

TECH TECH CONTROLLERS

USER MANUAL

EU-401N PWM

EN



www.tech-controllers.com

I. Safety

Before using the device for the first time the user should read the following regulations carefully. Not obeying the rules included in this manual may lead to personal injuries or controller damage. The user’s manual should be stored in a safe place for further reference. In order to avoid accidents and errors it should be ensured that every person using the device has familiarized themselves with the principle of operation as well as security functions of the controller. If the device is to be sold or put in a different place, make sure that the user’s manual is there with the device so that any potential user has access to essential information about the device.

The manufacturer does not accept responsibility for any injuries or damage resulting from negligence; therefore, users are obliged to take the necessary safety measures listed in this manual to protect their lives and property.

WARNING

- **High voltage!** Make sure the regulator is disconnected from the mains before performing any activities involving the power supply (plugging cables, installing the device etc.).
- The device should be installed by a qualified electrician.
- Before starting the controller, the user should measure earthing resistance of the electric motors as well as the insulation resistance of the cables.
- The regulator should not be operated by children.

NOTE

- The device may be damaged if struck by a lightning. Make sure the plug is disconnected from the power supply during storm.
- Any use other than specified by the manufacturer is forbidden.
- Before and during the heating season, the controller should be checked for condition of its cables. The user should also check if the controller is properly mounted and clean it if dusty or dirty.



Care for the natural environment is our priority. Being aware of the fact that we manufacture electronic devices obligates us to dispose of used elements and electronic equipment in a manner which is safe for nature. As a result, the company has received a registry number assigned by the Main Inspector of Environmental Protection. The symbol of a crossed out rubbish bin on a product means that the product must not be thrown out to ordinary waste bins. By segregating waste intended for recycling, we help protect the natural environment. It is the user's responsibility to transfer waste electrical and electronic equipment to the selected collection point for recycling of waste generated from electronic and electrical equipment.

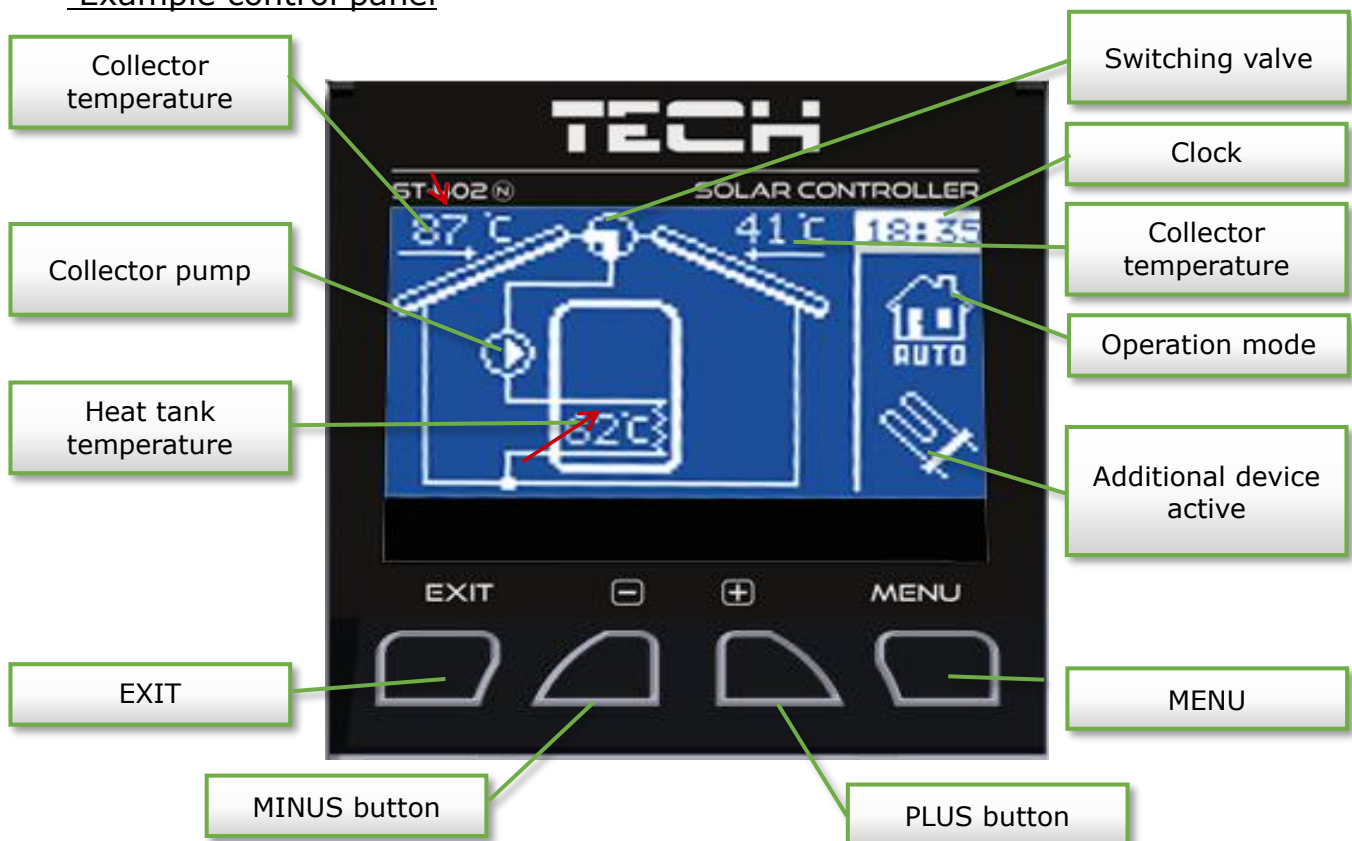
II. Use

EU-401N temperature regulator is intended for controlling solar collector systems in various configurations. The device controls the collector pumps (or both the pump and the valve) on the basis of solar batteries temperature and the accumulation tank temperature (two tanks). Optionally, it is possible to connect an additional device: circulating pump, electric heater or to send a signal to CH boiler in order to initialise the fire-up process.

Controlling the circulating pump and sending a fire-up signal to the CH boiler may be done directly from the controller. An additional signal relay is necessary in order to control the heater. The controller offers PWM pump control option enabling the user to adjust its rotational speed.

III. Principle of operation

Example control panel



Use buttons to navigate through the menu. Press MENU to enter the menu or confirm the settings. Use PLUS and MINUS buttons to switch between menu options. Press MENU to confirm your choice. In order to return to the main screen view (or higher level menu), press EXIT button. Follow the procedure to adjust the settings.










III. User menu



III.a) Home page

During standard operation of the controller, the **graphic** display shows the main page. Apart from the selected scheme, the display also shows:

- operation mode (or type of alarm),
- current time,
- collector temperature
- current temperature of the heat tank
- temperature of all additional sensors depending on selected configuration

On the right-hand side of the screen you may see the following icons:

Active operation mode icon		Icon of active additional device (peripherals)	
	Automatic operation mode		Circulating pump
	Collector defrost mode		Pellet boiler fire-up (voltage-free signal)
	Holiday mode		Heater
	Collector overheating (alarm mode)		Anti-legionella
	Sensor damage (alarm mode)		

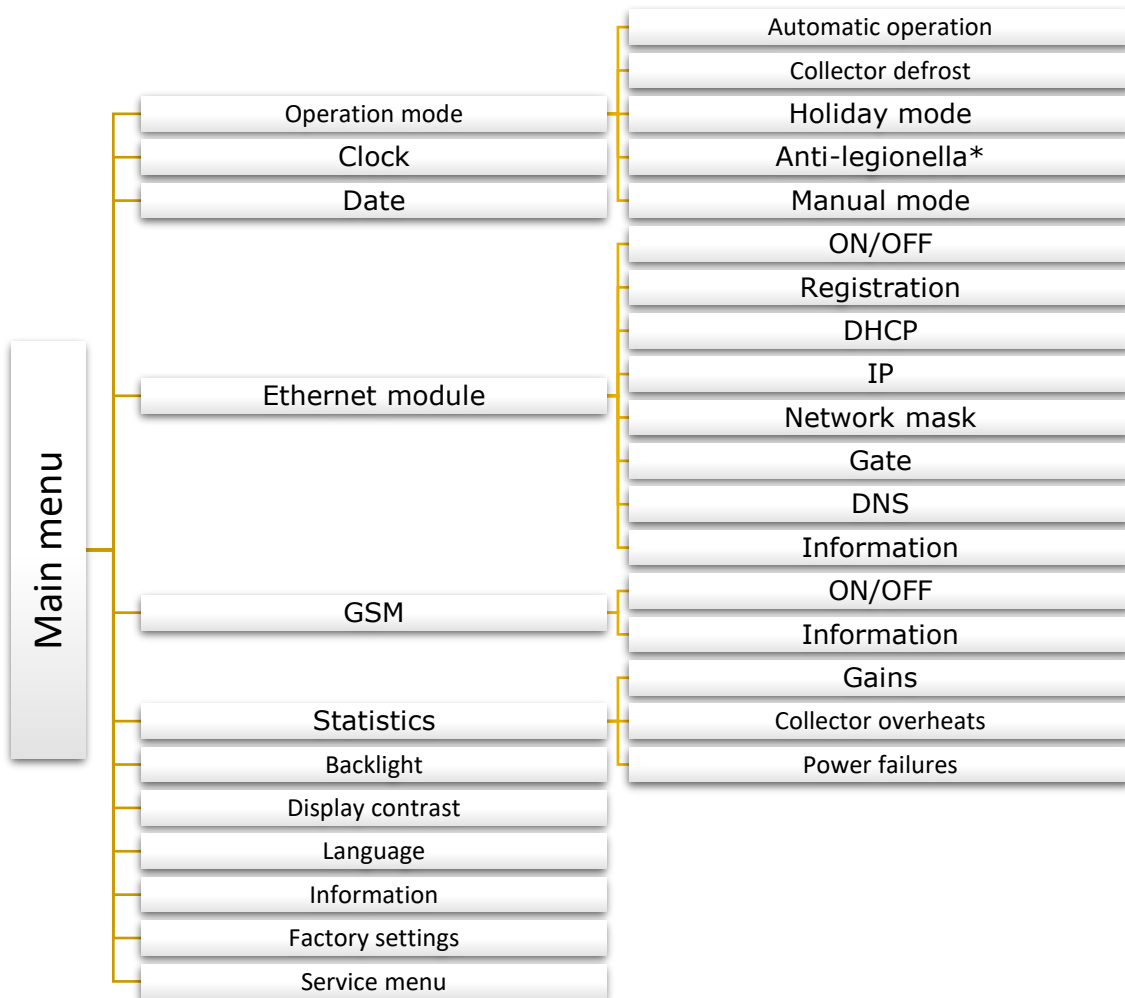
If one of the sensors is damaged, an additional icon  will be flashing in  the place of the damaged sensor temperature. The icon indicates which sensor was disconnected or damaged.

Additionally, the pump icon will be displayed on the system scheme (if the pump is working/rotating) or/and the valve icon will appear (with an indication of current circulation direction).

III.b) Main menu – block diagram

Due to multiple functions fulfilled by the controller, the menu is divided into Main menu and Service menu.

The main menu includes basic controller options such as operation mode, time and date settings, language version etc. It is illustrated by the following block diagram.



* The parameter is available only when an additional device (heater) is connected.

III.c) Operation mode

This function enables the user to select the operation mode.

Automatic operation.

In automatic operation mode the pump is active when the minimum difference between collector and tank temperature is reached (the temperature difference at which the pump is enabled is defined as *Solar pump activation delta in: SERVICE MENU>Pumps>Solar pump activation delta*).

The pump remains active until the pre-set temperature is reached (to define the pre-set temperature go to *SERVICE MENU>Accumulation tank>Pre-set temperature*) or until the difference between collector and tank temperature reaches solar pump deactivation delta : *SERVICE MENU>Pumps>Solar pump deactivation delta* (in this case the pump will be activated again when the collector temperature exceeds the tank temperature by the value of solar pump activation delta). When the pump is disabled after the pre-set temperature is reached, it will be activated again when the temperature drops below the pre-set value by the *tank hysteresis* value (the hysteresis may be defined in *SERVICE MENU>Accumulation tank>Tank hysteresis*).

Collector defrosting

This function enables the user to activate the collector pump manually in order to cause the snow deposited on the solar collector to melt. After this function has been activated, the mode is active for a user-defined period of time. After this time automatic operation is resumed. To set the defrosting time go to: *SERVICE MENU > Solar collector > Defrosting time*. The function may be deactivated manually, to shorten its operation time, by selecting a different operation mode.

Holiday mode

After this mode has been activated, the pump is active when one of the following conditions has been fulfilled:

Collector temperature reaches the overheating temperature value (*SERVICE MENU > Solar collector > Overheating temperature*) minus the value of Holiday delta parameter (*SERVICE MENU > Solar collector > Holiday delta*). When this condition is fulfilled, the pump is activated in order to cool the collector down. The pump is disabled when the temperature drops by 5°C.

Collector temperature is lower than the tank temperature – the pump is activated in order to cool the tank down. It remains active until the temperatures of the tank and the collector are equal.

Anti-legionella

This function is active only when an additional device is connected (one of the Peripherals in the Service menu must be selected).

Thermal disinfection involves raising the temperature of water in the tank to the required disinfection temperature, read from the upper sensor of the tank (in the case of using an optional sensor, the user should make sure that it measures the temperature of water in the upper part of the tank, as it is the priority sensor for this function). Disinfection aims to eradicate *Legionella pneumophila* – bacteria which lower the cell-mediated immunity. The bacteria often multiplies in hot water reservoirs (optimum temperature: 35°C). After this function has been activated, the water tank is heated until the pre-defined temperature is reached (*SERVICE MENU > Peripherals > Heater > Anti-legionella > Anti-legionella temperature*). The temperature is maintained for the whole disinfection time (*SERVICE MENU > Peripherals > Heater > Anti-legionella > Anti-legionella time*). Next, the standard operation mode is restored.

Disinfection temperature needs to be reached within a pre-defined period of time from its activation (*SERVICE MENU > Peripherals > Heater > Anti-legionella > Maximum anti-legionella time*). Otherwise, the function will be automatically deactivated.

Manual mode

This function enables the user to check the system devices manually (using MENU button) by switching ON/OFF:

- the solar pump,
- the second solar pump or the switching valve,
- peripherals - additional devices (voltage-free contact e.g. for firing up the pellet boiler).

III.d) Clock

This function is used to set current time.

III.e) Date

This submenu enables the user to set current date. Time and date settings are essential for energy counting function to operate correctly.

III.f) Ethernet module

NOTE



This type of control is available only after purchasing and connecting an additional controlling module ST-505 which is not included in the standard controller set.

Internet module is a device enabling the user remote control of the solar heating system via the Internet at emodul.eu. The user controls the status of all heating system devices on the home computer screen and the operation of each device is presented in the form of animation. Apart from the possibility to view the temperature of every sensor, the user can change the pre-set temperature of the tank etc. The installation process is intuitive. Connect the module and go to the main controller menu to activate the Internet module (Menu>>Ethernet module>>ON). Once Registration option has been selected, the device generates a code which must be entered on the website.

NOTE



The code is valid for 60 minutes. If the user fails to register on the website within this time, a new code must be generated.

Internet module parameters such as IP address, IP mask, gate address etc. may be set manually or by selecting DHCP option.

III.g) GSM module

NOTE



This type of control is available only after purchasing and connecting an additional controlling module ST-65 which is not included in the standard controller set.

GSM module is an optional device which, cooperating with the controller, enables the user remote control of the CH boiler operation via a mobile phone. The user is sent an SMS every time an alarm occurs. Moreover, after sending a certain text message, the user receives feedback on the current temperature of all the sensors.

The ST-65 module may operate independently of the collector controller. It has two additional inputs with temperature sensors, one contact input to be used in any configuration (detecting closing/opening of contacts) and one controlled output (e.g. a possibility of connecting an additional contractor to control any electric circuit)

When any of the temperature sensors reaches the pre-set maximum or minimum temperature, the module automatically sends an SMS message with such information. A similar procedure is used in the case of opening or closing of the contact input, which may be used as a simple means of property protection.

III.h) Statistics

This submenu enables the user to monitor current operating status of the controller:

III.h.1) Gains

This parameter enables the user to check how much energy was gained in different time periods: daily, weekly, monthly, annually and temporary.

NOTE



Statistics provide only approximate data to illustrate roughly the energy gain.

IV. Collector overheats

This submenu shows a list of collector overheats (instances of too high temperature detected by the collector sensor). The user may view:

- date of the overheat incident
- time
- duration
- reading from collector sensor

V. Power failures

This submenu shows a list of power failures registered by the controller. The user may view:

- date
- time
- duration

V.a) Backlight

This parameter is used to adjust the screen brightness. The screen brightness changes after a few seconds of inactivity.

V.b) Display contrast

This parameter is used to adjust the display contrast.

V.c) Language

This option is used to select the language version of the controller menu.

V.d) Information

Once this option has been selected, the display shows the controller manufacturer’s logo and current software version.

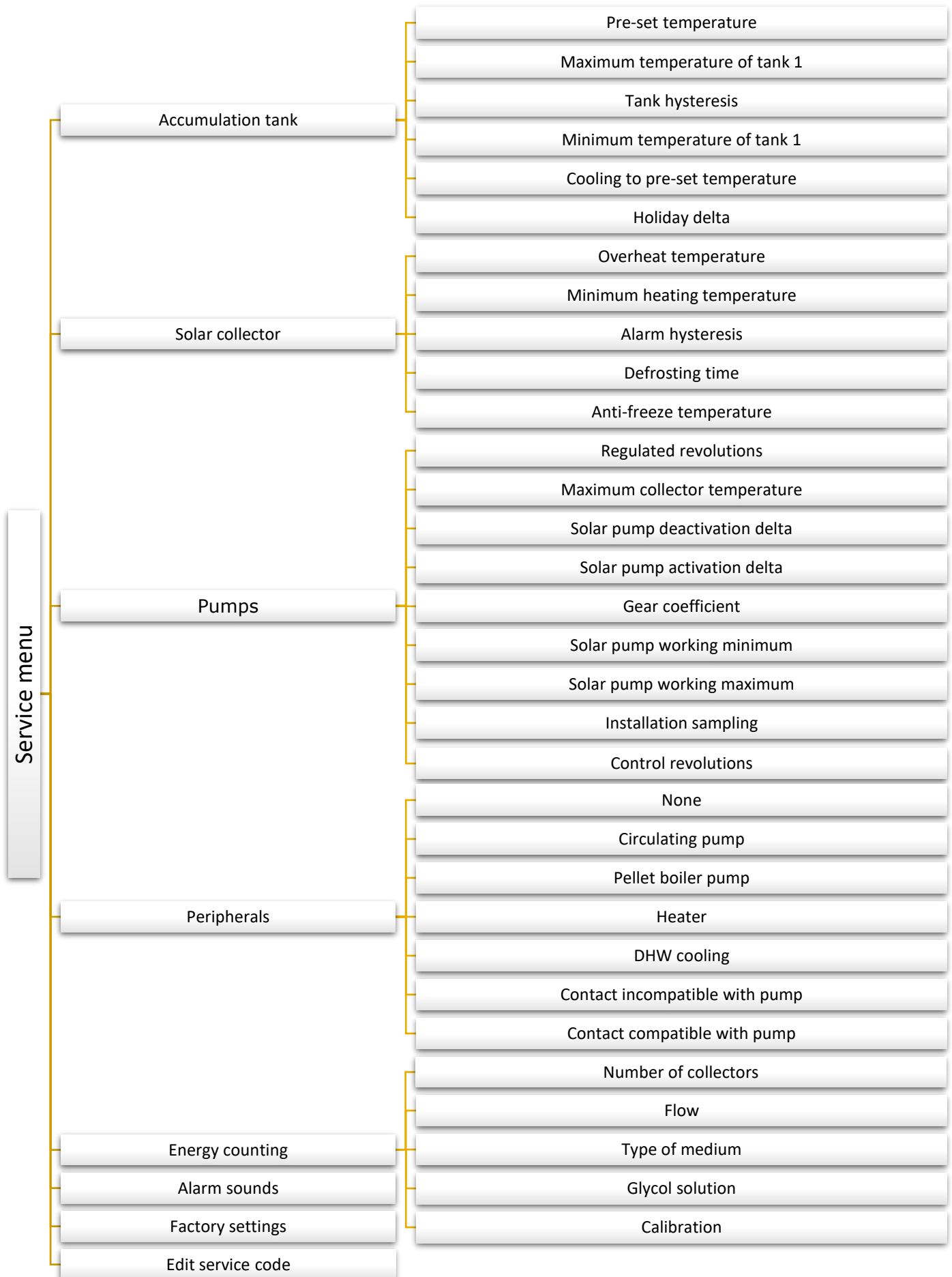
V.e) Factory settings

This function is used to restore factory settings saved previously in the service menu.

IV. Service menu

In order to enter the service menu, select SERVICE MENU, enter the code using plus and minus: 0112 and confirm by pressing MENU. In order to return to the main screen view (leave the service menu), press EXIT a few times or wait about 30 seconds (the controller will leave the service menu automatically).

A block diagram of the service menu is presented below.



IV.a) Accumulation tank

This menu enables the user to adjust all the parameters related to the tank (heat accumulator).

IV.a.1.) Pre-set temperature

This function is used to adjust the pre-set tank temperature. After reaching this temperature the collector pump is deactivated.

IV.a.2) Maximum temperature of tank 1

Using this option, the user may declare the maximum acceptable safe temperature value which the tank can reach in case of *collector overheat*.

If the collector reaches its alarm temperature (overheat), the pump is activated automatically in order to cool down the heated collector, regardless of the pre-set temperature. The pump operates until the tank maximum temperature is reached or until the collector temperature drops by the value of the alarm hysteresis (see: SERVICE MENU > Solar collector> Alarm hysteresis).

IV.a.3) Minimum temperature of tank 1

Using this parameter, the user may declare the minimum acceptable temperature value which the tank can reach. Below this temperature the pump is not activated in collector defrosting mode.

IV.a.4) Tank hysteresis

Using this function, the user declares the tank hysteresis value. If the tank reaches the pre-set temperature and the pump is deactivated, it will be activated again after the tank temperature drops below the pre-set value by the value of this hysteresis.

IV.a.5) Cooling to pre-set temperature

When the collector reaches the overheat temperature, the pump is activated in emergency mode to cool it down. In this case, the heat is transferred to the tank until the maximum temperature is reached. To prevent the accumulation of too hot water in the tank, *Cooling to pre-set temperature* function should be activated. Once activated, when the collector temperature drops below the temperature of the tank, the pump is activated in order to cool down the tank until it reaches the pre-set temperature.

IV.a.6) Holiday delta

This function is active only in Holiday mode. This parameter determines how many °C before reaching the collector overheat temperature the pump is activated in order to cool it down. The pump is deactivated after the collector temperature drops by at least 5°C.

IV.b) Solar collector

These parameters enable the user to configure solar collector operation.

IV.b.1) Overheat temperature

It is acceptable alarm temperature of the solar collector at which the pump is forced to activate in order to cool down the solar panels. The discharge of warm water will take place regardless of the tank pre-set temperature. The pump will operate until the tank temperature drops below the alarm temperature by *alarm hysteresis* value (*Service Settings > Solar collector > Alarm hysteresis*) or until the tank reaches the maximum acceptable temperature (*Service settings > Accumulation tank > Maximum temperature*).

IV.b.2) Minimum heating temperature

It is the collector threshold temperature. If the collector temperature is higher and starts to drop, the controller disables the pump when the minimum heating temperature is reached. When the collector temperature is below this threshold and starts to increase, the pump is activated when the minimum heating temperature plus hysteresis (3°C) is reached. The threshold heating temperature is not active in the emergency mode, manual mode or collector defrosting.

IV.b.3) Anti-freeze temperature

Due to the different freezing temperatures of the liquid in the solar installation *anti-freeze temperature* was introduced. This parameter determines the minimum safe temperature at which glycol liquid does not freeze (temperature measured at the collector). In case of a significant drop in the collector temperature (to the value of *anti-freeze temperature*), the pump is activated and operates continuously until the collector reaches safe temperature. The setting range of this parameter is within -50: +10°C.

IV.b.4) Alarm hysteresis

Using this function the user sets the value of the collector alarm hysteresis. If the tank reaches the alarm temperature (Overheat temperature) and the pump is activated, it will be deactivated again when the collector temperature drops below the maximum temperature by alarm hysteresis value.

IV.b.5) Defrosting time

Using this function the user determines for how long the pump is enabled once collector defrosting function has been activated.

IV.c) Pumps

IV.c.1) Pump revolutions - regulated or constant

Using this function the user defines the mode of the pump operation: constant revolutions, when the pump operates at all times at full power (when enabled) or regulated revolutions. In the case of regulated revolutions, the user should adjust several additional parameters (see below).

IV.c.2) Maximum collector temperature

Using this setting the user declares the value of the collector maximum alarm temperature at which the pump may be damaged. This temperature should be adjusted according to the collector technical specification. Due to the phenomenon of glycol "gelation" at high temperatures and the risk of damaging the solar pump, the pump is deactivated after reaching the maximum alarm temperature (the controller switches to Collector overheat mode.).

IV.c.3) Solar pump deactivation delta

This function determines the difference between the collector temperature and the tank temperature at which the pump is deactivated (so as not to cool down the tank).

IV.c.4) Solar pump activation delta

This function determines the difference between the collector temperature and the tank temperature at which the pump is enabled (this is the pump activation threshold).

IV.c.5) Gear coefficient

This parameter is available only if regulated revolutions option is selected. When the conditions for the pump activation are met, it is initially activated at minimum speed (solar pump work minimum). Then the pump speed increases according to this coefficient which determines the difference (°C) between the collector temperature and the tank temperature at which the pump speeds up by 10%. The gear coefficient applies only to the pump operating revolutions, namely the value of revolutions within the limits of the solar pump work minimum (0% for the gear coefficient) as well as the solar pump work maximum (100% for the gear coefficient). The greater the difference between the collector temperature and the tank temperature, the higher the pump speed.

Example:

If the gear coefficient value is 3, each 3°C difference between the tank temperature and the collector temperature results in 10% increase in pump speed.

The table below contains examples of the coefficient values and its results.

	Gear coefficient 3	Gear coefficient 4	Gear coefficient 5	Gear coefficient 6	Pump working revolutions
Δ value (collector temp. – tank temp.)	Δ3	Δ4	Δ5	Δ6	10%
	Δ6	Δ8	Δ10	Δ12	20%
	Δ9	Δ12	Δ15	Δ18	30%
	Δ12	Δ16	Δ20	Δ24	40%
	Δ15	Δ20	Δ25	Δ30	50%

IV.c.6) Solar pump work minimum

This parameter is available only if regulated revolutions option is selected. Using this setting the user should define the pump minimum initial speed.

IV.c.7) Solar pump work maximum

This parameter is available only if regulated revolutions option is selected. Using this setting the user should define the pump maximum operating speed (%).

IV.c.8) Installation sampling

This function enables the user to activate or deactivate circulation sampling, aimed at updating the temperature reading, by activating the collector pump for a short period of time (when standard conditions of pump activation are not met). Sampling forces short-time activation of the pump after the collector temperature increase of at least 3°C.

IV.c.9) Control revolutions

These parameters enable the user to choose the type of PWM pump used:

- **Increase**

It concerns PWM pump whose speed increases when the signal increases.

- **Decrease**

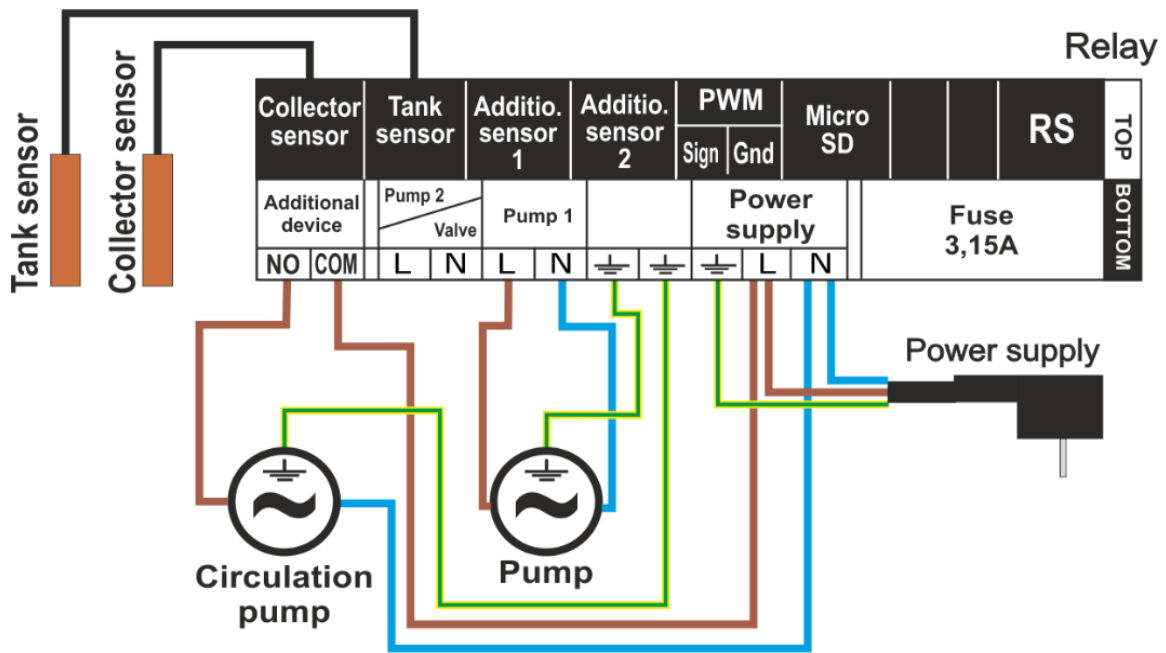
It concerns PWM pump whose speed decreases when the signal increases.

IV.d) Peripherals

The user may connect and configure the settings of an additional device. If there is no additional device, the user should select NONE (deactivate). Additional devices to choose from and examples of connections supporting all available installation schemes are presented below. In the case of schemes 12 and 14 it is not possible to connect an additional device - the function is unavailable.

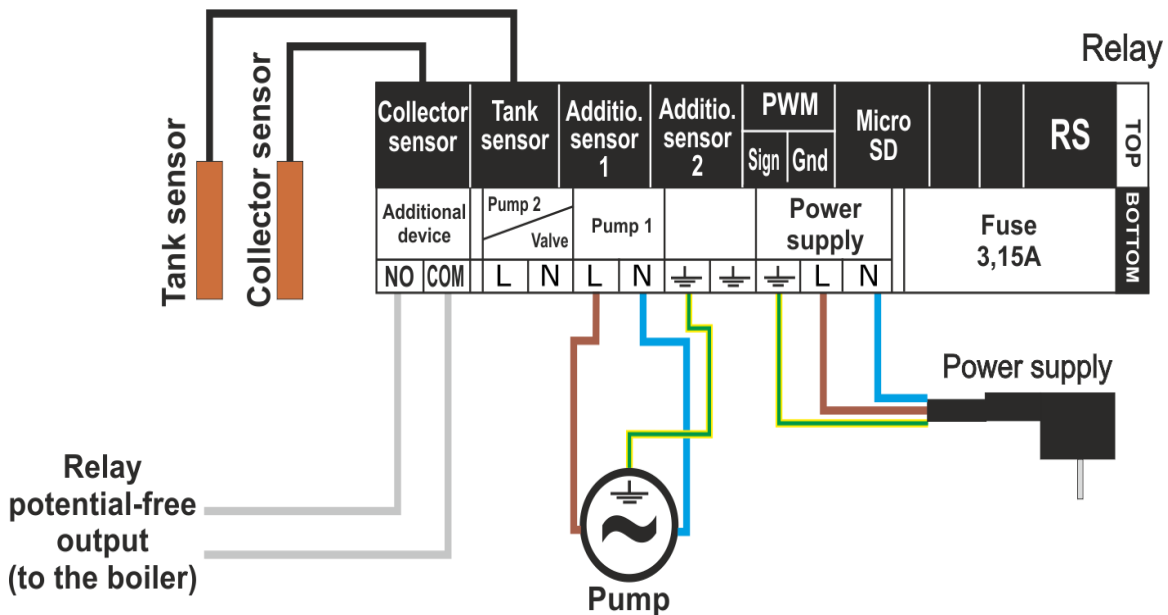
IV.c.10) Circulating pump

Once this device is selected, the user should adjust *operation time* and *pause time* of the pump during its activity. Next, the user should define the hours of pump operation using *From hour* and *Through hour* functions. Entering the same times (from – through) will result in the device being active throughout the whole day.



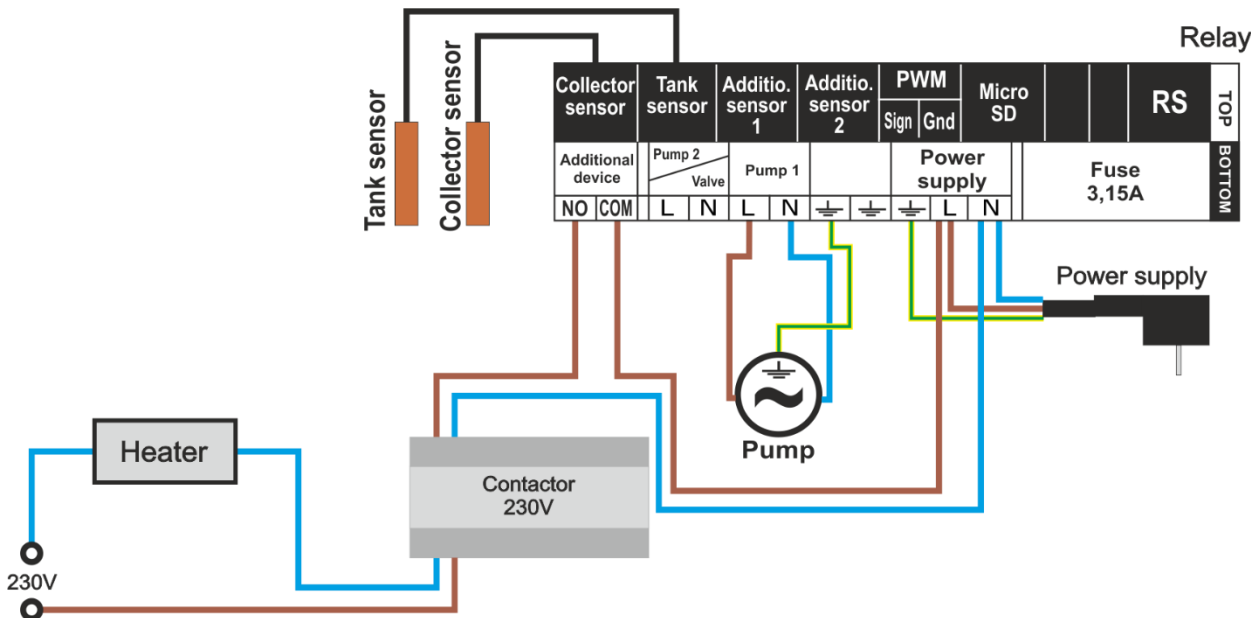
IV.c.11) PLT (pellet) boiler fire-up

This option is used to set the voltage-free signal to fire up the pellet boiler. The user defines *activation delta* - the difference between the pre-set tank temperature and the current tank temperature at which the controller sends a signal to fire up the boiler. Next, the user selects the time period throughout which this function will be active (with the use of *from hour* and *through hour* parameters).



IV.c.12) Heater

The heater is used to electrically heat the tank. The principle of operation is similar to that in the previous case but the heater should be connected by means of an additional contactor. The user defines the activation delta (the difference between the pre-set tank pre-temperature and current tank temperature) below which the controller activates the heater. Next, the user selects the time period in which the electric heating function will be active (using *from hour* and *through hour* parameters).



IV.c.13) Contact (in)compatible with pump

This setting determines the operation of the voltage-free contact. If the option *Contact compatible with pump* is selected, the voltage-free contact will always close when the pump operates (the additional device will be enabled). Otherwise (when the icon is deselected), the contact will open at each activation of the solar pump.

IV.c.14) Cooling down with DHW pump

This function is active beyond the time period, which means all the time. Sensor 4 is required for it to operate correctly (it should be installed in the external DHW tank). This function will not operate in the installation scheme which uses all the sensors. The tank sensor is also necessary for it to operate (in the case of two sensors in the tank - the top sensor).

If the conditions listed above are met, the peripheral device will be activated (contact closing) when:

- the tank temperature during its growth exceeds its maximum temperature reduced by *cooling activation delta* and operates until the temperature drops below the tank maximum temperature reduced by *cooling deactivation delta* (both parameters may be adjusted in the menu).
- the temperature in the tank is higher than the DHW temperature. A constant hysteresis of 3°C is used here.

IV.e) Energy counting

The following parameters need to be configured to achieve more accurate energy measurement.

IV.c.15) Number of collectors

On the basis of the number of collectors the controller calculates how much heat has been produced by the solar installation (energy gain).

IV.e.2) Flow

The user should specify the amount of glycol that flows through the pump during one minute.

IV.e.3) Type of medium

The user chooses the agent used: ethylene glycol, propylene glycol or water.

IV.e.4) Glycol solution

The user specifies glycol concentration in water (given in percent).

IV.e.5) Calibration

This function allows the user to calibrate the temperature difference between the sensors. The temperature is measured in the place where the temperature sensor is installed. Deviations may occur in the flow and temperature measurement at the tank return. The manufacturer does not recommend changing this setting.

IV.f) Alarm sound

This function enables the user to activate/deactivate the sound signal after an alarm occurs.

IV.g) Factory settings

The controller is pre-configured for operation. However, the settings should be customized to the user's needs. Return to factory settings is possible at any time. Once the factory settings option is activated, all customized settings of the solar installation controller (saved in the user's menu) are lost and replaced with the manufacturer's settings. Then, the parameters may be customized anew. Return to factory settings results in activating the default installation scheme.


IV.h) Edit service code

It is possible to edit service menu code. Go to this submenu, enter the code and confirm the settings.

V. Protections


In order to ensure safe and failure-free operation, the controller is equipped with a range of protections.

1. Sensor protection.

If one of the sensors is damaged, an acoustic signal is activated and the following symbol  will

appear on the right hand side of the display. An additional icon informing the user which sensor is disconnected or damaged will flash in the place of its temperature. In order to deactivate the alarm signal in case of error, press **EXIT** button.

2. Protection against collector overheating.

If the maximum (alarm) temperature is reached, the regulator switches to the so-called *collector overheat mode* and the display shows a corresponding symbol . The pump is enabled in order

to cool down the collector until the *maximum tank temperature* is reached or until the collector temperature drops by the value of the *alarm hysteresis* (see: *SERVICE MENU* > *Solar Collector* > *Alarm Hysteresis*) In the case of two tanks, both of them are used to cool down the overheated collector (at the same time or one by one, depending on the operation algorithm setting).

3. Heat tank protection.

In the event of collector overheating, each tank may be heated to no more than the pre-set maximum safe temperature. After reaching this temperature, the pump of a given tank is disabled (in system configuration with two tanks and a valve, the circulation is switched to the second tank).

4. Fuse.

The regulator is equipped with a WT 3.15A tube fuse-link protecting the network.



WARNING

Higher amperage fuse should not be used as it may lead to controller damage.

V. Software update



NOTE

Software update shall be conducted only by a qualified fitter. After the software has been updated, it is not possible to restore previous settings.

In order to install new software, the controller must be unplugged from the power supply. Next, insert the flash drive with the new software into the USB port. Connect the controller to the power supply holding MENU button at the same time until a single sound signal is heard. It indicates that the software updating process has started.

VI. Maintenance

Before and during the heating season, **EU-401N** controller should be checked for condition of its cables. The user should also check if the controller is properly mounted and clean it if dusty or dirty.

Power supply	230V ±10% / 50Hz
Power consumption	4W
Collector sensor thermal resistance	-30÷180°C
Tray sensor thermal resistance	-30÷99°C
Pump 1 max. output load	0,5A
Pump 2/Valve max. output load	0,5A
Additional output 1 max. output load	1A
Fuse	3,15A

VII. How to install the device



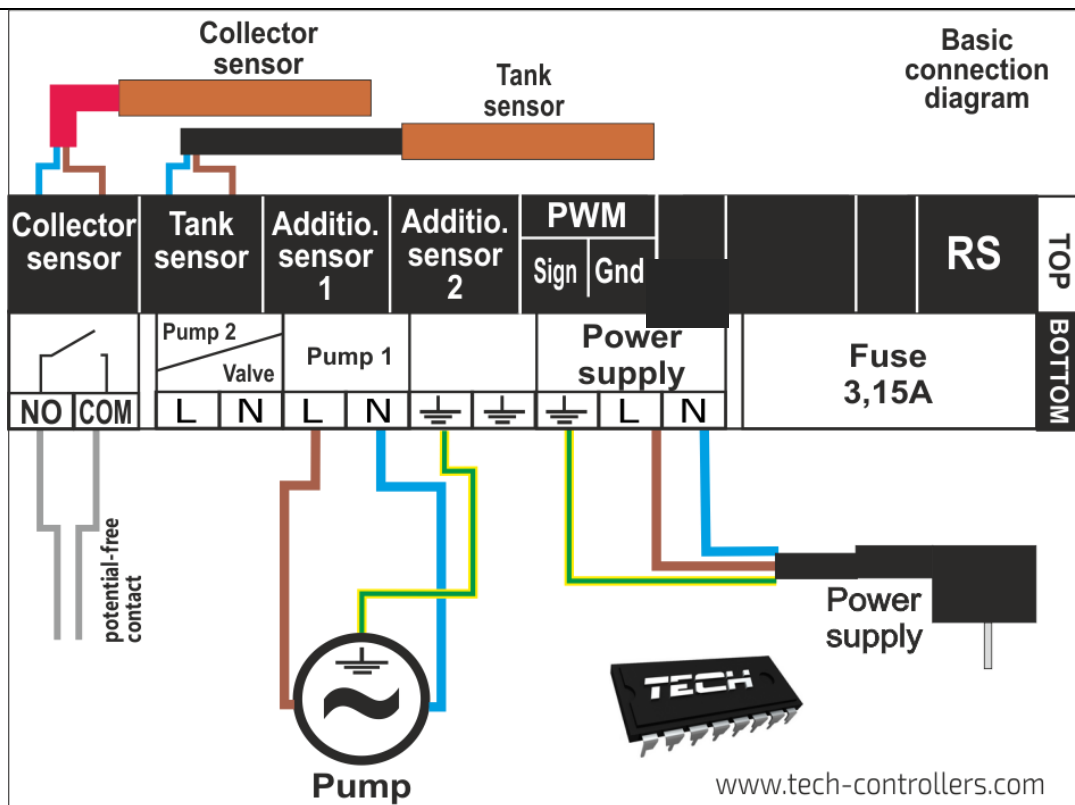
CAUTION:

The controller should be installed by a qualified electrician! Make sure that the plug is disconnected from the power supply at that time.

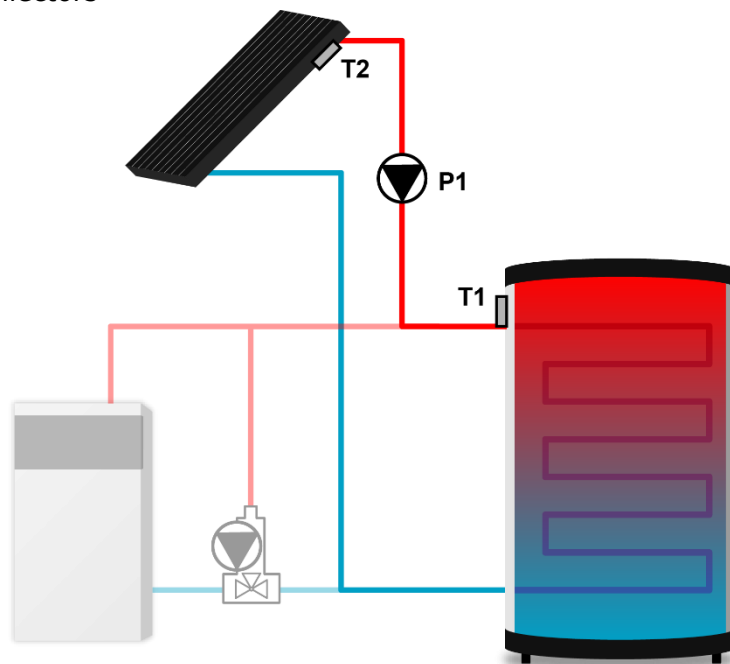


NOTE

The cable connecting the temperature sensor should be put in a protective tube and it should not be exposed to weather conditions. The cable connection of the solar controller should be durable, made under shelter and well insulated. Metal parts of the sensor and the collector system should be earthed.



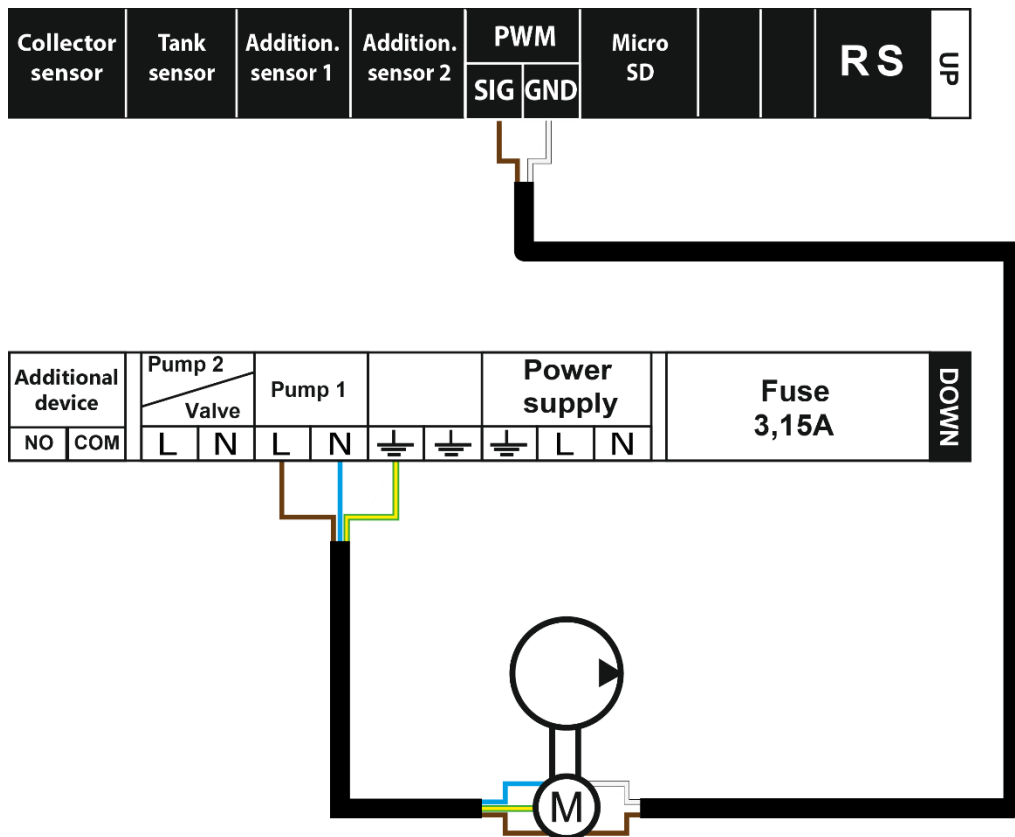
Pictorial diagram - collectors



T1 - Heat tank sensor
 T2 - Collector sensor
 P1 - Pump 1

*Pictorial diagram – it cannot replace CH installation project. Its aim is to present how the controller may be expanded. This heating installation diagram does not include protective elements which are necessary to ensure correct installation.

PWM pump connection scheme:



TECH CONTROLLERS

EU DECLARATION OF CONFORMITY

Hereby, we declare under our sole responsibility that **EU-401N PWM** manufactured by TECH STEROWNIKI, head-quartered in Wieprz Biała Droga 31, 34-122 Wieprz, is compliant with Directive **2014/35/EU** of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of Member States relating to **the making available on the market of electrical equipment designed for use within certain voltage limits** (EU OJ L 96, of 29.03.2014, p. 357), **Directive 2014/30/EU** of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of Member States relating to **electromagnetic compatibility** (EU OJ L 96 of 29.03.2014, p.79), Directive **2009/125/EC** establishing a framework for the setting of ecodesign requirements for energy-related products as well as the regulation by the MINISTRY OF ENTREPRENEURSHIP AND TECHNOLOGY of 24 June 2019 amending the regulation concerning the essential requirements as regards the restriction of the use of certain hazardous substances in electrical and electronic equipment, implementing provisions of Directive (EU) 2017/2102 of the European Parliament and of the Council of 15 November 2017 amending Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (OJ L 305, 21.11.2017, p. 8).

For compliance assessment, harmonized standards were used:

PN-EN IEC 60730-2-9:2019-06, PN-EN 60730-1:2016-10.


PAWEŁ JURA


JANUSZ MASTER

Wieprz, 08.04.2022

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