

Programmable Differential Thermostat for solar systems

Introduction

DELTA is specialized device that controls the heat exchange between solar collector and boiler. It maintains the optimal work of the system and also monitors for emergencies and thus prevents potentially dangerous situations.

The device monitors the temperatures of solar collector and boiler and when the conditions of control algorithm are met, the solar heat energy, generated in the collector, is transferred to the boiler by activating the circulation pump. The device is flexible, as most of the control parameters can be tuned by the user or the installer. This way the specific needs of every heating system can be met.

The boiler cooling function, which is activated when the set temperature is exceeded, along with **Vacation** mode, provide security and comfort to any modern heating system.

Installation

DELTA is designed for DIN rail mounting, use it indoors only and away from strong electromagnetic fields.

The device is powered from mains high voltage! Please follow the safety regulations for operating under high voltage!




Included in the set

2 temperature sensors:

- Collector sensor with high temperature silicone cable
- NTC (-40 .. 125°C) or optionally Pt1000 (-40 .. 200°C)
- Boiler sensor mounted on the heat exchanger level NTC (-40 .. 125°C)

Electrical connection

The thermostat should be powered through external mains breaker (last step of the installation process), voltage 230 V / 50 Hz.

Connection	Terminals	
Mains Power	3 4	L N 230V / 50Hz
Pump	1 2	R1 N Max 5A / 1 kW
Collector	10 11	T1  or 
Boiler	12 13	T2 

The temperature sensors have no polarity and when installing them, the cables can be extended up to 100 m with the following size: up to 50 m - 0.75 mm², up to 100 m - 1.5 mm². It's advised, that the cables of the temperature sensors and the high voltage ones be distanced from one another at 100 mm. When using in environment with strong electromagnetic fields, use shielded cable for low voltages, grounded in both ends.

Maximum size of the cable to be connected to the terminals - 2.5 mm².

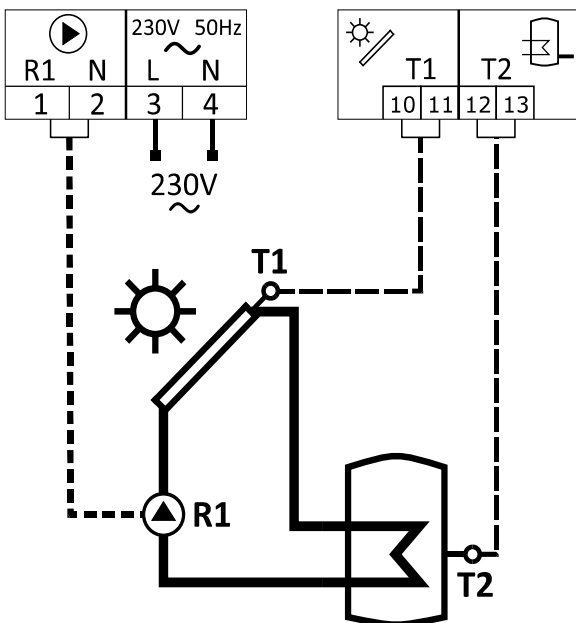


Fig. 1 Electrical connection

Operation

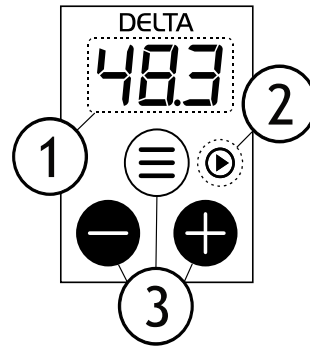











Fig. 2 Control panel

- Three digit seven-segment display 
- LED, indicating the state of the circulation pump 
- Buttons:
 -  Increase
 -  Decrease
 -  parameters, exit confirmation



When powered, the device is in **Main** mode and follows the algorithm of differential thermostat. The display shows the temperatures, measured by the sensors, alternating them every 5 sec. When the temperature shown is changed, first its name is displayed, then the value in degrees centigrade.

Temperatures




- Collector (T1)  - collector temperature
- Boiler (T2)  - boiler temperature

Use  button to change the displayed temperature. If you choose a specific temperature, then it will be the only one displayed. In order to alternate periodically the displayed temperature, keep pressing the button, until you reach , then the temperature shown will alternate every 5 sec.

Special modes



Press  button from main screen to enter the **Special Mode** menu, use  to exit from it. The modes are two:

- Holiday 
- Pump test 

Use the button  to choose a mode and press  to activate it. The device makes a long beep and enters the selected mode. You can find detailed description of the modes in the following sections of the manual. Press again  to quit the selected special mode and return back to **Main** mode.


Errors







The device automatically switches to error display state, when any of the temperatures is out of the allowed limits (see section **Emergency cases**). In this state the device makes distinct sound and the display shows the temperature, causing the error and its blinking value.


If there is an electrical issue with some of the sensors, then instead of temperature the error cause is shown:  for broken sensor connection and  for shorted sensor.

If you want to quit the error display mode, just press any button or remove the cause of the error. The device goes back to the previous work mode and if the error is still present, the temperature value blinks.

Setting User Parameters



Hold the button  pressed for 2 sec from **Main** mode in order to enter **User Parameters** menu. While holding the button, a specific sound is made and an animation is shown on the display.

When you enter the menu, the display shows the name of the current parameter and using the buttons  and  you can choose a parameter to edit. The name, description, values and order of the user parameters are described in the table following. Press  to change the value of the current parameter. The blinking value is shown,  and  change the parameter value and by pressing  the current value is saved and you get back to choosing parameter.



If you want to exit the menu, then choose the element that is before the first / after the last parameter (reverse menu enter animation is displayed) and confirm by pressing . Also if for 20 sec no button is pressed, then the device goes back to **Main** mode.

Setting Service Parameters

Altering the service parameters can lead to potentially dangerous state of the heating system! This should be only done by qualified personnel!

You can enter **Service Parameters** menu by holding the button  down for 5 sec from **Main** mode. First you enter **User Parameters** menu, keep holding the button pressed until you hear a beeping confirmation and the first parameter is displayed .

Browsing, editing and exiting the menu is performed the same as in **User Parameters** menu. A description of the parameter is displayed 2 sec after the parameter number (complete list in the parameters table).

The values of all parameters can be reset to their **factory** settings by choosing the element  and then confirming the reset by .

Working principle

Differential thermostat /heating the boiler/

The main goal of the thermostat is to transfer the heat energy, generated in the heat source /collector/, to the consumer /boiler/. The circulation pump is activated when the temperature difference between the collector and boiler is bigger than the one set ($Coll - Boil > \Delta T$) and the collector temperature is high enough ($Coll > CollMin$) as the boiler temperature is below the set one ($Boil < BoilSet$). If any of the heat exchange conditions are not met, then the pump is turned off.

Every condition is being added/subtracted the value of the hysteresis parameter **HYS**. For example for a hysteresis of 2°C and $\Delta T = 10^\circ C$, the pump will be activated in temperature difference of $10 + 2 = 12^\circ C$ and turned off at $10 - 2 = 8^\circ C$.

Emergency cases

- The circulation pump is **ALWAYS turned on** in case of a damaged temperature sensor!
- The pump is **turned off** when the boiler is overheated $Boil > BoilMax$
- If the boiler and collector are both overheated ($Boil > BoilMax$ and $Coll > CollMax$), then the pump is turned on for 2 sec every 2 min until $Boil < BoilMax + 5^\circ C$.

Special cases

Cases in which the pump is **turned on** if no emergency is present:

- Collector freeze - $Coll < CollFreeze$ u $Boil > BoilMin$
- Collector overheat - $Coll > CollMax$

Holiday mode /cooling the boiler/



If you are not planning to use the boiler for a continuous period, then **Holiday** mode prevents the boiler from overheating, by dissipating heat to the atmosphere through the collector. This way during the day the boiler is cool enough, so overheating of the boiler or collector is unlikely to happen.

The parameter **BoilCool** enables boiler cooling functionality /overheating protection/ in heating mode, as the only difference with **Holiday** mode is the temperature to which the boiler is cooled down.

Algorithm


The pump is activated when the boiler is hotter than the collector by ΔT degrees ($Boil - Coll > \Delta T$) and the boiler temperature is higher than the boiler set temperature ($Boil > BoilSet$), as the set temperature in cooling mode is **BoilSet** and in **Holiday** mode - **HoliBoilSet**.


The hysteresis is fixed to 1°C. In this mode the device monitors for emergency cases as in normal heat exchange mode.

Test Pump mode



When initially filling up the solar system or just to check that the circulation pump is working, use **Test Pump** mode.

In this mode, consecutively the mode label and the remaining minutes of pump operating are displayed. The time remaining can be changed by using the  and














 buttons. The device automatically exits this mode once the time is up.

Circulation pump blocking protection

If the pump has not been activated in 24 hours, then the thermostat forcefully activates it for 20 sec, as a prevention of the pump's blocking.

Technical parameters

Power	230 V, 50 Hz, 1.5 VA
Relay output (R1)	5 A / 1 kW, 250 VAC
Temperature sensor NTC	-40 ... 125 °C, ±1 °C
Temperature sensor Pt1000	-40 ... 200 °C, ±1 °C
Operating ambient temperature	0 ... 40 °C
Protection	IP 40
Dimensions	36 x 90 x 58 mm
Mounting	DIN шина
Warranty	24 months

Parameter	Description	Limits		
		min	set	max
User Parameters				
	Boiler set temperature	20	70	80
	Temperature difference	2	5	40
	Collector minimal temperature	10	40	80
Service Parameters				
	Hysteresis	0.5	2.0	10.0
	T1 temperature sensor type	NTC	NTC	Pt 1000
	Pump minimal ON time	0	10	240
	Boiler cooling enable, in case of exceeding the set temperature	On	On	OFF
	Holiday mode - boiler set temperature	20	40	70
	Collector freeze temperature	-30	10	15
	Collector protection temperature	90	115	125
	Boiler overheat temperature	80	92	100
	Boiler minimal temperature to enable collector defrosting	5	15	30
	Factory reset of all parameters	no	no	YES

Limited warranty

The warranty is valid for 24 months from the sale date.

Warranty is void in case of:

- Incorrect installation
- Alteration of the product and/or attempts to repair or modify
- Visible damage of the housing and/or the inside of the device
- Damage caused by lightning storms
- Usage in inappropriate conditions (temperature and humidity)
- Broken warranty stickers

Warranty Card

Sold (client/date): _____

Invoice No (Receipt No): _____

Signature: _____

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