Daylight Window

An illustrated assembly manual for the two-pane, daylight-synchronized 24 V lightbox.



Installed concept · One window, no sill. Decorative lighting for an existing room.

FIND YOUR STEP

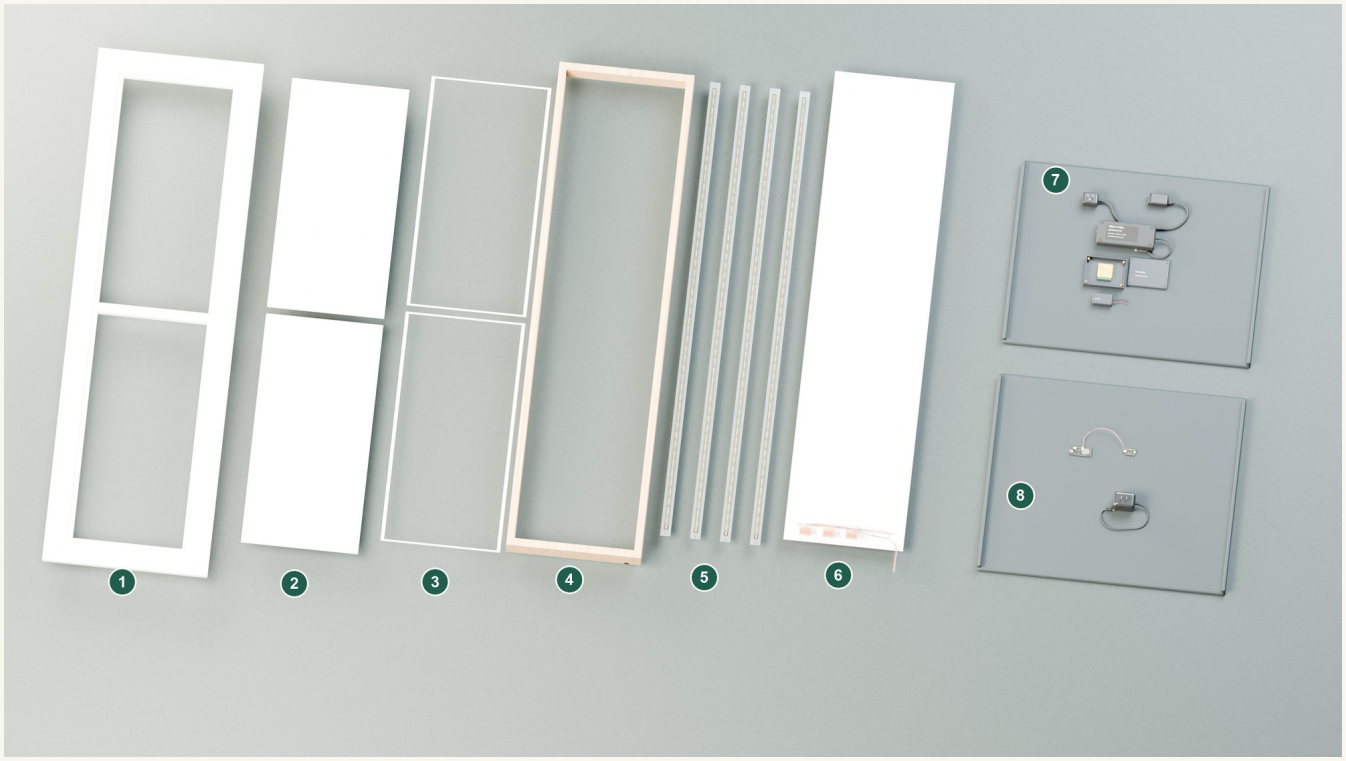
2	Complete exploded view	**3**	Parts and tools
4	Dimensions and fit	**5–10**	Build the lightbox
11	Assemble the daylight station	**12**	Program and test daylight response
13	Mount, troubleshoot and service	**14**	Source and test record

BENCH PROTOTYPE

Use the dimensions as planning targets. Confirm hardware, thermal behavior and the property’s requirements before permanent installation.

The entire assembly

Read left to right across the lightbox. The two right-hand stations are external to the box.



All physical parts on the bench share model scale. Cable slack and part spacing are arranged for the illustration.

1 Front cassette

Painted mitered trim, center bar and glazing gaskets.

2 Diffusers

Two 2447 white acrylic inserts, cut to fit.

3 Removable stops

Glazing stops and room-side service fasteners.

4 Pine lightbox

Four rails and a protected low-voltage exit.

5 Light engine

Four BTF 24 V COB runs on Everbilt aluminum.

6 Rear and harness

White backer and three five-port WAGO splices.

7 Accessible power

Mean Well adapter, Quail cord, Shelly PWM and example housing.

8 Daylight station

AS7341, Feather ESP32 V2, STEMMA QT and USB-C supply.

THREE CONNECTIONS

The three-conductor 24 V harness powers the lightbox. A short four-wire STEMMA QT cable links the sensor to the Feather. The Feather and Shelly communicate over local Wi-Fi.

Parts and tools

One lightbox and one daylight station. IDs at left match the complete exploded view.

ID	Item	Order ID	Qty
1, 3	Primed pine, 1 × 3 × 8 ft	252958 / 424600	2 sticks
1	White semigloss finish	BEHR 305004	1 qt
2	2447 white cast acrylic, 1/8 × 12 × 24 in	W031251224	2 sheets
4	KD whitewood, 1 × 3 × 8 ft	914649	2 sticks
5	BTF 24 V FCOB CCT, black PCB, 5 m	46144731742434	1 roll
5	Solid aluminum, 1 in × 1/8 in × 8 ft	Everbilt 6208	2 sticks
6	Tempered hardboard, nominal 1/8 in	SS1254825 / 832777	1 sheet
6	Five-port lever splice, WAGO 221-415	221-415K006-000	3 of 10
7	24 V 90 W desktop adapter	GST90A24-P1M	1
7	Grounded NEMA 5-15P to IEC C13 cord	Quail 2500.072	1
7	Shelly Plus RGBW PM	Plus RGBW PM	1
8	Adafruit AS7341 spectral sensor	4698	1
8	Adafruit Feather ESP32 V2	5400	1
8	STEMMA QT four-wire cable, 300 mm	5384	1
8	Raspberry Pi USB-C supply, 5.1 V	Adafruit 4298	1

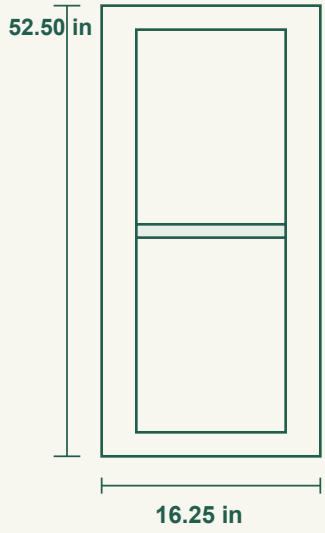
Allow for measured hardware. Gaskets, cassette and carrier fasteners, wiring and strain relief, stiffening, fusing as required, protective controller housing and the rated DC connector. Select mounts for the real wall and sensor location.

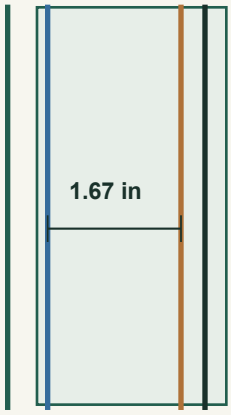
Lay out your tools. Tape and square, straightedge and clamps, saws suitable for each stock, acrylic scoring or cutting tools, file, drill, wire tools, meter and temperature probe. Use eye protection and material-appropriate dust control.

Quote basis. $286.52 in priced items plus $25–$45 planned hardware on November 22, 2026. Sample materials and installation are additional. Recheck sale prices, availability and checkout charges.

Size the enclosure

Nominal no-sill model. Use the actual lumber, glazing seat, and wall or mounting substrate.





2.50 in body

CASE • ACRYLIC • LED • REAR

Box outside
13.25 × 49.50 × 2.50 in

Clear interior
11.75 × 48.00 in

Optical spacing
1.67 in modeled. Test 1.5–2.0 in on the bench.

Part	Qty	Nominal cut	Check
Side rails	2	49.50 in	3/4 in thick × 2.50 in deep
Head and bottom rails	2	11.75 in	Between side rails
Reflective rear panel	1	11.75 × 48.00 in	Nominal 1/8 in; check the seat
Casing verticals	2	52.50 in	Long point of both 45° miters
Casing horizontals	2	16.25 in	Long point of both 45° miters
Muntin and stops	1 set	Fit to frame	Muntin about 1 in high
Acrylic inserts	2	~11.50 × 23.45 in	Start oversize; measure pockets
Aluminum carriers	4	1,180 mm	Two from each Everbilt stick
COB tape runs	4	1,150 mm	46 × 25 mm if delivered tape matches

Dry-fit all rails square. For a recess, verify the full cavity and obstacles before cutting drywall. Check the backing projections and the actual cable bend. The model assumes intact studs.

Test the light before the wall

Confirm diffusion, load and heat with the actual LED tape, aluminum and acrylic.



Illustration · A movable face on a nominal 12 × 12 in sample.

1. **Dry-fit a sample.** Hold the acrylic 1.5–2.0 in from the tape face. Use the intended white backing, carrier type and roughly 75 mm rail pitch. A small sample needs separate tape stock, or temporarily reuse the four future runs in an open full-size test jig.

2. **Compare the optics.** Start with low output. Check warm, cool and blended light. Photograph from the front and at an angle with fixed exposure. Adjust the gap, pitch or diffuser layers if you can see stripes or edge shadows.

3. **Measure the steady-state temperature.** With the enclosure in the intended orientation and guarded from contact, log ambient, each carrier, the wood and the acrylic at the highest planned sustained setting. Proceed only when measured temperatures, wiring and component ratings have been reviewed.

BEFORE YOU MOVE ON

A 5 m roll leaves 400 mm after four full-length cuts. Budget extra tape for a four-strip 12 in square sample. Treat temperature readings from the square sample as preliminary and repeat on the full unit.

Dry-fit the box and backer

Work from the real stock dimensions. Check the frame fits before drilling or cutting the glazing.

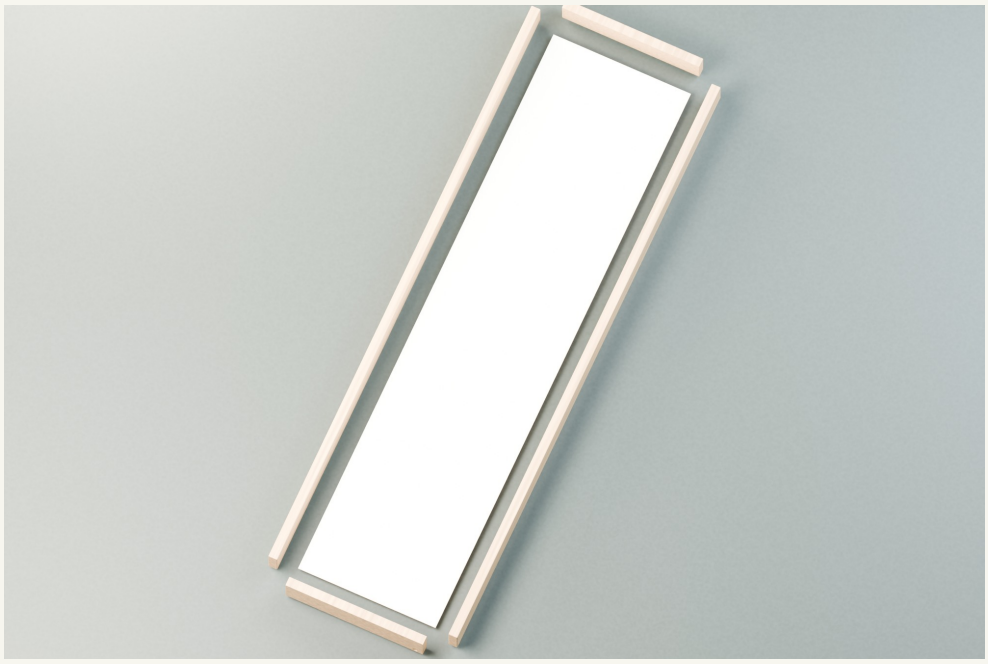


Illustration · White reflective face up. End rails fit between the two side rails.

1. **Measure and mill the rails.** Check actual thickness and depth. Cut two full-height sides and two between-stile end rails. Lay the four on a flat table. Verify outer width, depth, and that both diagonals agree before fastening.

2. **Fit the backer and plan service.** Cut the hardboard to its measured seat. Paint the inside face and let it cure. Dry-fit the backer supports and fastener heads. Leave access to the carrier screws, terminations and cassette screws.

3. **Locate the low-voltage exit.** Locate the actual rated grommet or clamp before boring the end rail. Check its retention, bend radius and clearance from the tape pads. Keep the cable protected from wood and metal edges.

BEFORE YOU MOVE ON

The rear washers and nuts shown extend about 4 mm behind the nominal box. Account for that projection, backing support and cable bend when evaluating either mount.

Build four carrier runs

Cut at the actual tape marks and keep the three conductors labeled.

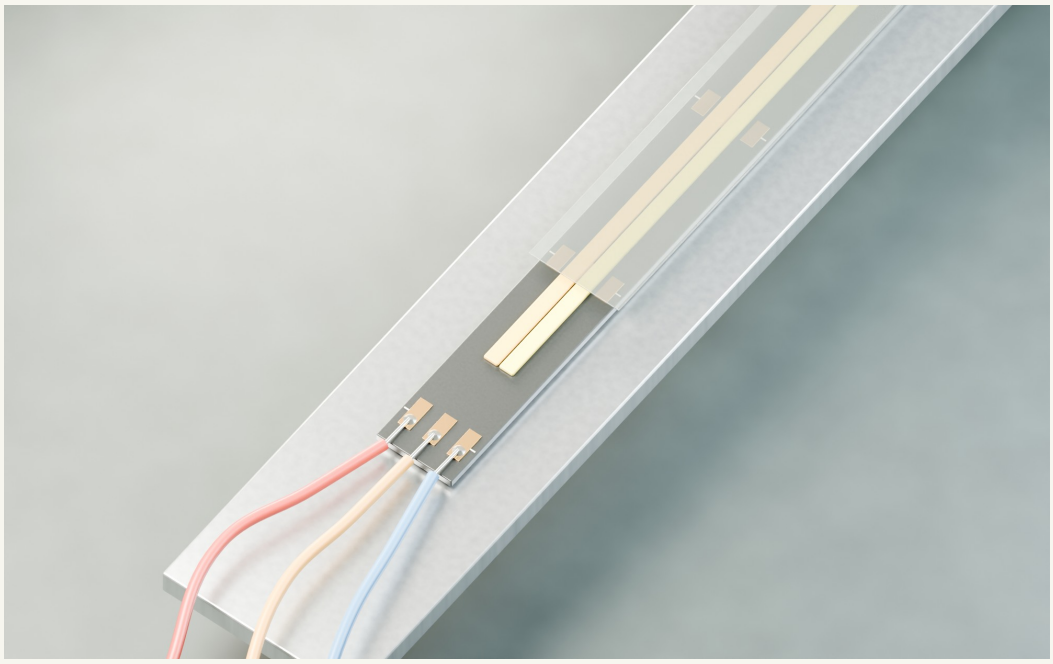


Illustration · Three conductors, black flexible PCB, two phosphor bands and the clear sleeve.

1. **Size and deburr the carriers.** Cut four 1,180 mm bars from two 8 ft sticks. Deburr the ends and drill fastener holes outside the 1,150 mm tape runs. Dry-fit the hardware. Mark four centerlines, approximately 75 mm apart.

2. **Verify and cut the LED tape.** Confirm 24 V analog CCT, three copper pad labels and the 25 mm cut interval on the delivered roll. Cut four 46-interval runs. Leave clearance at the ends, expose only the terminal area and work with power disconnected.

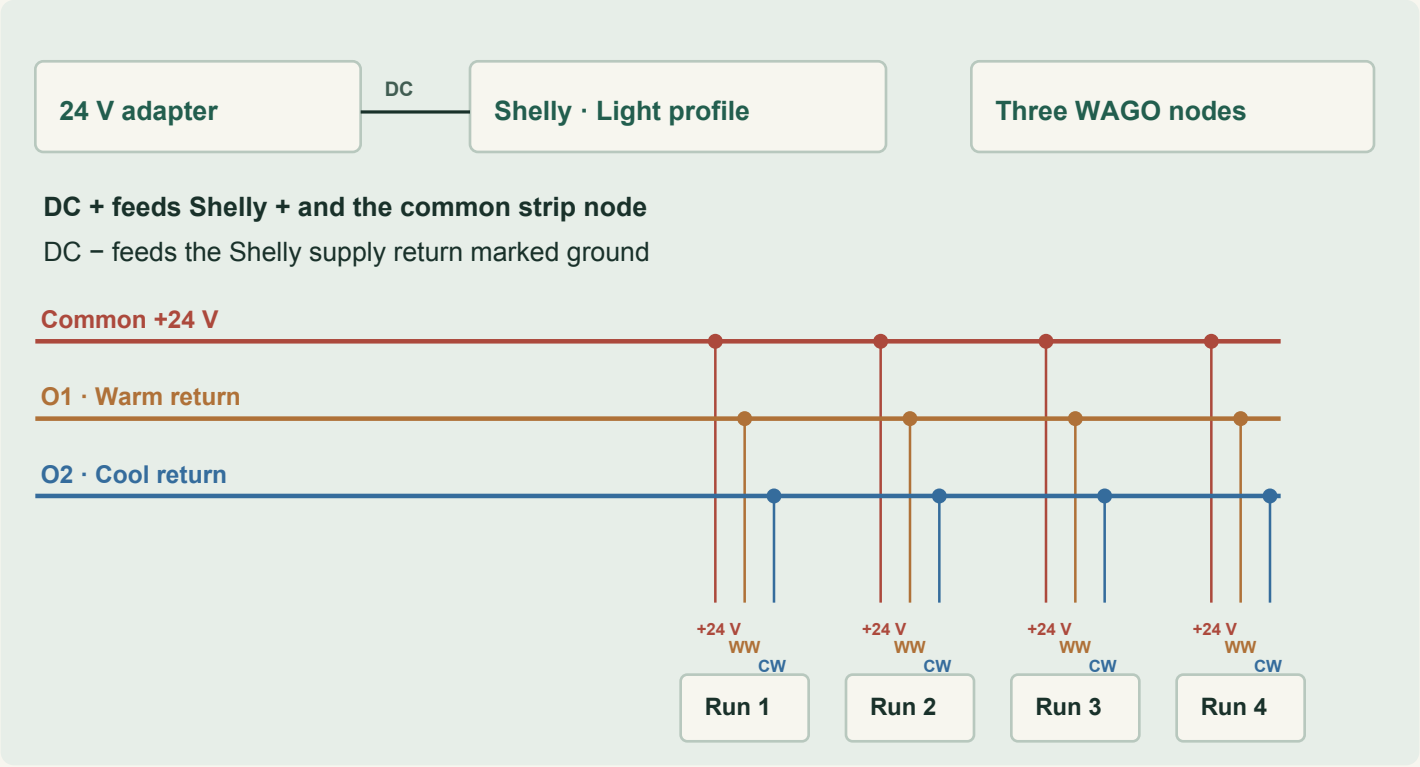
3. **Fasten, bond and terminate.** Secure the bars to the stiff backer, clean the bond surface, and follow the tape maker’s mounting guidance. A suitable terminations method must fit all three pads and the carrier. Confirm with continuity and short checks, then support each lead independently of its pad.

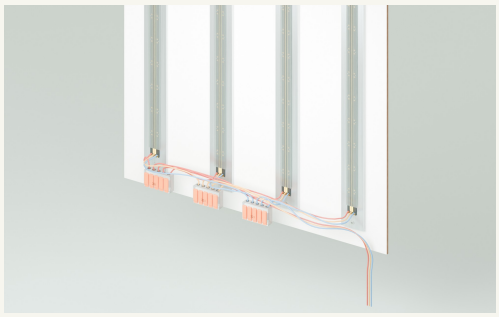
BEFORE YOU MOVE ON

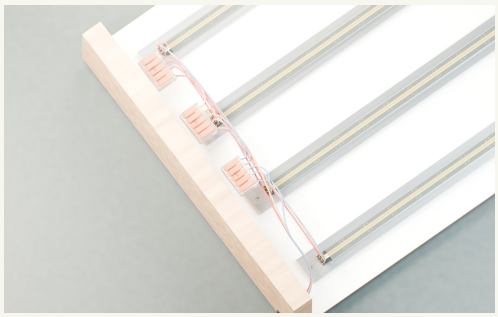
Cutting the sleeve changes the assembly’s protection. Use this as an indoor dry prototype. Do not rely on the tape adhesive, thin foil or an untested backer for safe operation.

Connect the four runs in parallel

Concept terminal map for the quoted 24 V analog tape. Wire and inspect with the adapter unplugged.







Illustrations · Three five-port nodes and the protected low-voltage exit.

Common anode. +24 V goes directly to all four positive pads. Each WW pad joins O1 through its splice. Each CW pad joins O2 through its splice. Keep unused terminals clear. Verify the actual pad markings and the current Shelly diagram.

Inspect the route. Give the lower exit rated strain relief and abrasion protection. Use the connector instructions for conductor type, gauge and insertion. Confirm blade, supply, harness and each return before energizing.

Set the panes and stops

Build the front as a removable cassette, then offer it up to the enclosure.



Illustration · Rear face up, so the retaining stops and acrylic seats are visible.

1. **Assemble the casing and muntin.** Dry-fit the mitered casing, inside reveal and center bar. Check that both panes have even sight lines and that the cassette overlaps the wood box evenly.
2. **Cut the acrylic to measured pockets.** Use the finished pockets to size both inserts; the nominal preview is about 11.50 × 23.45 in. Leave the clearance recommended for the actual acrylic and support system. Preserve the protective film during cutting and dry fitting.
3. **Seat the acrylic and attach the stops.** Place the gasket and acrylic from the back. Fit the removable stops without clamping or drilling through the acrylic. Fit the complete cassette squarely and retain it mechanically with accessible fasteners.

BEFORE YOU MOVE ON

Remove the protective film before service. With the fixture unplugged, verify you can remove the cassette, then the stops, without disturbing the wall or the wiring.

Set up the power station

The Mean Well plug-in supply and the housed Shelly remain accessible outside the wall.



Illustration · Mains cord and DC plug disconnected. Housing and mating interface are examples.

1. **Identify the actual plugs.** Fit the grounded C13 cord to the adapter. The captive DC output is center-positive P1M, 5.5 mm OD × 2.5 mm ID × 11 mm barrel. Select a fully mating connector with compatible ratings and a protected enclosure. Verify fit, polarity and retention before any energizing.

2. **With mains disconnected, inspect the 24 V circuit.** Follow the terminal map on page 8 and the current manufacturer drawing. Have the protection, current ratings, wiring, terminations, mounting and ventilation reviewed. Check for shorts and verify the warm and cool circuit labels at each end.

3. **Commission on the bench.** Configure Shelly in Light profile with the outputs initially off. Test warm on O1 and cool on O2 one at a time at low output. Verify all four runs, then test blended settings and measure actual supply and channel currents at the intended maximum.

BEFORE YOU MOVE ON

4.60 m × 16 W/m = 73.6 W, or 3.07 A at 24 V, is the conservative tape planning ceiling. The 90 W adapter rating does not establish safe installed performance. Keep its cord and adapter outside the concealed cavity.

Assemble the daylight sensor

A separate indoor station samples daylight through an existing real window.

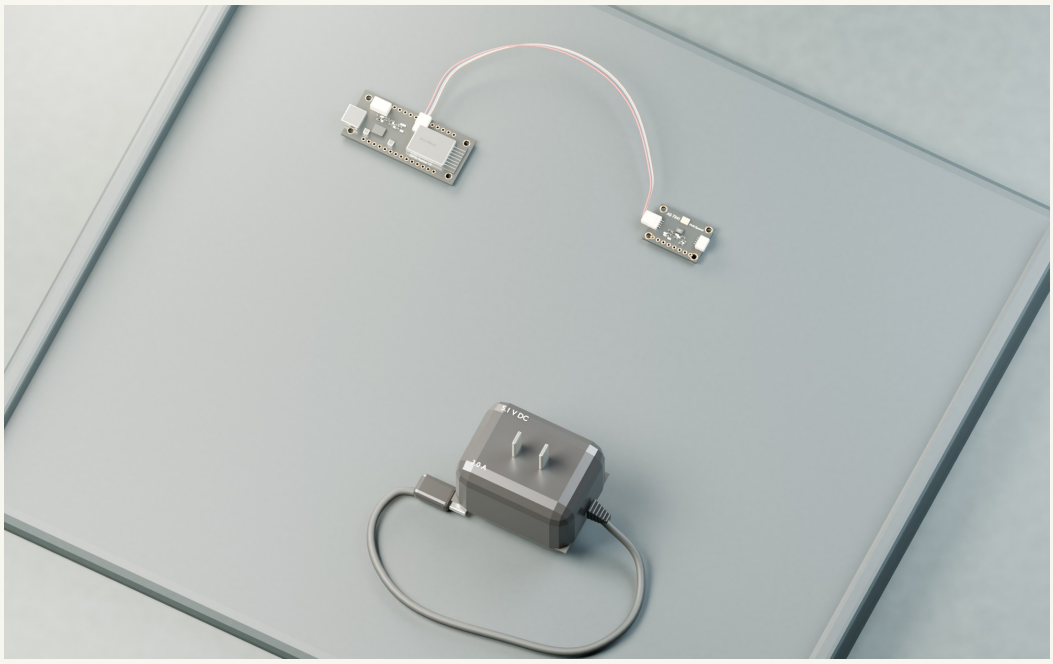


Illustration · AS7341 #4698, Feather #5400, STEMMA QT #5384 and USB-C adapter #4298.

1. **Connect the two boards with USB unplugged.** Use a four-position STEMMA QT cable between the Feather and the AS7341. Use the keyed sockets. Secure the boards using their mounting holes and standoffs so the bench and mounting hardware cannot short the board.

2. **Power and confirm readings.** Connect the Feather over USB-C. Load sensor firmware that supports the AS7341 and scan its I²C bus. Confirm the sensor appears at 0x39. Use the sensor's spectral readings as a relative daylight signal and disable its onboard illumination for passive sensing.

3. **Test the real window position.** Place the sensor indoors near the living-room window, aimed at a repeatable patch of sky. Compare readings with nearby room lights on and off, with and without shade, and in darkness. Keep its mount serviceable.

BEFORE YOU MOVE ON

The diagram shows Wi-Fi between stations. Only the short STEMMA QT cable links the two sensor-side boards. The Feather has its own USB supply.

Make the window follow the light

Set up a local mapping from the real window to the two PWM channels. Calibrate using the actual room.

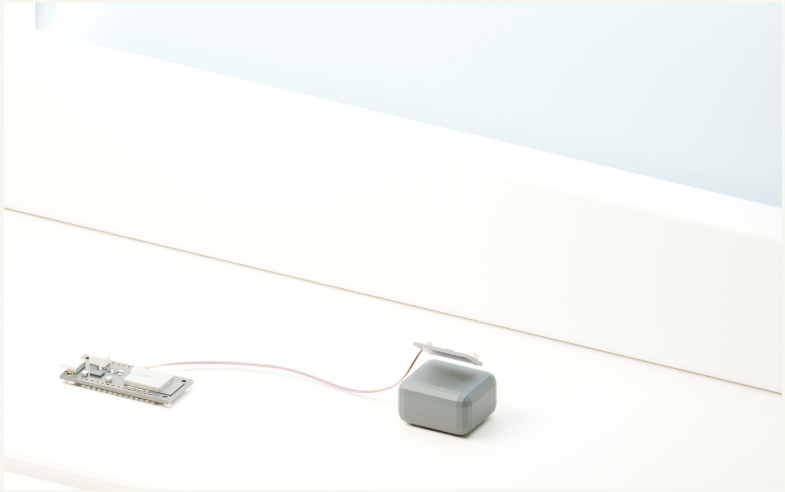


Illustration · The optical aperture is aimed toward real daylight. Choose a stable indoor position.

1. **Sample and calibrate.** Read the sensor approximately every 30–60 seconds. Log dawn, bright daylight, cloud cover, dusk and darkness. Record a relative brightness value and a color proxy. Set gain and integration time to avoid saturation and confirm an off threshold with hysteresis.

2. **Mix the channels and smooth the result.** Put the sensor and Shelly on the same local network. Use the local Light component to set the verified O1/O2 channels. If the target brightness is B and the cool fraction is f, start with warm = B × (1 − f) and cool = B × f. Smooth over 2–5 minutes and cap outputs at the tested maximum.

3. **Test loss of input and manual control.** Add a local watchdog so stale readings or network loss turn both outputs off after a tested timeout. Decide how manual off works at the accessible point. Confirm night-off and safe startup with a reboot, Wi-Fi loss and disconnecting the sensor.

LOOK FOR THIS BEHAVIOR

Brighter and cooler in bright daylight, softer when overcast, warmer and dimmer as measured light falls, and off in darkness. The spectral sensor needs empirical calibration. This guide specifies the logic and checks rather than a preflashed firmware image.

Install only after bench tests

Choose the verified mount and leave the fixture, power equipment and sensor serviceable.



Recessed concept · Confirm cavity



Surface option · Preserve wall

1. **Pick the mounting route.** Recess only after checking clear width and depth, structure, obstructions, insulation and moisture layers, electrical requirements, and room egress. Keep studs intact. If the cavity is unsuitable, use the wall-color surface box and secure it to appropriate substrate.

2. **Attach, dress and re-test.** Secure the fixture square and account for rear fasteners, terminations, protected cable, service space and validated cooling. Keep the 120 V cord and desktop supply accessible outside the cavity. Confirm the controller and sensor can be serviced separately.

3. **Diagnose with power disconnected.** One dark run suggests a branch connection or cut/tape issue. One dark color across all four points to the shared WW/CW return or controller output. Visible stripes call for a new optical test. Excess heat, damage, or odor requires shutdown and review before reuse.

DECORATIVE LIGHT ONLY

The faux window provides no exit or ventilation. Building, wiring, ventilation, egress and fire-safety requirements depend on the actual room and location.

Sources and commissioning record

Open the exact vendor references when you inspect the delivered hardware. Record actual measurements per fixture.

- BTF 24 V FCOB CCT tape
- Shelly Light profile and local API
- Quail grounded IEC cord
- Adafruit AS7341 product page
- Adafruit Feather ESP32 V2
- Adafruit Raspberry Pi USB-C power adapter
- Shelly outputs, terminals and ratings
- Mean Well GST90A24-P1M ratings and connector
- WAGO 221-415 splice and conductor data
- Adafruit AS7341 overview and pinouts
- Adafruit 300 mm STEMMA QT cable
- 2447 white cast acrylic

Record before close-up	Reading / pass / notes
Wall cavity or surface attachment observed	_____
DC connector fully mates and polarity verified	_____
WW / CW / blended currents at set maximum	_____
Ambient / carriers / wood / acrylic at steady state	_____
No glare bands or hotspots at normal viewing angle	_____
Sun, cloud, dusk, night-off and manual control	_____
Reboot, stale-reading fallback and network loss	_____
Cassette and controls can be accessed for service	_____

Quoted parts are catalog selections. Model dimensions represent the design. Some small component details, fasteners, housings and cable dress are approximated. This manual establishes the prototype sequence and verification work.

Open the private project, 3D viewer and downloads