TWERD ENERGO-PLUS

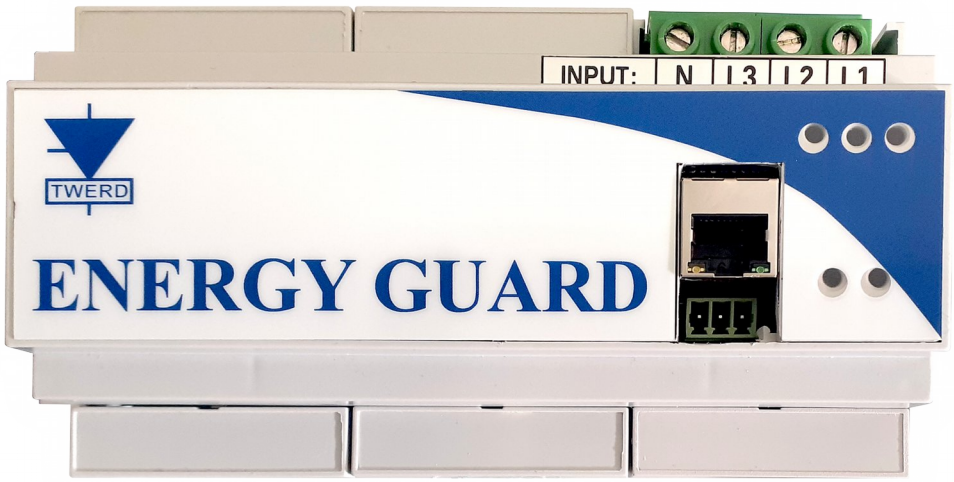
Renewable Energy Sources

Energy meter module
for PS100 and PS300
Inverter Series

PS Energy Guard

User manual

Version 3.1



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Contents

1. Device description

The **PS Energy Guard** module is a measuring device designed to monitor the energy flow in renewable energy installations and energy storage facilities.

The **PS Energy Guard** module measures the active power, reactive power and apparent power of a single-phase or three-phase network and sends the current values to the PS100, PS300 or BSI1000 systems to regulate the energy flow.

The **PS Energy Guard** module can be equipped with internal or external electric current sensors.

> **!** Please note that the PS Energy Guard module is not an electricity consumption meter and its readings cannot be used to settle electricity consumption!

2. Order code

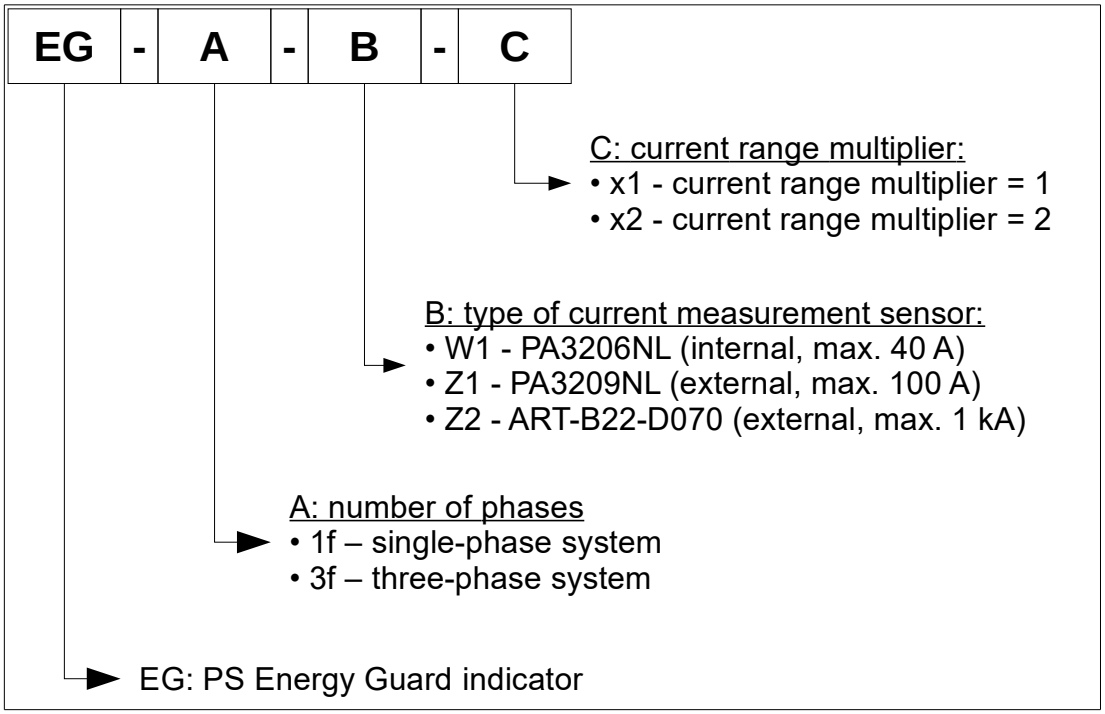

Fig. 2.1. Order code

For example, the symbol **EG-3f-Z2-x2** means a three-phase Energy Guard module with an external sensor of the **ART-B22-D070** type and a measurement current of up to **2 kA**.

3. Conditions of safe operation

Before start to work with the device 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 device.

RISK OF ELECTRIC SHOCK

HOT SURFACE

3.1. Warnings

- Incorrect installation, using, and maintenance of the device can cause physical injury or death, or damage to the device and connected equipment.
- Installation, using, and maintenance of the device must be performed only by qualified personnel.
- Before working on the device, disconnect all power sources and make sure that there is no dangerous voltage at the connection terminals.
- Before switching on the voltage, make sure the device has been correctly installed.
- Don't make any connections changes when the device is connected to the power supply.

3.2. Basic rules

- Don't measure the voltage endurance of any unit devices.
- To measure the cables insulation it is necessary to disconnect them from the device.
- 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.

3.3. 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 3.1. Installation, warehousing and transport conditions

	Installation site	During warehousing	During transport
Temperature	-10 ºC .. +40 ºC	-25 ºC .. +55 ºC	-25 ºC .. +70 ºC
		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

3.4. 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.

4. Parameters

Table 4.1: 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}	A	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

5. Variants of the PS Energy Guard module

Figures 5.1 - 5.6 show the configurations of connectors used in various variants of the PS Energy Guard module:

- PS Energy Guard EG-1F-W - fig. 5.1, 5.2
- PS Energy Guard EG-3F-W - fig. 5.3, 5.4
- PS Energy Guard EG-3F-Z – fig. 5.5, 5.6

Installation notes:

- the installation must be carried out carefully, maintaining the sequence of phases at each point of the installation,
- when using the device with external current sensors, pay attention to the following:
  - install sensors on the appropriate phase,
  - the label with the marking placed on the sensor was directed towards the network,
- communication cables should be routed using twisted pair, which will reduce the impact of interference on communication,
- if the cross-section of the cable is changed, the cables should be protected with appropriately selected protection.

5.1. PS Energy Guard EG-1F-W

Single-phase version with internal current measurement transducer.

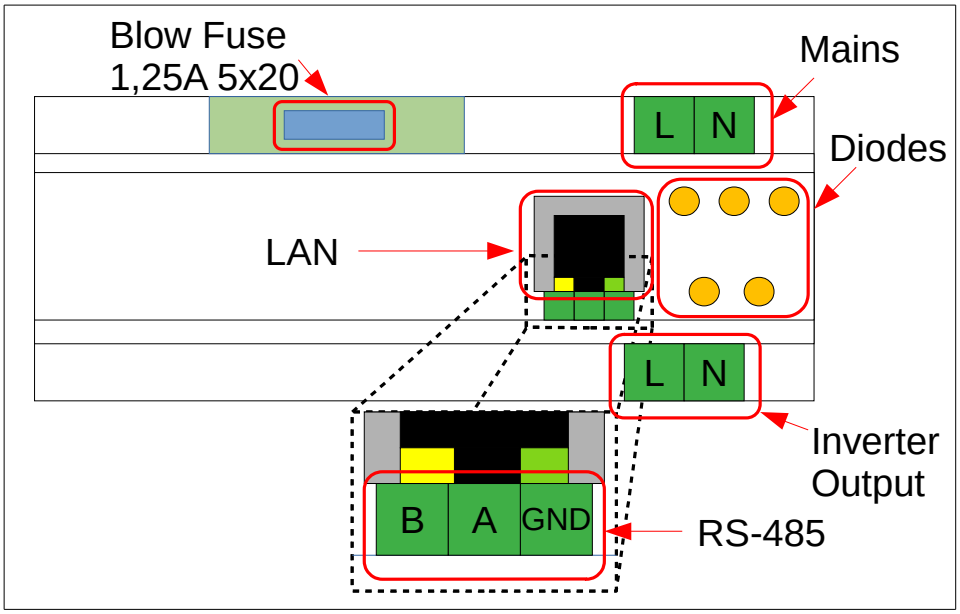

Fig. 5.1. PS Energy Guard – 1F-W variant

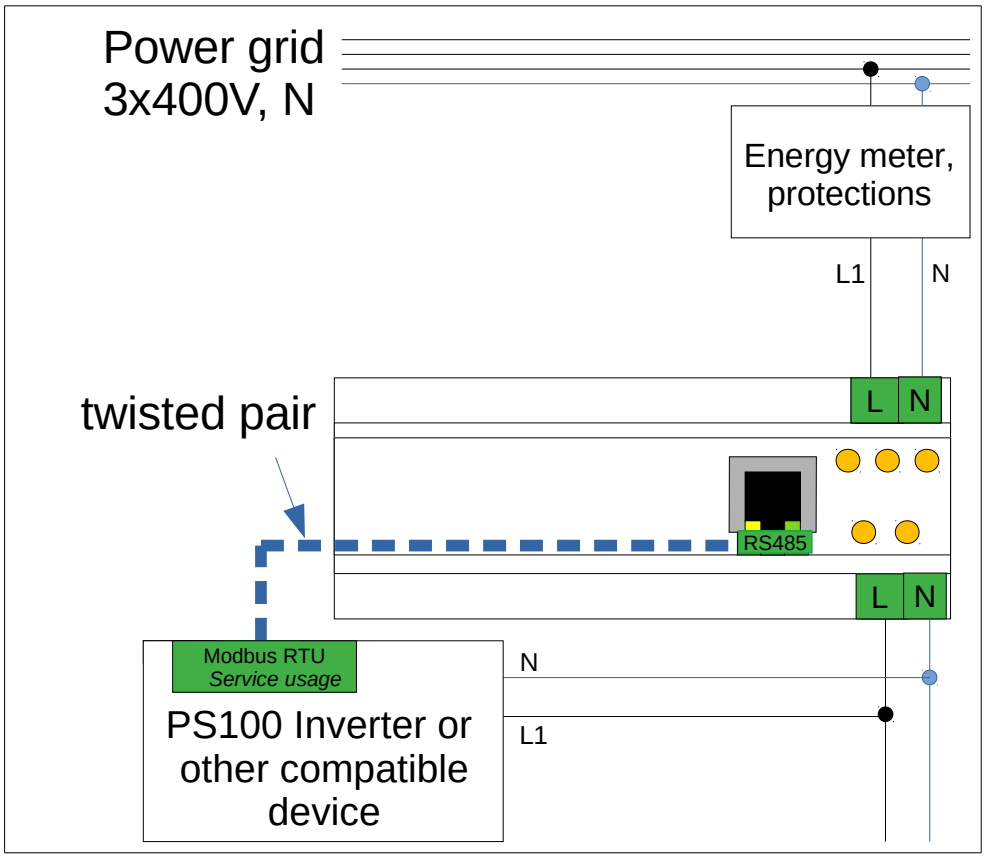

Fig. 5.2. PS Energy Guard 1F-W - connection diagram

5.2. PS Energy Guard EG-1F-W

Three-phase version with internal current measurement transducer.

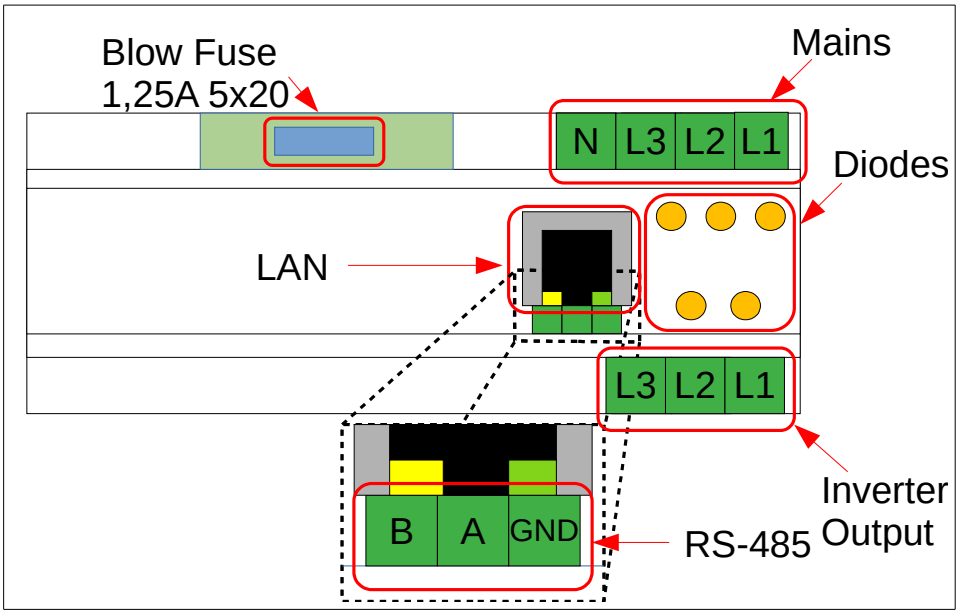

Fig. 5.3. PS Energy Guard – 3F-W variant

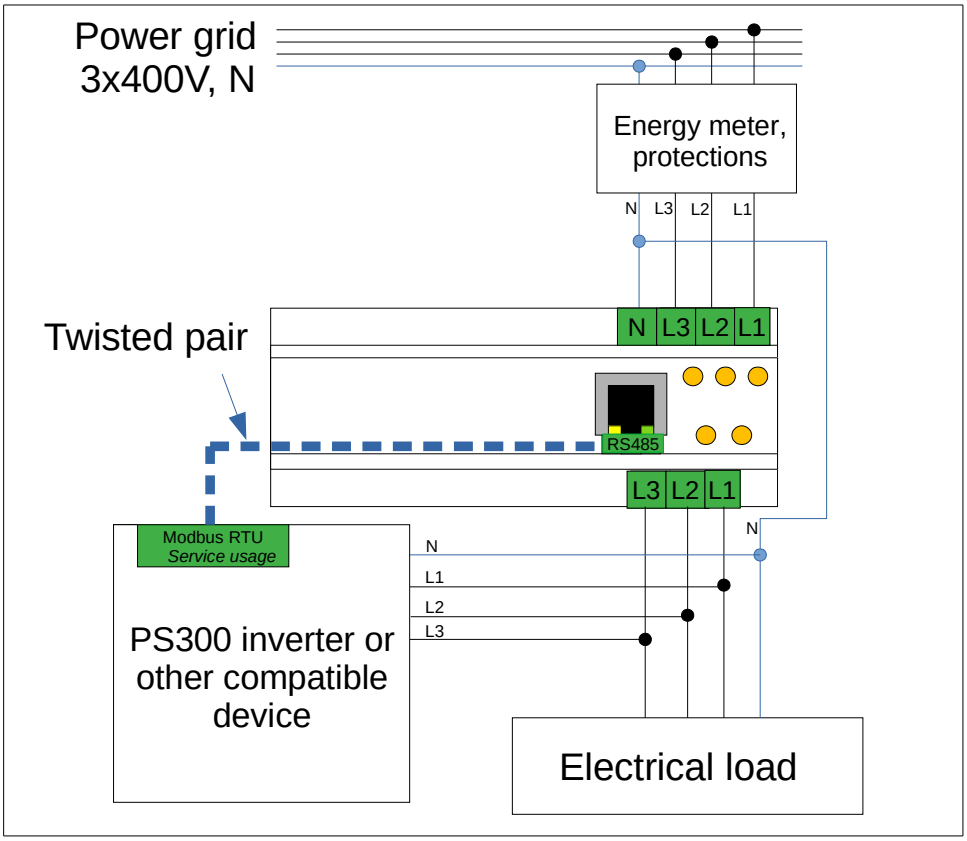

Fig. 5.4. PS Energy Guard 3F-W - connection diagram

5.3. PS Energy Guard EG-3F-Z

Three-phase version with external current measurement transducer.

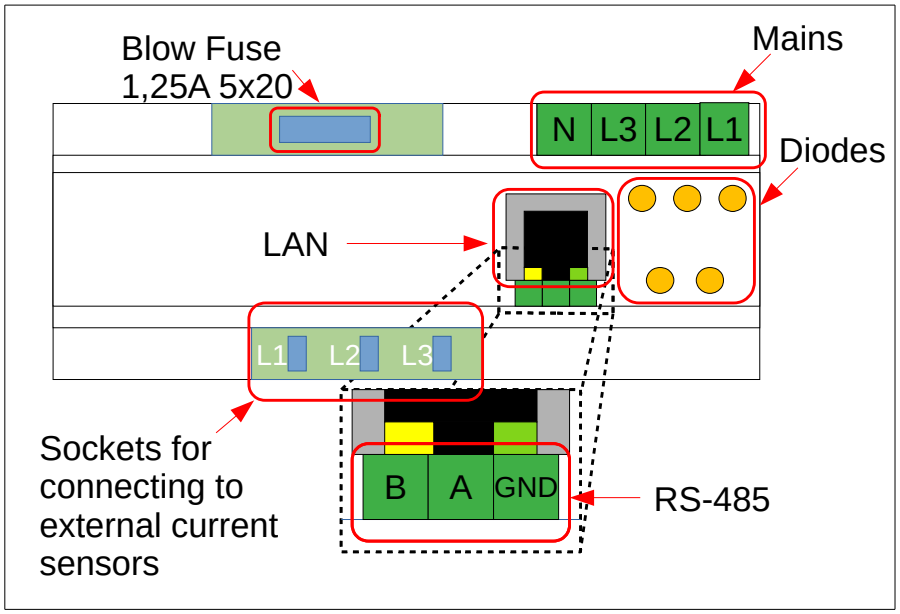

Fig. 5.5. PS Energy Guard – 3F-Z variant

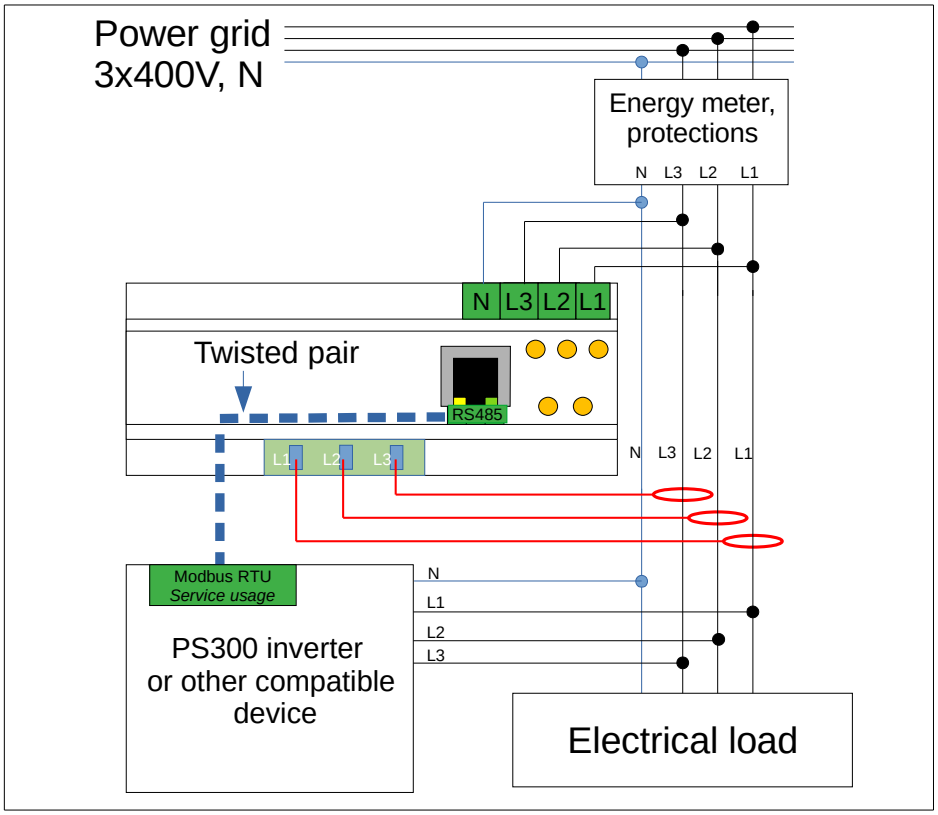

Fig. 5.6. PS Energy Guard 3F-Z - connection diagram

6. Current measurement transducers

Table 6.1: Parameters of the current transmitters used

Transducer symbol	Mnożnik prądu [4]	Transducer type	Max. cable diameter	Maximum current [A]	Max. active power P [W] [1]	
					1-phase connection	3-phase connection
PA3206NL	1	internal	16 mm² [2]	40 A	9 kW	28 kW
PA3209NL	1	external	Φ 7,5 mm [3]	100 A	23 kW	70 kW
ART-B22-D070	1	external	Φ 70 mm [3]	1000 A	230 kW	692 kW
ART-B22-D070	2	external	Φ 70 mm [3]	2000 A	460 kW	1385 kW

1) Calculated for a sinusoidal current with cosφ=1 and a network voltage of 230/400 VAC.
2) For each wire.
3) Transducer bore diameter.
4) The current multiplier is determined at the time of placing the order and cannot be changed later.

When using the PA3209NL transducer, mount it on the cable so that the "PULSE" inscription is on the mains side (Fig. 6.1).

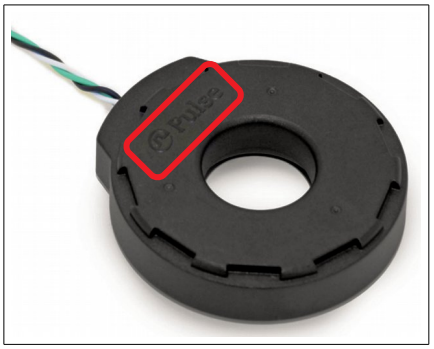

Fig. 6.1. PA3209NL transducer

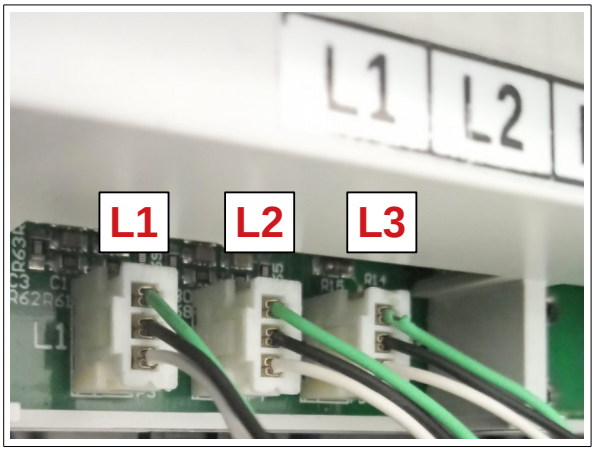

Fig. 6.2. Connecting PA3209NL transmitters to PS Energy Guard

7. Connection to the PS100 single-phase inverter

Attention! All connections must be made in a voltage-free condition!

1. Connect PS Energy Guard according to the diagrams presented in chapter 5.
2. Connect the PS100 inverter according to the instructions attached to the inverter.
3. Connect the RS485 communication socket in PS Energy Guard with the RS485 socket (service usage) in the PS100 inverter using a twisted pair cable.
   When connecting, connect the A-A and B-B inputs.
4. Apply voltage and select OK → Settings → Service in the inverter, enter the service code **123321** and press OK, this will unlock access to the service group. Then select Parameters. Use the up and down buttons to navigate between groups.
5. The parameter **10.29** determines the phase on which the PS100 inverter is connected. At the same time, setting the value of this parameter to "0" disables power limitation. The phase designation is given below:

Value of parameter 10.29	Description
0	Power limitation disabled
1	PS100 inverter on phase L1
2	PS100 inverter on phase L2
3	PS100 inverter on phase L3
4	The PS100 inverter first charges the batteries connected to the built-in charger and feeds the excess energy into the grid.
5	The PS100 inverter limits the maximum output power to the value in par. 5.12 Does not require PS Energy Guard

6. The parameter **5.12** determines the power to which the power outflow in the installation will be limited. A negative value means the possibility of returning energy to the power grid. A positive value or equal to 0 does not allow flow into the network and all power is consumed by loads connected downstream of PS Energy Guard.

It is possible to connect several PS100 inverters with the Energy Guard module. For this purpose, inverters must be connected on different phases. Connect RS485 communication in series from the measuring device to the last inverter, leaving the communication terminators on the last inverter in the series. On each inverter, set parameter 10.29 to the power supply phase on which it is connected.

8. Connecting the PS300 3-phase inverter

Attention! All connections must be made in a voltage-free condition!

1. Connect the PS Energy Guard according to the diagrams presented in Chapter 5.
2. Connect the PS300 inverter according to the instructions attached to the inverter.
3. Connect the RS485 communication socket in PS Energy Guard with the RS485 socket (service usage) in the PS100 inverter using a twisted pair cable.
   When connecting, connect the A-A and B-B inputs.
4. Apply voltage and select OK → Settings → Service in the inverter, enter the service code **123321** and press OK, this will unlock access to the service group. Then select Parameters. Use the up and down buttons to navigate between groups.
5. The parameter **10.29** determines the phase on which the PS100 inverter is connected. At the same time, setting the value of this parameter to "0" disables power limitation. The phase designation is given below:

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

6. The parameter **5.12** determines the power to which the power outflow in the installation will be limited. A negative value means the possibility of returning energy to the power grid. A positive value or equal to 0 does not allow flow into the network and all power is consumed by loads connected downstream of PS Energy Guard.

It is possible to connect several PS300 inverters with PS Energy Guard. For this purpose, the inverters must be connected to the grid. Connect RS485 communication in series from the measuring device to the last inverter, leaving the communication terminators on the last inverter in the series. Set parameter **10.29** on each inverter specifying the lock operation mode. However, in parameter **5.12**, you should set increasing power every few hundred watts, e.g. 300 W, 600 W, 900 W. Thanks to this, as the demand changes, the inverters will limit their power.

Example 1

The installation where the inverter is connected cannot transmit energy to the grid on any phase, but at the same time the load is asymmetric and variable in time.

The value 1 should be selected in parameter **10.29**, which always selects the phase with the least load. Parameter **5.12** should be set to 0, which will cause the inverter to limit power production when it equalizes consumption on the least loaded phase.

Example 2

The installation with a connected inverter with a bidirectional charger and an energy bank is intended to reduce the demand for electricity. The manufacturer wants to limit the total power to 1 kW.

The value 1 should be selected in parameter **10.29**, which always selects the phase with the least load. Parameter **5.12** should be set to 1000W.

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

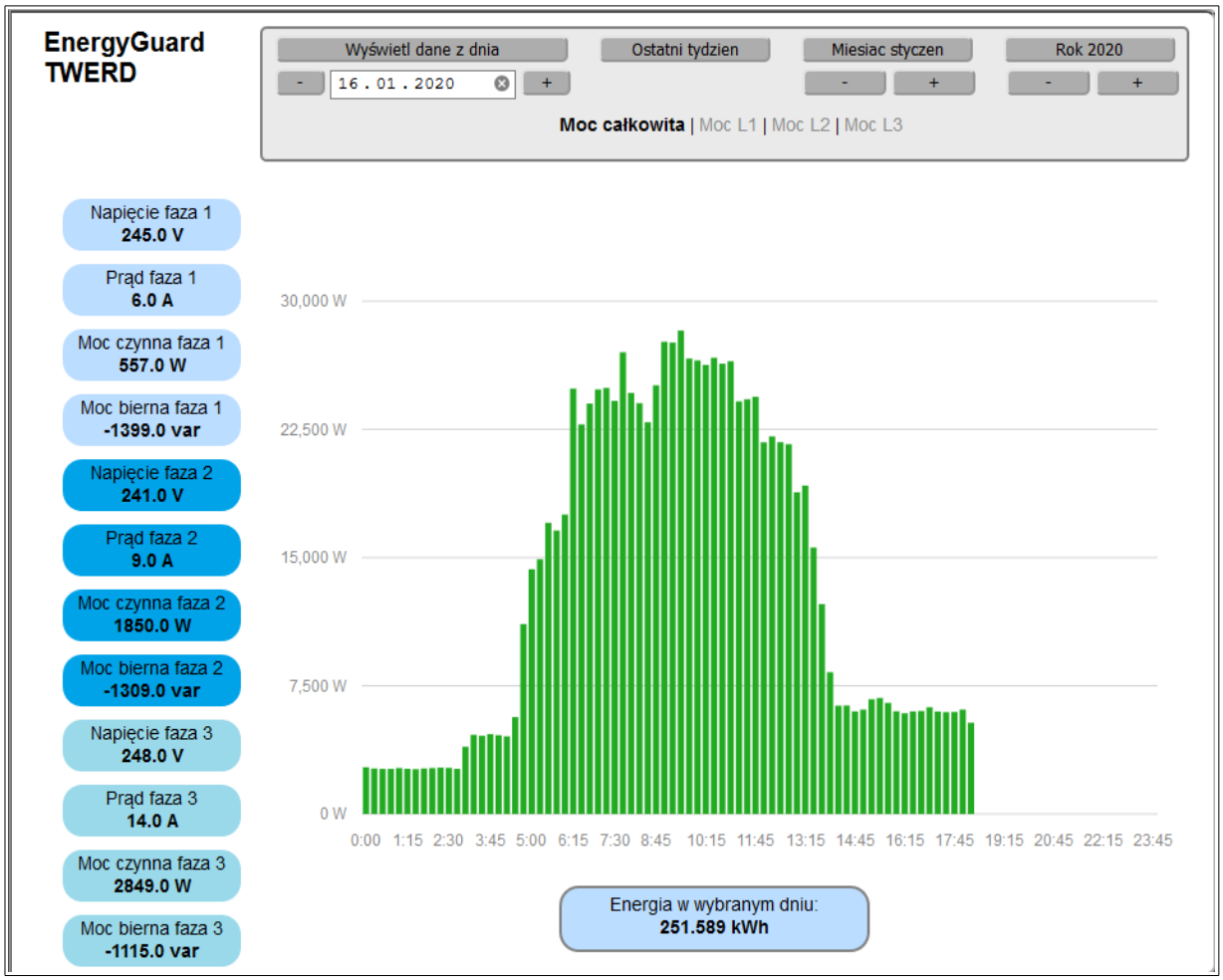

Fig. 9.1. Information panel preview for PS Energy Guard through www.inverters.pl

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