MicroniK 200

R7426B,C
TEMPERATURE CONTROLLER
WITHOUT REAL TIME CLOCK

SPECIFICATION DATA

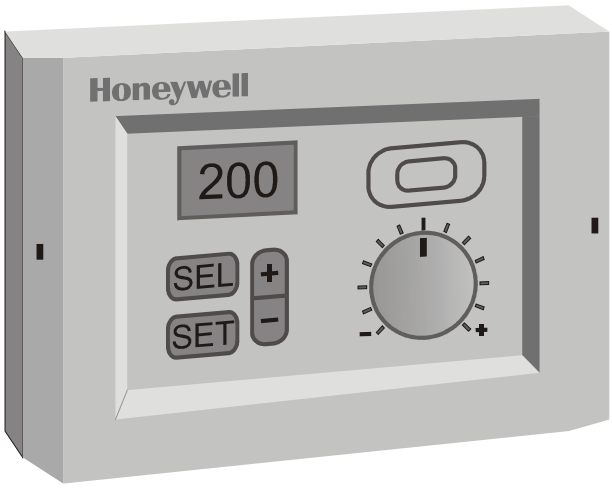


Fig. 1. Temperature Controller

GENERAL

The R7426B,C temperature controllers cover all space and/or discharge air temperature applications within the specified control range of 0...50 °C requiring sequence operation of heating, mixed air damper or energy recovery system and cooling with optional outside air temperature compensation reset of the main setpoint. The controllers can be configured to perform space or discharge air or space-discharge air temperature cascade control with limit control.

For special higher temperature control applications the control range 0...130°C can be selected.

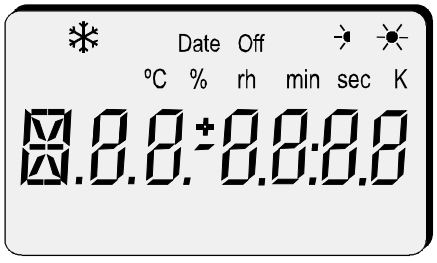


Fig. 2. LC Display

FEATURES

- **Microcontroller design based on modern digital technology**
- **User interface with LC display, 4 push buttons and CPA/SPA-potentiometer**
- **Selectable proportional plus integral (P+I) or proportional-(P)-only control**
- **Three inputs for temperature sensors**
- **Automatic sensor type identification of Balco 500, Pt 1000 or NTC 20kΩ**
- **3 digital inputs for plant/system ON/OFF, occupancy, and freeze protection**
- **Dehumidification control via humidity deviation input**
- **Selectable floating output functions:**
  - Floating
  - 2, 3, 4, 6 or 15 stage On/Off (TRIAC's)
  - Pulse width modulation
- **Analog outputs 0/2...10 Vdc selectable**
- **Pre-programmed control parameters**
- **Start-up routine**
- **Cascade control with space/supply limit**
- **Sequence control of heating, mixed air damper or energy recovery system and cooling**
- **Serial communication bus interface for PC-based operator's terminal**
- **Easy application configuration with parameter up and download possibility**

Models

Order-No.	Controller Description
R7426B2004	Temperature controller, Plant/System On/Off input and three 3-position floating outputs. The controller offers the choice of selectable different output sequence operations and output signals suitable to drive Solid State Relays or step relays.
R7426C2002	Temperature controller, Plant/System On/Off input and three analog outputs. The controller offers selection of different output sequence operations.
Order-No.	**Accessories**
43193862-001	Front panel mounting frame.

CE

TECHNICAL DATA

General	Electronic	8-bit microcontroller, 10-bit A/D converter, EEPROM and LC display	
	Power supply	24 Vac +10...-15%, 50/60Hz	
	Power consumption	3 VA + Actuator power requirements	
	Control range	0...50 °C	
Temperature Inputs	T1 T2 T3	Main temperature sensor Cascade temperature sensor Compensation temperature sensor	accuracy ±0.5 K excl. sensor
Sensor type[1]	**Automatic identification of sensor type**	**Temperature range**	**Characteristics**
	Pt 1000	-30....+130 °C	1000Ω at 0 °C
	BALCO 500	-30....+130 °C	500Ω at 23.3 °C
	NTC 20kΩ	-30....+85 °C / -30....+130 °C[1]	20kΩ at 25 °C
CPA/SPA-Input[1]		**CPA/SPA range**	**Sensor & CPA/SPA types**
	CPATYP 0	CPA: ±5 K	internal
	CPATYP 1 (953...1053Ω)	CPA: ±5 K	T7412B1016 (Pt 1000)
	CPATYP 2 (100kΩ...0Ω)	CPA: ±5 K	T7412B1057 (Pt 1000) T7412C1030 (Pt 1000) T7412B1008 (NTC 20kΩ) T7412C1006 (NTC 20kΩ) 43193982-001
	CPATYP 3 (10...20kΩ)	SPA: 15...30 °C	T7412B1024 (BALCO 500) T7412B1040 (Pt 1000)
	CPATYP 4 (0...10kΩ)	CPA: ±5 K	43182671-001
	CPATYP 5 (0...100kΩ)	SPA: 15...30 °C	43193982-001
	CPATYP 6 (0...100kΩ)	SPA: 0...50°C or 0...130°C	43193982-001
Analog input	Humidity deviation (X_{wrh})	-5...+5Vdc, 200mV/%rh	
Digital inputs		**Mode**	**Potential free contact**
	Occupancy	unoccupied occupied	open > 40kΩ closed < 100Ω
	Freeze protection input	freeze protection operation normal operation	open > 40kΩ closed < 100Ω
	On/Off input	Off On	open > 40kΩ closed < 100Ω
Outputs	TRIAC outputs	• Floating[1] • 2, 3, 4, 6 or 15-stage[1] On (24 Vac) / Off (0 Vac) • Pulse width modulation[1] 0...100% based on run time (P21, 22, or 23)	max. load 450 mA at 24 Vac
	Analog outputs on controller R7426C	Control range[1] 0/2...10 Vdc (0...100%) full range 0...12 Vdc	max. load 1.2 mA at 12 Vdc
Ambient limits	Operating temperature Transport and storage temperature Relative humidity	0...50°C (32...122°F) -35...+70°C (-31...+158°F) 5...95%rh non condensing	
Safety	Protection class Protection standard	II in accordance with EN60730-1 IP30 or IP40 (front panel mounting) in accordance with EN60529	
Housing	Dimensions (H x W x D) Weight Mounting	105 x 152 x 37 mm 250 g Front door[2], back panel, wall or rail	
Connections	Connection terminal	Friction spring screwless terminals max. 1 x 1.5 mm^2	

[1] Selectable

[2] With optional mounting frame 43193862-001

CONTROL AND CONFIGURATION PARAMETER

Control Parameter		Parameter Description	Setting			Reso-lution	Unit
No.	Name		Low	High	Default		
P.01	**W1**	Main setpoint for input T1	0	50	21	0.5	°C
P.02	**Wlim**	Limit setpoint (low or high) for input T2	5	50	16	1	°C
P.03	**Wcomp**	Compensation changeover point for input T3	-5	40	20	1	°C
P.04	**Wi**	Winter compensation authority	-350	+350	0	2	%
P.05	**Su**	Summer compensation authority	-100	+100	0	1	%
P.06	**Wcas**	Submaster or cascade setpoint	Off, 0	50	20	0.5	°C
P.07	**Rcas**	Cascade reset span adjustment	0	40	10	0.5	K
P.08	**Xp1**	Throttling range (main control loop) T1	0.5	40	2	0.5	K
P.09	**Xp2**	Throttling range (cascade control loop) T2	0.5	40	10	0.5	K
P.10	**Xpc**	Cooling throttling range for sequence control	Off, 1	40	3	0.5	K
P.11	**Xph**	Heating throttling range for sequence control	1	40	6	0.5	K
P.12	**tr1**[1)]	Reset time (main control loop) T1	Off, 20 sec	20 min	Off	10/0.5	sec/min
P.13	**tr2**[1)]	Reset time (cascade control loop) T2	Off, 20 sec	20 min	Off	10/0.5	sec/min
P.14	**MINPOS**	Minimal pos. for air damper actuators	0	50	20	1	%
P.15	**Ystart**	Start point for mid range shift of output Y1	-20	+20	0	0.5	K
P.16	**SOFFS**	Offset of main setpoint in Standby mode	0	10	2	0.1	K
P.17	**T1Cal**	Calibration of temperature sensor T1	-20	+20	0	0.1	K
P.18	**T2Cal**	Calibration of temperature sensor T2	-20	+20	0	0.1	K
P.19	**T3Cal**	Calibration of temperature sensor T3	-20	+20	0	0.1	K
P.20	**RetOffs**	Return air offset to simulate exhaust air cond.	Off, 0	5	Off	0.1	K
P.21	**RuntimeY1**	Actuator run time for output Y1 (R7426B only)	6	180	60	1	sec
P.22	**RuntimeY3**	Actuator run time for output Y3 (R7426B only)	6	180	60	1	sec
P.23	**RuntimeY2**	Actuator run time for output Y2 (R7426B only)	6	180	60	1	sec

Config. Parameter		Values	Default	Unit
No.	Name			
C.01	**DIR/REVY1**	Dir, Rev (R7426C only)	Dir	
C.02	**DIR/REVY3**		Dir	
C.03	**DIR/REVY2**		Dir	
C.04	**Ctrltyp**[2)]	Lo = 0...50°C, Hi1 = 0...130°C	Lo	
C.05	**CPATYP**	0 = internal (default), 1 = ±5K (953...1053Ω), 2 = ±5K (100kΩ...0Ω), 3 = 15 … 30°C (10...20kΩ), 4 = ±5K (0...10kΩ), 5 = 15 … 30°C (0...100kΩ), 6 = 0...50 °C or 0...130 °C (0...100kΩ)	0	
C.06	**YRange**	0 = 2 … 10Vdc , 1 = 0 … 10 Vdc (R7426C only)	1	
C.07	**Startup**	On, Off	Off	
C.08	**Y1Mode**	0= float., 1= 2 stage On/Off, 2= 3 stage On/Off, 3 = pwm, 4 = unconfig. (R7426B only)	4	
C.09	**Y3Mode**		4	
C.10	**Y2Mode**		4	
C.11	**YMode**	0: Y1 = D, Y2 = C, Y3 = H; 1: Y3/2/1 = H or C; 2: Y3/1 = H, Y2 = C; 3: Y3/1 = C, Y2 = H; 4: Y1 = 2Pos D, Y2 = C, Y3 = H; 5: Y3/1 = 15H, Y2 = C	0	
C.12	**T2ext**	0 = T2 installed; 1 = T1 signal used for T2	0	
C.13	**LimTyp**	0 = Low limit; 1 = High limit	0	
C.14	**Senstyp**	0 = Auto detection; 1 = NTC sensor type	0	
C.15	**Y1CTRF**	Output Y1 used for: 0 = mixed air damper; 1= energy recovery	0	
C.22	**Adr**[2)]	Serial communication address: 0 = Min. 255 = Max.	254	
C.23	**DefProg**	0 = No Defaultprogramming; 1 = Initiates Defaultprogramming	0	

[1)] for tr > 2 min resolution = 0.5 min , for tr < 2 min resolution = 10 sec

[2)] actual value will not be changed during reset to default parameter

APPLICATION

The R7426B,C controllers can be used for sequence control applications of heating, mixed air damper or energy recovery system and cooling.

NOTE: All diagrams show proportional control action only. If P+I control is in operation the slopes for heating and cooling are not defined.

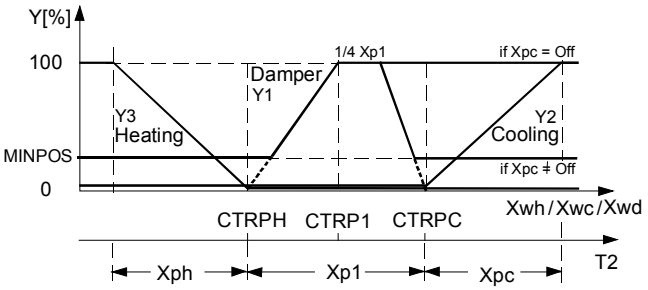
Temperature Sequence Control with Heating, Mixed Air Dampers and Cooling

This application will be active with the R7426B,C controllers when T2 is not connected. It can be used for sequence control of a heating valve, a mixed air damper and a cooling valve.

The characteristic of each output on the R7426C controller can be selected via the control parameters **DIR/REVx** (x = Y1, Y2 or Y3). The diagram shows Dir characteristic for all outputs.

Within the range **Xp1**, the damper signal is controlled as shown in the diagram below. If no cooling actuator is available, the control parameter **Xpc** can be set to Off and the damper output is maintained at 100 % above control point (CTRP1).

If the damper output should be decreased to **MINPOS** level above control point (CTRP1) as shown in the diagram, the control parameter **Xpc** has to be adjusted to any value between 1 and 40K, also if no cooling actuator is available.

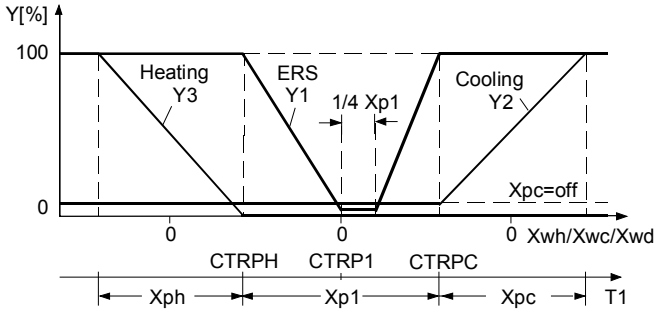


Note: If the R7426B controller with floating output is used for mixed air damper control, care must be taken, that the output load of maximum 450mA is not exceeded.

Temperature Sequence Control with Heating, Energy Recovery System and Cooling

For applications with energy recovery system (ERS) the configuration parameter **Y1CTRF** has to be set to 1 to perform a reverse acting Y1 output. The adjustment **MINPOS** is inactive in this configuration and the control parameter **Xpc** has to be set to Off, if the output should be maintained at 0% above the control point (CTRP1) for summer operation.

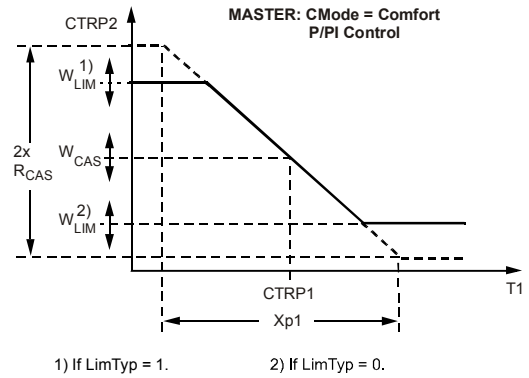
Within the range **Xp1**, the energy recovery system is controlled as shown in the diagram below. With the R7426C controller also a rotary energy recovery wheel can be controlled instead of a valve, if the output signal of 0...10Vdc or 2...10Vdc is suitable to control the rotation speed of this device.



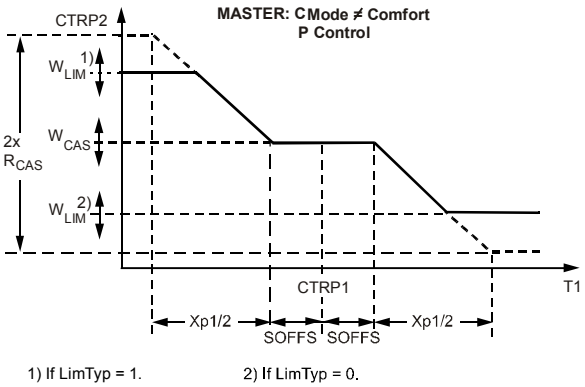
Temperature Cascade Control with Heating, Mixed Air Dampers and Cooling

This application will be active with the R7426B,C controllers, if temperature sensor T2 is connected and the control parameter $\mathbf{W_{cas}}$ is set to any value other than Off. It can be used for sequence control of a heating valve, a mixed air damper and a cooling valve.
Two cascade control modes are available:

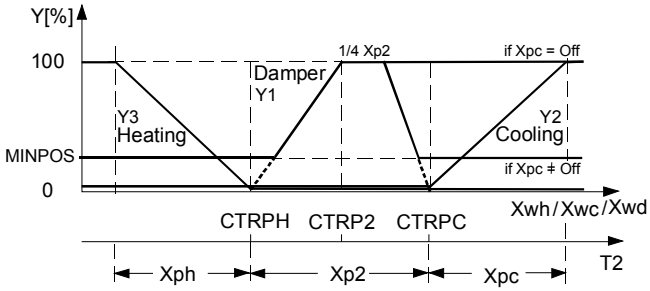
- With occupied (contact closed) mode



- With unoccupied (contact open) mode



Low limit of CTRP2 is performed if control parameter **LimTyp** = 0 and high limit of CTRP2 is performed if control parameter LimTyp = 1.
Within the range **Xp2**, the damper signal is controlled as shown in the diagram below. If no cooling actuator is available, the control parameter **Xpc** can be set to Off. If control parameter **Xpc** = Off , the cooling signal is set to 0% and the damper output is maintained at 100 % above control point (CTRP2).

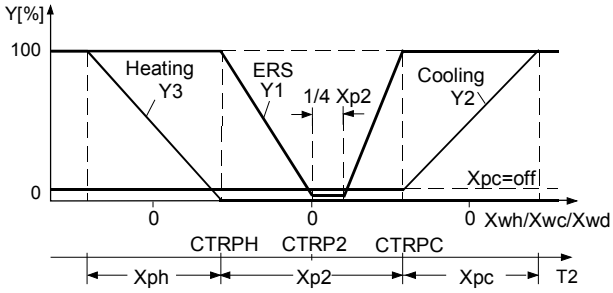


Note: If the R7426B controller with floating output is used for mixed air damper control, care must be taken, that the output load of maximum 450mA is not exceeded.

Temperature Cascade Control with Heating, Energy Recovery System and Cooling

For applications with energy recovery system (ERS) the configuration parameter **Y1CTRF** has to be set to 1 to perform a reverse acting Y1 output. The adjustment **MINPOS** is inactive in this configuration and the control parameter **Xpc** has to be set to Off, if the outputs Y1 and Y2 should be maintained at 0% above the control point (CTRP2) for summer operation.

Within the range **Xp2**, the energy recovery system is controlled as shown in the diagram below. With the R7426C controller also a rotary energy recovery wheel can be controlled instead of a valve, if the output signal of 0...10Vdc or 2...10Vdc is suitable to control the rotation speed of this device.



Economizer Modes

The economizer modes are suitable for installations where the main temperature sensor (T1) is installed in the exhaust air or in the room with a constant offset between room and exhaust air conditions. The offset value is programmable within 0...5K with the control parameter **RetOffs** which will be added to the actual measured room temperature value to simulate exhaust air conditions.

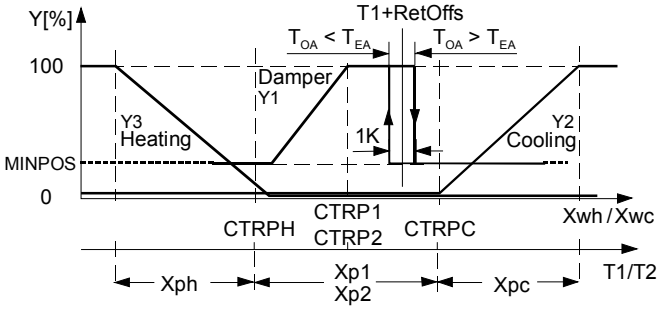
The economizer mode is disabled if the value of the control parameter **RetOffs** is programmed to Off, or if no outdoor air temperature sensor is connected.

By comparing the outside air condition with the exhaust air condition the output for Y1 on the controller operates as follows:

Mixed Air Dampers

RetOffs ≠ Off; **Y1CTRF** = 0

AIR CONDITION	Y1
Outside air temperature > Exhaust air temperature	MINPOS
Outside air temperature < Exhaust air temperature	Incl. in heating sequence control (direct acting)

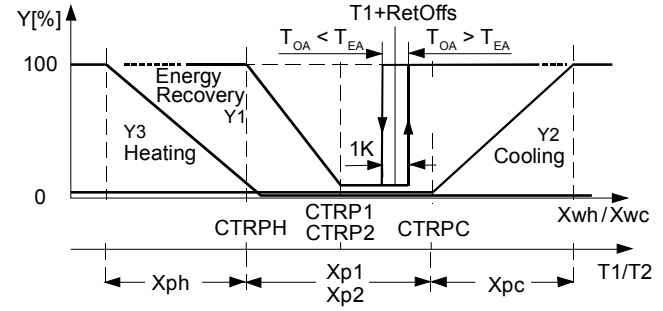


A fixed hysteresis of 1K is used, to switch between **MINPOS** and actual Y1 signal.

Energy Recovery System

RetOffs ≠ Off; **Y1CTRF** = 1

AIR CONDITION	Y1
Outside air temperature > Exhaust air temperature	100%
Outside air temperature < Exhaust air temperature	Energy Recovery System incl. in heating sequence control. MINPOS not active.



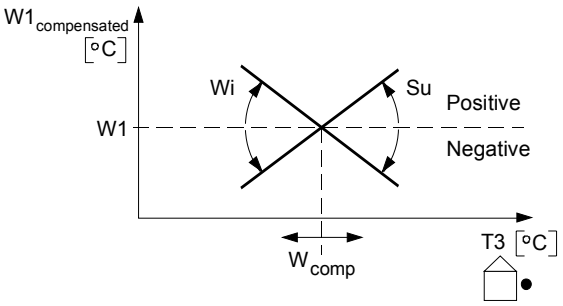
A fixed hysteresis of 1K is used, to switch between 0% position and actual Y1 signal.

CONTROLLER FUNCTIONS

Outside Air Temperature Compensation

Outside air temperature compensation is performed when T3 is connected. The control parameter **W_{comp}** defines the compensation changeover point for summer and winter compensation. The degree of summer and winter compensation is defined by control parameters **Wi** and **Su**.

Winter compensation is performed if temperature T3 < **W_{comp}**. Summer compensation is performed if temperature T3 > **W_{comp}**.



Smoothing Filter for Outside Air Temperature Input

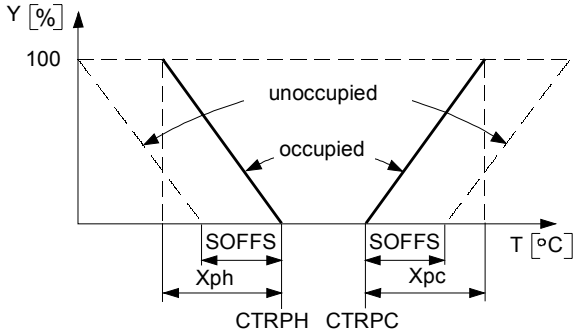
A smoothing filter for the outside air temperature input T3 is incorporated to eliminate sudden temperature variations. This provides more stable operation of the control system.

Occupied/Unoccupied Function (SOFFS)

A potential free contact can be used between terminals 1 and 4 to switch the controller between occupied (contact closed) or unoccupied (contact open) mode. The input is active during Comfort and Standby mode.

In occupied mode the temperature set point **W1** is used for the control point calculation. In unoccupied mode the **SOFFS** parameter value is added (cooling) to and subtracted (heating) from the calculated control point for cooling and heating.

The diagram below shows the occupied/unoccupied function for sequence control.



Freeze Protection

If the contact connected to the freeze protection input is open the heating valve (Y3) will be driven into the fully open position. The final control devices operated by the outputs (Y1 and Y2) will be driven in the closed position.

A closed contact performs a frost recovery:

Conditions of Outdoor Temp. T3	Frost Recovery
> 6°C or T3 not connected	Main temperature control
< 6°C	Setpoint W1 is temporarily raised by Xp1 and linearly decreased to its normal value over approx. 10min.

Freeze protection operation has the highest priority over all other control operations.

Start-up Routine

A start-up routine is provided on the R7426B,C controllers to prevent start-up problems. This routine can be enabled by setting the configuration parameter **Startup** to On.

After power up reset (initial start) or the plant/system **ON/OFF** input signal changes to On, the mixed air dampers stay in the full return air recirculation position or in energy recovery system applications the valve is fully open for full energy recovery. After approximately 5 minutes operation, the controller will switch the output signal Y1 to normal operation.

In addition, if an outside air sensor is connected and the outside air temperature is below 6°C, the setpoint **W1** is temporarily raised by **Xp1** and linearly decreased to its normal value over approximately 10 minutes.

If the **ON/OFF** input signal changes to Off, the output signals Y1,Y2 and Y3 are set to 0%.

Dehumidification Control by Humidity Deviation Input

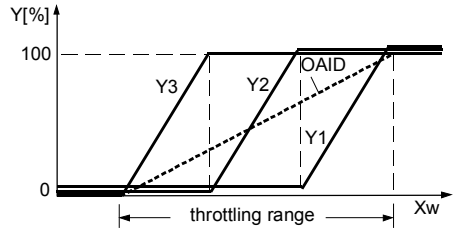
Dehumidification control can be performed by using in addition a humidity controller. The deviation input signal $X_{w\,rh}$ received from the humidity controller is compared with the cooling deviation signal of the temperature control (X_{wc}). The signal with the highest cooling demand is used to control the cooling output Y2.

OUTPUT SEQUENCE OPERATION

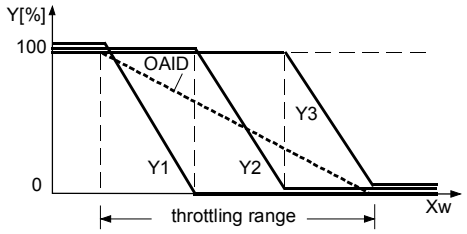
The controllers are supplied from the factory configured for sequence operation of heating, mixed air and cooling control.

The output sequence operation can be configured for the following control applications in accordance with the parameter setting **Y1CTRF** or **YMode**:

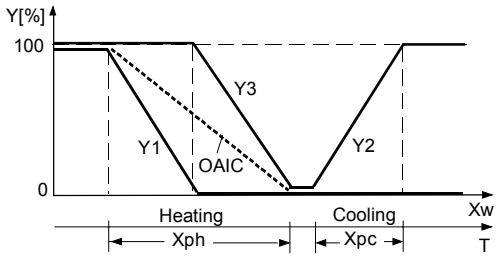
- Sequence control for cooling with three outputs (**Y1CTRF** = 0 and **YMode** = 1)



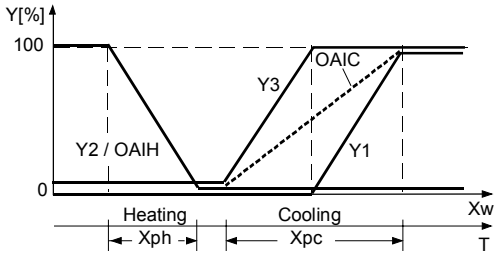
- Sequence control for heating with three outputs (**Y1CTRF** = 1 and **YMode** = 1)



- Sequence control with two outputs for heating and one output for cooling (**YMode** = 2)



- Sequence control with one output for heating and two outputs for cooling (**YMode** = 3)



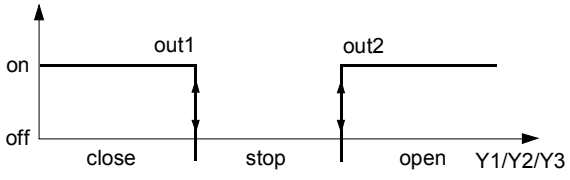
OUTPUT FUNCTIONS

The R7426B controllers provide a choice of output signals suitable for operating a range of final control devices according to the parameter setting of **YMode** and **YxMode** (x = 1, 2 or 3) control parameters.

3-position Output for Valve or Damper Actuators (floating mode)

The controller converts the deviation signal to a proportional output pulse which drives the actuators depending on the **Runtimex** (x = Y1, Y2 or Y3) parameter value.

Parameter setting for Heating / Cooling Control Outputs :
YMode = 0, 1, 2 or 3; **YxMode** (x = 1, 2 or 3) = 0.



An automatic synchronization function ensures correct positioning of the actuators. This is performed by running all actuators to the closed position periodically. The run time for synchronization is derived by control parameter **RuntimeYx** (x = 1, 2 or 3) multiplied by 1.25.

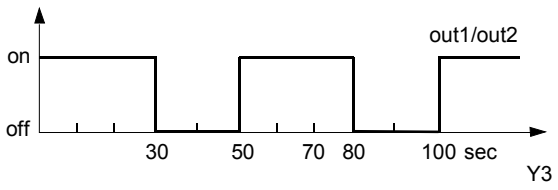
Synchronization by the controller is initiated:

- after power up reset (initial start)
- after 250 control steps as soon as control output is below 5%
- if plant/system ON/OFF input is switched to Off

Electric Heat Current Valve (pwm output)

The pulse width modulated output is suitable for driving electric heat current valves and is controlled from the heating signal. The interval or total cycle time is set by the control parameter **RuntimeY3**.

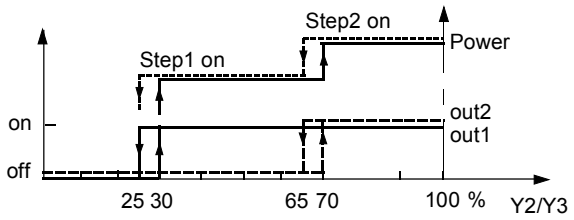
The diagram below shows as example, 60% Output Signal with Motor **RuntimeY3** set to 50 sec:
YMode = 0; **Y3Mode** = 3.



2-stage On/Off Sequence Control

The R7426B controllers convert the output signal into a 2-stage On/Off sequence output signal suitable for operating relays. Two relays can be connected to provide sequence control of e.g. 2 electric heater stages.

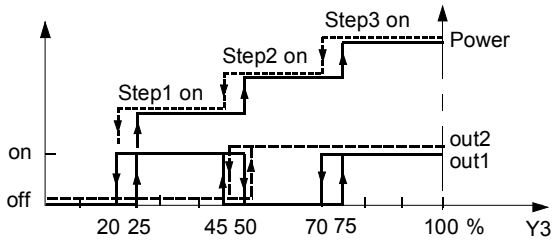
Parameter setting for Output Switching Position:
YMode = 0; **YxMode** (x = 2 or 3) = 1



3-stage Binary On/Off Sequence Control

The R7426B controllers convert the heating signal into a 3-stage binary On/Off sequence as shown in the following diagram.

Parameter setting for Output Switching Position:
YMode = 0; **Y3Mode** = 2

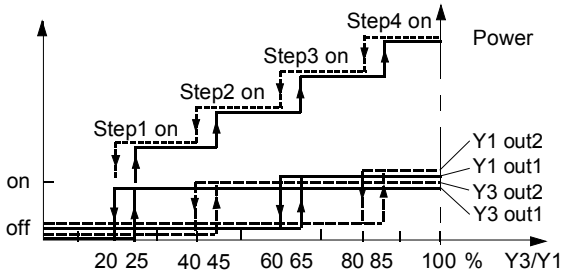


4-Stage On/Off Electric Heating or Cooling

For **YMode** = 2 the output sequence of Y3/Y1 is controlled from the heating signal and the output Y2 is controlled from the cooling signal. For **YMode** = 3 the output sequence of Y3/Y1 is controlled from the cooling signal and the output Y2 is controlled from the heating signal.

The output of Y2 is operated in accordance with **Y2Mode**.

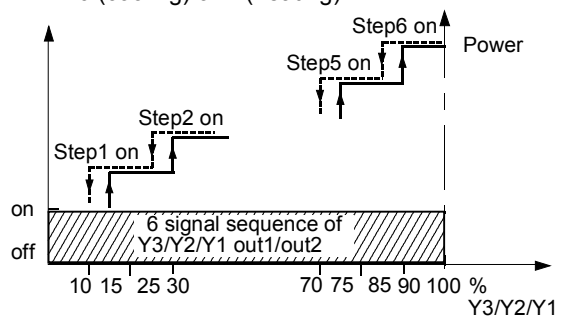
Parameter setting: **YMode** = 2 or 3,
Y1Mode and **Y3Mode** = 4



6-stage On/Off Sequence Control Heating or Cooling

The output sequence of Y3/Y2/Y1 is controlled from one output signal, *Main Temperature Control* or *Cascade Control*.

Parameter setting: **YMode** = 1,
Y1Mode, Y2Mode and Y3Mode = 4
Y1CTRF = 0 (cooling) or 1 (heating)

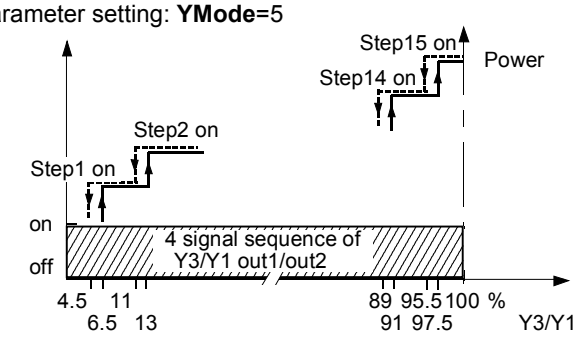


15-stage Binary On/Off Electric Heating and Cooling

The output sequence of Y3/Y1 is controlled from the heating signal. The output sequence of Y2 is controlled from the cooling signal.

The output of Y2 is operated in accordance with **Y2Mode**.

Parameter setting: **YMode**=5



Two Position Damper Control

If the value of the control parameter **YMode** = 4, the damper output signal Y1 operates as two-position control as follows:

- If the controller mode ≠Off (Comfort- or Standby) the output signal Y1 is set to 100%.
- If the controller mode = Off the output signal Y1 is set to 0%.
- The output sequence of Y2/Y3 operates as *Temperature Sequence Control with Heating and Cooling.*
- The start-up routine must be disabled.

Analog Outputs on R7426C only

Three output control signals are provided to control valve or damper actuators or E/P transducers for pneumatic actuators.

The full output range is 0...12Vdc. The control range is common to all outputs and is software configurable via the control parameter **YRange** to either 2...10Vdc or 0...10Vdc.

Each output can be selected for direct or reverse acting.

ADJUSTMENTS

Control Point / Setpoint Adjustment (CPATYP)

The control or setpoint can be adjusted via the internal or an external potentiometer connected to the CPA/SPA input. The CPA/SPA type is selected by the control parameter **CPATYP** (see page 2, *Technical Data*).

Calibration of Temperature Sensors (T1CAL, T2CAL and T3CAL)

In case of an offset as a result of long wiring lengths the temperature sensor inputs (T1, T2 and T3) can be adjusted separately by the control parameters **T1CAL**, **T2CAL** and **T3CAL**.

WIRING

Wiring run	Type of wires	Length max.	
		1.0mm^2	1.5mm^2
From controller to all input and output devices	local standard	100m	150m

Offset for temperature sensors due to wire resistance per 10m distance from sensor to controller:

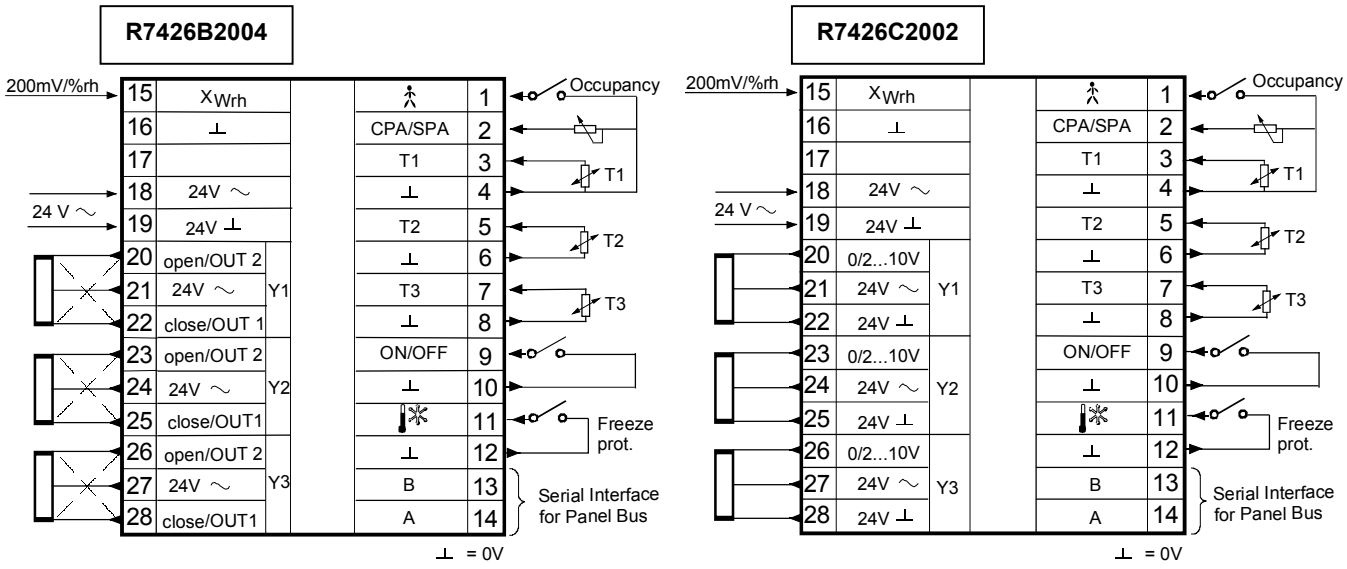
Type of wire	Temperature offset		
	Pt 1000	BALCO 500	NTC
0.5mm^2 (AWG20)	0.18°C (0.324°F)	0.3°C (0.54°F)	negligible
1.0mm^2 (AWG17)	0.09°C (0.162°F)	0.15°C (0.27°F)	
1.5mm^2 (AWG15)	0.06°C (0.108°F)	0.1°C (0.18°F)	

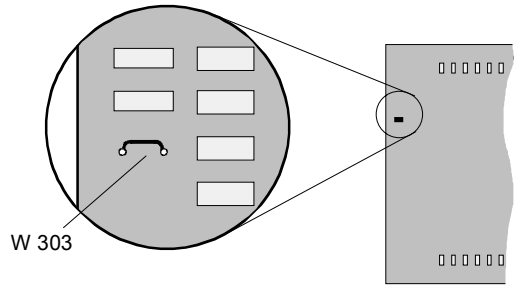
Serial Communication Address (Adr)

The configuration parameter **Adr** sets the serial communication address.

The serial communication bus allows to connect the PC-based Operator's Terminal to one or several controllers. It provides access to all application configuration and control parameters, time schedules, input and output values of the connected controllers and easy setting of these via the bus by mouse click or keyboard.

CONNECTIONS





Jumper[1)]	State	Description
W303[2)]	closed open	T3 supplied by this controller T3 supplied from another controller

1) Default jumper position = closed
2) Only cut (open) jumper W303, if the T3 input is fed from another controller (parallel connection, max. 6 devices). This disconnects the T3 input from the internal power supply.

⚠ CAUTION

- **Outputs are not isolated from power supply**
- **Observe correct phasing with 24Vac power supply**

Fig. 3. Connections and Jumper coding

MOUNTING AND DIMENSIONS

All dimensions in mm.

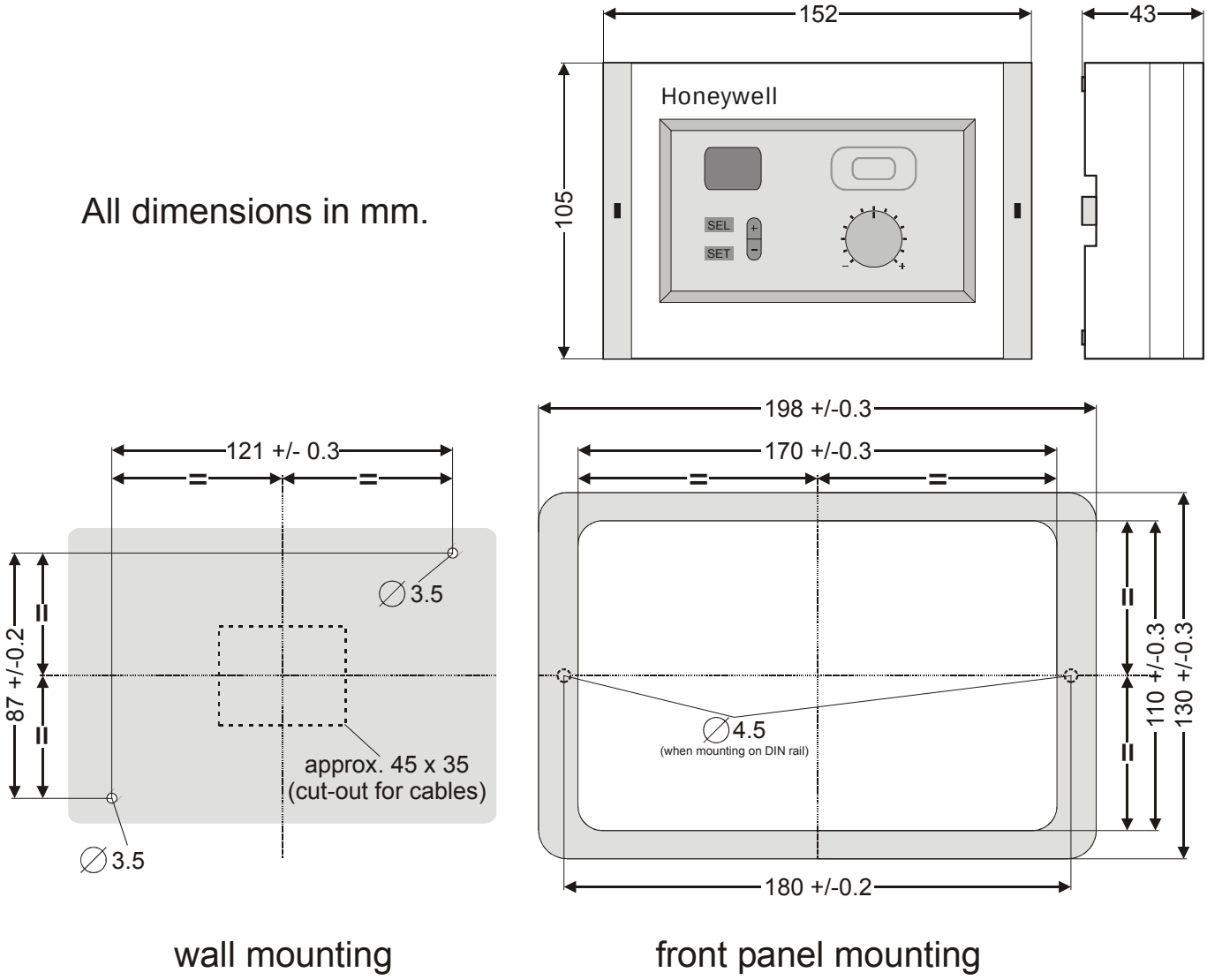


Fig. 4. Mounting and dimensions

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