

# Free Energy Band™ RCC30U

## Room Temperature Controller for Four-pipe Fan Coil Unit



<b>Description</b>	Room temperature controller for four-pipe fan coil units.	
<b>Features</b>	<ul style="list-style-type: none"> <li>• Outputs for on/off valve actuators.</li> <li>• Outputs for three-speed fan.</li> <li>• Dual setpoint temperature scale.</li> <li>• Control depending on the room or return air temperature (remote sensing).</li> <li>• Automatic Heating/Cooling changeover.</li> <li>• Operating modes: Normal, Energy Saving, Freeze Protection and Off.</li> <li>• Operating mode changeover input for remote control.</li> <li>• Selectable control parameters.</li> <li>• Free Energy Band between Heating and Cooling for energy conservation.</li> <li>• Operating voltage 120 Vac.</li> </ul>	
<b>Application</b>	<p>Typical use:</p> <ul style="list-style-type: none"> <li>• Controlling room temperature in individual rooms that are heated or cooled with four-pipe fan coil units.</li> <li>• Opening or closing heating and cooling valves.</li> <li>• Switching a three-speed fan.</li> </ul>	
<b>Product Number</b>	RCC30U	
<b>Accessories</b>	ARG70	Adapter plate for 2-inch x 4-inch or 4-inch x 4-inch electrical wall boxes
	QAH11.1	Return Air Temperature Sensor
	141-570	Lockable Thermostat Guard



## Ordering

The QAH11.1 temperature sensor (which can be used as a return air temperature sensor) and zone valves must be ordered separately. An ARG70 Wall Box Adapter (used to mount the controller to a 2-inch x 4-inch or 4-inch x 4-inch electrical wall box) must also be ordered separately.

**Table 1. Equipment Combinations.**

Product Number	Description	Technical Instructions
QAH11.1	Temperature sensor	155-329P25
599 Series	Two-way and Three-way Zone Valves	155-320P25
SF Series	Zone Valve Actuator	155-321P25

## Warning/Caution Notations

<b>WARNING:</b>		Personal injury, or loss of life may occur if you do not follow a procedure as specified.
<b>CAUTION:</b>		Equipment damage, or loss of data may occur if you do not follow a procedure as specified.

## Functions

The controller measures the room temperature with its integrated sensor or external return air temperature sensor (QAH11.1)—if used—and maintains the setpoint by delivering control commands to two-position (On/Off) valves. The switching differential can be 2°F or 7°F (1°C or 4°C) in Heating mode or 1°F or 3.5°F (0.5°C or 2°C) in Cooling mode.

## Fan Operation

The fan is switched to the selected speed via control output 11 (Low), 10 (Medium) or 9 (High).

When the temperature-dependent fan control function is activated (can be selected with DIP Switch No. 1), the fan and valve are switched ON or OFF depending on the temperature.

It is switched OFF by:

- Leaving the Heating or Cooling sequence, if the Temperature-dependent fan control function is activated.
- Manually changing to standby  $\cup$ , if room conditions do not call for Freeze Protection mode.
- Activating an external operating mode changeover switch, if installation conditions do not call for Energy Saving or Freeze Protection mode, or
- Turning the controller's power supply OFF.

## Heating Mode

### (Heating On)

Output terminals 7 and 5 (neutral) command the heating valve.

Output terminals 7 and 5 are open (0 Vac) when:

1. The measured room temperature is at half the switching differential (SDH) below the setpoint (W, Heating Mode) and
2. The heating valve has been fully closed for more than one minute.

**Heating Mode, Cont'd**

Output terminals 7 and 5 are closed (120 Vac) when:

**(Heating Off)**

1. The measured room temperature is at half the switching differential (SDH) above the setpoint (W, Heating Mode) and
2. The heating valve has been fully open for more than one minute.

**Cooling Mode**

Output terminals 8 and 5 (neutral) command the cooling valve.

**(Cooling On)**

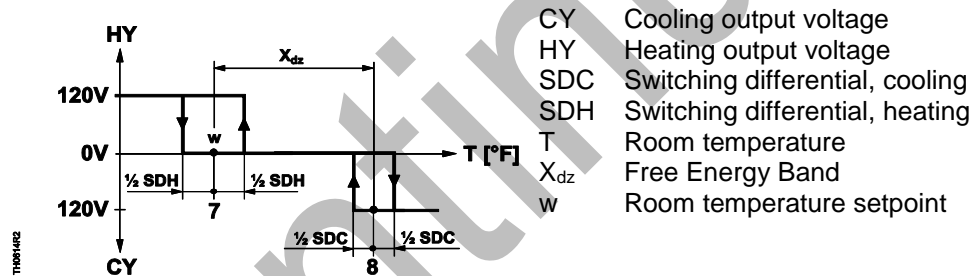
Output terminals 8 and 5 are closed (120 Vac) when:

1. The measured room temperature is at half the switching differential (SDC) plus the Free Energy Band above the setpoint (W), and
2. The cooling valve has been closed for more than one minute.

**(Cooling Off)**

Output terminals 8 and 5 are open (0 Vac) when:

1. The measured room temperature is equal to the setpoint (W) plus the Free Energy Band, less one half the switching differential (SDC), and
2. The cooling valve has been closed for more than one minute.



**Figure 1. Heating/Cooling Mode.**

**Return Air Temperature**

The Free Energy Band RCC30U provides control based on either the measured room temperature or the fan coil unit's return air temperature.

Changeover from the internal sensor to the remote sensor is automatic if a QAH11.1 cable temperature sensor is connected to the device. Place the sensor in the return air duct and terminate it to the controller.

Order the QAH11.1 separately for return air sensing.

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### Setpoint Limit Stops

The room temperature setpoint can be limited in increments of 2°F (1°C) by using the minimum and maximum setpoint limit stops. This prevents unauthorized setpoint adjustment.

To set limit stops, remove the setpoint knob by pulling straight off the shaft. Reposition gray tabs for high and low stops in the holes around the perimeter of knob as required. See Figure 2.

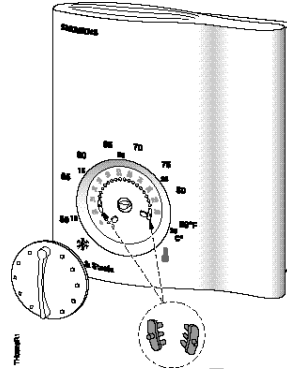






Figure 2. Setpoint Limit Stops.

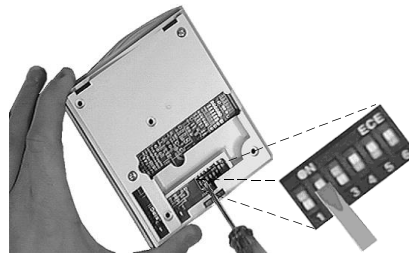
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<b>Operating Modes</b>	The following operating modes are available:
<b>Normal Operating Mode</b>	Heating or Cooling mode with automatic changeover and with manually selected fan speed:  (Low),  (Medium),  (High). In Normal operation, the controller maintains the adjusted setpoint in Heating mode and, in Cooling mode, a temperature level represented by the setpoint plus the Free Energy Band.
<b>Freeze Protection Mode</b>	<p>The Freeze Protection function is activated only when DIP Switch No. 4 is set to OFF. The Freeze Protection mode can be activated by either:</p> <ul style="list-style-type: none"><li>• Manually switching to Standby .</li><li>• Activating the external operating mode changeover switch, if DIP Switch No. 2 is set to OFF.</li></ul> <p>If the room temperature falls below 46°F (8°C), the controller will automatically switch to Freeze Protection mode. In that case, the heating valve opens and the fan operates at the selected speed. The room temperature is maintained at a setpoint of 46°F (8°C) and the setpoint adjusted by the user will be ignored.</p> <p>If Freeze Protection operation is locked (DIP Switch No. 4 in position ON), Standby is also locked, which means that the controller will switch to OFF instead of Standby.</p>
<b>Energy Saving Mode</b>	<p>In Energy Saving mode, the heating setpoint is 61°F (16°C) and the cooling setpoint is 82°F (28°C), independent of the position of the setpoint knob. This operating mode will be activated when input D1 for operating mode changeover is active and DIP Switch No. 2 is set to ON.</p> <p>When the DIP switch is in Energy Saving mode and the fan speed control is set to Standby, the Energy Saving mode takes precedence over standby mode. Low fan speed will be selected even though the fan switch is on Standby.</p>
<b>Operating Mode Changeover Switch</b>	<p>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 will change from Normal operation to Energy Saving mode (provided DIP Switch No. 2 is set to ON), or from Normal operation to Standby (provided DIP Switch No. 2 is set to OFF). If the room temperature falls below 46°F (8°C) and if DIP Switch No. 4 is set to OFF, Freeze Protection mode becomes active.</p> <p>The operating action of the switch (NC or NO) can be selected by DIP Switch No. 3.</p>
<b>Mechanical Design</b>	<p>The unit consists of two parts:</p> <ul style="list-style-type: none"><li>• A plastic housing which accommodates the electronics, the operating elements and the built-in room temperature sensor.</li><li>• A controller base.</li></ul> <p>The housing snaps into the top of the mounting base and is secured with a screw at the bottom.</p> <p>The wire terminal block is mounted in the base; the DIP switches are located at the rear of the housing. To access the DIP switches, remove controller from controller base. See Figure 3.</p>

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**Mechanical Design,  
 Continued**



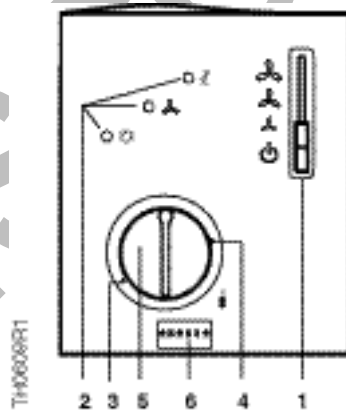
**Figure 3. DIP Switch Setting.**

**Table 2. DIP Switches.**

DIP Switch No.	Description	Position ON	Position OFF
1	Fan control	Fan control is temperature-dependent in all operating modes	Fan control in Normal operation is temperature-independent <sup>1</sup>
2	Operating mode changeover via an external switch	Changeover between Normal operation and Energy Saving mode	Changeover between Normal operation and standby <sup>1</sup>
3	Operating action of switch for external operating mode changeover	Changeover activated when contact of switch is closed (NO) <sup>1</sup>	Changeover activated when contact of switch is open (NC)
4	Standby	Freeze Protection function disabled	Freeze Protection function enabled <sup>1</sup>
5	Switching differential	2°F (1°C) in Heating mode <sup>1</sup> 1°F (0.5°C) in Cooling mode <sup>1</sup>	7°F (4°C) in Heating mode 3.5°F (2°C) in Cooling mode
6	Free Energy Band in Normal operation	3.5°F (2°C) <sup>1</sup>	9°F (5°C)

1. Factory setting

**Construction**

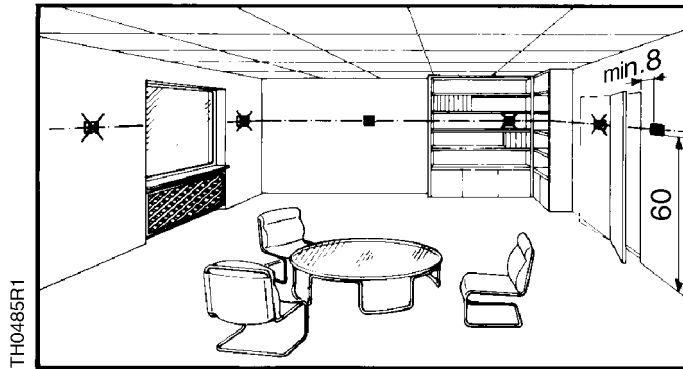


- Standby mode selector  $\cup$ /fan speed switch:  $\curvearrowright$  (Low),  $\curvearrowright$  (Medium),  $\curvearrowright$  (High).
- LEDs for indicating Heating mode, Cooling mode and fan operation.
- Setting for minimum setpoint limit stop (in increments of 2°F [1°C]).
- Setting for maximum setpoint limit stop (in increments of 2°F [1°C]).
- Room temperature setpoint knob.
- Set of DIP switches (mounted on circuit board).

**Figure 4. Construction.**

## Mounting, Installation and Commissioning

- The unit can be located on a wall or inside a fan coil unit. Do not mount in direct sunlight or near other heat or refrigeration sources.
- Mounting height is approximately 60 inches (150 cm) above the floor, when using the wall mounting option. See Figure 5.
- The unit can be fitted to most commercially available recessed electrical wall boxes or directly on the wall. A wall box adapter kit (ARG70), ordered separately, is recommended, but not required to mount the controller to a 2-inch x 4-inch electrical wall box. An ARG70 is required for mounting to a 4-inch x 4-inch electrical wall box. The wall plate will cover the drywall cutout.



**Figure 5. Acceptable Mounting Height in Inches.**

- Check the settings of DIP Switches No. 1 through No. 6 and change them, if required.
- After applying power, the controller makes a reset during which the fan LED flashes indicating that the reset has been accomplished. This takes about three seconds. When the LED stops flashing, the controller is ready to operate.
- The cables used must meet the insulation requirements for live voltage.
- User input via setpoint knob or operating mode/fan speed selector results in instantaneous response. There is a one-minute delay before changes made to temperature sensing and Changeover are implemented.



### **WARNING:**

Sensor inputs 1 and 2 carry live voltage potential. If the sensor's cables must be extended, the cables used must be suited for live voltage.

- Installation Instructions are included with the controller.

## Installation Instructions

An ARG70 wall plate adapter is required to mount a Free Energy Band RCC30U controller to a 4-inch x 4-inch electrical wall box.

### 4-inch x 4-inch Electrical Wall Box Mounting

1. Loosen the screw at the bottom of the controller with a small screwdriver.
2. Lift the bottom of the controller from the controller base and push up to remove.



Figure 6. Controller Separation.

3. Fasten the wall box adapter (3) to plaster ring (2), supplied by others, using the four screws provided with the ARG70.
4. Flex adapter mask (4) and snap in place inside wall box adapter (3).
5. Pull wires through plaster ring (2).
6. Fasten controller base (5), to wall box adapter assembly (3) and (4) with the two screws provided.

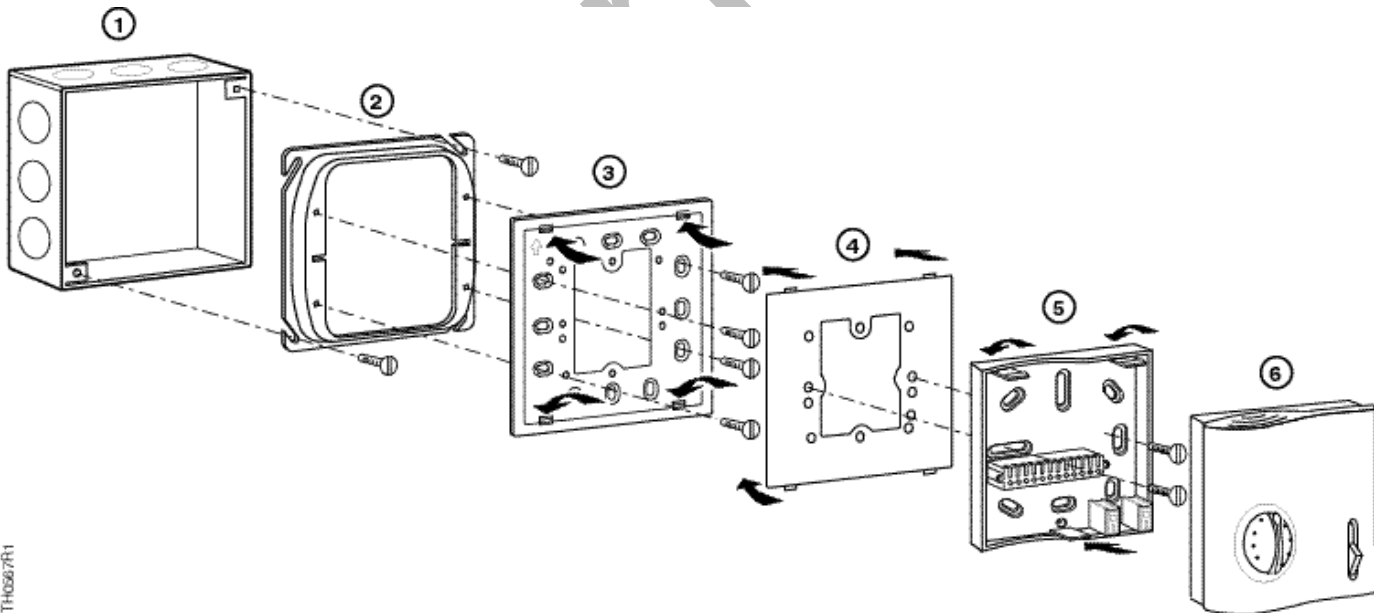


Figure 7. 4-inch x 4-inch Electrical Wall Box Installation.

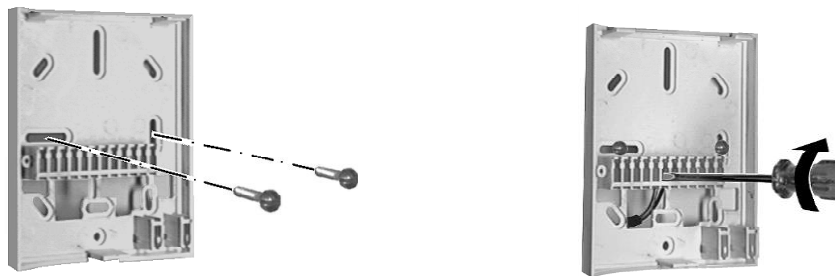
- |   |                     |   |                 |
|---|---------------------|---|-----------------|
| 1 | Electrical wall box | 4 | Adapter mask*   |
| 2 | Plaster ring        | 5 | Controller base |
| 3 | Wall box adapter*   | 6 | Controller      |

\* Included with ARG70



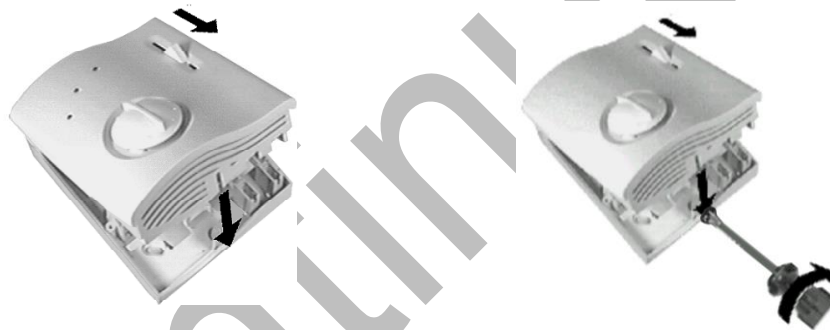
**4-inch x 4-inch Electrical  
Wall Box Mounting,  
Continued**

7. Terminate wires per wiring instructions located above the terminal block.



**Figure 8. Wiring Termination.**

8. Reattach the controller to the controller base.
9. Secure by tightening the screw at the bottom of the controller.



**Figure 9. Controller Reattachment.**

The installation is now complete.

## 2-inch x 4-inch Electrical Wall Box Mounting

An ARG70 wall plate adapter is recommended, but not required to mount a Free Energy Band RCC30U controller to a 2-inch x 4-inch electrical wall box.

1. Loosen the screw at the bottom of the controller with a small screwdriver.
2. Lift the bottom of the controller from the controller base and push up to remove. See Figure 6.
3. Fasten the wall box adapter (3) to plaster ring (2), supplied by others, using the two screws provided.
4. Flex adapter mask (4) and snap in place inside wall box adapter (3).
5. Pull wires through plaster ring (2).
6. Fasten controller base (5), to wall box adapter assembly (3) and (4) with the two screws provided.
7. Follow Steps 7 through 9 in the *4-inch x 4-inch Electrical Wall Box Mounting* section.

The installation is now complete.

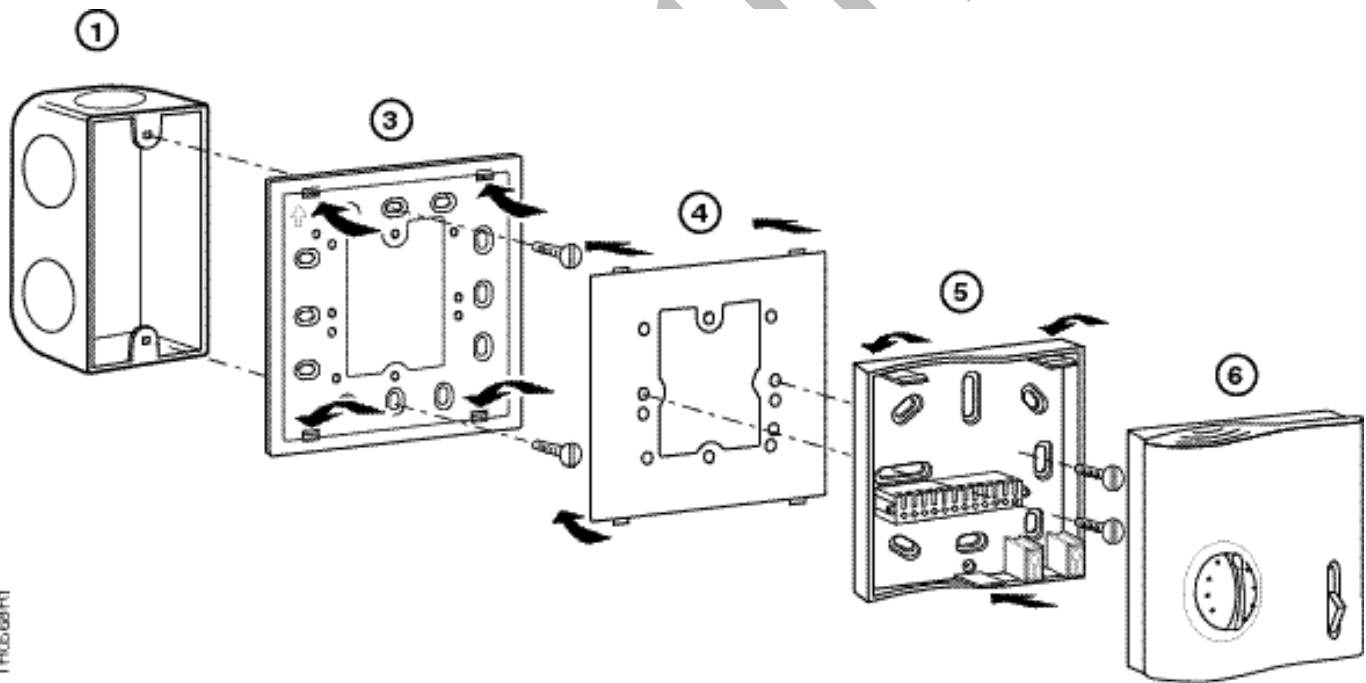





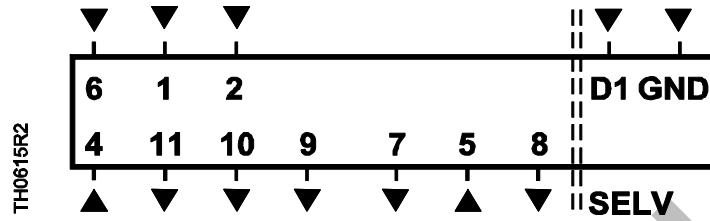
Figure 10. 2-inch x 4-inch Electrical Wall Box Installation.

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

\* Included with ARG70

<b>Specifications</b>	Operating voltage	120 Vac +10/-15%
	Frequency	50/60 Hz
<b>Power Supply</b>	Power consumption	Maximum 10A
	Control Outputs (Fan) 9, 10, 11.	120 Vac max./3A res./3.5 FLA/7.0 LRA
	Control Outputs (Heat) 7 and 8	120 Vac max./3A res./3.5 FLA/7.0 LRA
	Control Output 5 (Common)	120 Vac/7A maximum
	Signal Input 1 for return air sensor	QAH11.1, Class 2 NTC resistor 3K @ 77°F (25°C)
	Operating action	Single-pole, Single-throw
	Permissible cable length with copper cable 16 AWG for connection to Terminals 1, D1, and GND	262 feet (80 m)
<b>Operational Data</b>	Setpoint setting range	50°F to 85°F (10°C to 30°C)
	Maximum control deviation at 72°F (22°C)	Maximum ±1.5°F (0.7°C)
	Switching differential in Heating mode SDH (selectable)	2°F or 7°F (1°C or 4°C)
	Switching differential in Cooling mode SDC (selectable)	1°F or 3.5°F (0.5°C or 2°C)
	Dead zone in Normal operation	3.5°F or 9°F (2°C or 5°C)
	Setpoint (Energy Saving mode  , heating)	61°F (16°C)
	Setpoint (Energy Saving mode  , cooling)	82°F (28°C)
Setpoint (Freeze Protection  )	46°F (8°C)	
<b>General Ambient Conditions</b>	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	
<b>Agency Approvals</b>	UL Listing	UL 873
	cUL certification	C22.2 No. 24-93
	Conforms to CE requirements	
<b>General</b>	Connection terminals	Solid wires or prepared standard wires 2 × 16 AWG or 1 × 14 AWG Minimum 20 AWG
	Weight	0.5 lb (0.23 kg)
	Housing color	
	Cover	White and gray
	Base	Gray
Degree of housing protection	NEMA 1	

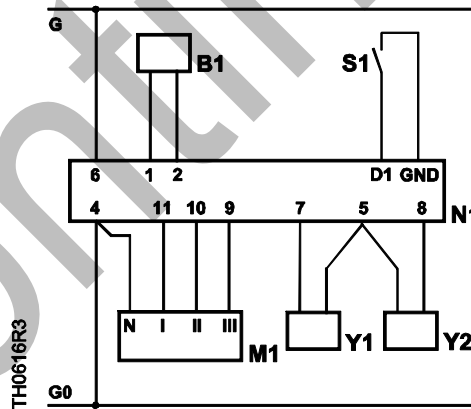
## Wiring Terminals



- 1 Status input, Return air temperature sensor
- 2 Measuring neutral, Return air temperature sensor
- 4, 5 Neutral
- 6 Operating voltage 120 Vac
- 7 Zone Valve (heating), 120 Vac
- 8 Zone Valve (cooling), 120 Vac
- 9 Fan speed III, 120 Vac (High)
- 10 Fan speed II, 120 Vac (Medium)
- 11 Fan speed I, 120 Vac (Low)
- D1, GND Status input for potential-free operating mode changeover switch (operating action can be selected)

Figure 11. Wiring Terminals.

## Wiring Diagram



- B1 Return air temperature sensor (QAH11.1)
- L Operating voltage 120 Vac
- M1 Three-speed fan
- N Neutral
- N1 Free Energy Band RCC30U room temperature controller
- S1 External operating mode changeover switch
- Y1 599 Series Zone Valve for Heating mode
- Y2 599 Series Zone Valve for Cooling mode

Figure 12. Wiring Diagram.

## Dimensions

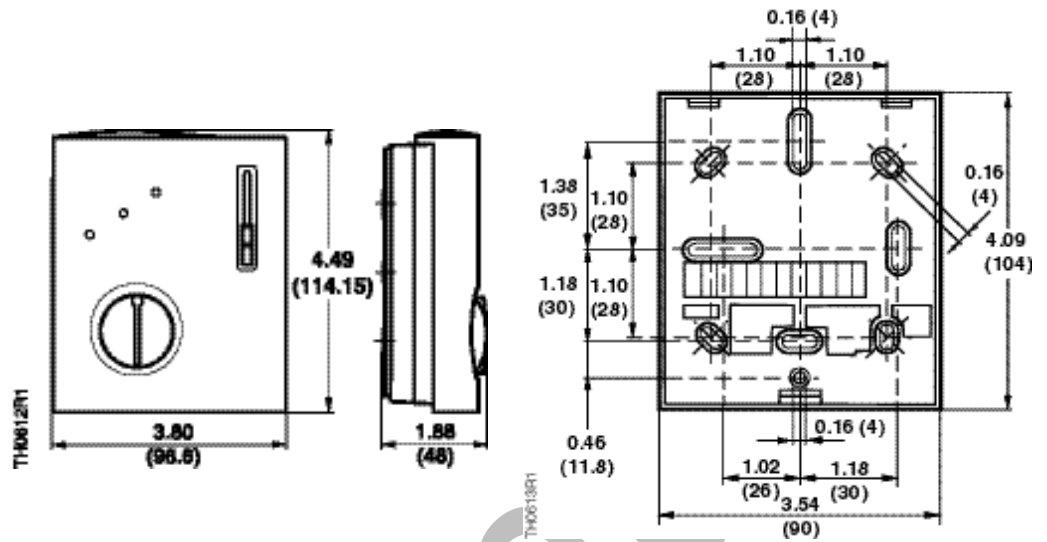


Figure 13. Free Energy Band RCC30U and Base Plate in Inches (Millimeters).

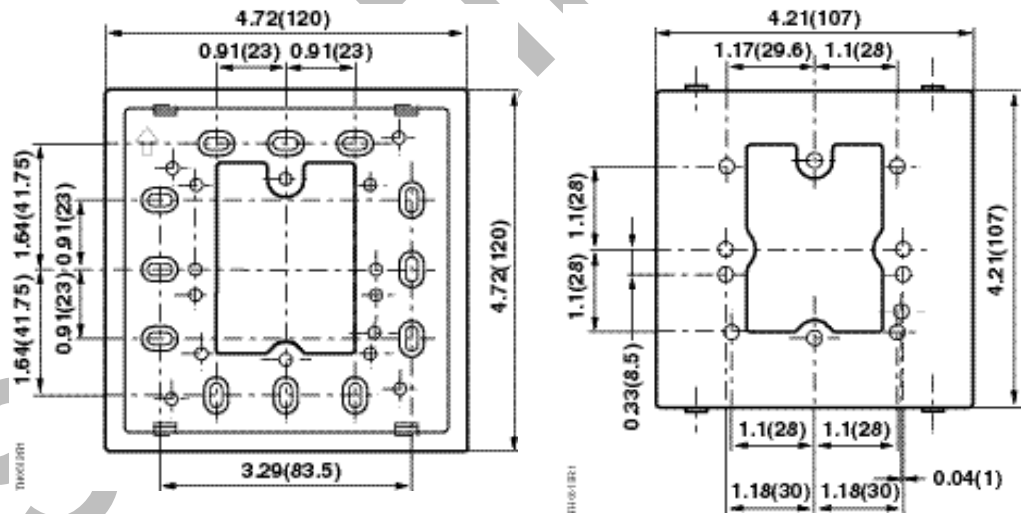


Figure 14. ARG70 Dimensions in Inches (Millimeters).

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