



ROOM THERMOSTAT PROPORTIONAL CONTROLLER

MODEL RTC-2P



DESCRIPTION

The **Model RTC-2P Room Thermostat Proportional Controller** features two proportional outputs (heating and cooling). The Proportional plus Integral (PI) control is suitable for pressure-dependent VAV box control, as well as fan coil, baseboard, or air handler applications. The occupant controls include a digital display and buttons for setpoint adjustment and night setback/setup override. The **Model RTC-2P** comes with a remote setback input for use with BAS systems and a changeover input for one-pipe system applications. Field setup is through push buttons with adjustments for setback temperatures, deadband, and °F or °C display.

FEATURES

- *Digital display for °F or °C*
- *Setpoint adjustment buttons*
- *Night setback manual button or clock input*
- *Remote sensor input*
- *Changeover input*
- *Two proportional outputs for heating and cooling*
- *PI control algorithm*
- *0-10V or 2-10V outputs*



RTC-2P

APPLICATION

The stand-alone **Model RTC-2P** is ideal for use when a central temperature control system may not be possible. Applications include any pressure-dependent VAV box control. The H/C output can also be used for modulating control of room-based discharge air, fan coil valves, or baseboard heat.

SPECIFICATIONS

Voltage	24 VAC $\pm$ 20%, 50/60 Hz	Display	0.35" (0.89 cm), two-digit LCD
Power	3 VA	Proportional band	Cooling, 1.8°F (1.0°C) Heating, 2.7°F (1.5°C)
Outputs	Proportional, 0-10V, 2-10V selectable PI control algorithm	Reset integral time	15 min.
Inputs		Changeover	Contact or 80°F (26.6°C) with a Type III thermistor
Remote sensor	10 k Ω Type III thermistor	Deadband	-1.8° to 9.0°F (-1.0° to 5.0°C)
Changeover	Contact or thermistor, Type III	Dimensions	4.0"H x 4.9"W x 1.2"D (12.45 x 10.16 x 3.05 cm)
Setback	Isolated 24V contact	Weight	4 oz (140 g)
Shutdown	Isolated 24V contact		
Controls	Setpoint buttons up/down 40° to 90°F (4° to 32°C) Setback-enable button or 30-min. override		

SEQUENCE OF OPERATION

The **RTC-2P** Proportional plus Integral thermostat controller is designed to modulate two proportional actuators in order to maintain a temperature set by the digital setpoint display. All parameters are permanently stored in memory until manually changed; therefore, no battery backup is needed.

Terms and Identifications (see Sequence Graph below for more details)

Cvar Controlled variable: This is the physical entity under control. In this case, Cvar is temperature.
Deadbd Deadband: This is the temperature setting below the setpoint. The deadband is when Yc and Yh are at minimum.
Yc Cooling output: Terminals [3,1] selectable output range from 0-10V or 2-10V
Yh Heating output: Terminal [5,1] selectable output range from 0 -10V or 2-10V
[X] Terminal designation

Sequence of Operation

Simple cooling "cooling mode" (Ycc is direct acting)

As the Cvar goes above setpoint, the cooling output Ycc [3] starts low (0V or 2V) and increases its signal proportionally over the next 1.8°F (proportional band) to its maximum output of 10V (see Sequence Graph — @72°). The heating output remains at the low signal 0V or 2V.

Simple heating "cooling mode" (Yhc is reverse acting)

As the Cvar goes *below* the deadband from setpoint, the heating output Yhc [8] starts low (0V or 2V) and increases its signal proportionally over the next -2.7°F (proportional band) to its maximum output of 10V (see Sequence Graph - - - @71°). The cooling remains at low signal 0V or 2V.

Changeover to "heating mode" (Ych goes to reverse acting, Yhh output remains low)

If the changeover terminals [12,13] are closed or the changeover thermistor goes above 80°F (15° differential), then the cooling output Ych changes to reverse acting and Yhh goes to minimum and remains. Therefore, as the Cvar goes below setpoint, the cooling output Ych starts low (0V or 2V) and increases proportionally over the next -1.8°F (proportional band) to its maximum output of 10V (see Sequence Graph ••• @ 72°). Above the setpoint, Ych will remain low. Yhh remains low during changeover (see Sequence Graph ~~xxx~~).

Night setback (NSB)

Auto NSB (J2 closed): During the occupied hours, the NSB terminals [9,17] are closed from an external time clock, and the setpoints are as indicated on the display during operator adjustment. During unoccupied hours, the NSB terminals [9,17] open and the NSB setpoints for cooling and heating are selected. These are individually adjustable between 50° and 90°F during installer adjustment. The setback button on the cover will extend the occupied settings for three hours.

Manual NSB (J2 open): Terminals [9,17] are not used for manual NSB. Pressing the setback button on the cover will put the thermostat in unoccupied, and the NSB setpoints for cooling and heating are selected. These are individually adjustable between 50° and 90°F during installer adjustment. The green cover LED will illuminate. Pushing the button again will revert back to occupied setpoints and the LED will extinguish.

In night setback the control outputs operate as follows:

Cooling: As the Cvar goes above the unoccupied cooling setpoint, the cooling output Ycc [3] starts to increase (see Sequence Graph — @76°). The heating remains low.

Heating: As the Cvar goes below the unoccupied heating setpoint, the heating output Yhc [8] starts to increase (see Sequence Graph - - - @69°). The cooling output remains low unless the thermostat is in changeover. Then, Ych [3] will increase as the Cvar goes down (see Sequence Graph ••• @ 72°).

Shut down

If the shut-down contact [16, 17] is closed, then both outputs Yc and Yh will go to minimum (0V or 2V). The closed circuit must have a 1000Ω resistor in series with the shut-down contact. See Wiring.

SEQUENCE GRAPH

Adjustable Parameters

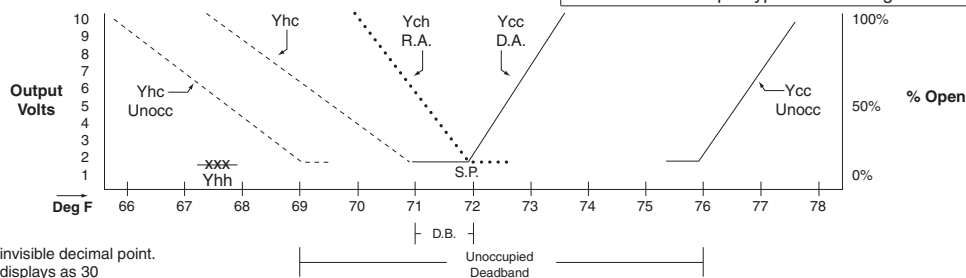
S.P. = Setpoint = 40° to 90°F (4° to 35°C)
D.B. = Deadband = -1.8° to 9°F (-1° to 5°C)
Unoccupied = Htg = 50° to 90°F (10° to 30°C)
Ctg = 50° to 90°F (10° to 30°C)
Outputs = 0-10V or 2-10V
Display = °F or °C

Example (factory default)

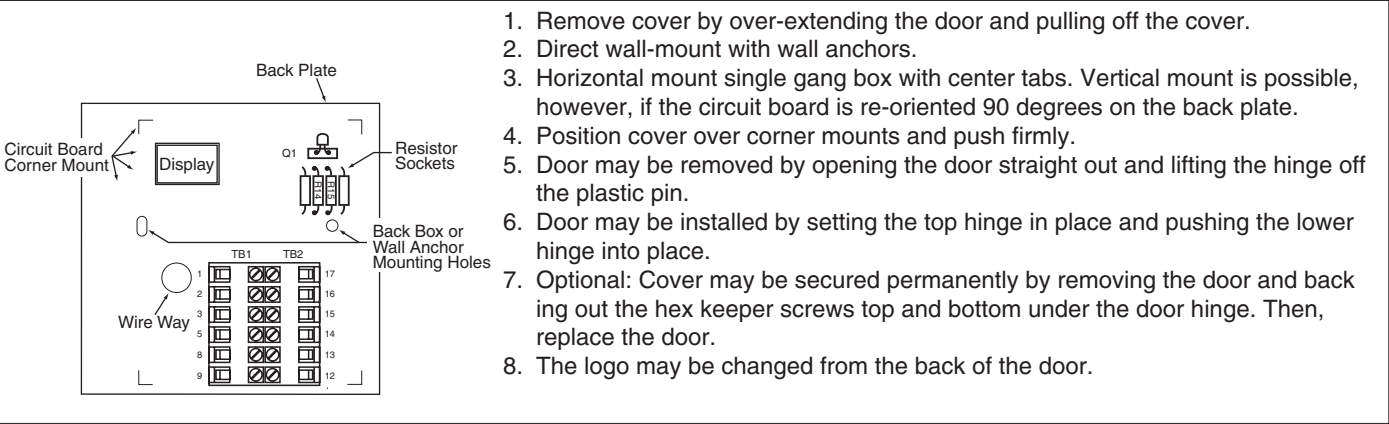
S.P. = 72°F
D.B. = 1°F
Unoccupied = Htg = 69°F
Ctg = 76°F
Outputs = 2-10V
Display = °F

OUTPUT*	SIGNAL	CHANGEOVER MODE	ACTION
Ycc	—	Cooling mode (c)	D.A.
Yhc	- - - - -	Cooling mode (c)	R.A.
Ych	•••••	Heating mode (h)	R.A.
Yhh	-XXX- minimum	Heating mode (h)	N/A

*Output type  changeover mode



MOUNTING



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- The diagram illustrates the internal structure of the door's back plate. Key components and features include:
- Back Plate:** The main structural component at the top.
 - Circuit Board Corner Mount:** A bracket used to secure the circuit board.
 - Display:** The central component, shown as a rectangular box.
 - Q1:** A component, likely a transistor or diode, located near the display.
 - Resistor Sockets:** Two sockets for resistors, positioned below the Q1 component.
 - Back Box or Wall Anchor Mounting Holes:** Two circular holes for mounting the back box or wall anchors.
 - Wire Way:** A circular opening for wiring, located on the left side.
 - Terminal Blocks (TB1, TB2):** Two terminal blocks at the bottom, each with 16 pins (8 on each side). The pins are numbered 1 through 16.
- Below the diagram is a list of 8 numbered instructions:
1. Remove cover by over-extending the door and pulling off the cover.
 2. Direct wall-mount with wall anchors.
 3. Horizontal mount single gang box with center tabs. Vertical mount is possible, however, if the circuit board is re-oriented 90 degrees on the back plate.
 4. Position cover over corner mounts and push firmly.
 5. Door may be removed by opening the door straight out and lifting the hinge off the plastic pin.
 6. Door may be installed by setting the top hinge in place and pushing the lower hinge into place.
 7. Optional: Cover may be secured permanently by removing the door and backing out the hex keeper screws top and bottom under the door hinge. Then, replace the door.
 8. The logo may be changed from the back of the door.

INSTALLATION SETUP

Installer Configuration

<u>Jumper</u>	<u>Open</u> 	<u>Closed</u> 
J1	°F display	°C display
J2	Setback button (occupied/unoccupied)	Setback button is three-hour override (assumes external input terminals [9,17])
J3	Normal operating mode	Installer adjustment mode
J4	External sensor used	Internal sensor used
J5	Internal sensor used	External sensor used
R14	Remove for 2-10V Yh	Install for 0-10V Yh, R14 = 42.2 kΩ 1%
R15	Remove for 2-10V Yc	Install for 0-10V Yc, R15 = 42.2 kΩ 1%

Installer Adjustments

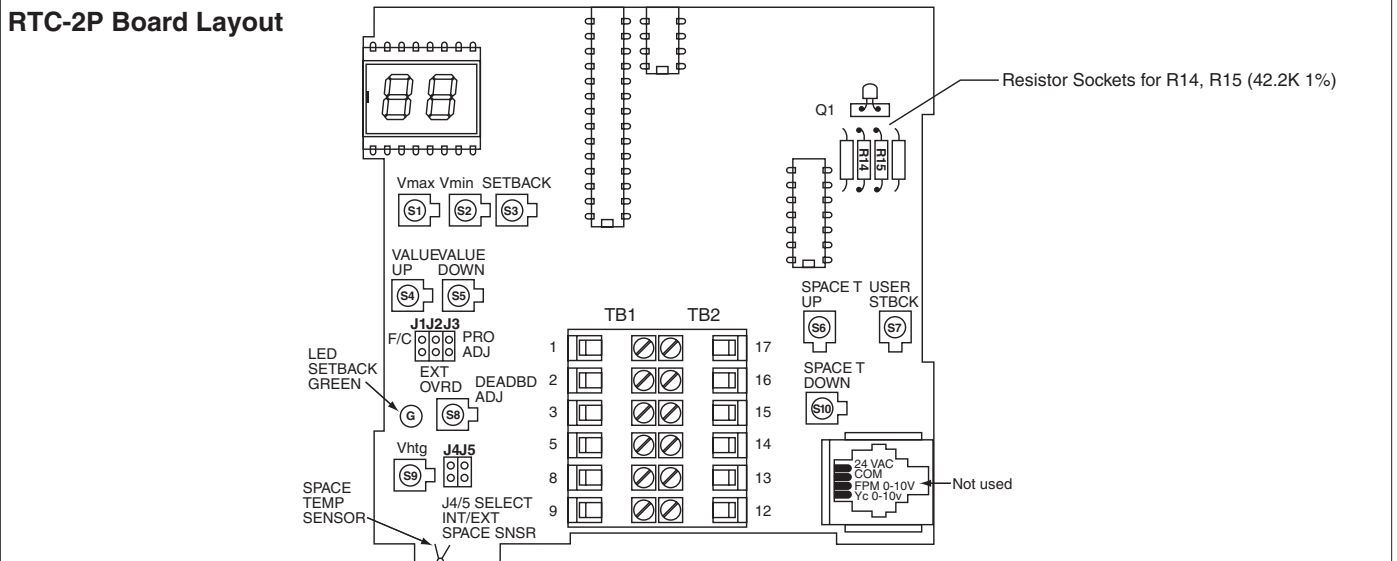
Description	Action in order of event (J-Jumper, S-Push Button Switch)
Deadband	J3 closed – S8 – S4 ↑ – S5 ↓ – J3 open [0.0 invisible decimal between digits]
Setback	J3 closed – S3 for C – S4 ↑ – S5 ↓ – S3 for H – S4 ↑ – S5 ↓ J3 open

– denotes next step in order of event

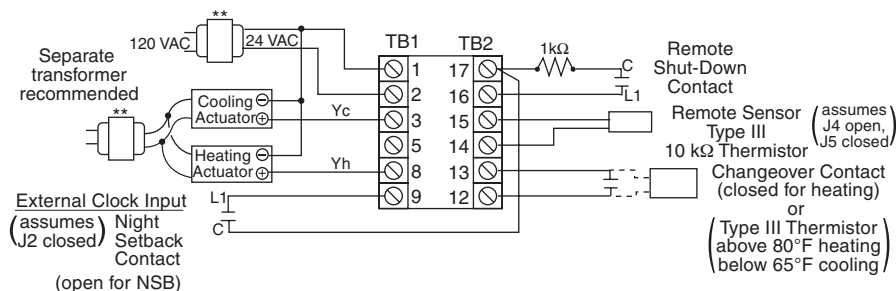
Adjustment Notes

1. The display reads the values under change.
2. After 10 seconds of inactivity, the display reverts to reading room temperature.
3. Adjusting these parameters will change the Yc output during adjustment to the indicated value.
4. After the setup, all settings are held in permanent memory until further adjustment is initiated.

RTC-2P Board Layout



WIRING



TB1-1 = Common
 TB1-2 = Hot 24 VAC
 TB1-3 = Cooling 0-10V*
 TB1-5 = N/C
 TB1-8 = Heating 0-10V*
 TB1-9 = Setback, remote
 TB2-17 = Common
 TB2-16 = Remote Shut Off
 TB2-15 = Remote Space Sensor
 TB2-14 = Remote Space Sensor
 TB2-13 = Heat/Cool Changeover
 TB2-12 = Heat/Cool Changeover

(TB1-1 and TB2-17 are connected internally)

*0-10V or 2-10V selectable

**If one common transformer is used, the actuators must use 1/2 wave rectified power, and polarity must be observed.

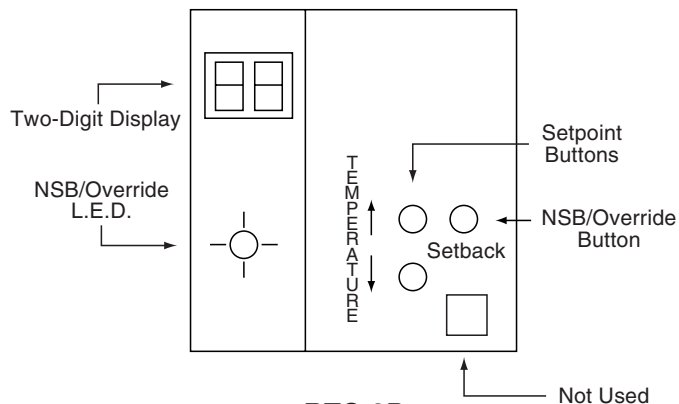
* 0-10V or 2-10V selectable

** If one common transformer is used, the actuators must use 1/2 wave rectified power, and polarity must be observed.

All Belimo, Johnson, Kele, Honeywell, and Invensys actuators use 1/2 wave rectifiers as of the printing of this document.

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OPERATOR CONTROLS



RTC-2P

The display on the **RTC-2P** reads the current temperature. During adjustment, it displays the values being changed. After 10 seconds of inactivity, the display on the **RTC-2P** will revert back to the current room temperature.

Temperature setpoint buttons, when depressed, will change the setpoint up or down and will be shown on the display.

The setback button, when depressed, will either put the thermostat into night setback or, in the case of an external clock input, bring the thermostat back to day operation for an extended three hours.

A green LED will illuminate indicating a setback or extended operation.

ORDERING INFORMATION

MODEL
RTC-2P

DESCRIPTION

Room temperature controller, two-output H/C proportional thermostat

RELATED PRODUCTS

ST-U3
ST-R3S
ST-S3E

Universal duct and immersion sensor 10 kΩ type III thermistor
 Pipe strap-on sensor 10 kΩ type III thermistor
 Room sensor 10 kΩ type III thermistor