

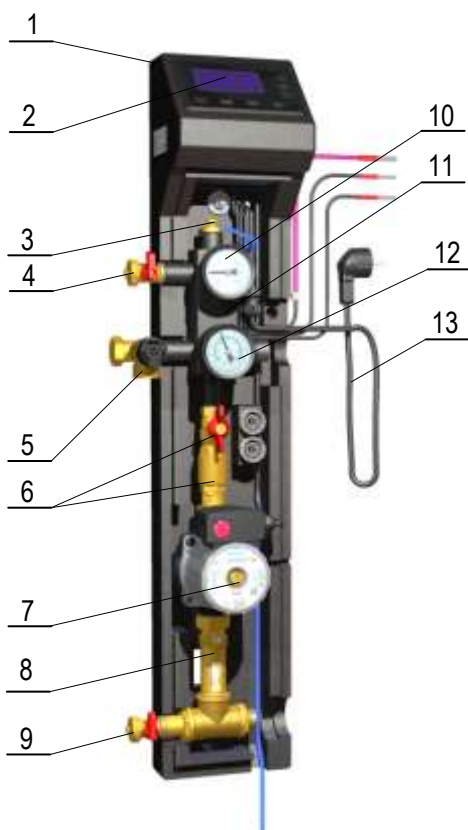
ASSEMBLY INSTRUCTIONS FOR THE PUMP AND CONTROL UNIT

1. Use and construction of the pump and control unit

Pump and control unit is used to cooperate with solar collectors in an installation with a required heat transfer fluid. Maximum flow rates of up to 28 l/min can be set, depending on the type of flow controller.

The pump and control unit is compacted in a foamed polypropylene cover and it contains accessories necessary for correct functioning of the solar installation.

Construction of the pump and control unit is presented in **Figure 1** below.



Rys. 1

1	Pump and control unit cover of foamed polypropylene
2	G422 controller with 4 temperature sensors
3	Automatic vent with a cable
4	Release valve - top
5	Safety valve 6bar
6	Ball valve with a non-return valve
7	Circulating pump WILO 15-6
8	Flow meter 8 - 28 l/min
9	Release valve - bottom
10	Thermometer 0 ÷ 120°C
11	Air separator
12	Manometer 0 ÷ 6bar
13	Power cord

Spacing of $\varnothing 10$ openings for attaching the unit

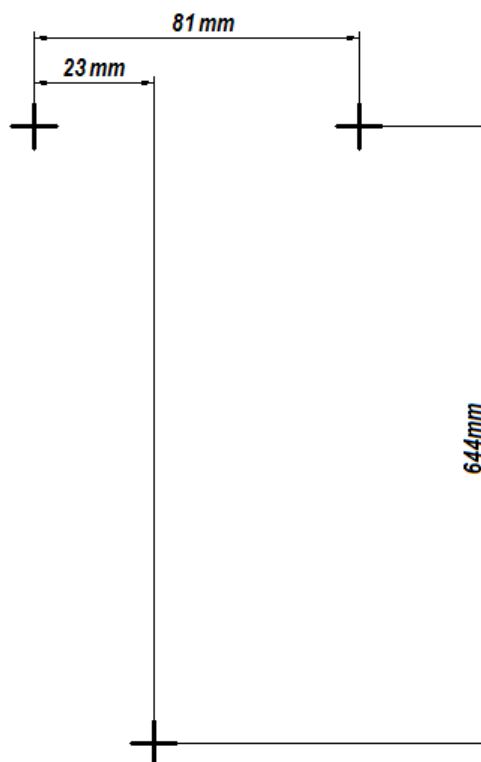


Fig. 2. Diagram of spacing between $\varnothing 10$ openings necessary for attaching the pump control unit

2. Diagram of solar installation connections

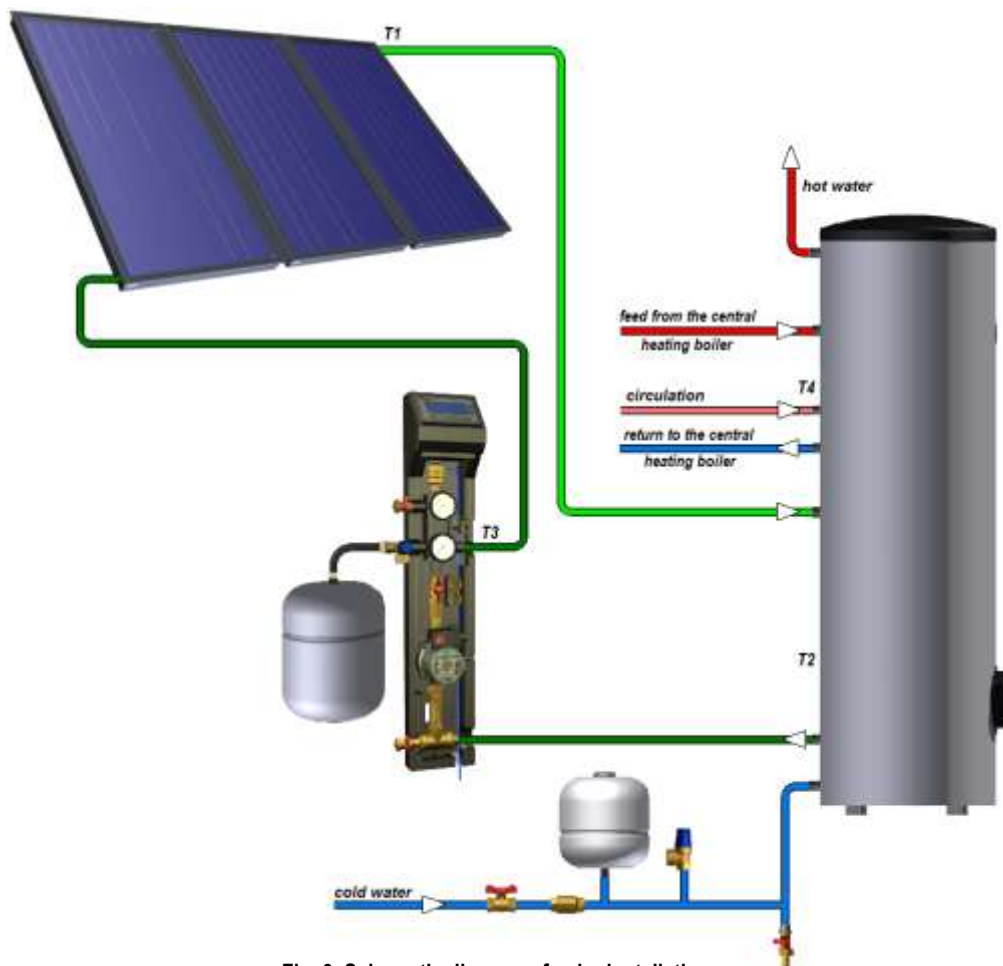


Fig. 3. Schematic diagram of solar installation

3. Assembly of the pump and control unit.

Consecutive steps.

- Attach the pump and control unit to the wall using 3 anchor screws in spacing as presented in **Figure 2**.
- Connect the hydraulic connections of the pump and control unit with the solar collectors, the boiler, and the expansion tank, as shown in the schematic diagram of the installation (**Fig. 3**).
- Cold water connection should be done according to the presented schematic diagram of the installation (**Fig. 3**), or the schematic diagram of the installation in a warranty card.
- Place temperature sensors in appropriate locations in the installation and connect to the controller (according to the diagram of electric connections presented in the later part of the instruction).






Filling and starting the installation.


The installation should be filled with a proper heat transfer fluid, namely **TERMSOL EKO** or **ERGOLID EKO**, which is a water solution of propylene glycol, with a solidification temperature of -25°C with an addition of an inhibitor pack, protecting the installation from corrosion.

ATTENTION!!! TERMSOL EKO should not be diluted with water.

System filling with heating medium, with the use of a rotary pump unit.

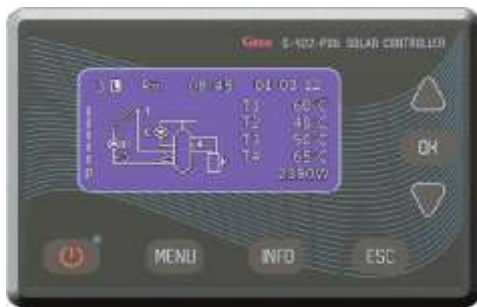
Consecutive steps.

- Unit pipes: connect supply pipe to the lower discharge valve (**9**), and overflow pipe to the upper discharge valve (**4**). Fill the unit tank with the heating medium, open discharge valves (**4** and **9**) and start up the rotary pump.
- After pumping the heating medium for about 30 seconds, close the ball valve (**8**) inside the ZPS unit (open valve causes the liquid to flow through the inner element of the ZPS unit).
- Do not switch off the rotary pump until full deaeration of the system – that is, till air bubbles stop appearing in the overflow pipe.
- When air bubbles stop appearing in the overflow pipe, close the upper discharge valve (**4**) and continue pumping heating medium to the system, to reach system overpressure of $p = 2.5$ bar, which is measured by pressure gage (**12**). When required overpressure is reached, close lower discharge valve (**9**), switch off rotary pump and open the ball valve (**8**).
- Insert the controller plug into the $\sim 230\text{V}$ mains socket and switch on the solar collector pump in the manual mode. In order to switch on the pump in a manual mode, one should:
 - Switch on the controller with the  button - CAUTION!! this will calibrate temperature detectors.
 - Go to MENU pressing the  button.
 - Using the arrow buttons  or  choose the option „Manual control” and confirm pressing  button.
 - Switch off the pump P manually replacing the option „On” with „Off”.
- Remaining air should be removed automatically by opening the manual valve (**3**).
- In case of a reduction or interruption of the flow (**flow controller floater - fell**) turn counter clockwise the circulation pump main screw (**11**) and let out the air blocking the pump. Continue till full deaeration of the system.
- In case the pressure measured by the pressure gage (**12**) is below 1.5 bar, fill in the system to reach required system overpressure of $p = 2.5$ bar.

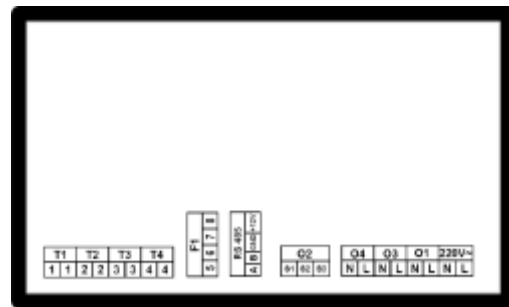
- i. Disconnect supply and overflow pipes of the rotary pump.
- j. When option **Measure = Rotameter**, turn on option of measurement from the electronic flow meter.
- k. Set the required flow rate of the heating medium – to do this, choose the option **flow/rotameter**.
- l. Entering the **Nominal** option will switch the pump on. While in the **Nominal** option, input the proper value calculated for the number of solar collectors (count 1.5 l/min per each flat plate collector, or 1.0 l/min per each evacuated tube collector) - **respective flow is indicated by the bottom of the float in the flow controller**.
- m. If current flow exceeds requirements, reduce rotational speed of the pump, by switching to the lower pump mode.
- n. If, even with the pump switched to the 1-st mode, the flow is still excessive, it can be controlled with the screwdriver via the flow regulator screw (8) – closing or opening will change the flow rate. Set the heating medium flow so that value read on the flow meter scale coincides with the input value **Nominal**.
- o. Go to the option **Minimal** (option is active when the option of Regulation of rotational speed of collectors pump is on) – the pump rotational speed will decrease and so will decrease flow on the flow regulator. Read the value and input into the controller.
- p. Input the set circulation pump mode number into the controller.
- q. Set the controller in the automatic mode by triple pressing  button.

G422 electronic controller

The controller is an independent control block designed to control circulation pumps and other devices, which may be a part of solar collector installations. G422 controller has 4 temperature sensors, which depending on the selection of one of various installation programmes (schemes), should be placed in appropriate temperature measurement locations indicated in the diagram of the respective installation scheme (see: G422 independent control block operation manual).



Front view



Back view

Input / Output	Description
220V~	Connection to a 230V~/50Hz power line
O1	Collector pump input – Maximum current capacity: 3,15A
O2	Relay output – potential free output
O3	Circulation pump input - Maximum current capacity: 8A
T1	Solar collector temperature sensor
T2	Heater temperature sensor – bottom coil
T3	Air separator temperature sensor (heat transfer return)
T4	Heater temperature sensor – top coil
F1	Output from the electronic flow meter – type G916 5..... +12V 6..... GND 7..... +FRQ 8..... GND
RS485	Input: 9:+A, 10: -B, 11: GND, 12: +12V

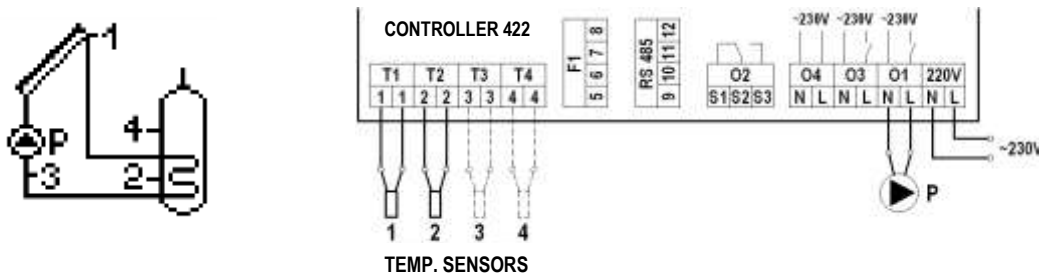



Fig. 5. Schematic and electric diagram of installation no. 1

ATTENTION!!! On the electric diagram dashed lines denote sensors which may be connected, but are not necessary for proper functioning of the controller (for scheme no. 1 these are sensors T3 and T4).





Description of G422 controller

Controller is equipped with an LCD screen and 7 buttons.


After connecting electric connections correctly, turn on the controller by pressing .

In normal operation, the controller's screen displays:

- Current installation scheme number and diagram,
- Current date and time,
- Current temperatures in respective measurement locations (a lack of the sensor is indicated by displaying - - -, and damage of the sensor by displaying **Err** messages)

- During pump's operation (pump symbol flashing) instantaneous power output of solar collectors is displayed. Pressing  selects controller's menu.
- Using directional buttons  and  select the desired option and confirm by pressing .

The selected options of the controller include, for example:

Scheme selection – allows for selecting one of various installation schemes. After selecting the desired scheme, confirm by pressing .

Parameters – option of setting operating parameters

Control parameters – a set of options, which enable configuration of operating parameters for the selected scheme,

Heat transfer fluid – solidification temperature of the heat transfer fluid (this parameter is necessary for calculating collectors' instantaneous power output),

Flow rate – flow rate of the heat transfer fluid used in the solar installation.

Description of control parameters for the first programme.

Parameter	Description	Range
Solar collector type	This parameter allows for choosing a type of solar collector (flat or tube). When selecting tube in the period from 8AM to 5PM (at full hour), solar pump turns on for a minute. Since the temperature sensor is located on the bottom of the collector, especially in case of low temperature of the outside air, the temperature measured by the sensor may be different than that inside the collector. If sensor T1 reaches the temperature required to start the operation, the pump will start working.	Flat / Tube
Temp. T1&T2 difference – pump ON	It defines operating conditions of the collector pump. If the temperature in solar collectors measured by sensor T1 is greater than the sum of $\Delta T1$ and temperature of the water in the water heater T2 ($T1 > \Delta T1 + T2$), the pump will switch on. Additionally, to ensure stable operation of the system, hysteresis protection was applied, that is, 1°C for switch-on and 2°C for switch-off.	4 – 15 °C
Max.Temp. T2 OFF collectors' pump	It relates to temperature sensor T2 , located on the bottom of water heater. It defines the maximum temperature permitted in the water heater, measured by the sensor T2 (above that temperature the solar installation will stop working).	10 – 85 °C
Regulation of collectors' pump	Regulation of the operation speed of the solar collector pump. When ON, the pump speed is adjusted smoothly by the controller to ensure proper flow rate of the heat transfer fluid at any time. When OFF the controller switches the pump on and off alternatively. Switching the pump regulation ON may cause noise level of the solar collector pump to increase, which is a typical phenomenon.	Yes / No
Overheat protection of collectors ON	It enables switching on solar collector pump P to prevent overheating of the installation. When the temperature on the collectors (measured by sensor T1) reaches 110°C the controller turns the pump on to evacuate excess heat. Once the temperature drops to 100°C or it reaches the preset value for MaxTempT2 in the water heater, measured by sensor T2 , the pumps is turned off. This parameter is active despite exceeding the maximum water temperature set as T2max .	Yes / No
MaxTemp. T2 overheat protection OFF	It defines the maximum temperature in the water heater at which the overheat protection function is active.	60 – 85 °C
Freezing protection of collectors ON	It applies to countries where heat transfer fluid in the collector circuit is water and defines when the function should be active to prevent the installation from freezing. When ON, solar pump P turns on if water in the water heater, measured by sensor T2 is greater than 7°C and temperature on the collectors drops below 0°C. In case of further temperature drop in the water heater up to 4°C or the increase of the temperature on the collectors above 0°C, the pump will turn off. The function is active only when value of the heat transfer fluid parameter is set to 0°C.	Yes / No

Alarms indicated by the controller

Temperature sensor error


The controller is provided with a control function for installed temperature sensors. If any sensor fails or its wire is broken, the sensor will be disconnected and the controller will indicate an alarm for such sensor. In the alarm state, all outputs are OFF. Additionally, when the controller is in the main screen mode, alarm occurrence can be signalled with a sound.

In the alarm mode, it is still possible to view the menu, configure the parameters and control external devices manually. Indication of the failed sensor is presented on the main screen. Temperature value next to the sensor is replaced with "Err" code. If the controller reports sensor alarms, check the system for correct installation, connections of sensor and damage of the temperature sensor.


Insufficient heating medium flow rate while pump is operative.

Option of the analog rotameter is switched on: (option Flow/Rotameter : Measure : Rotameter)

Insufficient flow control has two stages.

Stage I – If, after 5 min collectors pump operation, temperature delta $T1-T3 > 30^{\circ}\text{C}$ – the controller generates acoustic signal and displays message: **INSUFFICIENT FLOW. CHECK AND ADJUST**. After accepting with the  button, the message will disappear and the acoustic signal is stopped.

Stage II – If, after additional 5 min collectors pump operation, temperature delta $T1-T3 > 50^{\circ}\text{C}$ - the controller generates acoustic signal, switches the collectors pump off and displays message: **INSUFFICIENT FLOW. PUMP FAILURE. AIR TRAPPED IN THE SYSTEM. FLOW BLOCKED**.

After user accepts with the  button, the solar collectors pump is switched on again. If the flow is still insufficient, the alert will be cyclically repeated.

ATTENTION!!! All options are described in detail in a separate manual of the controller.