SIEMENS

Technical Instructions
Document No. 155-327P25
Rev. 1, March, 2002

RCU50U and RCU50.2U

Room Temperature Controllers for CAV Systems

RCU50U

RCU50.2U

Description

The RCU microprocessor controlled CAV room controller is designed for air only, or air and water heating and/or cooling systems. Controllers have proportional response.

Features

- Modulating P-control
- 0 to 10 Vdc output for heating or cooling
- Automatic heating/cooling changeover (RCU50U)
- Manual heating/cooling changeover (RCU50.2U)
- Operating modes: Normal, Energy Saving, Frost Protection and Standby (RCU50U)
- Operating modes: Normal and OFF (RCU50.2U)
- Active 0 to 10 Vdc input for set point shifting (RCU50U)
- Operating mode changeover input for remote control (RCU50U)
- Adjustable minimum limitation for cooling output (RCU50U)
- Operating voltage 24 Vac

Application

Controlling individual room temperature in HVAC installations that are heated or cooled.

Controlling these types of equipment:

- Valve actuators
- Air damper actuators

Product Numbers

Table 1.

Product Numbers	Features
RCU50U	Without operating mode selector
RCU50.2U	With manual heating/cooling changeover switch

NOTE: To order without logo, change suffix to "/U/NL". **Example:** RCU50/U/NL.

Ordering

The temperature sensor, changeover mounting kit, and valve and damper actuators must be ordered separately.

Table 2. Equipment Combinations.

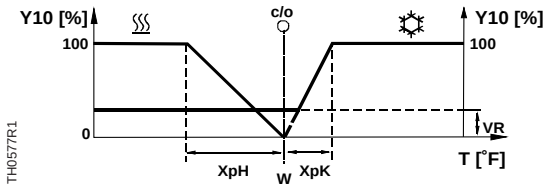
Product Number	Description	Technical Instructions
QAH11.1	Temperature sensor	155-329P25
GDE16…	44 lb-in NSR Air damper actuator	155-187P25
GLB16…	88 lb-in NSR Air damper actuator	
SSB61U	Valve actuator	155-192P25
SSC61U SSC61.5U	Valve actuator	155-313P25
SQS65U SQS65.5U	Valve actuator	155-190P25

Function

The controller measures the room temperature with its integrated sensor and maintains the set point by delivering 0 to10 Vdc control commands. The RCU50U and RCU50.2U provide P-control. With the RCU50U, the proportional band can be 2°F or 7°F (1°C or 4°C) in heating mode and 1°F or 3.5°F (0.5°C or 2°C) in cooling mode (selectable with DIP Switch No. 4). With the RCU50.2U, the proportional band is fixed, 7°F (4°C) in heating mode and 3.5°F (2°C) in cooling mode.

- RCU50U – When in the heating mode, on increase in temperature, the output signal goes down (Reverse Acting - R.A.) from 10 to 0 volts. When in cooling mode, on increase in temperature, the output signal goes up (Direct Acting - D.A.) from 0 to 10 volts.
- RCU50.2U – The output signal can be reversed 0 to 10 or 10 to 0 volts via the DIP switch.

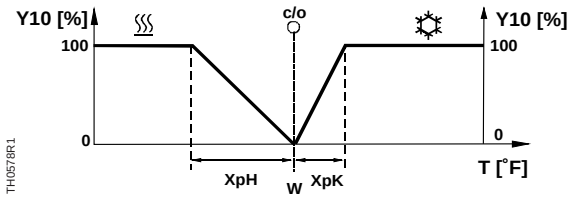
Heating-Cooling with Minimum Limitation Cooling



T	Room temperature
Y10	Output percentage
W	Room temperature set point
XpH	Proportional band heating
XpK	Proportional band cooling
VR	0 to 100% minimum limitation of cooling output
c/o	Changeover

Figure 1. RCU50U Function Diagram.

Heating-Cooling



T	Room temperature
Y10	Output percentage
W	Room temperature set point
XpH	Proportional band heating
XpK	Proportional band cooling
c/o	Changeover

Figure 2. RCU50.2U Function Diagram.

Minimum Limitation of Cooling Signal

RCU50U

Using the potentiometer located on the circuit board, the cooling signal output can be limited to a minimum value of between 0 and 100%. This can be used to ensure a minimum supply air volume. When used in connection with a VAV controller, this setting must be taken into account. To set minimum limitation, use a screwdriver to adjust the potentiometer (see Figure 3). Values on the scale are percentage of full operation.

Minimum Limitation of Cooling Signal, Continued

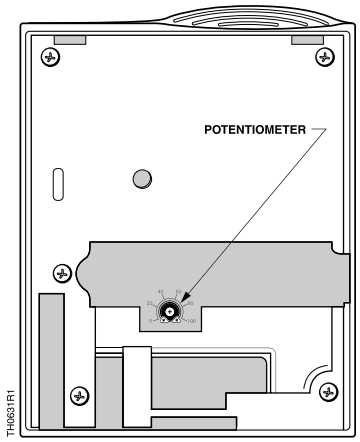


Figure 3. Potentiometer Location (RCU50U).

Inversion of Output Signal

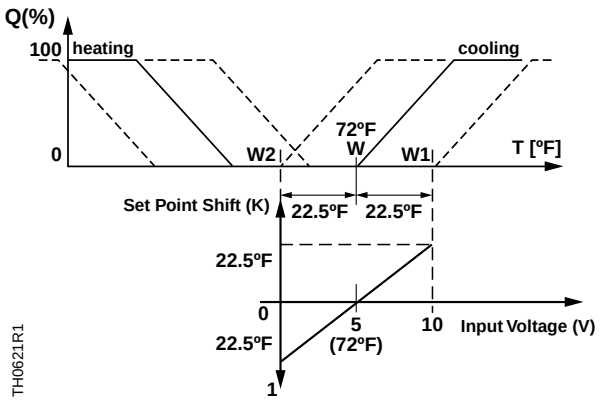
RCU50.2U

With the RCU50.2U, the output signal can be inverted with the help of DIP Switch No. 1. If set to ON, 0V corresponds to 0% travel and 10V to 100% travel. In position OFF, 0V corresponds to 100% travel and 10V to 0% travel.

Set Point Shifting

RCU50U

Signal Input 1 and 2 is used for outside temperature compensation. Using a 0 to 10 Vdc signal, the set point can be shifted by ±22.5°F at 72°F set point. The neutral position is at 5 Vdc and means no set point shift.



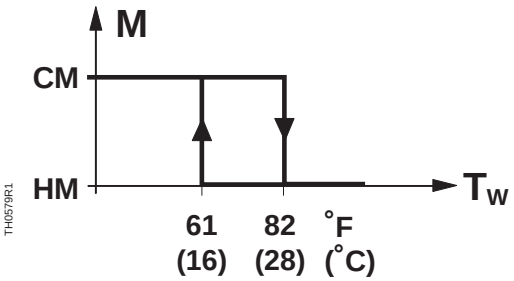
W Original set point
W1 Highest set point at 10V input
W2 Lowest set point at 0V input set point shift
(V) Input voltage

Figure 4. Set Point Shifting (RCU50U).

Automatic Changeover

RCU50U

The water temperature measured by the changeover sensor (QAH11.1) is used by the controller to switch from heating to cooling mode, or vice versa. When the water temperature is above 82°F (28°C), the controller switches to heating mode; below 61°F (16°C) it switches to cooling mode.



CM Cooling mode
HM Heating mode
M Operating mode
T_W Water temperature

Figure 5. Automatic Changeover Mode.

Set Point Limit Stops

The room temperature set point can be limited in increments of 2°F (1°C) by using the minimum and maximum set point limit stops. This prevents arbitrary set point readjustments.

To set limit stops, remove the set point knob by pulling it straight off the shaft. Reposition gray tabs for high and low stops in the holes around the perimeter of knob as required. See Figure 6.

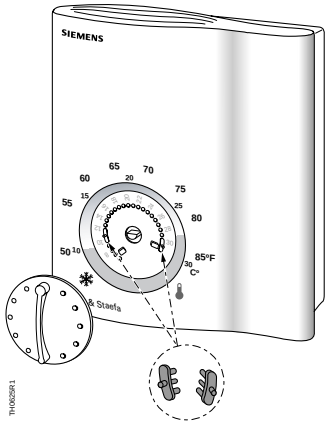


Figure 6. Set Point Limit Stops.

Operating Modes

When dry contact (D1 and Ground) is open, the set point knob setting takes over control and normal mode is initiated.

Normal Mode

Frost Protection Mode (RCU50U)

Frost protection mode can be initiated by activating the external operating mode changeover switch, if DIP Switch No. 1 is set to OFF.

If the room temperature falls below 46°F (8°C), the controller will automatically switch to frost protection mode. In that case, the heating valve opens and the room temperature is maintained at a set point of 46°F (8°C). The set point adjusted by the user will be ignored.

Energy Saving Mode

Energy saving mode can be initiated by activating the external operating mode changeover switch, if DIP Switch No. 1 is set to ON.

In energy saving mode, the heating set point is 61°F (16°C) and the cooling set point is 82°F (28°C), independent of the position of the set point knob.

Operating Mode Changeover Switch

(RCU50U)

A changeover switch can be connected to status input D1–GND. When the switch closes its contact (caused by an open window, for instance), the operating mode changes from normal operation or standby to energy saving mode (if DIP Switch No. 1 is set to ON), or from normal operation or energy saving mode to standby (if DIP Switch No. 1 is set to OFF).

The operating action of the switch (N.C. or N.O.) can be selected.

Mechanical Design

The unit consists of two parts:

- Plastic housing which accommodates the electronics, the operating elements and the built-in room temperature sensor.
- Controller base.

The housing snaps into the top and bottom of the mounting base.

Mechanical Design, Continued

The screw terminals are mounted on the base. The DIP switches and the potentiometer are located at the rear of the unit. To access the DIP switches, remove the controller from the controller base. See Figure 7.

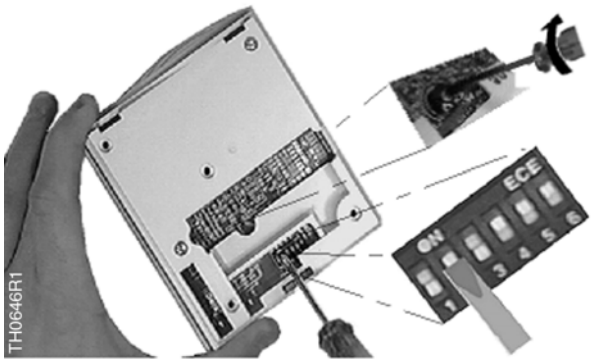


Figure 7. Dip Switch Setting.

Table 3. RCU50U DIP Switches.

DIP Switch No.	Meaning	Position ON	Position OFF
1	Operating mode changeover via external switch	Changeover between normal operation and energy saving mode	Changeover between normal operation, energy saving and standby[1]
2	Operating action of switch for external operating mode changeover	Changeover activated when contact of switch is closed (N.O.) [1]	Changeover activated when contact of switch is open (N.C.)
3	Standby	OFF	Frost protection mode (heating output ON at a set point of 46°F (8°C)[1]
4	P-band	2°F (1°C) in heating mode 1°F (0.5 C) in cooling mode	7°F (4°C) in heating mode[1] 3.5°F (2°C) in cooling mode[1]
5	Cooling signal output in energy saving mode	Active	Inactive[1]

Table 4. RCU50.2U DIP Switches.

DIP Switch No.	Meaning	Position ON	Position OFF
1	Signal inversion 0 to 10 Vdc	Output signal 0 to 10 Vdc[1]	Output signal 10 to 0 Vdc

1. Factory setting

Accessories

ARG70	Adapter Plate for 2 × 4-inch or 4 × 4-inch conduit boxes
QAH11.1	Changeover/remote sensor

Notes

- In systems without automatic changeover, the temperature sensor can be replaced by an external switch for manual changeover.
- In systems with cooling only operation, the controller changeover input (terminals 2 and 3) must be bridged.
- In systems with heating only operation, do not connect sensor to, or bridge controller changeover input (terminals 2 and 3).

Notes, Continued

- Check the settings of DIP Switches No. 1 through No. 5 and of the potentiometer of the RCU50U, and of DIP Switch No. 1 of the RCU50.2U and change them, if required
- After applying power, the controller makes a reset, which takes about three seconds; it is then ready to operate.
- The unit can be located on a wall of the room to be conditioned. Do not mount in direct sunlight or near other heat or refrigeration sources.
- Mounting height is approximately 60 inches (150 cm) above the floor. (See Figure 8.)
- The connecting wires can be run to the controller from a recessed conduit box.
- The controller should be opened by authorized personnel only.

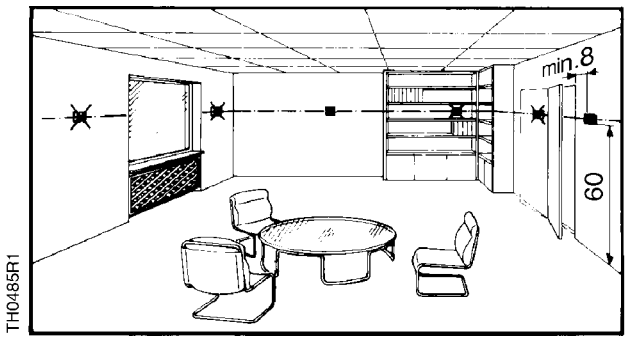


Figure 8. Acceptable Mounting Height.

- When mounting the unit, attach the controller base first. Then, make the electrical connections and fit and secure the cover.
- The controller must be mounted on a flat wall and in compliance with local regulations.
- Any radiator valves in the room must be set to their fully open positions upon start-up.
- User input via set point knob or operating mode/fan speed selector (RCU50.2U only) results in instantaneous response. There is a one-minute delay before changes made to temperature sensing and changeover are implemented.

Drywall Mounting

1. Insert a small screwdriver into the bottom of the controller and press in the tab located in center of the controller.
2. Lift the bottom of the controller from the controller base and push up to remove cover from two tabs located at the top of the controller base.
3. Separate the controller base from the controller.

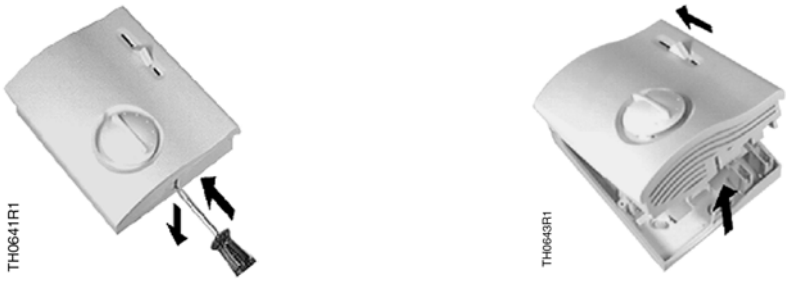


Figure 9. Thermostat Cover Separation.

Drywall Mounting, Continued

4. Using the controller base as a template, mark the hole locations with a pencil.
5. Drill two 1/4-inch diameter holes for plastic wall anchors.
6. Using a mallet, tap in the plastic wall anchors flush with wall.
7. Pull the wiring through the opening in the upper portion of the controller base.
8. Level mounting plate.
9. Using the two wood screws provided, fasten controller base to wall. Thermostat is not position sensitive.
10. Pull the wiring through the controller base.
11. Position controller housing over the two mounting lugs located at the top of the controller base, and press down on cover until bottom lugs snap in place.
12. Terminate wires per wiring instructions located above the terminal block.

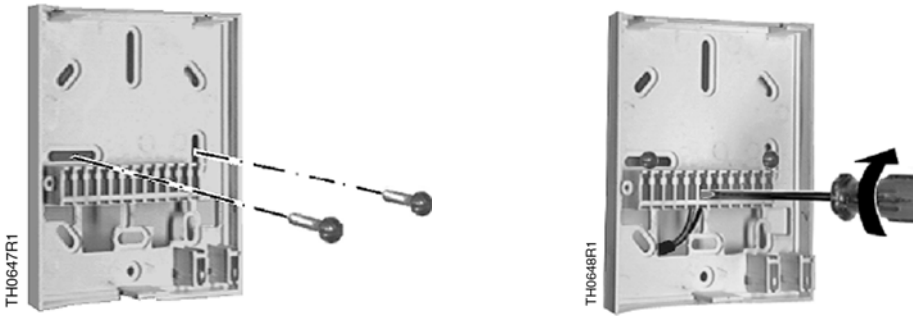


Figure 10. Wiring Termination.

13. Reattach the controller to the controller base.

Figure 11. Controller Reattachment.

14. Return selector switches to the normal position (RCU50.2U only). Adjust set point dial to desired setting.

The installation is now complete.

4 × 4-inch Electrical Wall Box Mounting

An ARG70 wall plate adapter is required to mount an RCU50U or RCU50.2U controller to a 4 × 4-inch electrical wall box. The ARG70 wall plate adapter is included with electrical wall box mount models.

1. Insert a small screwdriver into the bottom of the controller and press in the tab located in center of the controller.
2. Lift the bottom of the controller from the controller base and push up to remove cover from two tabs located at the top of the controller base.
3. Separate the controller base from the controller.
4. Using the four screws provided, fasten wall box adapter (3) to plaster ring (2). (Plaster ring supplied by others.)
5. Flex adapter mask (4) and snap in place inside wall box adapter (3).
6. Fasten the controller base (5), included with controller, to wall box adapter assembly (3) and (4) with the two screws provided.
7. Pull wires through plaster ring (2).
8. Follow *Drywall Mounting Steps 6* through *15*.

The installation is now complete.

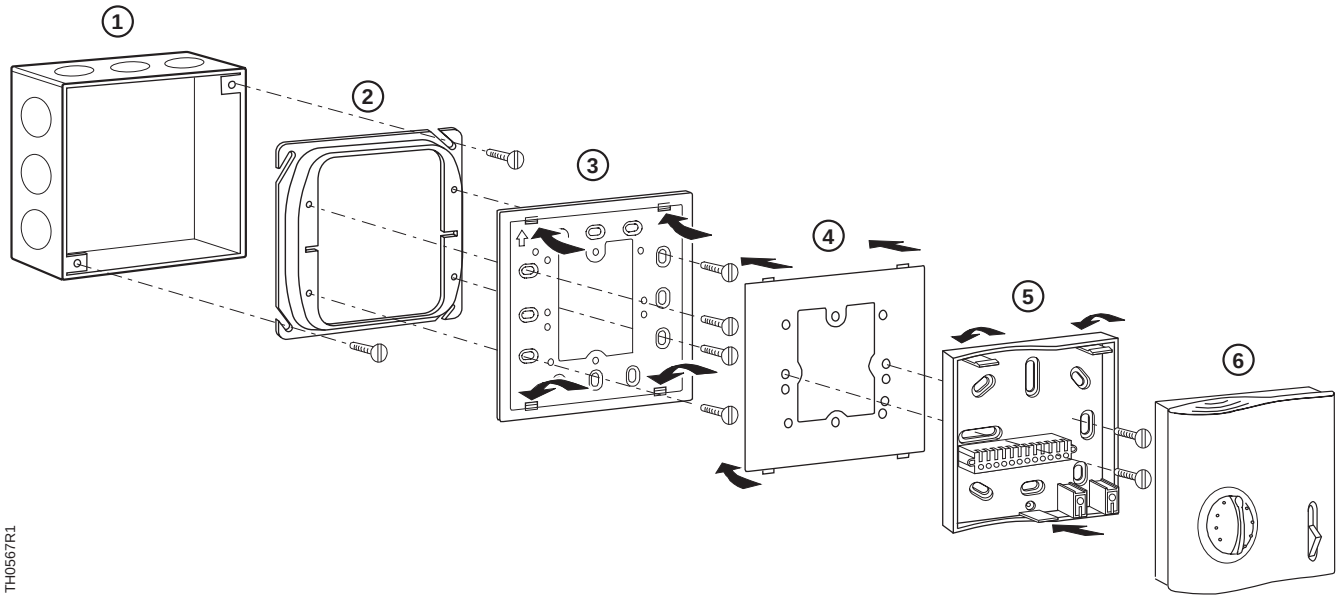


Figure 12. 4 × 4-inch Electrical Wall Box Installation.

1 Electrical wall box
2 Plaster ring
3 Wall box adapter *
4 Adapter mask *
5 Controller base
6 Controller

* Included with ARG70

2 × 4-inch Electrical Wall Box Mounting

An ARG70 wall plate adapter is required to mount an RCU50U or RCU50.2U controller to a 2 × 4-inch electrical wall box. The ARG70 wall plate adapter is included with electrical wall box mount models.

1. Insert a small screwdriver into the bottom of the controller and press in the tab located in center of the controller.
2. Lift the bottom of the controller from the controller base and push up to remove cover from two tabs located at the top of the controller base.
3. Separate the controller base (5) from the controller (6).
4. Using the two screws provided, fasten wall box adapter (3) to plaster ring (2). (Plaster ring supplied by others.)
5. Flex adapter mask (4) and snap in place inside wall box adapter (3).
6. Pull wires through plaster ring (2).
7. Fasten the controller base (5) to wall box adapter assembly (3) and (4) with the two screws provided.
8. Follow *Drywall Mounting Steps 6* through *15*.

The installation is now complete.

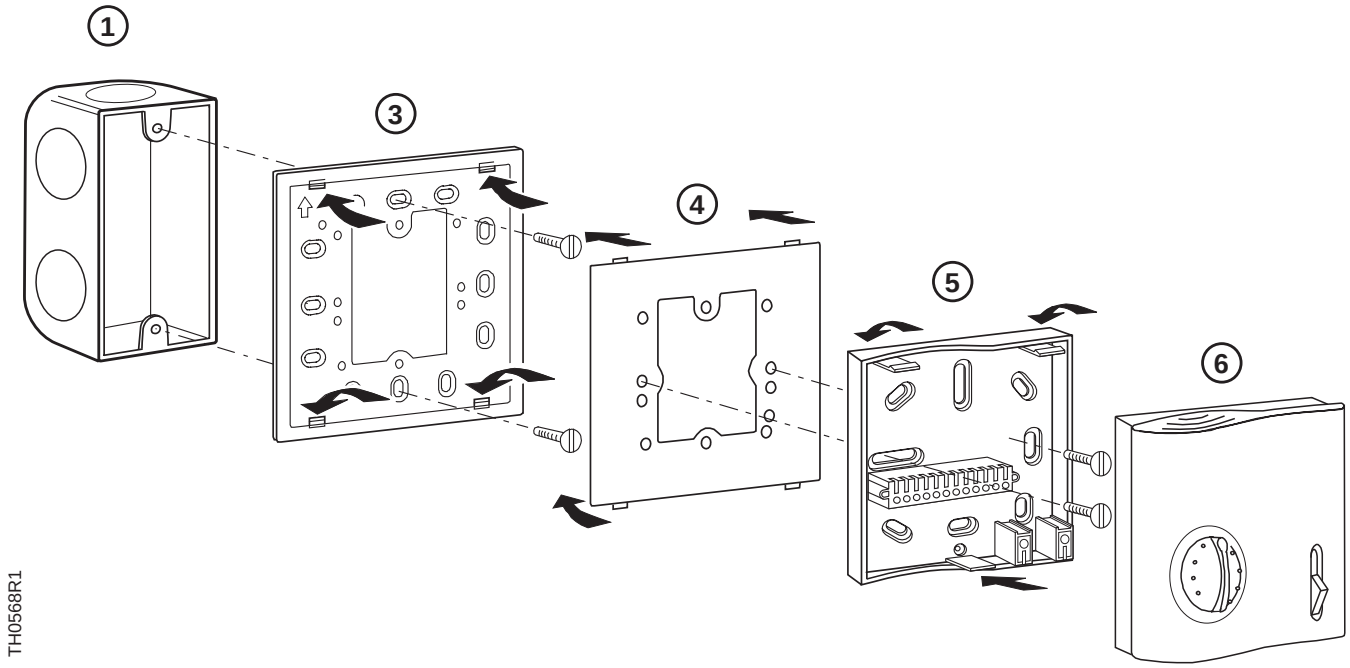


Figure 13. 2 × 4-inch Electrical Wall Box Installation.

1 Electrical wall box
3 Wall box adapter *
4 Adapter mask *
5 Controller base
6 Controller

* Included with ARG70

Specifications

Power Supply	Operating voltage	24 Vac ±20%
	Control action	(P) Proportional
	Frequency	50/60 Hz
Functional Data	Set point setting range	50°F to 85°F (10°C to 30°C)
	P-band in heating mode	
	RCU50U	2°F or 7°F (1°C or 4°C)
	RCU50.2U (fixed)	7°F (4°C)
	P-band in cooling mode	
	RCU50	1°F or 3.5°F (0.5°C or 2°C)
	RCU50.2 (fixed)	3.5°F (2°C)
	Set point (Energy Saving Mode ☾), heating	61°F (16°C)
	Set point (Energy Saving Mode ☾), cooling	82°F (28°C)
	Set point Frost Protection	46°F (8°C)
	Set point shift temperature @ 72°F (22°C)	±22.5°F (±40°C)
	Control outputs, terminals 4 and 5	
	Voltage	0 to 10 Vdc
	Current	±1 mA
	Status input D1 (RCU50U)	
	Contact sensing	6 to 15 Vdc/3 to 6 mA
	Insulation against live voltage	4 kV
	Maximum number of contacts connected in a panel	50
	Status inputs 1 and 2 (RCU50U)	
	Set point shift of ± 22.5°F @ 72°F (22°C)	0 to 10 Vdc
	Neutral position (no set point shift)	5 Vdc
	Signal input terminals 2 and 3 for changeover sensor	QAH11.1 safety class 2
	NTC resistor 3K Ω @ 77°F (25°C)	
	Maximum copper cable length 16 AWG	
	For Input Signal terminals 1 & 2 (RCU50U)	262 feet (80m)
	For Input Signal D1 (RCU50U)	262 feet (80m)
Environmental Conditions	Operation	
	Temperature	32°F to 122°F (0°C to 50°C)
	Humidity	<95% rh
	Shipping and storage	
	Temperature	–13°F to 158°F (–25°C to 70°C)
	Humidity	<95% rh
Agency Approvals	UL listed	UL 873 Conforms to CE requirements cUL certified to Canadian Standard C22.2 No. 24-93
General	Connection terminals	Use solid wires or prepared stranded wires. 2 × 16 AWG or 1 × 14 AWG Maximum 20 AWG
	Weight	
	RCU50U	0.5 lb (0.23 kg)
	RCU50.2U	0.5 lb (0.23 kg)
	Housing color	
	Cover	White
	Base	Gray

Wiring Diagrams

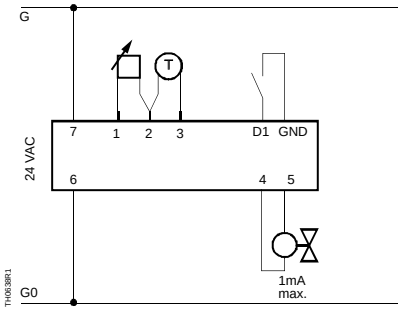


Figure 14. RCU50U Wiring Diagram.

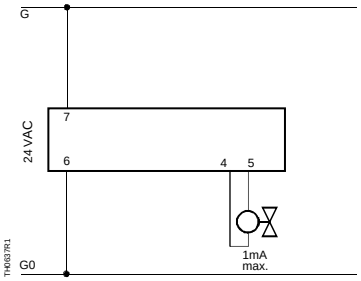


Figure 15. RCU50.2U Wiring Diagram.

1	Signal input set point shift	7	Operating voltage, 24 Vac positive
2	Measuring neutral	D1	Signal input for potential-free operating mode changeover switch
3	Heat/cool "changeover sensor" input	G	24 Vac, digital input
4	0 to 10 Vdc control signal	G0	24 Vac
5	Ground for control signal	GND	Ground
6	Operating voltage, 24 Vac negative		

Dimensions

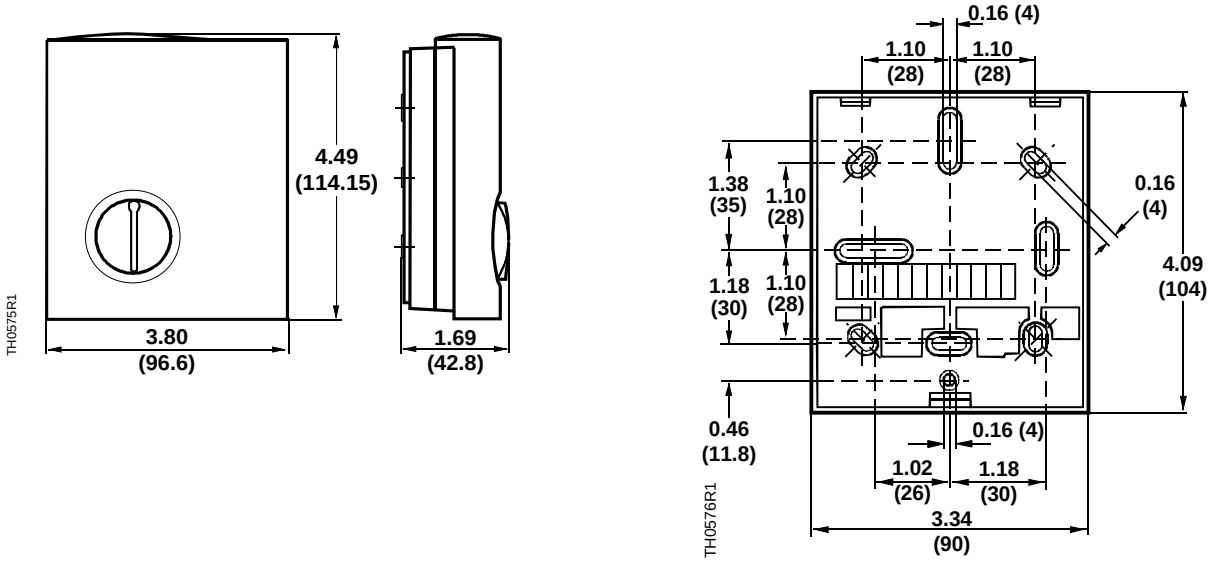


Figure 16. Controller and Baseplate Dimensions in Inches (Millimeters).