Smart Home Simulator — Build Guide 02

Mocking Up, Cutting Out, Installing, and Rough-Wiring Plug & Light Boxes

TYPE	PHASE	SURFACE	USE
Tabletop Simulator Panel	Box Layout + Cutouts	1/2" Drywall in 2x4 frame	IoT / Smart Home Training

SAFETY:	This build guide covers mechanical layout and mounting. Do not connect exposed 120V wiring on a training wall. Keep the simulator unplugged while cutting, drilling, or installing boxes.

GOAL OF THIS PHASE

In this phase you will mock up the smart-home devices on the drywall face, mark the openings, cut clean holes, and install the plug and light boxes so the simulator is ready for device wiring and face plates.

- Use the actual box, ring, or device plate as the layout template whenever possible.
- Confirm the look from the front and the working clearance from the back before cutting.
- Cut openings slightly tight first; trim only after a test fit.
- Keep boxes clear of the frame ledge, legs, screw heads, and any planned router or patch-panel hardware.

MATERIALS, HARDWARE & TOOLS

QTY	ITEM	SPEC / NOTES
2	Old-work single-gang boxes	Blue plastic boxes for outlets, switches, and smart modules. Choose boxes with drywall clamp ears.
2	Round old-work light boxes or rings	Use fixture-rated boxes for any real line-voltage light. Low-voltage demo lights may use low-voltage rings if allowed by the instructor.
As needed	Face plates / device plates	Use plates during mockup to verify final visual spacing and coverage.
As needed	Cable clamps / bushings	Protect wire where it enters boxes. Use strain relief for cords and power strips.
As needed	Romex / NM-B electrical wire	Use the wire gauge and type approved by the instructor for the training simulator load.
1	Power-strip plug adapter / cord end	Training-wall feed from the protected power strip. Must be enclosed, strain-relieved, and inspected before use.
1 roll	Painter's tape	Temporary layout marks; easier to move than pencil lines.
1	Label tape or marker	Label every opening before wiring begins.

RECOMMENDED TOOLS	LAYOUT RULES
Tape measure, pencil, level, speed square	Minimum 2" clearance between cutouts
Oscillating multi-tool with drywall blade	Stay at least 2" away from frame members
Drywall jab saw or utility knife	Keep device plates level and aligned
Hole saw for round light openings	Leave rear access for wire routing
Drill and small pilot bit	Never cut through hidden wiring
Vacuum and sanding block	Dry-fit every box before final screws

MOCK UP THE FRONT LAYOUT

The best layout is the one that looks correct from the front and still leaves enough room behind the wall to route cables. Start with tape, not holes.

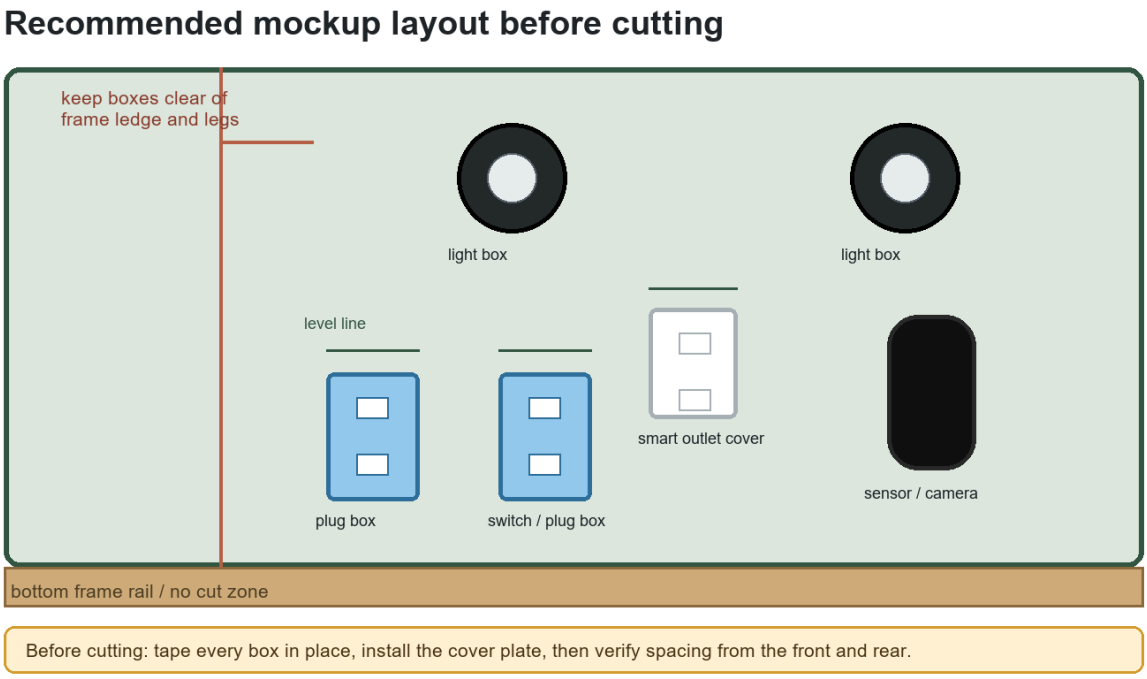


Fig 1 — Example front layout: tape boxes in place first, then check level, spacing, and back-side clearance before cutting.

1 **Mark a level reference line**
Draw a light pencil or tape line across the working area. Use it to align outlets, switches, and smart outlet plates.

2 **Tape boxes and cover plates to the wall**
Temporarily tape the box and its face plate in place. The face plate shows what students will actually see after installation.

3	**Check spacing from the front** Leave enough room for labels, hands, plugs, adapters, and power cords. Avoid crowding devices near the frame.

4	**Check clearance from the back** Make sure clamp ears, cable exits, power strips, and router hardware will not collide behind the panel.

5	**Label each future opening** Write OUTLET, SWITCH, LIGHT 1, LIGHT 2, SENSOR, or the planned device name on tape above the opening.

TRACE AND CUT THE OPENINGS

Cutout sequence

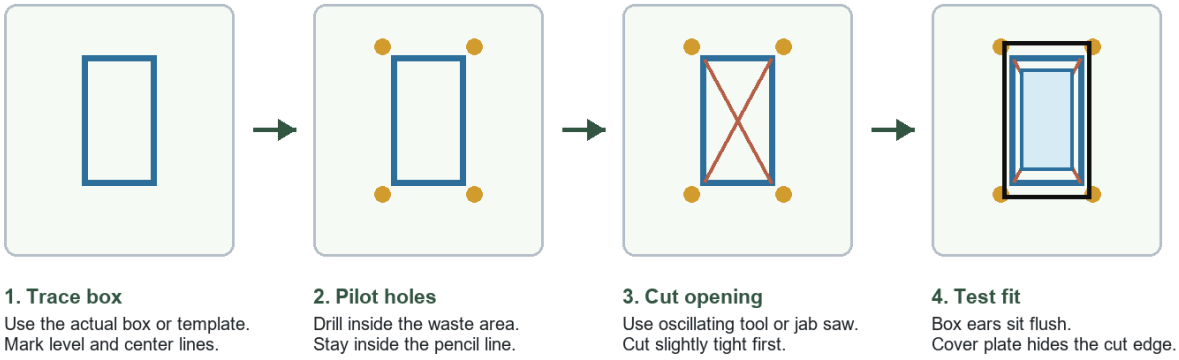


Fig 2 — Cut slightly inside the line first. A tight opening can be trimmed; an oversized opening is hard to hide.

TIP:	For rectangular plug boxes, trace the box body, not the cover plate. For round light boxes, use the manufacturer template or or trace the box body. Keep the box ears or mounting flange on the face side of the drywall.

1	**Trace the box outline** Hold the box level and trace around the cutout body. Mark which side is top. For old-work boxes, keep the clamp-ear area outside the opening.

2	**Drill starter holes in the waste area** Drill inside the traced shape, near corners for rectangular boxes. The holes give the saw a clean place to start.

3 **Score the paper face**
Lightly score the cut line with a utility knife. This reduces paper tear-out and gives the saw a clear path.

4 Cut just inside the line. Support the panel from behind if it flexes. Vacuum dust as you go so the line stays visible.

5 **Test fit and trim**
Insert the box without forcing it. Trim high spots a little at a time until the box seats square and flush.

INSTALL PLUG BOXES

1 **Prepare the box**
Open only the knockouts you need. Install bushings or clamps before the box goes into the wall.

2 **Route cable into the box**
Feed cable through the knockout with enough slack for device installation. Keep slack neat behind the panel.

3 **Seat the box flush**
Push the box into the opening until the front ears sit flat against the drywall face.

4 **Tighten old-work clamps**
Tighten clamp screws until the box is secure. Stop when snug; over-tightening can crush drywall.

5 **Check the plate fit**
Temporarily install the outlet, blank, or smart-device plate. It should sit level and cover the cut edge cleanly.

INSTALL LIGHT BOXES

1 **Confirm the box rating**
Use fixture-rated boxes for real lights. For LED/demo-only modules, follow the instructor-approved low-voltage mounting method.

2 **Cut the round opening**
Use a hole saw when possible. If using an oscillating tool, trace carefully and cut slowly so the circle stays clean.

3	**Feed cable and add strain relief** **Protect wire where it passes into the box. Keep low-voltage and line-voltage circuits separated.**

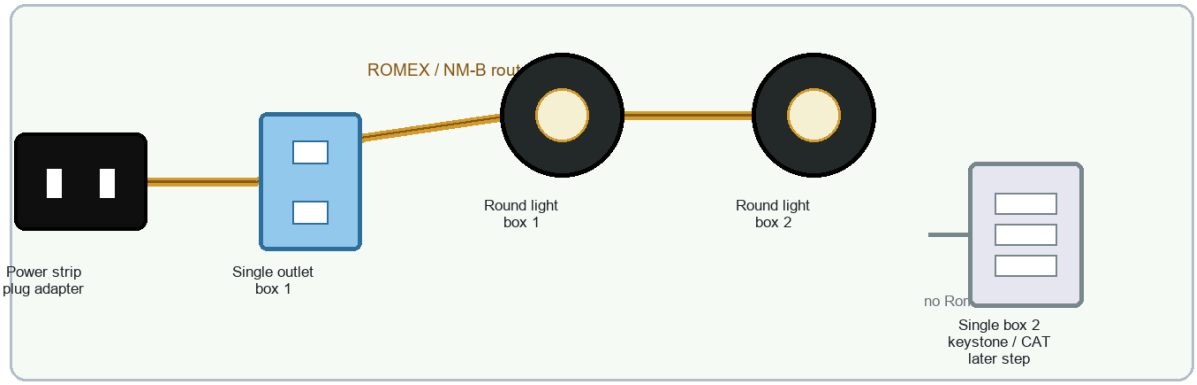
4	**Seat and fasten the box** **Old-work round boxes clamp to the drywall. Surface brackets should be screwed into backing or rated anchors.**

5	**Install a temporary cover** **Install a blank cover or fixture ring during the build so the opening is protected before wiring begins.**

RUN ROMEX FROM THE POWER STRIP FEED

After the holes are cut and the boxes are mounted, rough-in the electrical path before installing devices. This simulator uses one single outlet box as the powered plug box, two round light boxes, and one separate single-gang box reserved for keystone/CAT cables in a later step.

Romex rough-in route after boxes are mounted



Power stays OFF during wiring. Final energizing and line-voltage approval must be done by the instructor or a qualified electrician.

Fig 3 — Rough-in route: power strip plug adapter to outlet box 1, then light box 1, then light box 2. The second single-gang box is for low-voltage keystone/CAT cable only.

POWER OFF:	Keep the power strip unplugged while routing or terminating wire. Do not energize the simulator until all boxes are covered, the cord feed is strain-relieved, grounds are bonded where required, and the instructor or qualified electrician has inspected the wiring.

LEG	FROM	TO	PURPOSE
1	Power strip plug adapter / cord feed	Single outlet box 1	Brings protected simulator power into the first plug box.
2	Single outlet box 1	Round light box 1	Continues power path from the plug box to the first light point.

3	Round light box 1	Round light box 2	Continues power path to the second light point.
Hold	Single outlet box 2	Keystone / CAT cable later	Do not run Romex into this box unless the design changes. Reserve it for low-voltage data cables.

1 **Prepare the power-strip feed**
Use the approved plug adapter or cord end from the power strip as the simulator feed. Add strain relief so a tug on the cord cannot pull wire loose inside the box or panel.

2 **Run Romex to single outlet box 1**
Route the Romex from the power-strip feed into the first single outlet box. Leave enough service loop to terminate the device without tension, then secure the cable so it cannot sag into moving or sharp areas.

3 **Terminate outlet box 1**
Inside the first plug box, connect the feed conductors to the outlet/device following the device markings and instructor-approved wiring method. Keep insulation intact up to the terminal area and fold conductors neatly into the box.

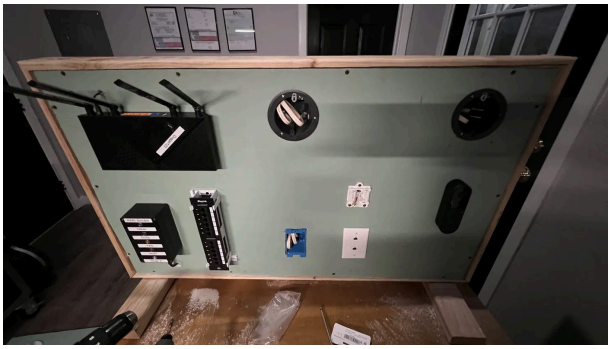
4 **Run Romex from outlet box 1 to round light box 1**
Route the next Romex leg from the first plug box into the first round light box. Protect the cable at every box entry with the proper clamp or bushing.

5 **Run Romex from round light box 1 to round light box 2**
Continue the route from the first round light box to the second round light box. Leave slack for fixture/device connections and keep the cable path neat on the back side of the wall.

6 **Cap, cover, and label unfinished conductors**
If lights or devices are not installed immediately, cap conductors individually, install temporary blank covers, and label each box before any power is applied.

7 **Leave single outlet box 2 for data**
Do not connect this box to the power feed. Mark it KEYSTONE / CAT so it is ready for the later low-voltage networking step.

PHOTO REFERENCES



Front reference — boxes, plates, round openings, and equipment layout after mockup.

Rear reference — old-work boxes, cable paths, and back-side access before final wiring.

FINAL FIT CHECKLIST

CHECK	PASS CRITERIA	STATUS
Box flush	Box ears touch drywall face; no rocking or proud corners.	[ ] Pass
Plate coverage	Cover plate hides cut edge on all sides.	[ ] Pass
Level / plumb	Outlets and switches align with the reference line.	[ ] Pass
Rear clearance	Clamp ears, cable exits, and cords do not hit frame or other devices.	[ ] Pass
Cable protection	Bushings, clamps, and strain relief are installed where needed.	[ ] Pass
Romex path	Feed runs to plug box 1, then light box 1, then light box 2.	[ ] Pass
Data box reserved	Second single-gang box is marked keystone/CAT and has no power conductors.	[ ] Pass
Dust cleanup	Cutout dust vacuumed from front, rear, and device boxes.	[ ] Pass

Labels	Each opening/device is labeled before wiring starts.	[ ] Pass

NEXT PHASE — DEVICES, KEYSTONE & LABELS

READY FOR DEVICE WORK Smart outlet or plug module Switch or scene button Light module or LED fixture Sensor, camera, or doorbell mount Router / hub / patch panel mounting Keystone and CAT cable install	DO NOT SKIP Verify power is disconnected before device work Separate low-voltage and line-voltage paths Use strain relief on cords and cable entries Label each circuit and simulator function Test with instructor-approved power only

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