Smart Home Simulator — Build Guide 07

Build and Install the HVAC Simulator Module

TYPE	PHASE	MODULE	USE
Tabletop Simulator Panel	HVAC Simulator Install	Project box + smart thermostat	IoT / Smart Home Training

SAFETY:	This guide is for a low-voltage HVAC simulator only. Do not connect the board directly to real HVAC equipment or line voltage. Use the instructor-approved transformer/power supply and verify power is off before wiring.

GOAL OF THIS PHASE

Build a low-voltage HVAC simulator project box with colored 24V LEDs, connect the 24V AC power supply, wire the smart thermostat terminals, mount the finished project box to the demo wall, and verify heat, cool, fan, stage 2, and common wiring.

- Cut and drill the project box before installing LEDs and wire strain relief.
- Mount brackets, standoffs, or backing plate before wiring the project box to the board.
- Label every terminal and wire on both ends.
- Use low-voltage power only and keep HVAC wiring separate from line-voltage wiring.
- Test the module before moving on to smart thermostat configuration.

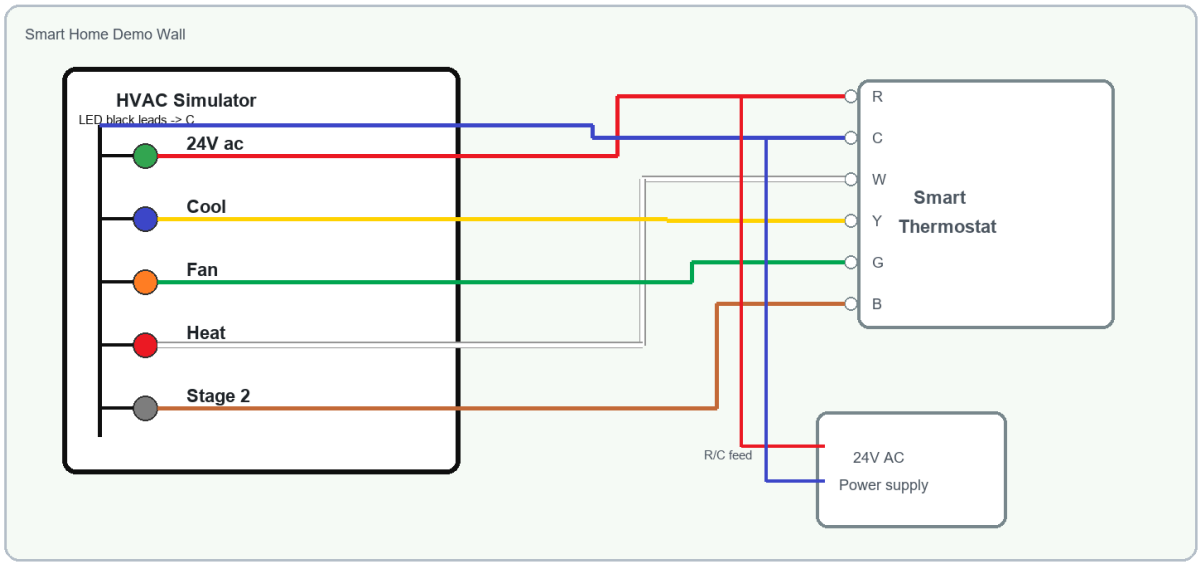
MATERIALS, HARDWARE & TOOLS

QTY	ITEM	SPEC / NOTES
1	Smart thermostat and wall/base plate	Thermostat used to control the simulator calls.
1	Project box (3x6x2 min.)	Holds colored 24V LEDs and internal wiring.
1	24V AC low-voltage supply	Instructor-approved transformer/power supply sized for simulator load.
5	Colored 24V LED indicators	24Vac/power, cool, fan, heat, and stage 2 indicators.
5’	Thermostat, wire 5-7 conductor	5-conductor preferred for R, C, W, Y, G.
As needed	Small wire nuts	Use for low-voltage splices inside the project box; size to match conductor count and gauge.
As needed	Standoffs / brackets / backing plate	Secure the project box to the wall without stressing terminals.
As needed	Cable glands / grommets	Protect thermostat and power-supply wires where they enter the box.
As needed	Labels / wire markers	Label both ends of each conductor.
1	Multimeter	Verify low-voltage output and continuity before final test.

1	In-line fuse 1amp	1 amp Inline fuse for power supply wire.

MODULE LAYOUT

HVAC simulator project box wiring layout



Use 24V AC low-voltage simulator power only. Do not connect this project box directly to HVAC equipment or line voltage.

FIG 1:	Each LED red lead goes to its matching call wire. Each LED black lead returns to the blue C/common wire. Mount the completed project box to the demo board after wiring is tested.

TERMINAL REFERENCE

HVAC simulator terminal reference

R	**24V power**	Feeds thermostat/simulator control power and 24V LED bus.
C	**Common**	Completes the 24V AC circuit for thermostat and LEDs.
W	**Heat call**	Turns on the red HEAT LED.
Y	**Cool call**	Turns on the blue COOL LED.
G	**Fan call**	Turns on the orange FAN LED.
B	**Stage 2 / aux call**	Turns on the gray STAGE 2 LED if used by the thermostat/lab.

Wire colors may vary by kit. Match labels and terminal function first; document the color actually used.

Fig 2 — HVAC simulator terminal functions. Match labels and document the wire colors actually used.

BUILD THE HVAC SIMULATOR PROJECT BOX

1	Lay out the project box face Mark LED positions for 24Vac, Cool, Fan, Heat, and Stage 2. Keep labels readable from the front of the demo wall.
2	Drill LED and wire-entry holes Drill clean holes for the colored LEDs and cable glands/grommets. Deburr plastic edges so wires are not cut by the box.
3	Install colored 24V LEDs Install LEDs in the project box: green for 24Vac/power, blue for Cool, orange for Fan, red for Heat, and gray for Stage 2.
4	Label each LED and wire Label the outside of the box and label internal conductors. Include R, C, W, Y, G, and B/Stage 2 labels.
5	Wire LED common and call leads Use C/common as the LED return/common as required by the LED type. Route W to Heat, Y to Cool, G to Fan, and B to Stage 2. Use small wire nuts for approved low-voltage splices inside the project box.
6	Connect 24V AC power supply Wire the low-voltage supply to the simulator R and C feed points. Protect the power-supply wire where it enters the project box.
7	Inspect wire nuts and bench test Confirm each small wire nut is tight and no bare copper is exposed below the connector. With instructor approval, power the 24V supply and verify the power LED turns on. Momentarily test each call LED before closing the box.

INSTALL THE PROJECT BOX TO THE DEMO WALL

1. **Choose mounting location**
   Place the project box where students can read LED labels and where wire routing will not cross line-voltage wiring.

2. **Install brackets or standoffs**
   Mount the backing plate, brackets, or standoffs first. Confirm the project box will sit flat and can be opened for service.

3. **Attach project box**
   Fasten the project box to the mount. Do not over-tighten screws into plastic. Keep the lid removable if students need to inspect wiring.

4. **Route thermostat wire**
   Route the thermostat wire neatly from smart thermostat location to the project box. Leave service loops at both ends.

5. **Secure wire path**
   Use cable clips or Velcro ties. Avoid sharp bends and keep low-voltage wiring separated from power wiring.

6. **Install covers and labels**
   Add any terminal covers, wire labels, and front-facing labels before testing.

WIRE SMART THERMOSTAT TO PROJECT BOX

TERMINAL	FUNCTION	SKETCH COLOR	CONNECTS TO	CHECK
R	24V power	Red	Thermostat R / project box R feed	Green 24Vac LED/power feed active.
C	Common	Blue	Thermostat C / project box C common	Smart thermostat has common.
W	Heat call	White/gray	Thermostat W / red Heat LED	Heat LED responds.
Y	Cool call	Yellow	Thermostat Y / blue Cool LED	Cool LED responds.
G	Fan call	Green	Thermostat G / orange Fan LED	Fan LED responds.

B or W2	Stage 2 / aux call	Brown/orange	Thermostat B / gray Stage 2 LED	Stage 2 LED responds if used.

TEST AND DOCUMENT

TEST	ACTION	EXPECTED RESULT	STATUS
Power	Apply 24V AC simulator power	Green 24Vac LED powers without call LEDs stuck on.	[ ] Pass
Heat	Activate W call	HEAT indicator/load turns on.	[ ] Pass
Cool	Activate Y call	COOL indicator/load turns on.	[ ] Pass
Fan	Activate G call	FAN indicator/load turns on.	[ ] Pass
Stage 2	Activate B/Stage 2 call if used	STAGE 2 indicator turns on.	[ ] Pass
Wire nuts	Gently tug each low-voltage splice	Small wire nuts stay tight and no bare copper is exposed.	[ ] Pass
Common	Verify smart thermostat C wire	Thermostat remains powered through R/C.	[ ] Pass
Mount	Gently move wall/project box	Project box, lid, power supply, and wires stay secure.	[ ] Pass

HVAC BUILD WORKSHEET

FIELD	VALUE / NOTES
Smart thermostat model	
Project box size/type	
Low-voltage supply rating	
24Vac LED color used	
Cool LED color used	
Fan LED color used	
Heat LED color used	
Stage 2 LED color used	
R wire color used	
C wire color used	
W wire color used	
Y wire color used	
G wire color used	
B or W2 wire color used	

Mounting location	
Instructor initials/date	

NEXT PHASE — CONFIGURE SMART THERMOSTAT AND SMART DEVICES

READY FOR CONFIGURATION Thermostat app Alexa linking Heating/cooling/fan test Room assignment Demo commands	DO NOT SKIP 24V low-voltage only Wires labeled both ends Small wire nuts secure Project box mounted securely Colored LEDs tested Worksheet completed

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