On-Off controller in heating and cooling modes with timer

Project for PR200-24.2

Project overview

The example explains the use of an on-off controller in heating and cooling modes with a timer. The project contains 2 data processing blocks and 2 screens.

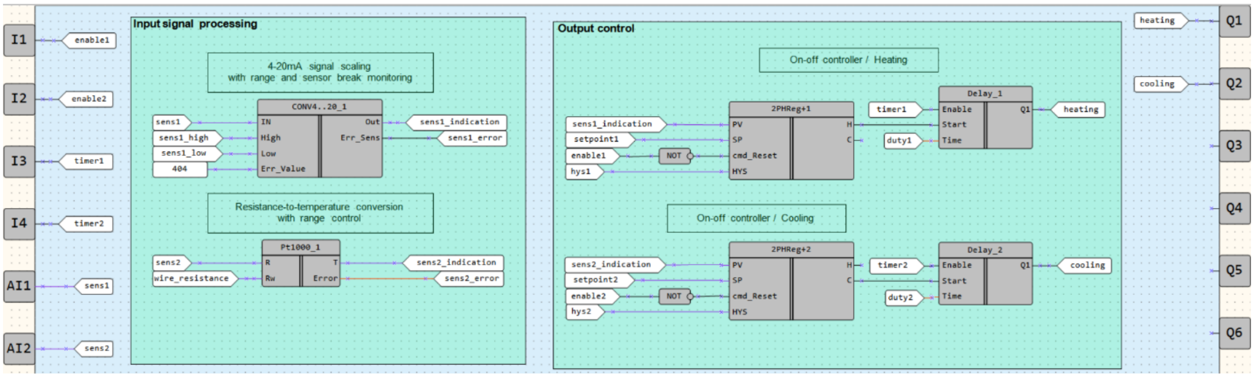

Fig. 1. Program workspace

Data processing blocks:

- Input signal processing
- Output control

Screens:

- *Sensors*
- *Controllers*

Table 1. Device inputs/outputs

Name	Type	Description
I1	BOOL	Heater enable (NO contact, latching)
I2	BOOL	Cooler enable (NO contact, latching)
I3	BOOL	Heater / timer on (NO contact)
I4	BOOL	Cooler / timer on (NO contact)
AI1	REAL	1st temperature sensor (4-20 mA)
AI2	REAL	2nd temperature sensor (RTD)
Q1	BOOL	Heater
Q2	BOOL	Cooler

Table 2. Project variables

Name	Type	Description
heating	BOOL	Heater control signal
cooling	BOOL	Cooler control signal
enable1	BOOL	Heater enable
enable2	BOOL	Cooler enable

timer1	BOOL	Heater / timer on
timer2	BOOL	Cooler / timer on
sens1_error	BOOL	1st sensor / error
sens2_error	INT	2nd sensor / error
hys1	REAL	Heater / hysteresis
hys2	REAL	Cooler / hysteresis
duty1	INT	Heater / duty time
duty2	INT	Cooler / duty time
sens1	REAL	1st sensor / signal (temperature 4-20 mA)
sens1_indication	REAL	1st sensor / signal (temperature °C)
sens1_high	REAL	1st sensor / upper limit
sens1_low	REAL	1st sensor / lower limit
setpoint1	REAL	Heater / setpoint
sens2	REAL	2nd sensor / signal (temperature Ω)
sens2_indication	REAL	2nd sensor / signal (temperature °C)
setpoint2	REAL	Cooler / setpoint
wire_resistance	REAL	2nd sensor / wire resistance (Ω)

Input signal processing

The sensor connected to input *AI1* is a current sensor with a 4-20 mA output signal. The output signal is converted into temperature using the *CONV4..20* macro, which scales the current signal.

The constant applied to the input *Err_Value* is the value on the macro output *Out* in case of error.

The sensor connected to the *AI2* input is a PT1000 resistance thermometer. The output signal is converted to temperature with *PT1000* macro that scales the resistance signal. It also provides the wire resistance compensation over *Rw* input.

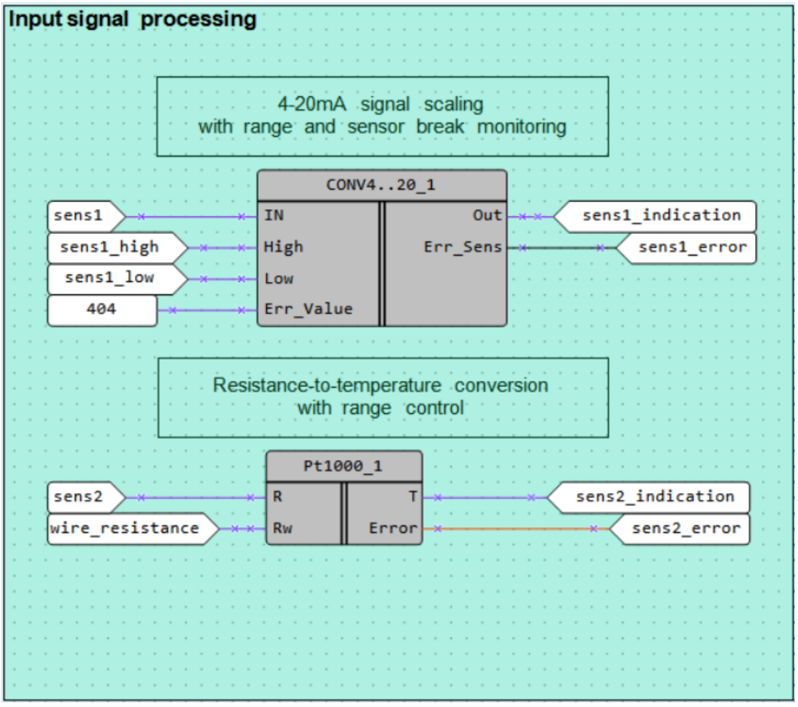

Fig. 2. Input signal processing

Output control

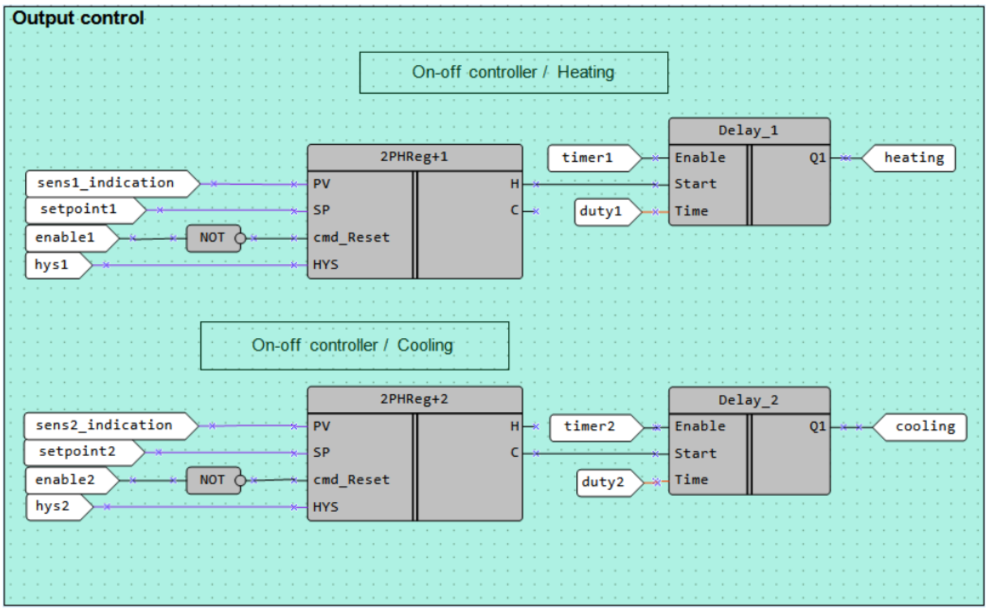

Fig. 3. Output control

The on-off temperature control is provided by two *2PHReg+* macros. One of them works in heating mode, the other in cooling mode.

If the timer is enabled, the desired temperature is kept constant for the set duty time.

The duty time, setpoint and hysteresis for each controller can be read on the device display and changed using the function buttons.

The controllers can be enabled/disabled over two latching NO contacts connected to the *I1* and *I2* inputs.

Screens

Table 3. Function buttons

Function buttons	Action
︾	Scroll down through screen rows
︽	Scroll up through screen rows
ALT + ︾	Switch to the next screen
ESC	Switch to the first screen

Initially, the screen *Sensors* is displayed (Fig. 4). It shows the status of the both sensors (*normal/error*) and the measured temperature.

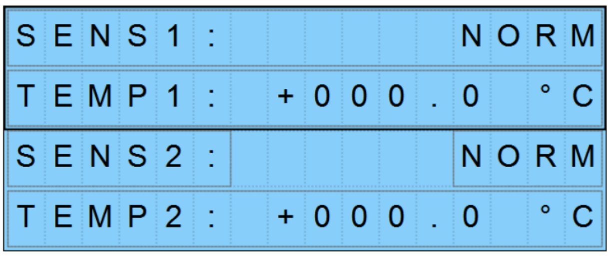

Fig. 4. Screen *Sensors*

The next screen *Controllers* (Fig. 5) shows the parameters *Setpoint, Hysteresis* and *Runtime* for both controllers that can be set using the function buttons.

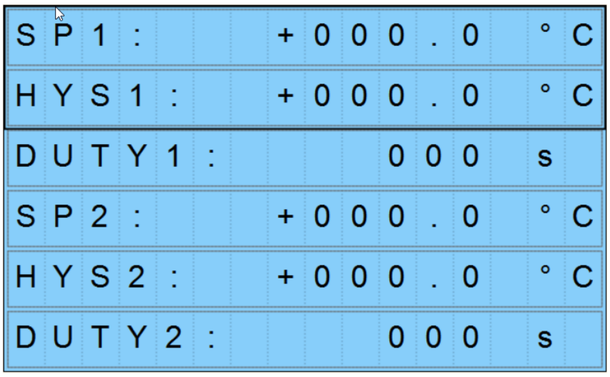

Fig. 5. Screen *Controllers*