

# Automation System TROVIS 5400

## District Heating Controller TROVIS 5475



On-off or three-step controller designed for wall or panel mounting  
(Front frame dimensions: 144 mm x 96 mm)

### Application

Controller for self-optimizing, weather-sensitive flow temperature control in hot water heating systems and hot water temperature control incorporating two control loops. Also applicable as district heating controller with variable return flow temperature limitation.



Weather-sensitive heating control guarantees constant temperatures in all rooms and optimum use of energy. The TROVIS 5475 District Heating Controller is capable of calculating the ideal characteristic heating curve from the measured room temperature, thus eliminating the need to manually set the heating characteristic. Moreover, the instrument can be used for optimizing the heating in periodically used buildings. It is provided with an adaptive algorithm for determining the building's thermal characteristic from the measured temperatures and calculating the optimum switch-on and switch-off times of the system.

### Special features:

- Water heating from either the primary circuit containing three-step output version, or from the secondary circuit (priority circuit).
- Three binary outputs to control the heating circulating-pump, storage charging pump and circulating pump.
- Inputs for connection of maximum 7 PTC or PT 100, or 7 NTC sensors.
- Outdoor temperature can also be applied as 4 (0) to 20 mA current signal.
- Storage temperature sensor, optionally interchangeable with a storage thermostat.
- Variable return flow temperature limitation in respect to the outdoor temperature.
- Option of maximum and/or minimum limitation of volume flow.
- Adjustable minimum and maximum flow temperature limitation.
- 365-day clock providing three integral schedules and automatic summertime/wintertime changeover.
- Optional connection of a remote control unit to correct the room temperature and select the operating mode.
- Easy data input and interrogation via three keys only, supported by symbols displayed on a LCD panel.
- Configuration and parameterization on the PC using the program Editor 5475, data transmission facilitated by means of memory module.

### Version

**TROVIS 5475** (Fig. 1) · On-off or three-step controller for connection to electric control valves used in heating and district heating systems.

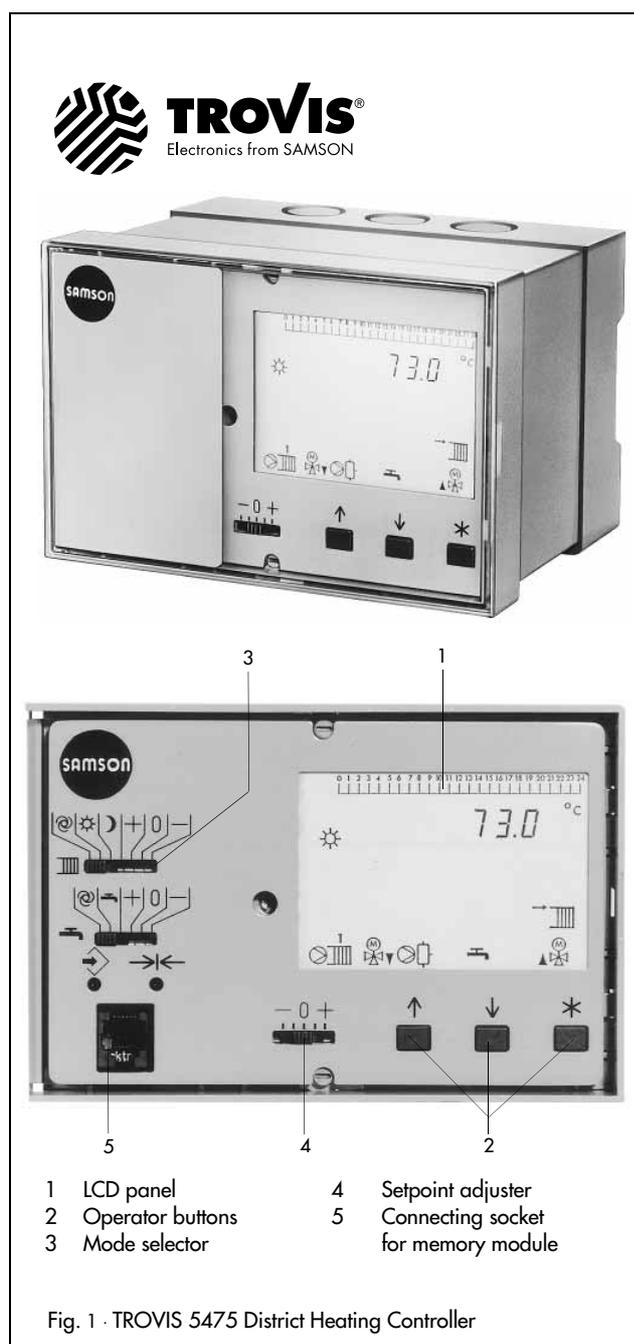


Fig. 1 · TROVIS 5475 District Heating Controller

## Principle of operation (Fig. 2)

Central signal processing in the heating controller is managed by a microcontroller. Besides the microprocessor, this module contains further elements for analog/digital signal conversion.

The measured flow, room, outdoor and return flow temperature data are transmitted to the microcontroller via input units (1). Subsequently, the microcontroller produces a control signal corresponding to the adjusted set points, which is converted into a three-step control signal by the output unit (4). If the actual temperature values are identical to the set points entered, the relays in the output unit remain in their resting position. If, however, the temperature measured by the connected temperature sensors varies, system deviation  $x_w$  assumes one of two states, positive or negative. As soon as this value exceeds the dead band, the microcontroller releases the relay in the output unit (4), which produces clockwise (+) or counter-clockwise rotation (-) of the driving motor of a connected three-step control valve. When connected to actuators with a transit time of 15 to 240 s, the controller features a PI-action corresponding to the set parameters.

In addition, the controller assumes operation of the heating circulating-pump, storage charging pump and circulating pump.

Adaptation of the open and closed-loop control program to the requirements of the respective heating system is accomplished by entering a system code number corresponding to one of the system configuration diagrams outlined in the "Mounting and operating instructions".

A calorimeter output signal that is proportional to the volume flow rate may be applied to a pulse-counting or current input, enabling maximum and/or minimum volume flow limitation.

## Adaptation of the controller characteristic heating curve

This controller provides the option of automatically adapting the heating curve to the required system conditions, provided that a room temperature sensor is available. The microcontroller automatically determines the correlation between flow temperature and measured outdoor temperature in respect to the room temperature. Minimum and maximum flow temperature limitation is supported.

## Manual setting of the characteristic heating curve (Figs. 3 and 4)

The heating curve may also be set manually. In this case, the relationship between flow temperature and measured outdoor temperature is to be determined first by entering a corresponding gradient value (see Fig. 3). Then, the minimum and maximum flow temperature values are to be entered. If required, a parallel displacement of the heating curve is possible. In this case, the flow temperature limit values are not changed.

The return flow temperature characteristic (Fig. 4) is also determined by entering the following: a corresponding gradient value, the maximum and minimum limits and, if necessary, a parallel displacement of the curve.

1	Converter for analog input signals	$t_V$	Flow temperature
2	Binary input unit	$t_A$	Outdoor temperature
4	Output unit for on-off or three-step signals	$t_{Vmax}$	Maximum flow temperature
5	Output unit with binary control signal	$t_{Vmin}$	Minimum flow temperature
6	Program and data memory	$t_{Rmax}$	Maximum return flow temperature
7	Keypad and display unit	$t_{Rmin}$	Minimum return flow temperature
8	Timer		
9	Power supply		

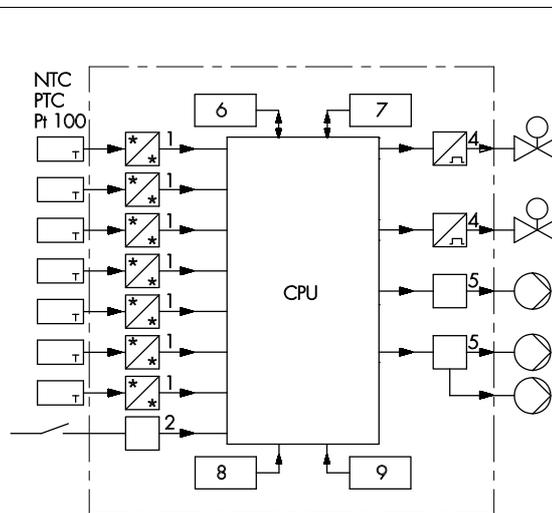


Fig. 2 · Functional diagram of the digital controller

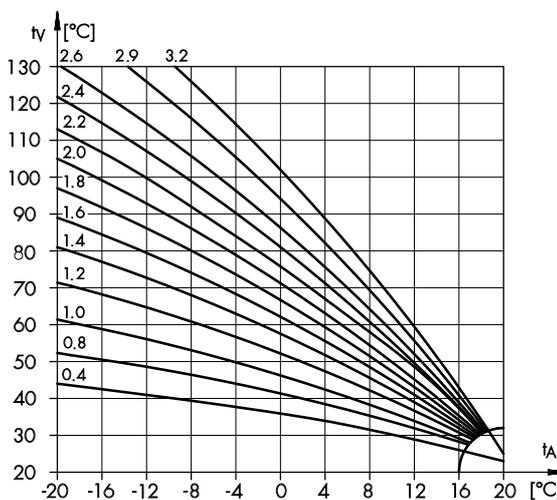


Fig. 3 · Family of characteristic heating curves

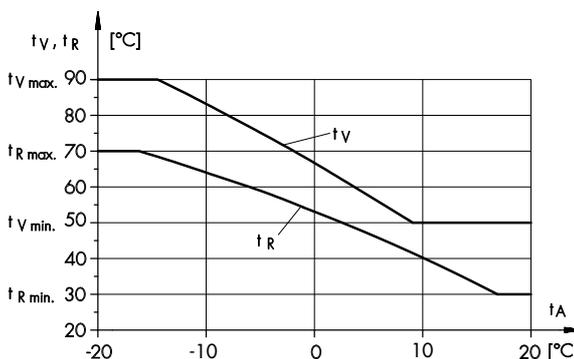


Fig. 4 · Weather-sensitive flow temperature control with variable return flow temperature limitation

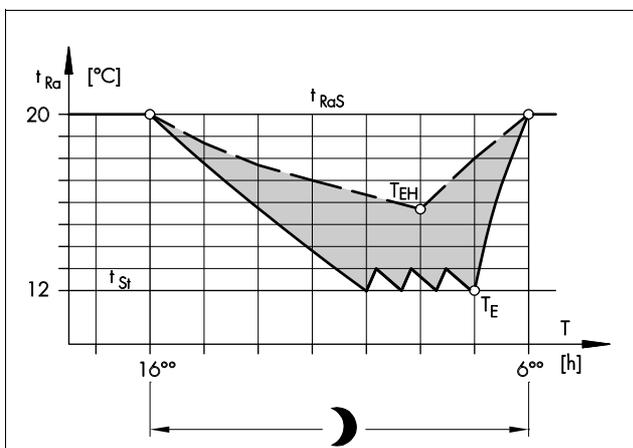


Fig. 5.1 · With high heat demand (low outdoor temperature)

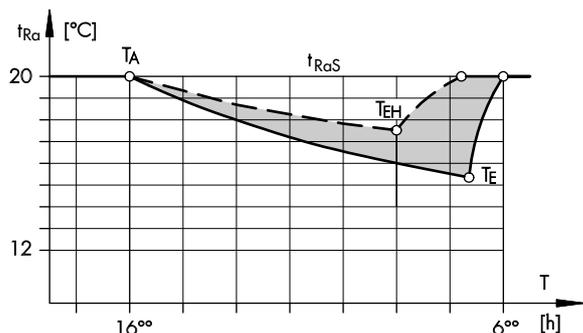


Fig. 5.2 · With average heat demand (average outdoor temperature)

- Temperature characteristic without optimization program
- Temperature characteristic with optimization program
- T Time
- $T_{EH}$  Changeover time without optimization program
- $T_A, T_E$  Switch-off and switch-on times with optimization program
- $t_{Ra}$  Room temperature
- $t_{RaS}$  Room temperature set point
- $t_{St}$  Sustaining temperature

Fig. 5 · Temperature characteristic of heating controllers with/without optimization program

### Optimizing switch-on and switch-off times (Fig. 5)

The controller implements a program for optimizing the switch-on and switch-off times of the heating system in periodically used buildings.

Energy consumption depends on four factors:

- 1) period of energy supply,
- 2) difference between room and outdoor temperature,
- 3) building's thermal characteristic, and
- 4) the properties of the heating of the building.

The controller determines the building's thermal characteristic and dynamic behaviour of the heating system from the succession of room and outdoor temperature measurement over a certain period of time. This data is used to calculate the latest possible switch-on time  $T_E$  in order to achieve minimum energy consumption.

During unoccupied periods, the controller monitors the system and switches on the heating whenever the temperature falls below the sustaining temperature  $t_{St}$  (stand-by operation).

### Operation (Fig. 1)

To select the parameterizing mode, press  $\rightarrow$  button. To select the configuration mode, the  $\uparrow$  and  $\downarrow$  keys must be pressed simultaneously. In this mode, the user is prompted to enter a system code number corresponding to a system configuration diagram shown in the "Mounting and operating instructions". This completes configuration of the controller for application in a system identical with one of the documented systems. Any further sensors and/or functions that are not contained in the standard system configuration must be chosen and set later. To prevent parameters for return flow temperature and volume flow rate from being changed, these are protected against unauthorized users by means of a code number.

All data such as time, date, heating characteristic curve, set points, time intervals for occupied periods are to be entered when the controller is in the parameterizing mode. Data input and interrogation is supported by means of symbols displayed on the LCD panel. By pressing the  $\leftarrow$  button, all parameters are reset to their default values.

A switch containing five switch positions (4) is used to correct a set point. The mode selector switch (3) is used to select the operating mode and to switch to manual operation of the control valve.

### Heating circuit:

- $\odot$  Time-based operation with changeover between nominal operation and reduced or stand-by operation
- $\odot$  Nominal operation
- $\smile$  Reduced or stand-by operation

### Hot water circuit:

- $\odot$  Time-based operation with disconnection of hot water circuit
- $\rightarrow$  Nominal mode; heating circuit off

### Manual operation:

- + Valve opens
- 0 Valve stationary
- Valve closes.

## Technical data

<b>Inputs</b>	
Sensor inputs	7 PTC and Pt 100, or 7 NTC temperature sensors (heating/hot water circuit) 2 flow temperature sensors 1 room temperature sensor 1 outdoor temperature sensor 1 return flow temperature sensor 2 storage temperature sensors
Binary inputs	Storage thermostat
Further inputs	Pulse-counting or current input 4 (0) to 20 mA for volume flow limitation Remote control unit to correct the room temperature and select the operating mode
<b>Outputs</b>	
Signal Y	Three-step signals: Load: Max. 250 V~, 3 A On-off signal: Load: Max. 250 V~, 3 A
Binary outputs	3 outputs for pump control Load: Max. 250 V~, 3 A
<b>Control parameters</b>	$K_p = 0.1 \dots 50$ ; $T_n = 1 \dots 999$ s Transit time 15...240 s
<b>Power supply</b>	230 V, 48 to 62 Hz, 3 VA
<b>Permissible ambient temperature</b>	0 to 40 °C
<b>Degree of protection</b>	IP 40
<b>Interference-suppression</b>	According to VDE 0875 with connection of SAMSON actuators, Type 5821/5822 and Type 5801/5802
<b>Weight</b>	(approx. kg) 0.6

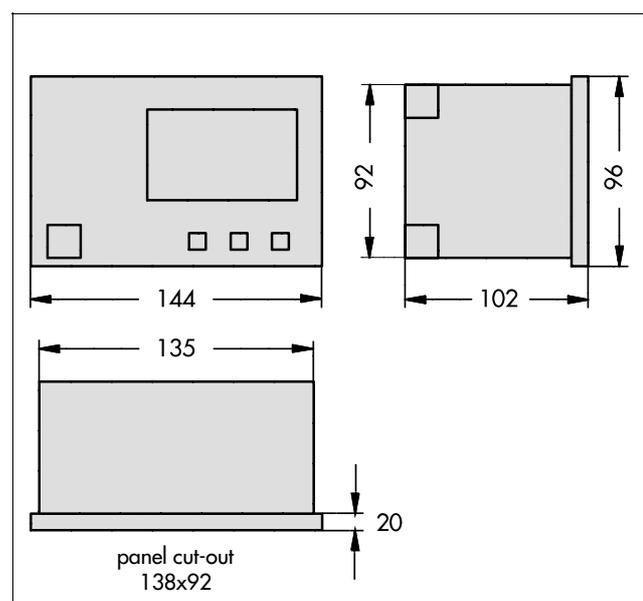
## Electrical connection and assembly

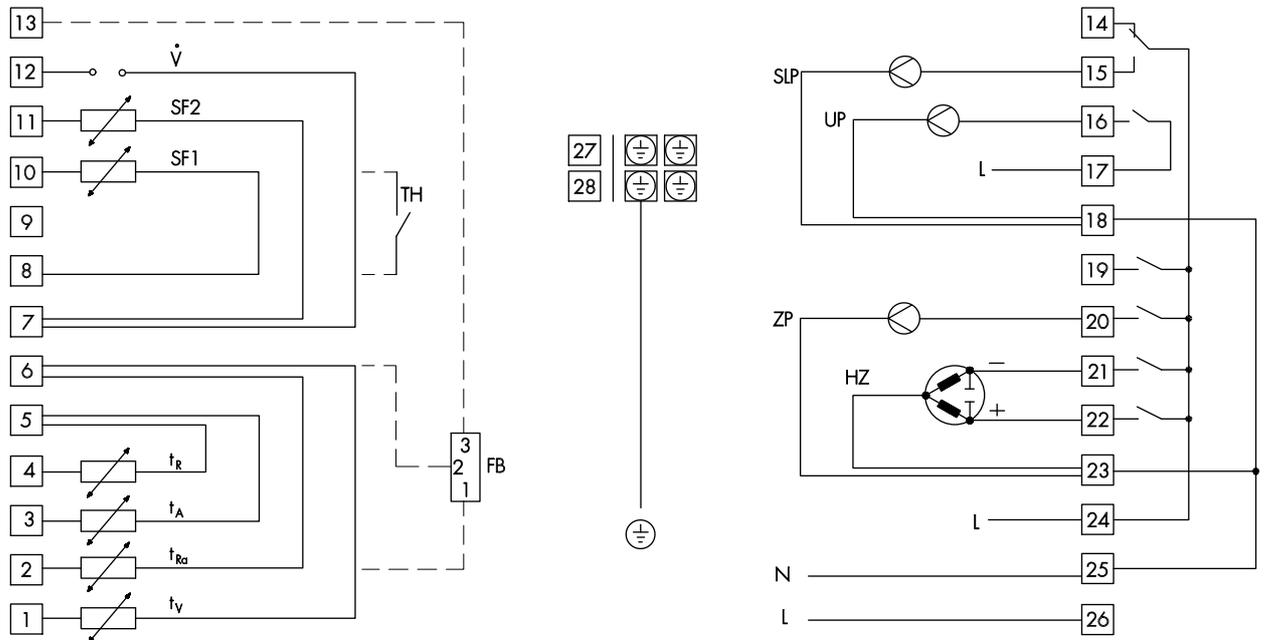
The controller consists of a controller housing containing the electronic components and a separate terminal board used for the electric connection. Two wires of max. 1.5 mm<sup>2</sup> can be connected to each terminal. The sensor connection lines must be installed separated from the output relay lines. For wall mounting, the terminal board must be fastened to the wall using screws. After having made all electrical connections, the controller housing must be plugged onto the terminal board and secured using one screw. For panel mounting, two mounting straps which can be swung-out using a screw driver are available for securing the controller.

## Ordering text

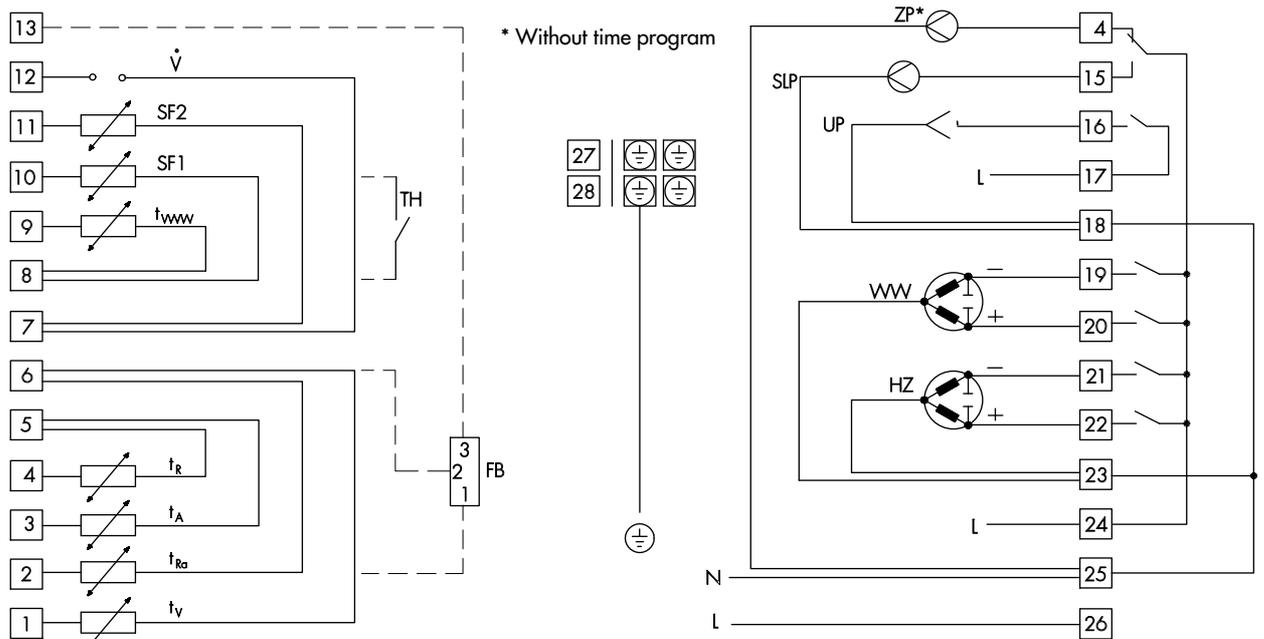
TROVIS 5745 District Heating Controller  
Editor 5475 with memory module no. 1400-6250

## Dimensions in mm





Terminal assignment corresponding to system code no. "2"



Terminal assignment corresponding to system code no. "5"

- SF Storage sensor
- TH Storage thermostat
- tv Flow temperature sensor
- tr Return flow temperature sensor
- tA Outdoor temperature sensor
- tRa Room temperature sensor
- tWW Hot water flow temperature sensor
- trWW Hot water return flow temperature sensor

- UP Heating pump
- SLP Storage charging pump
- ZP Circulating pump
- WW Hot water circuit
- HZ Heating circuit
- V Volume flow limitation
- FB Remote control

Specifications subject to change without notice.

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