12. NOTES.

ESCO™

SC-20D

TEMPERATURE CONTROLLER

Version 2.0

USER MANUAL / WARRANTY

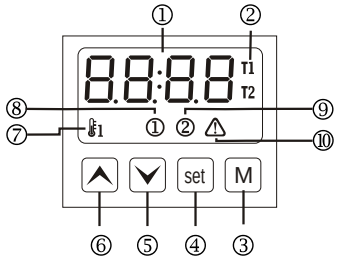
1. SPECIFICATIONS.

Input:	two temperature sensors: NTC 5kΩ by 25°C bistate input (normally opened or normally closed)
Measuring range::	-50...+150°C
Measuring accuracy:	±0,5%
Sampling period:	330 ms
Display resolutio:	0,1°C in whole range
Setting resolution:	0,1°C in whole range
Display:	LED, 4 digits, 11mm height with graphic icons
Control form:	ON-OFF with hysteresis
Protection class:	Ip20 / II
Power supply:	230V~ ±15% or 12V=/~, max 3VA
Operating conditions:	-5...60°C; 0...85%RH (non-condensing)
Storage conditions:	-40...85°C; 0...85%RH (non-condensing)

2. OUTPUTS CARRYING CAPACITY.

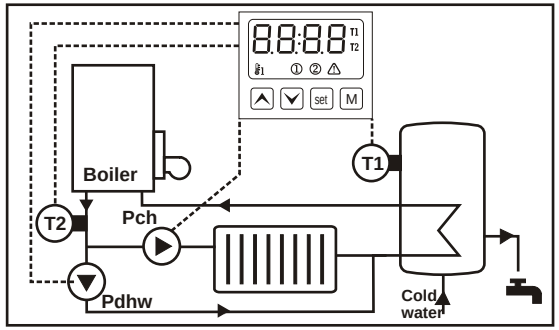
Output:	Relay:	Maximum resistive load (for example heater):	Maximum inductive load (for example engine):
① OUTPUT1	30A 250V~ 10^5 cycles	20A, 4500W	8A, 1500W, 2HP(2KM)
② OUTPUT2	8A 250V~ 10^5 cycles	8A, 1500W	2A, 400W, 0.5HP(0.5KM)

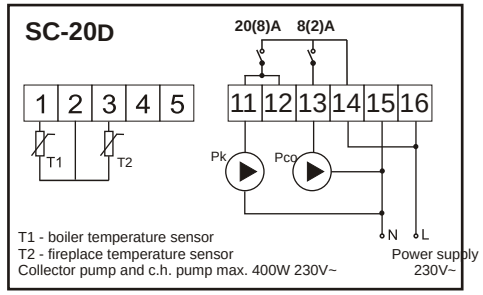
3. FRONT PANEL.



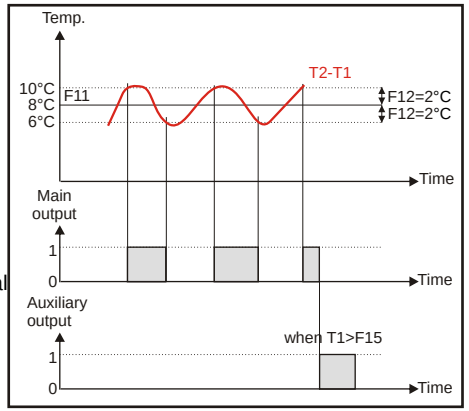
① temperature display
② temperature sensor number
③ entry to the parameters menu
④ temperature setting button
⑤ value increasing button
⑥ value decreasing button
⑦ temperature setting signalling
⑧ OUTPUT1 signalling. LIGHTS: output active; BLINKS: output waits for start-up
⑨ OUTPUT2 signalling. LIGHTS: min or max temperature value exceeded (see: F15 or F16); BLINKS: output waits for start-up (see: F17)
⑩ emergency states signalling

11.2. Domestic hot water circuit circulation pump and central heating circuit pump co



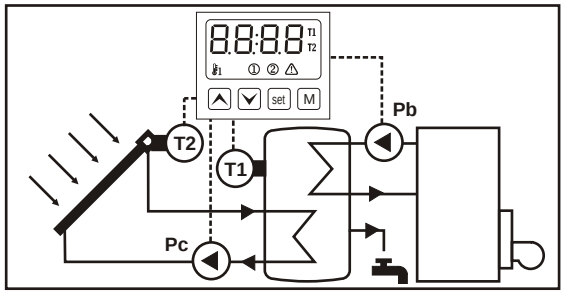


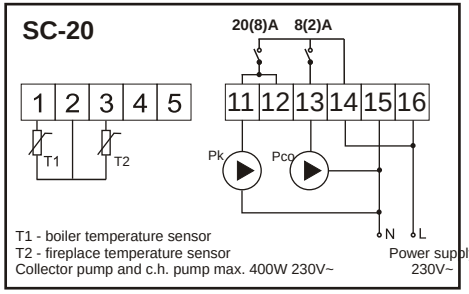
Functions performed by the controller in the system:
- domestic hot water circulating pump and central heating pump control system.
Tips for parameters programming:
F10=1 (container T1 and boiler T2 temp measurement)
F11=setting specifying the boiler temperature growth in relation to the container temperature so that the domestic hot water pump switches on, for example 8 °C
F12=DHW pump switching hysteresis, for example. 2°C
F15=given water temperature in the container. DHW pump has a priority, so that only after reaching this setting, central heating pump switches on, for example 60 °C
F16=OFF; F17=0.1; F21=0; F29=COOL ; F50=0 ; F51=0
F52=0 (when central heating pump switches on, domestic hot water pump switches off)



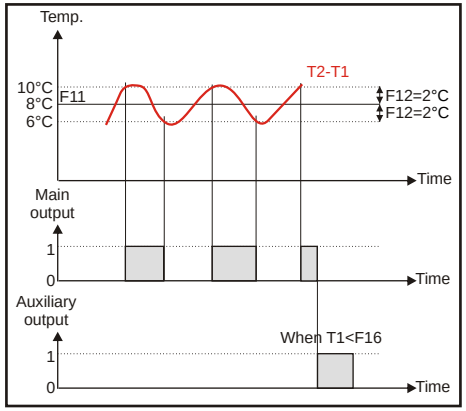
11. ADVANCED SYSTEMS.

11.1. Solar collector and boiler circulating pump control system.



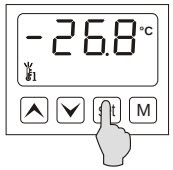


Functions performed by the controller in the system:
–collector pump control
–central heating boiler circulating pump control system
Tips for parameters programming:
F10=1 (boiler T1 and collector T2 temp. measurement)
F11=temperature difference T2-T1 between the solar collector and the boiler after reaching that, the collector's pump switches on, for example 8 °C
F12=pump switching hysteresis, for example 2°C
F15=OFF
F16=In cloudy days, when solar energy is low, it is essential to heat-up the boiler from the other source. This parameter specifies the boiler temperature below which an external heating source switches on, for example boiler circulating pump. Setting, for example 40 °C.
F17=90min (external heating source switching delay)
F21=0; F29=COOL ; F50=0 ; F51=0 ; F52=0



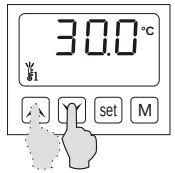
4. CONTROLLER HANDLING.

4.1. TEMPERATURE SETTING.

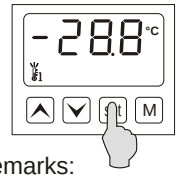
① 

Push the button set for 2 seconds.

Diode lights up.

② 

Using ⩓ or ⩔ button set the desired temperature value.

③ 

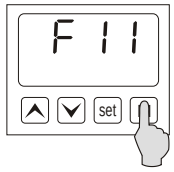
Confirm the set with set Key.

Diode lights off.

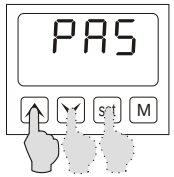
Remarks:
–to cancel the setting, press the M button in any time
–the setting change can be limited by F13 and F14 parameters

Information:
To improve quick increasing or decreasing the settings values hold the ⩓ or ⩔ button constantly for at least 1 sec.

4.2. PARAMETERS PROGRAMMING.

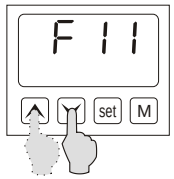
① 

Enter the menu holding M Key for 5 sec., Until: F10 Command displays.

② 

If the access is protected PAS Command displays.

Using ⩓ , ⩔ and set Buttons enter the password and confirm with set key.

③ 

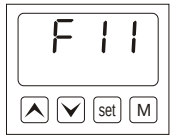
Using ⩓ or ⩔ key choose the parameter you want to change and enter with set Key.

④ 

Using ⩓ or ⩔ button set the desired parameter value.

⑤ 

Using set key confirm the new parameter value and return to the parameters list.

⑥ 

Finish programming pressing M button or enter the ''End'' command and press set key or wait 30 sec. without pressing any button

Remarks:
- press M button to cancel the parameter setting

Information:
Hold ⩓ or ⩔ button for at least 1 sec. to improve quick increasing and decreasing of setting values.

4.3. DESCRIPTION OF THE PARAMETERS.

Code:	Description:	Range:	Default:
F10	Controller work mode: 0 - normal (displays from the main sensor T1, auxiliary sensor T2 off) 1 - differential (display difference between auxiliary and main sensor (T2-T1) 2 - average (display average from two sensors: main and auxiliary (T1+T2/2)	0, 1, 2	1
F11	Value of tempereture setting. Range of changes is limited by F14 and F13.	F14...F13	8.0°C
F12	Hysteresis (temperature control accuracy).	0.1...20.0°C	0.5°C
F13	Maximum value possible to set by the user.	-50.0...150.0°C	150.0°C
F14	Minimum value possible to set by the user.	-50.0...150.0°C	-50.0°C
F15	High temperature alarm. F15=OFF – alarm off	-50.0...150.0°C	85°C
F16	Low temperature alarm. F16=OFF – alarm off	-50.0...150.0°C	5.0°C
F17	The delay of switching high and low temperature.	0.1...99.9min	0.1min
F18	Temperature sensor T2 calibration. This is the value of rescaling the T2 temperature sensor in relation to actually measured temperature.	-20.0...+20.0°C	0.0°C
F19	Temperature sensor T1 calibration. This is the value of rescaling the T1 temperature sensor in relation to actually measured temperature.	-20.0...+20.0°C	0.0°C
F21	Output1 minimum down time. It also means the delay time of switching the output on after giving power supply. Parameter protects devices, for example engine from too frequent switching in case of power failure.	0.0...10.0min	0.0min
F29	Controlling output work mode: COOLING/HEATING	COOL/HEAT	COOL
F50	Digital input D1: 0 – unused; 1 – alarm when circuit 4-5 closed, 2 – alarm when circuit 4-5 closed with maintaince of alarm signalling, 3 – alarm when circuit 4-5 opened, 4 – alarm when circuit 4-5 opened with maintance of alarm signalling	0...4	0
F51	Sound signaller (beep) active when temperature alarm: 0 – N0, 1 – YES	0, 1	1
F52	The way of protection the system and the devices connected to the main output when the temperature alarm occurs: 0 – main output off and locked when an alarm, 1 – main output on and locked when the alarm, 2 – alarm does not affect the operation of the main output	0, 1, 2	0
F57	Output2 contacts scheme: 0-contacts normally opened, closed when the temperature alarm or when digital input activation; 1-contacts normally closed, opened when the temperature alarm or when digital input activation	0, 1	0
F80	Password to access the configuration menu. OFF – password protection inactive, F80 = 0000 – no password	0000...9999	OFF
F83	Display mode 0 - measurement from two sensors displayed alternately every 3 sec.; 1 - measurement from T1 sensor; 2 - measurement from T2 sensor	0, 1, 2	0
F98	Reserved.	-	-
F99	Controller test. Disconnect output device to make the test! Otherwise the system can crash.	-	-
End	Exit the menu.	-	-

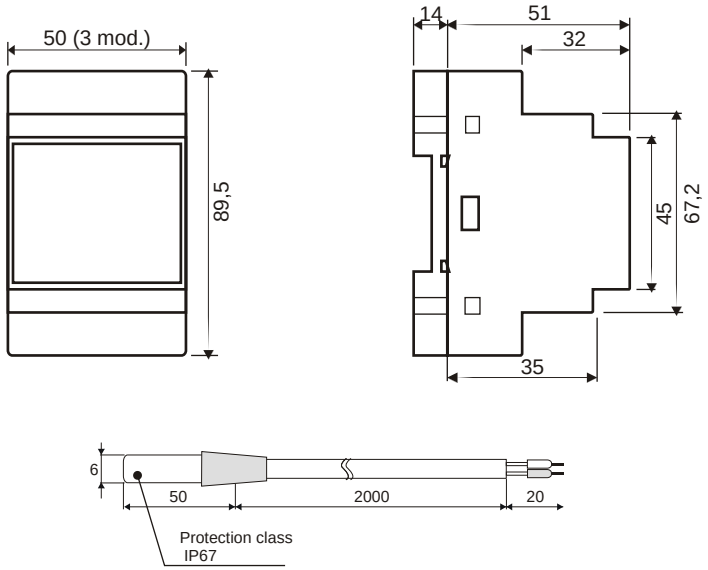
5. GENERAL DESCRIPTION.

5.1. ADJUSTMENT.

SC-20 is designed to control the heating and cooling system. A wide range of configuration makes the controller perfect for use in typical arrangements, such as boiler or circulating pump Control and complex, for example: solar collector or fireplace with water jacket control.
Adjustment is based on the measurement from one or two temperature sensors:
–when measuring from one sensor (F10=0) controller mainstains the set temperature switching on the main output in "heating" or "cooling" mode with deviation (regulated hysteresis)
– when measuring from two sensors the user can select the operating mode of the controller:
–the output is activated based on the difference (F10=1) or average (F10=2) from two temperature sensors.
In differential mode, the controller activates, e.g. Collector circulating pump after reaching an essential difference between boiler's and collector's sensor. And in averaging mode, the controller operates as an usual temperature controller except that the measured value is calculated from the arithmetic average of readings from two temperature sensors, for example at the two ends of the pipeline or the boiler.

8. MOUNTING.

Mounting on a DIN rail(TS35), 50cm width (3 modules).



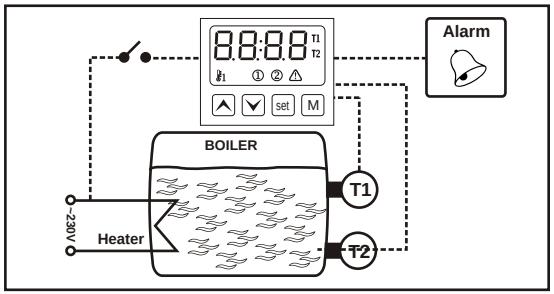
9. INSTALLATION.

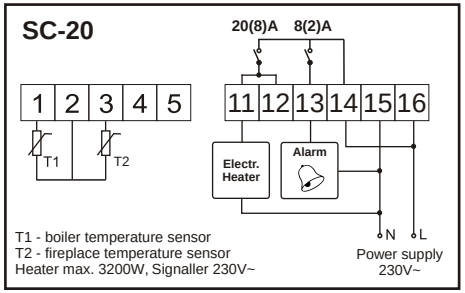
Be aware of the conditions where the controller operates. Install in a place, where there is not too high temperature and humidity and no condensation. Should be ventilated in order to remove the heat.
ATTENTION!
It is not allowed to work with electric cables when the device is energized.
You should avoid crossing wires using short connections. We recommend securing the source of controller power supply and temperature sensor input against electrical interference

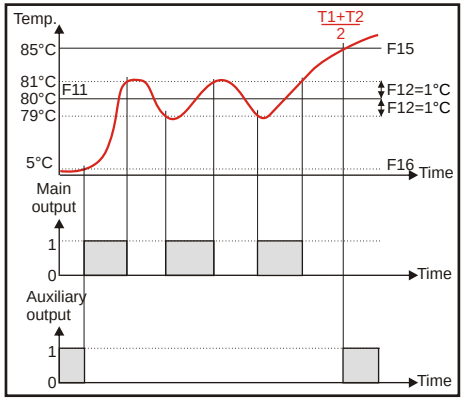
10. ADM ISSIONS.

Controller meets the requirements for immunity to electromagnetic interference in an industrial environment according to the following standards:
Electromagnetic compatibility (EMC):
–EN-61000 part 6-4 – requirements for emissivity in an industrial environment
–EN-61000 part 6-2 – requirements for immunity in an industrial environment
It also meets the safety requirements according to standard:
–EN-61000 part 1 – safety requirements for eletrical devices
Controller meets the requirements of EU directives No. 72/23/EEC; 93/68/EEC; 89/336EEC.

5.7. Chamber, incubator and boiler with adjustment calculated from the arithmetic mean of the measurements from two temperature sensors T1 and T1 PRECISE control system.







Functions performed by the controller in the system:
–heater control
–external acoustic signaller control
–system protection against overheating and freezing
–emergency states sound signalling

Tips for parameters programming:
F10 = 2 (temperature measurement from two sensors T1 and T2)
F11 = temperature setting
F12 = heater switching hysteresis, for example 1 °C
F15 = high temperature alarm, for example 85 °C
F16 = low temperature alarm, for example 5 °C
F17 = 0.1; F21 = 0;
F29 = HEATING;
F50 = 0; F51 = 1; F52 =0

6. DIGITAL INPUT.

Controller has digital input D1 for emergency states signalling, such as system failure, pressure control or safety thermostat activation, etc. Input type (normally opened, normally closed) is programmed by F50 parameter. After opening/closing circuit of 4-5 digital input, the controller turns off the main output and turns on the sound signaller (beep) and an auxiliary output and the display shows A11 code. Emergency state sound signalling can be maintained, until the alarm reset by using the buttons (F50=2 or 4).

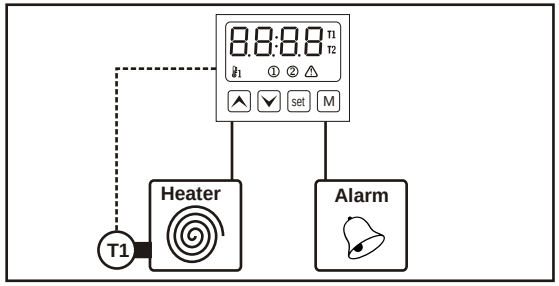
7. ALARM MESSAGES.

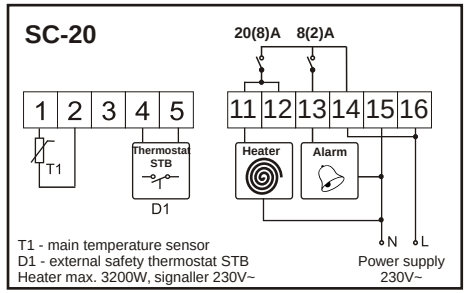
When alarm activates the indicator ⚠ starts to blink and the sound signaller (beep) activates (when F83=1). According to the occurence controller turns on/off output and the front panel displays one of the following alarm messages:

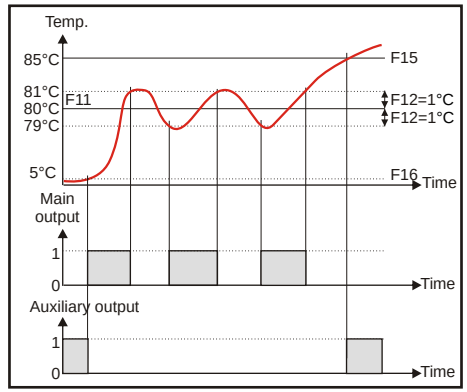
Statement	Occurence	Output operation
AL.d1	digital input activation F50	auxiliary output active, the main inactive
AL.t1	T1 sensor error: open circuit or short circuit	auxiliary output active, the main inactive
AL.t2	T2 sensor error: open circuit or short circuit	auxiliary output active, the main inactive
AL.Hi	high temperature alarm F15	auxiliary output active, the main depends on the setting of F52
AL.Lo	low temperature alarm F16	auxiliary output active, the main depends on the setting of F52

Here are some examples of control systems using the SC-20 including diagrams of supported installations, tips for programming and diagrams of electric connections.

5.2. Heater with external alarm control system.



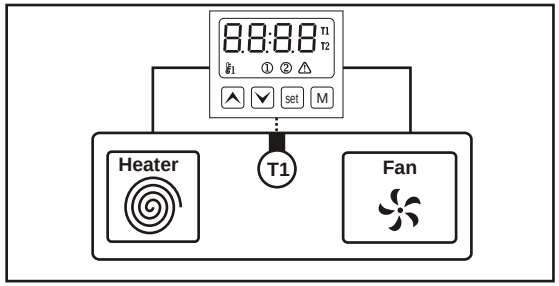


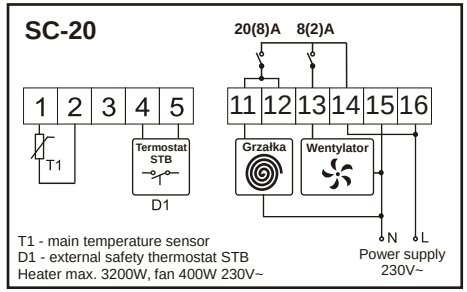


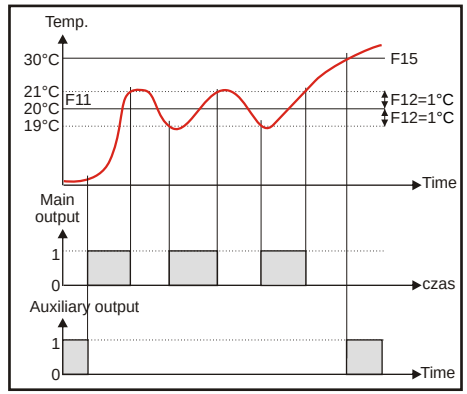
Functions performed by the controller in the system:
–heater control (boiler, electric heater, etc.)
–external acoustic signaller control
–system protection against overheating and freezing
–emergency states sound signalling

Tips for parameters programming:
F10 = 0 (system temp. measurement from T1 sensor)
F11 = temperature setting
F12 = heater switching hysteresis, for example 1 °C
F15 = high temperature alarm, for example 85 °C
F16 = low temperature alarm, for example 5 °C
F17 = 0.1; F21=0; F29=HEATING
F50 = 0 or 2 (2 – if you used the external safety thermostat STB connected to the D1 input)
F51 = 1 (sound signaller active)
F52 = 0 (heater off in danger point)

5.3. Heater and fan control system.



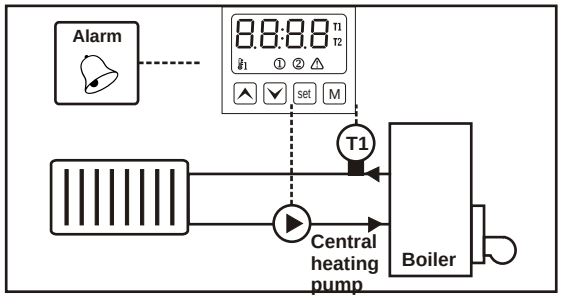


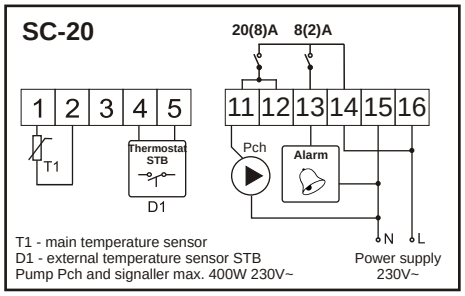


Functions performed by the controller in the system:
–heater heating up the chamber control
–fan cooling the chamber control
–emergency states sound signalling

Tips for parameters programming:
F10 = 0 (temperature measurement from T1 sensor)
F11 = temperature setting
F12 = heater switching hysteresis, for example 1 °C
F15 = temperature setting of switching the fan cooling the chamber, for example 30 °C
F16 = OFF
F17 = 0.1; F21 = 0
F29 = HEATING
F50 = 0 or 2 (2 – if you used the external safety thermostat STB connected to the D1 input)
F51 = 0; F52 = 0

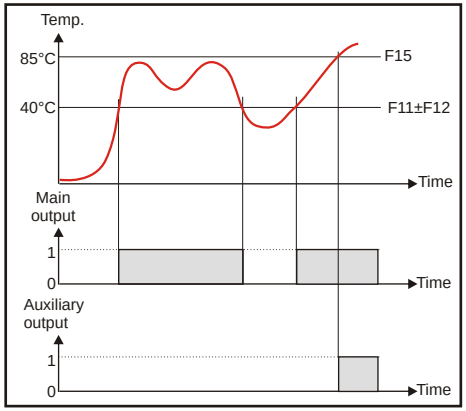
5.3. Central heating circuit circulating pump with an external alarm control system.



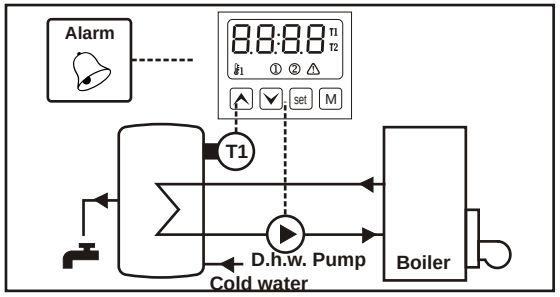


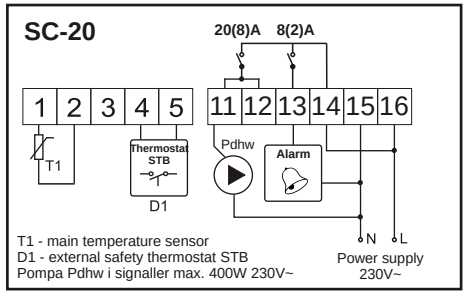
Functions performed by the controller in the system:
–central heating circulating pump control
–external acoustic signaller control
–system protection against overheating

Tips for parameters programming:
F10=0 (T1 pipeline temperature measurement)
F11=pump start temperature setting, for example 40 °C
F12=pump switching hysteresis, for example 0.1 °C
F15=high temperature alarm in boiler, for example 85 °C
F16=OFF; F1 = 0.1; F21 = 0
F29=COOLING (switching pump after reaching the temperature of the boiler)
F50=0 or 2 (2 – if you used an external safety thermostat STB connected to the D1 input)
F51=1 (sound signaller active)
F52=0 (when the high temperature alarm occurs, the pump switches on to cool down the water in the boiler)



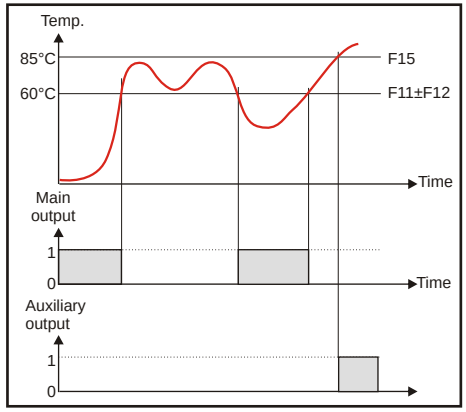
5.4. Domestic hot water circuit circulating pump with an external alarm control system.



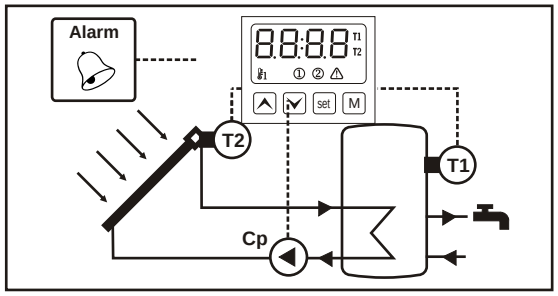


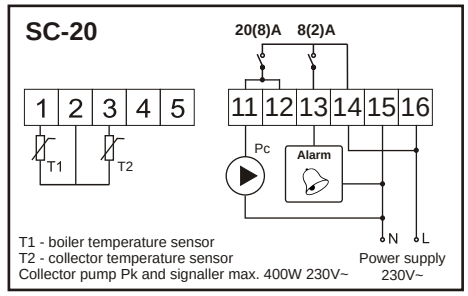
Functions performed by the controller in the system:
–domestic hot water circulating pump control
–external acoustic signaller control
–system protection from overheating

Tips for parameters programming:
F10 = 0 (T1 boiler temperature measurement)
F11 = boiler temperature setting, for example 60 °C
F12 = pump switching hysteresis, for example 0.1 °C
F15 = high temperature alarm, for example 85 °C
F16 = OFF; F17 = 0.1; F21 = 0
F29 = HEATING (pump works until the temperature is reached)
F50 = 0 or 2 (2 – if you used an external safety thermostat STB connected to the D1 input)
F51 = 1 (sound signaller active)
F52 = 1 (when high temperature alarm occurs, the pumps is switched on)

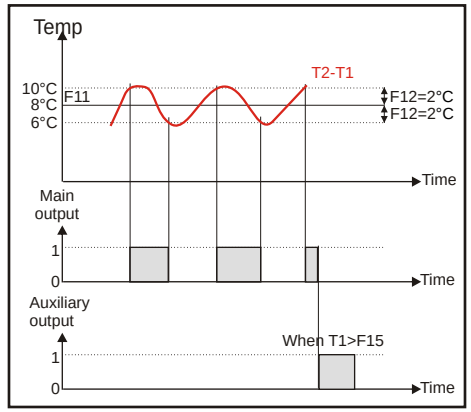


5.5. Solar collector with an external alarm control system .

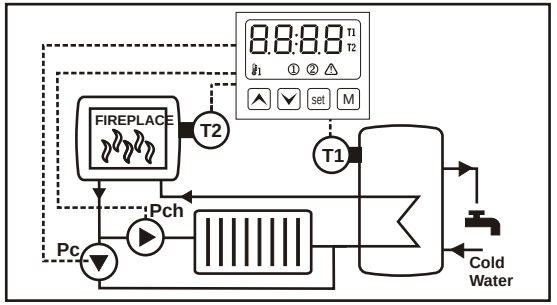


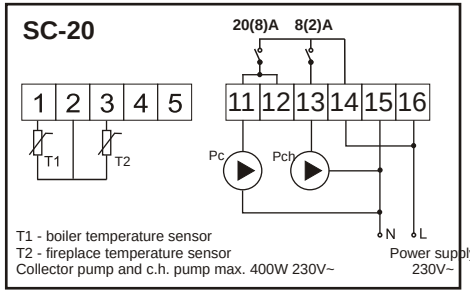


Functions performed by the controller in the system:
–collector pump control
–external acoustic signaller control
–boiler protection against overheating
Tips for parameters programming:
F10=1 (boiler T1 and collector T2 temperature measurement)
F11=temperature difference T2-T1 between the solar collector and the boiler after reaching
that, the collector's pump switches on, for example 8 °C
F12=pump switching hysteresis, for example 2 °C
F15=boiler overheating alarm, for example 85 °C
F16=OFF; F17 = 0.1; F21 = 0, F29 = COOL; F50 = 0
F51=1 (sound signaller active)
F52=0 (when the boiler overheating alarm occurs, pump is turned off so as not to collect a hot factor from the collector)



5.6. Fireplace with water jacket control system.





Functions performed by the controller in the system:
- fireplace pump control
- central heating circulating pump control.
Tips for parameters programming:
F10=1 (boiler T1 and fireplace T2 temp. measurement)
F11=setting specifying the fireplace temperature growth in relation to the boiler temperature so that the fireplace pump switches on, for example 8 °C
F12=fireplace pump switching hysteresis, for example 2 °C
F15=set water temperature in the boiler. Loading the domestic hot water boiler using the fireplace pump is a priority, so that only after reaching this setting, the central heating pump switches on, for example 60 °C
F16=OFF; F17=0.1; F21=0; F29=COOL; F50=0; F51=0
F52 = 0 (when the central heating pump switches on, fireplace pump is switched off)