supplied to the inverter: from the mains side, photovoltaic panels, wind turbine generator, battery bank.
- Don't measure the voltage endurance of any unit devices.
- To measure the cables insulation it is necessary to disconnect them from the device.
- Don't touch integrated circuits and any other parts on the device's electronic board, as they can be damaged by electrostatic discharge.
- Ensure that no other passive components, such as resistors, capacitors, or coils, are connected to the power cables.
- Any modifications or self-repairs of the device can cause physical injury or death, or damage to the device and connected equipment. Any attempt at self-repair will void any warranty.
- Periodically, you should check:
 - Connection of protective conductors,
 - Wiring (the connections, insulation),
 - Did not water get inside the system,

The device has built-in protection against earth fault currents, but it only protects the device and does not protect the user against electric shock.

2.3. Operation list after receiving the device

- After unpacking the device, it is necessary to check up visually presence of damages which could arise during the transport.
- Check up the correspondence between the delivered device and the order - check up the ratings plate on the case.
- Check up the correspondence between conditions in which the device will be used and conditions of an environment for which it is designed.
- Installation of the device should be made according to principles of safety and EMC rules.

2.4. Environmental conditions

a. Degree of pollution

During design second degree of pollution has been assumed, at which there are normally only non-conducting pollution. However there is a probability of temporary conductivity caused by a condensation, when the device is disconnected from the voltage source.

In case the environment in which the device will work, contains pollution which can influence its safety, it is necessary to apply appropriate counteraction, using, for example, additional cases, air channels, filters etc.

b. Climatic conditions

Table 2.1. Installation, warehousing and transport conditions

	Installation site	During warehousing	During transport
Temperature	-10 °C .. +40 °C	-25 °C .. +55 °C	-25 °C .. +70 °C
		In protective packing	
Relative humidity	5 % .. 95 %	5 % .. 95 %	Max 95 %
		Short-term, insignificant condensation on the external side of the device case is permitted only when the device is disconnected from the voltage source.	
Air pressure	86 kPa .. 106 kPa	86 kPa .. 106 kPa	70 kPa .. 106 kPa

2.5. Recycle

Always return your used electronic products, batteries, and packaging materials to dedicated collection points. This way you help prevent uncontrolled waste disposal and promote the recycling of materials.



3. Parameters

Table 3.1: Characteristic parameters

Size	Symbol	Unit	Value
Dimensions: H x W x D		mm	95mmx160mmx60mm
Housing			9 half DIN
Phase voltage range	U_{L-N}	V	80-270 VAC
Range of phase-to-phase voltages	U_{L-L}	V	135-460 VAC
Power consumption	P	W	3W
Maximum measured current	I_{max}		See tab. 6.1
Active power measurement error	ΔP	%	3% of max power Table 6.1
Reactive power measurement error	ΔQ	%	5% of max power Table 6.1
Apparent power measurement error	ΔS	%	5% of max power Table 6.1
Maximum adjustment time 90% -0% of the inverter nominal power	Δt	s	1,5 s

4. Device connectors

Figures 1 - 3 provides a description of the PS Energy Guard connectors.

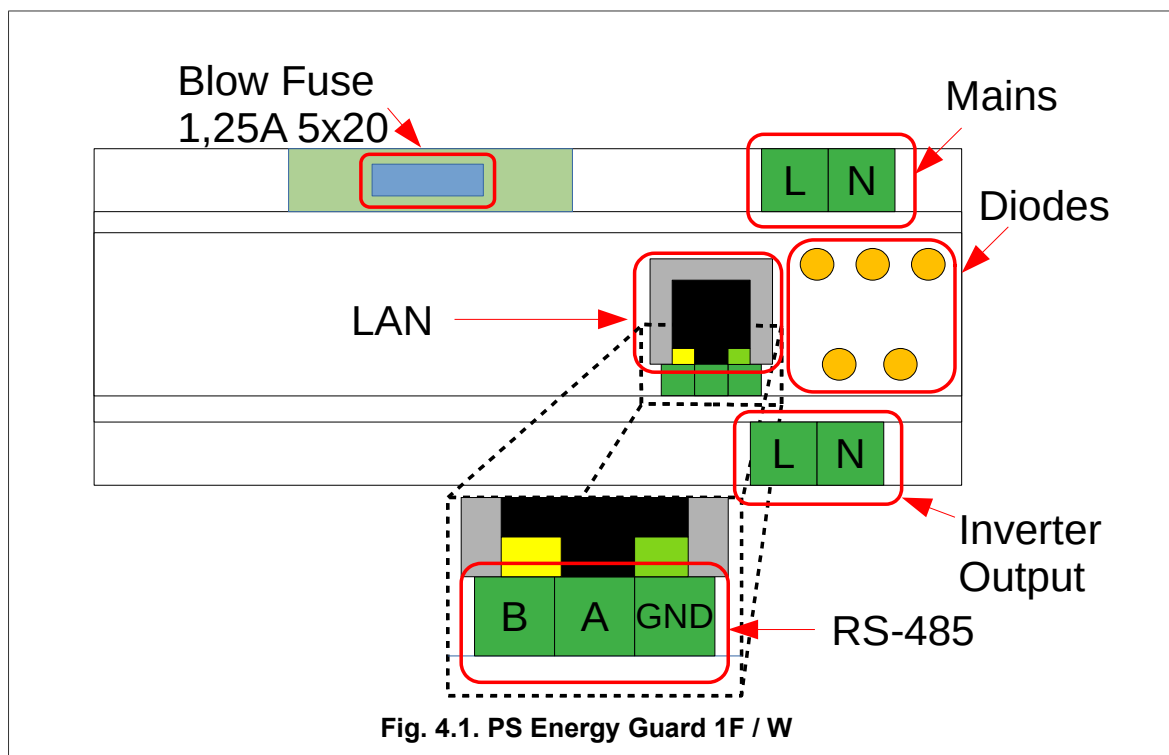


Fig. 4.1. PS Energy Guard 1F / W is showing the connectors on the PS Energy Guard for one-phase PS100 inverters appliances with internal current sensors.

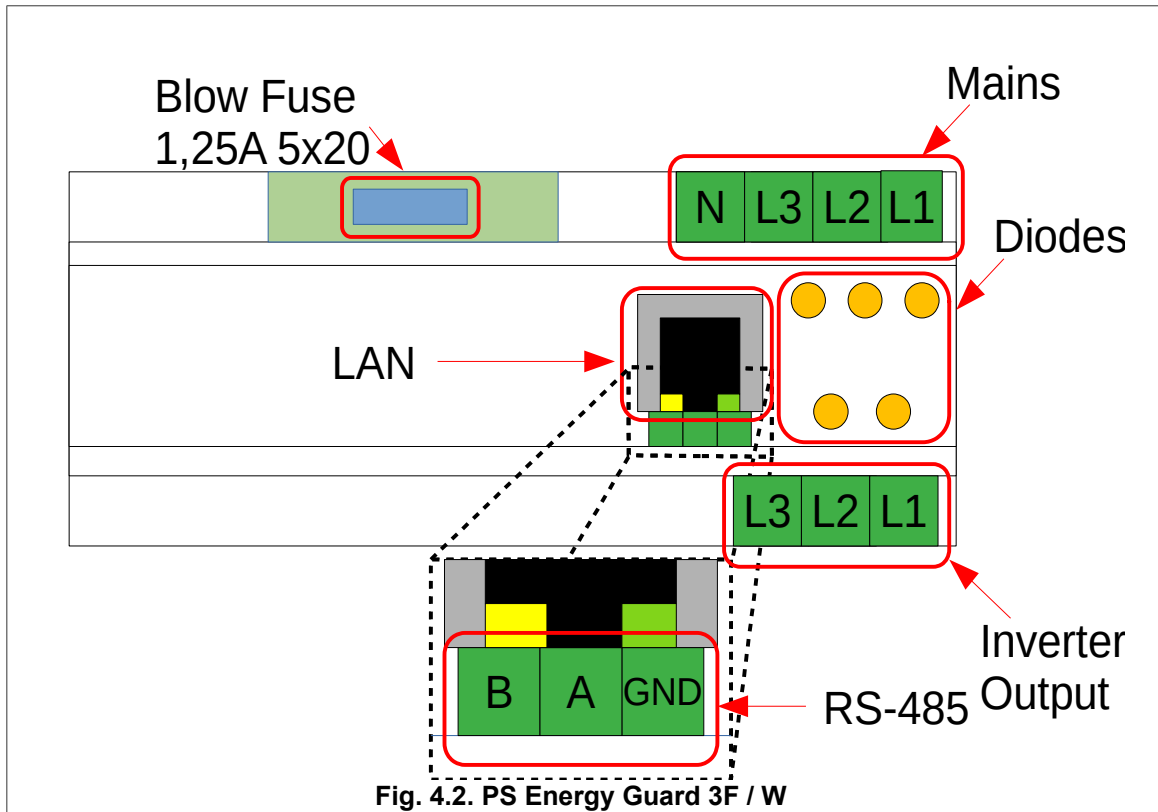


Fig. 4.2. PS Energy Guard 3F / W

Fig. 4.2. PS Energy Guard 3F / W is showing the connectors on the PS Energy Guard for three-phase PS300 inverters appliances with internal current sensors.

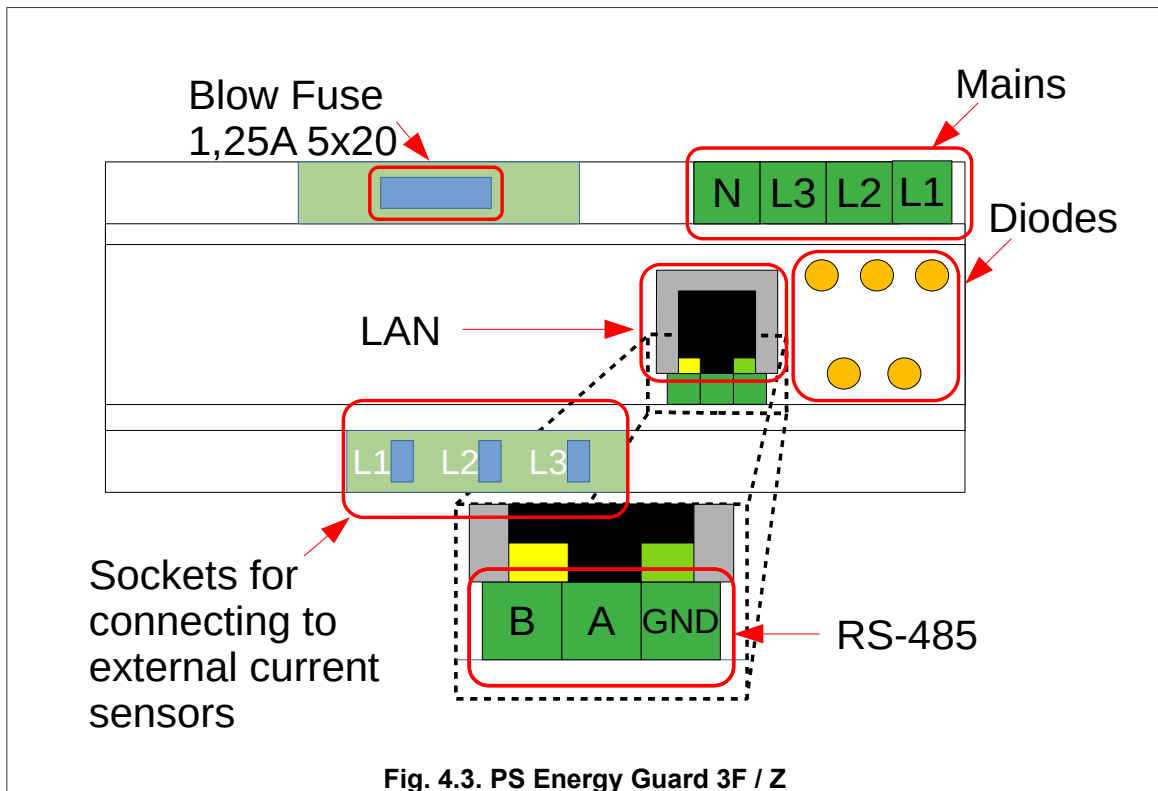


Fig. 4.3. PS Energy Guard 3F / Z

Fig. 4.3. PS Energy Guard 3F / Z is showing the connectors on the PS Energy Guard for three-phase PS300 inverters appliances with external current sensors.

5. Connection diagrams

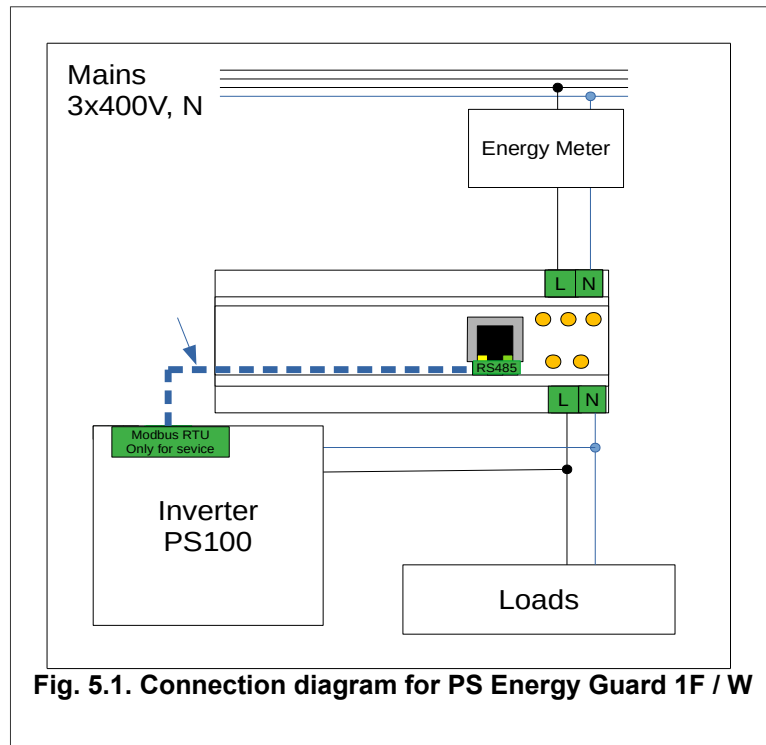


Fig. 5.1. Connection diagram for PS Energy Guard 1F / W is showing the how to connect PS Energy Guard with one-phase PS100 inverters.

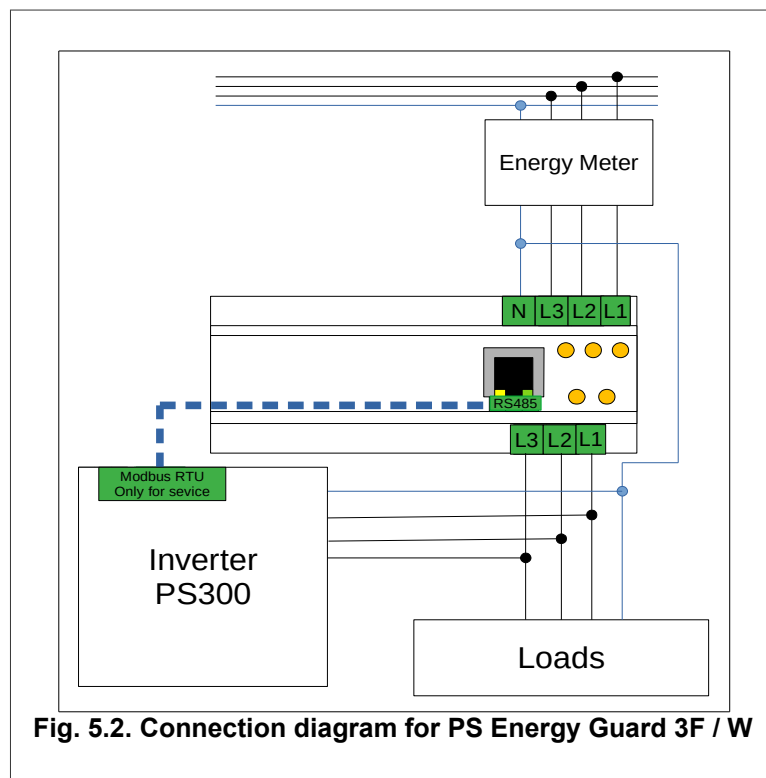


Fig. 5.2. Connection diagram for PS Energy Guard 3F / W is showing the how to connect PS Energy Guard with three-phase PS300 inverters.

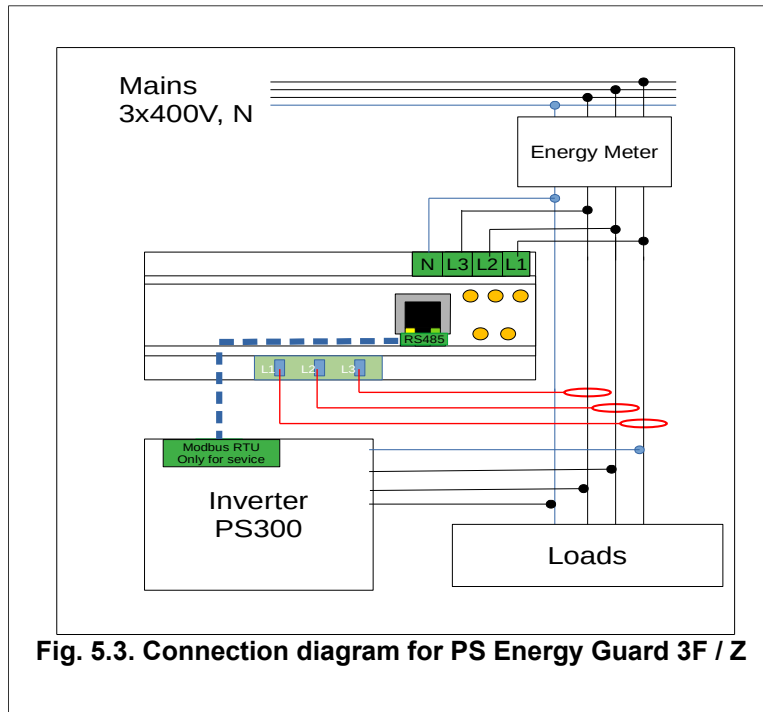


Fig. 5.3. Connection diagram for PS Energy Guard 3F / Z is showing the how to connect PS Energy Guard with three-phase PS300 inverters.

5.1. Installation notes:

- Installation must be carried out carefully, observing the phase sequence at each installation point.
- When using the device with external current sensors, pay attention to mount the sensors on the appropriate phase and that the arrow marked on the sensor runs from the mains to the electrical loads. (mains → loads)
- Communication cables should be routed using twisted pair cables, which will reduce the impact of interference on communication.
- In the event of a change in the cross-section of the cable, secure the cables with appropriately selected protection.

6. Measurement characteristics

Table 6.1: Characteristics of used current sensors

Sensor Code	Type of Sensor	Max. Cable Sizes	Maximum Current [A]	Maximum Active Power P [W] *	
				One-Phase Connection	Three-Phase Connection
PA3206NL	internal	25mm ²	40A	9kW	28kW
PA3209NL	external	Φ 7,5mm	100A	23kW	70kW
ART-B22-D070	external	Φ 70mm	300A	70kW	208kW

* calculated for sinusoidal current with $\cos\phi = 1$ and 230VAC / 400VAC mains.

7. Connecting the one-phase PS100 inverter with PS Energy Guard

Attention! All connections must be made without voltage!

1. Connect the PS Energy Guard according to the diagrams in chapter 5 Connection diagrams
2. Connect the PS100 inverter as described in the user manual which delivered with the inverter.
3. Connect the RS485 communication socket on the PS Energy Guard to the RS485 (only for service) socket on the PS100 inverter using a twisted pair cable. When connecting, connect A-A and B-B.
4. Apply voltage and select OK in the inverter → Settings → Service, enter the service code 123321 and press OK, this will unlock access to the service group. Then select Parameters. The up and down buttons can be used to navigate between groups.
5. The parameter from group 10 with the number 29 (10.29) determines the phase in which the PS100 inverter is connected. At the same time, setting this parameter to "0" disables the power limitation. The phase designations are given below:

Value of parameter 10.29	Action
0	Power limitation off
1	PS100 inverter on phase L1
2	PS100 inverter on phase L2
3	PS100 inverter on phase L3
4	The PS100 inverter limits the maximum output power to the value of par. 5.12 Does not require PS Energy Guard

6. The parameter from group 5 with the number 12 (5.12) defines the power to which the power flow in the installation will be limited. A negative value means the possibility of sending energy to the power grid. A positive value or equal to 0 does not allow it to flow into the mains and all power is consumed by loads connected behind the PS Energy Guard.

! It is possible to connect several PS100 inverters together with PS Energy Guard. To do this, connect the inverters at different phases. Connect RS485 communication in series from the measuring device to the last inverter, the communication terminators should be left on the last inverter in series. Set the power phase on which it is connected on each inverter with parameter 10.29.

8. Connecting the three-phase PS300 inverter with PS Energy Guard

Attention! All connections must be made without voltage!

1. Connect the PS Energy Guard according to the diagrams in chapter 5 Connection diagrams
2. Connect the PS300 inverter as described in the user manual which delivered with the inverter.
3. Connect the RS485 communication socket on the PS Energy Guard to the RS485 (only for service) socket on the PS100 inverter using a twisted pair cable. When connecting, connect A-A and B-B.
4. Apply voltage and select OK in the inverter → Settings → Service, enter the service code 123321 and press OK, this will unlock access to the service group. Then select Parameters. The up and down buttons can be used to navigate between groups.
5. The parameter from group 10 with the number 29 (10.29) determines the phase in which the PS300 inverter is connected. At the same time, setting this parameter to "0" disables the power limitation. The designation of the operating modes is shown below:

Value of parameter 10.29	Action
0	Power limitation off
1	The inverter takes into account the active power of the least loaded phase when limiting
2	The inverter limits the power taking into account the sum of active power from three phases
4	The PS300 inverter limits the maximum output power to the value of par. 5.12 Does not require PS Energy Guard

! Example 1: The installation where the inverter is connected must not give off energy to the grid at any phase, but at the same time the load is unbalanced and variable in time. Parameter 10.29 must be set to 1, which cause the inverter selects the least loaded phase. Parameter 5.12 should be set to 0, which will cause the inverter to limit power production when it equalizes consumption at the least loaded phase.

6. The parameter from group 5 with the number 12 (5.12) defines the power to which the power flow in the installation will be limited. A negative value means the possibility of sending energy to the power grid. A positive value or equal to 0 does not allow it to flow into the mains and all power is consumed by loads connected behind the PS Energy Guard.

It is possible to connect several PS300 inverters together with PS Energy Guard. To do this, connect the inverters to the network. Connect RS485 communication in series from the measuring device to the last inverter, the communication terminators should be left on the last inverter in series. Set parameter 10.29 on each inverter to determine the lockout operation mode. However, in parameter 5.12 you should set increasing power every few hundred watts, e.g. 300W, 600W, 900W. Thanks to this, as demand changes, inverters will limit their power.

9. Remote Monitoring via www.inverters.pl

It is possible to connect the PS Energy Guard device to the Internet and view installation data.

To do this, connect an Internet cable to the LAN output. The device has DHCP support and will download an IP address if available.

The parameters can be viewed through the account created at www.inverters.pl

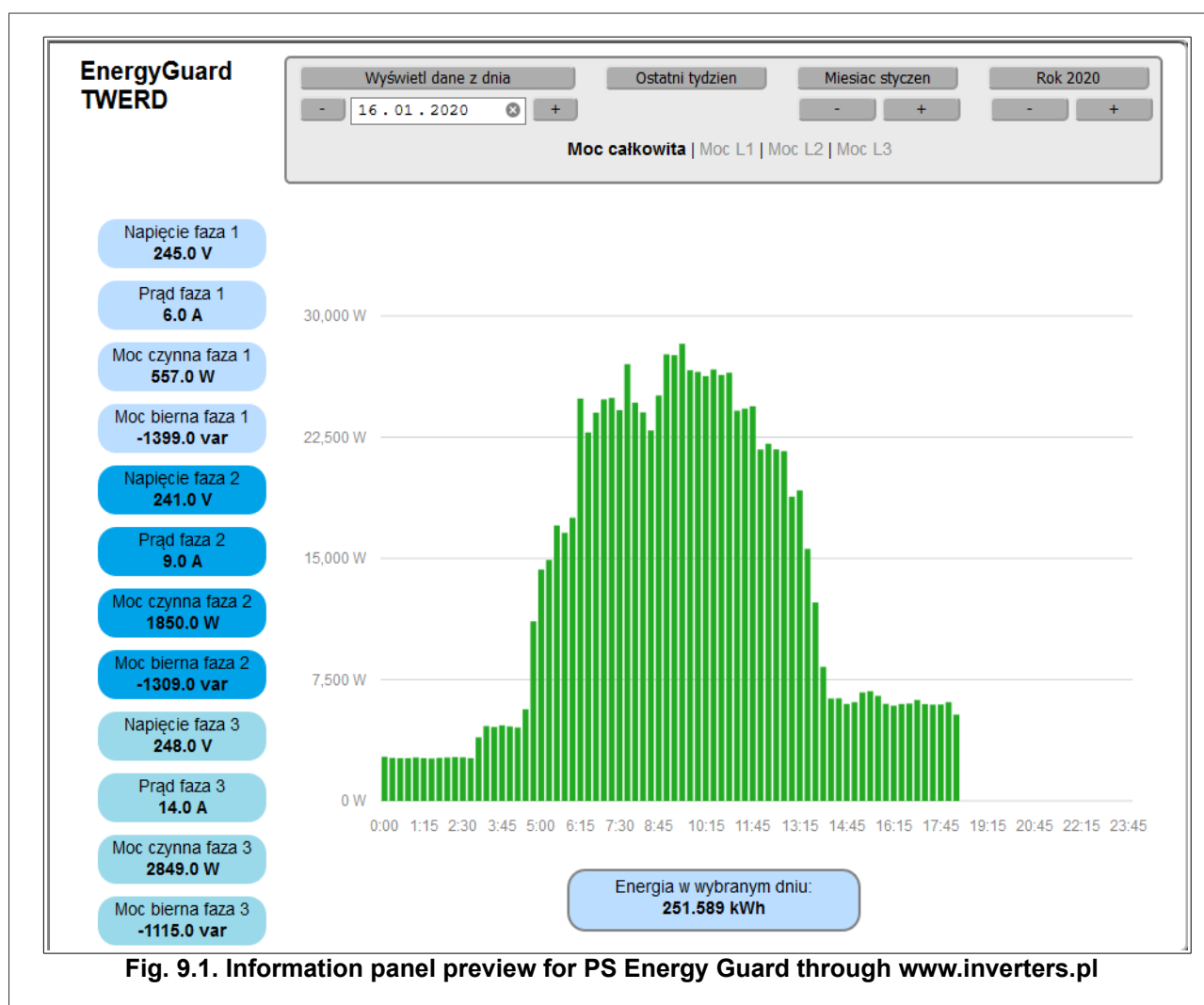


Fig. 9.1. Information panel preview for PS Energy Guard through www.inverters.pl

9.1.

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