



CLEAR**SHIFT**

SMART FILM · TRADE MANUAL

Installation Manual.

Everything you need to install Clearshift switchable film correctly the first time. Written so any qualified installer can follow it — even on their first job.

VERSION 1.0 · 2026

Clearshift Smart Film Co.
Australia · Trade Sales Only

What's in **this guide.**

Read sections 1–3 before you start. Sections 4 and 5 are for the install itself. Section 6 covers the electrical wiring (for your sparky). Section 7 is troubleshooting — keep it handy.

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Never installed switchable film before? Read this manual end-to-end first, then come back and follow it step-by-step on the day. Allow about 30 minutes per square metre for your first install. Three people make a 4m² panel feel easy. One person makes it feel impossible.

Before you **start.**

The six things every installer needs to know before opening the box.

What smart film actually is

Clearshift smart film is a self-adhesive PDLC (Polymer-Dispersed Liquid Crystal) film that applies to the interior side of existing glass. When 60V AC is applied to it, the liquid crystals align and the film becomes optically clear. When power is cut, the crystals scatter and the film becomes frosted-opaque. The switch happens in under a second.

It is not paint, not vinyl, and not tint. It is a low-voltage electrical product with copper bus bars along one edge that must be terminated, wired to a controller, and connected to mains by a licensed electrician.

The five non-negotiables

1. **Dry install only.** Never use water or any wet application method. Smart film is applied via self-adhesive backing only.
2. **Never fold, crease, or sharply bend the film.** Doing so delaminates the layers permanently. Always handle it flat or rolled.
3. **The mains-side connection must be done by a licensed electrician** under AS/NZS 3000. The 60V AC controller-to-film side is extra-low-voltage and can be terminated by the installer.
4. **Always test the film before applying it to glass.** A 30-second bench test catches the rare faulty panel before you've spent two hours installing it.
5. **Match wire colours when joining multiple panels.** Red to red, black to black. Always. Crossing wires when running panels in parallel can permanently damage them.

IMPORTANT — READ BEFORE OPENING THE FILM ROLL

Inspect the package for damage on arrival. If the cardboard tube is crushed or the film roll has been bent, photograph it immediately and email

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within 48 hours. Once the film has been unrolled and handled, damage claims become much harder to validate.

How long does it take?

Plan on the following per panel as a working installer:

- **Small panel (under 1m²):** 45–60 minutes for two people, including glass prep.
- **Medium panel (1–3m²):** 90 minutes for two people, more comfortable with three.
- **Large panel (3m²+):** 2+ hours, three or four people. Do not attempt large panels with two installers — you will damage the film.
- **Electrician's time:** Allow 1–2 hours per controller for the mains connection.

Tools & materials.

Everything you need to do the job properly. Don't start without all of it.

Essential — supplied with your order

Every Clearshift order ships with these items in the Connection Kit (SKU CS-KIT-01):



PDLC Smart Film

Cut to your specified dimensions with bus bar leads pre-attached



Controller + Transformer

RCM-marked. Plugs into mains, outputs 60V AC to the film



Copper Bus Bar Tape

5 m of conductive copper tape for terminating exposed edges



Lead Wires (2 × 1m)

Pre-tinned red and black 18-gauge wires for film termination



Edge Sealant

15g tube of non-acid silicone sealant for sealing film edges



Install Guide Card

Quick-reference card summarising the steps in this manual

You supply — required



Isopropyl Alcohol



Lint-Free Cloth



Plastic Razor Blade

99% IPA — for cleaning the glass before install. Do not substitute with water

Microfibre or nanofibre. Never paper towel — fibres remain on glass

For scraping the glass clean. Never use metal — it will scratch and pit



Soft-Edge Squeegee

Felt-edged or rubber. Used to push out air bubbles during application



Nitrile Gloves

Non-powdered. Prevents finger oils transferring onto the film adhesive



Painter's Tape

Low-tack masking tape. Used for creating handles and protecting edges during sealing

For the electrician — wiring stage



Butt Splice Connectors

18 AWG insulated crimp connectors for joining film leads to controller wires



Wire Strippers + Crimper

For 18 AWG wire. A combo tool covers both jobs



Heat Shrink Tubing

3mm and 6mm diameter, for insulating joins. Apply with a heat gun



Multimeter

For verifying 60V AC output from the controller before connecting to film



16/2 Shielded Cable

For runs over 3m from controller to film. Plenum-rated for in-wall



Electrical Licence

Mains side requires a current Australian electrical contractor's licence

ELECTRICAL SAFETY

Smart film operates at 60V AC. The transformer connects to 240V mains. The mains-side wiring must be performed by a licensed electrician under AS/NZS 3000. Never wire a film panel into a circuit that cannot be safely isolated and verified de-energised. RCD protection is recommended on the source circuit.

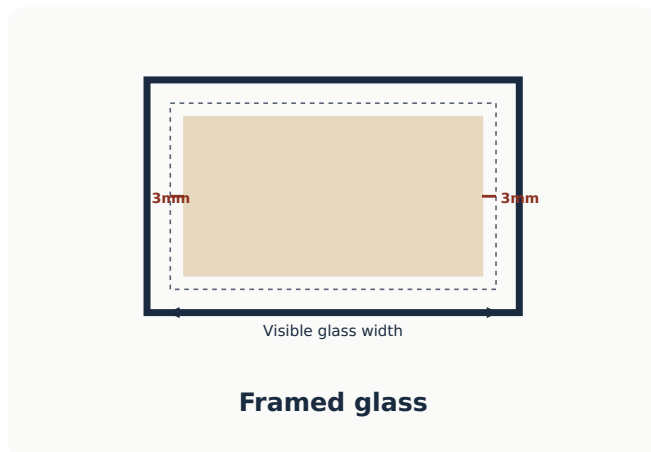
Measuring & ordering.

Get this right and the install is half done. Get it wrong and you're paying for two pieces of film.

Measure the visible glass area

Smart film must be slightly smaller than the visible glass area so the bus bars and edges have somewhere to sit, and so any frame irregularities don't push the film over the edge of the glass.

- **Framed glass:** measure from the inside edge of the frame on all four sides — this is the visible glass area.
- **Frameless glass:** measure from beveled edge to beveled edge.
- **Order size:** deduct 3mm from each side. The finished film panel will be 6mm shorter in both height and width than the visible glass.
- **Odd shapes (arches, circles, trapezoids):** measure the largest rectangle the shape fits within, and send us a sketch or photo with dimensions marked. We'll cut to the actual shape.



Wiring direction

The bus bars (where wires attach to the film) run along one of the four edges. When you order, specify which edge you'd like the wires to come out — typically the edge closest to the wall the controller will sit behind, or the top of the panel for clean overhead conduit runs. We'll confirm this on the shop drawing before cutting.

Save yourself a return trip: measure twice, then once more. Take photos of the window with a tape measure visible in the frame. If the dimensions you provide are wrong, we cut to what you told us — replacements are billable. We'll always send a shop drawing for you to sign off on before cutting, so you have one last chance to catch a mistake.

What you'll receive

- **Pre-cut film panel** with bus bars pre-attached and lead wires soldered on, sealed in a cardboard tube.
- **Controller + transformer** (RCM-marked) with a wireless remote and WiFi module.
- **Connection kit** (copper tape, additional lead wires, edge sealant, install guide card).
- **Shop drawing** showing dimensions, wire location, and serial number (also printed on the film itself — do not remove this label, it voids the warranty).

Preparing the **glass.**

The single most important stage. 90% of bubble and adhesion problems come from inadequate glass prep.

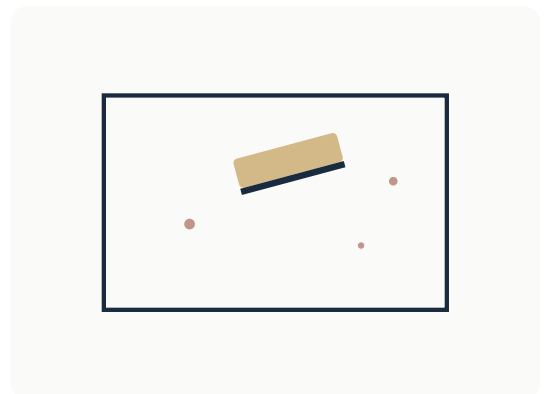
Choose the right environment

- **Clean and dust-free.** Avoid installing during ongoing renovation, sanding, or sweeping. If it's a renovation site, mist the air with a water spray bottle one hour before installation to settle dust.
- **Bright, even lighting.** Natural daylight or strong overhead lighting helps you see every speck of dirt on the glass before it ruins the install.
- **Temperature between 10-30°C.** Too cold and the adhesive doesn't bond well. Too hot and you have less working time before the film sticks.
- **Allow the film roll to acclimate to room temperature for 30 minutes before unrolling.**

STEP 4.1 — SCRAPE

Remove anything stuck to the glass

Use a **plastic razor blade** (never metal) to scrape off any paint flecks, putty residue, adhesive, silicone, or stuck-on grime. Work systematically across the whole pane. If the glass was previously tinted or had vinyl decals, every speck of adhesive residue must come off — it will telegraph through the film.



STEP 4.2 — CLEAN

Wipe down with isopropyl alcohol

Spray 99% IPA onto a clean lint-free cloth (never spray directly onto the glass — it can run into frames). Wipe the entire glass surface in straight overlapping strokes. Flip the cloth frequently. Repeat until the cloth comes away clean.

Never use: paper towel (leaves fibres), kitchen spray (leaves film), or water (leaves mineral deposits).



STEP 4.3 — INSPECT

Check from multiple angles

Stand back. Walk around the glass. View it from sharp angles where the light reveals streaks, smears, or trapped lint. If you see anything at all, repeat steps 4.1 and 4.2 until the surface is perfect.

If you have access to one, a particulate meter reading of PM2.5 or lower in the room is ideal. If not, just trust your eyes under good light.



DON'T SHORTCUT THIS STAGE

Every dust particle, fingerprint, or fibre on the glass will be visible through the film once it's applied — and pulling the film up to remove debris risks delaminating it. Spend the extra ten minutes here.

SECTION 05

Installing the **film.**

The dry-application process, step by step. Read once before you start.

CRITICAL REMINDER BEFORE OPENING THE FILM

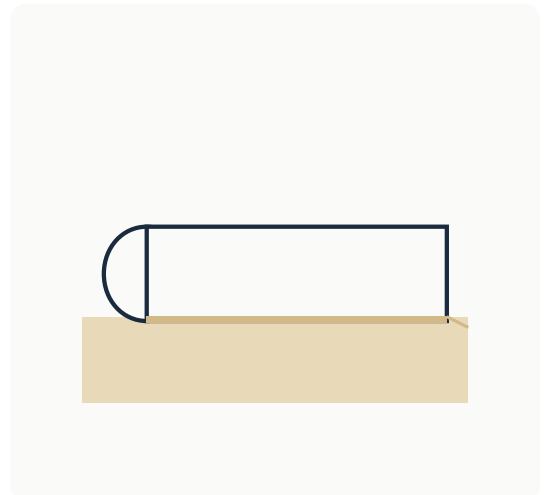
Once you peel back the release liner, the adhesive surface is exposed to dust. Have your workspace ready, your tools laid out, and a second (ideally third) installer present before you peel anything.

STEP 5.1 — UNBOX & INSPECT

Unroll on a clean, flat surface

Lay the film with the clear protective liner facing up. The adhesive (cling) side has its own separate release liner — leave both liners in place for now. Wipe both outer surfaces of the liners with IPA on a lint-free cloth to remove any shipping dust.

Inspect the bus bars and lead wires. They should be firmly attached. If anything is loose, photograph it and contact us before proceeding.



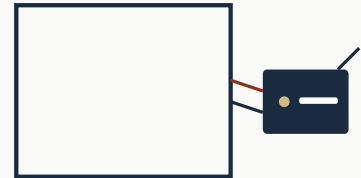
STEP 5.2 — BENCH TEST

Power the film on before installing

This is non-negotiable. With the film still on the table:

- Connect the lead wires to the controller using the supplied butt splice connectors (red to red, black to black).
- Plug the controller into mains.
- Switch on — the film should transition from frosted to clear within one second.
- Cycle it on and off a few times. Watch for dead zones, uneven switching, or sections that won't clear.

If the film fails the test, stop. Photograph the failure and email trade@clearshift.com.au. Do not attempt to install a faulty panel.



STEP 5.3 — DRY FIT

Test the fit against the glass

With both liners still in place, hold the film up against the glass (have a second person help) and confirm it matches the visible glass area with 3mm clearance on all sides. The bus bar edge should be at the side or top you specified on your order.

You should not need to trim the film on-site. If the fit is wrong, stop and contact us.

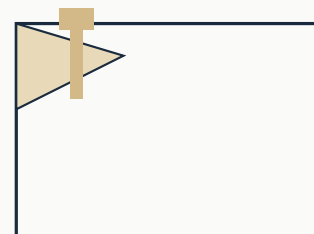


STEP 5.4 — CREATE TAPE HANDLES

Make your handle tabs

This is a pro tip that makes a huge difference. Take painter's tape and create two "bunny ear" handles at the corners of the release liner you'll peel first (usually the bottom).

Fold a 30cm length of tape sticky-side together with a tail sticking out, then stick that tail onto the release liner near each corner. Now you have two handles to pull on as you work your way down the panel. This stops the liner from re-sticking to the adhesive while you're trying to install.



STEP 5.5 — POSITION

Align and tack the top edge

Working with at least two people (preferably three or four for larger panels), peel back just the top 10–15cm of the adhesive-side liner. Position the film against the glass with the correct 3mm gap on all sides. Press the exposed top edge firmly against the glass to tack it in place.

Run your finger along the entire top edge to make sure the tack is even and the film is hanging straight.



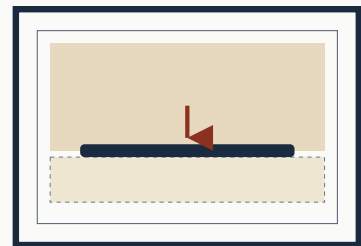
STEP 5.6 — APPLY DOWNWARD

Squeegee from top to bottom

Slowly peel back the adhesive liner 10–15cm at a time. As you do, use a soft-edge squeegee in firm, overlapping horizontal strokes from the centre outward to press the film onto the glass.

Work top to bottom in sections. Don't peel the entire liner at once. Don't rush. Take 30 minutes per square metre for your first install — you'll get faster.

If a bubble forms behind the squeegee, sweep it toward the nearest edge. Air should "outgas" through the edge.



STEP 5.7 — ADDRESS BUBBLES

Lift and reapply if needed

Small bubbles (under 5mm) will usually outgas on their own over 24–72 hours — Clearshift film has a self-outgassing adhesive.

For larger bubbles or any bubble containing a visible particle, mark it with an erasable marker, gently lift the film from the nearest edge using your fingernail (not a tool), use lint-roller tape sticky-side-out around your fingertip to lift off the particle, then squeegee back into place.

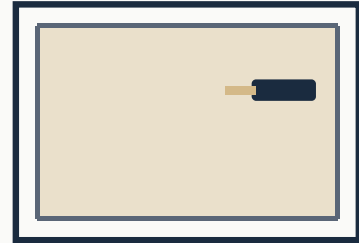


STEP 5.8 — SEAL THE EDGES

Apply non-acid silicone sealant

This is what stops moisture creeping under the film over time and is critical in bathrooms, kitchens, or anywhere humidity is high.

- Run painter's tape along the inside edge of the frame and just outside the film edge, leaving a 3–4mm gap exposed.
- Apply a thin, continuous bead of non-acid silicone (acid-cure silicone will damage the film — only use neutral-cure).
- Smooth with a damp gloved finger or a silicone tool.
- Immediately peel the painter's tape away before the silicone skins (within 5 minutes).
- Allow 10 hours minimum to cure before powering up.



STEP 5.9 — REMOVE OUTER LINER & ACCLIMATE

Final steps

Once the silicone has cured (minimum 10 hours), peel away the outer protective liner — the one that was facing you during install. The film surface underneath is the final visible surface and should be perfectly clean.

Leave the film unpowered for a further **24 hours minimum** after removing the protective liner. This allows any final small bubbles to outgas and the adhesive to fully cure. Powering up too early will not damage the film, but you may see bubbles that would have resolved on their own.

Handling: do and don't

The film is robust once installed, but fragile while you're handling it. Treat it as you would a sheet of glass: never fold, never crease, always carry flat or rolled.

✓ ALWAYS



Carry flat, two people minimum

✗ NEVER



Fold, crease, or sharply bend

✓ **ALWAYS**



Roll for transport (wide diameter)

✗ **NEVER**



Touch the adhesive side bare-handed

Wiring & electrical.

This section is for your licensed electrician. Mains-side work is not for the installer.

FOR LICENSED ELECTRICIANS ONLY

The information in this section is provided for the electrician completing the mains-side connection of the Clearshift transformer. All wiring on the 240V side must comply with AS/NZS 3000. RCD protection on the source circuit is recommended. Never energise the controller without verifying correct wiring and isolation.

System overview

A Clearshift smart film system has three electrical components:

1. **240V mains** from the wall outlet or hardwired circuit.
2. **Transformer/Controller** (RCM-marked, CS-CTL-60) that converts 240V AC to 60V AC.
3. **Smart film panel** with two bus bars and pre-attached lead wires (red and black, 18 AWG).

Specifications

- **Input:** 240V AC, 50Hz
- **Output:** 60V AC (nominal, 48–65V acceptable range)
- **Maximum load per controller:** 5m² of film. Use multiple controllers for larger installs.
- **Standby draw:** < 1 W
- **In-use draw:** approximately 5 W per m² of film
- **Connection from controller to film:** 18 AWG up to 3m, 16/2 shielded plenum-rated cable for runs 3–30m
- **Maximum cable run from controller to film:** 30m (longer runs require voltage compensation — contact us)

Standard single-panel wiring

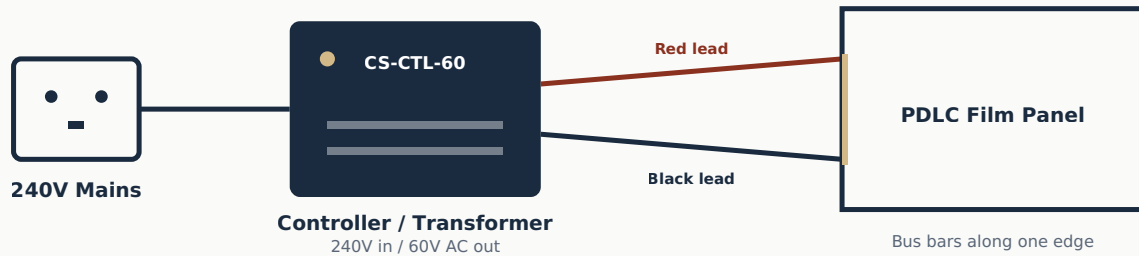


Figure 6.1 — Single panel wired to one controller

Multi-panel — parallel wiring (correct)

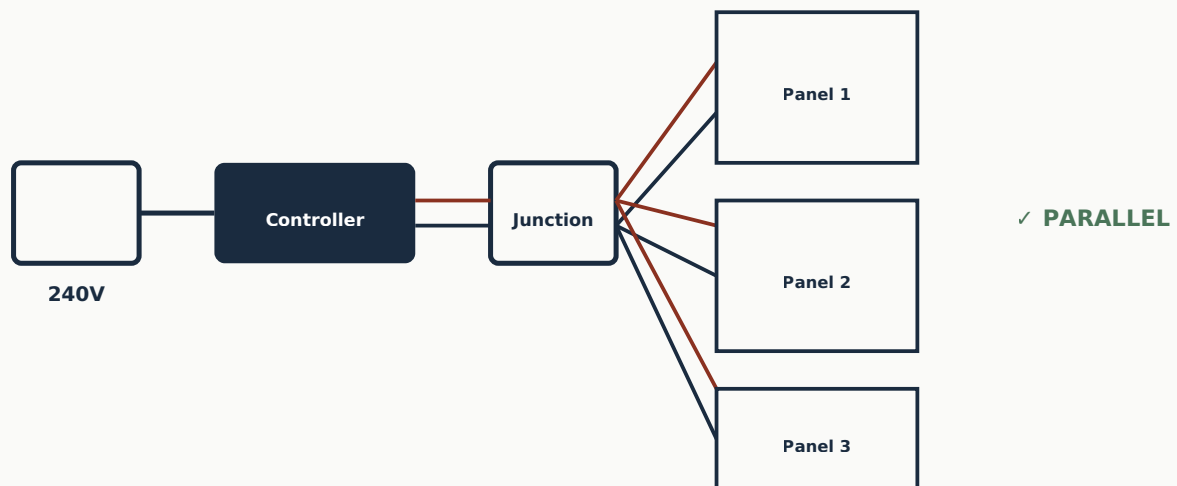


Figure 6.2 — Multiple panels wired in parallel from a junction box. Each panel has its own dedicated pair of wires.

NEVER WIRE PANELS IN SERIES AND NEVER DAISY-CHAIN

Multiple panels must each have their own dedicated pair of wires running back to the junction box or controller. Series wiring will cause uneven switching, hum, and may permanently

damage the film. Daisy-chaining causes voltage drop and erratic behaviour at the last panel in the chain.

Termination procedure

1. **Strip 8mm** from the end of each lead wire (both the film's wires and the controller's output wires).
2. **Insert into butt splice connector** — film lead in one end, controller output wire in the other. Match colours: red to red, black to black.
3. **Crimp firmly** with the correct die in your crimping tool. Test the joint by gently tugging — the wires should not pull free.
4. **Slide heat shrink tubing** over the connector and apply a heat gun for 5–10 seconds to shrink it tight.
5. **Leave approximately 25mm of exposed wire** between the heat shrink and the bus bar on the film — this provides strain relief and access for future maintenance.

Smart film is non-polarised. Red-to-red/black-to-black matters only when wiring multiple panels in parallel — if colours cross between panels, the panels will switch out of phase and may damage each other. On a single isolated panel, either lead can connect to either output of the controller without harm.

Troubleshooting.

Most issues fall into a handful of patterns. Here's how to diagnose them on-site.

Symptom	Likely cause & what to do
Film won't switch on at all	Check 240V at the controller input with a multimeter. Check 60V AC at the controller output. If both correct, check continuity through the lead wires from controller to bus bars. If the film is dead with confirmed voltage at the bus bars, photograph and contact us — likely a faulty panel.
Film switches but flickers or hums	Usually a poor electrical connection. Re-crimp all butt splices. Check that wires aren't running parallel to high-current AC cables (separate by at least 30cm). On multi-panel installs, verify all panels are wired in parallel, not series.
Part of the film stays frosted when powered	"Dead zone" caused by bus bar contact failure. Check the conductive bus bar tape at the dead end of the panel — if it's lifted or torn, the conductive path is broken. If the dead zone covers more than ~10% of the panel surface, the film is faulty.
Bubbles persisting more than 7 days after install	Small bubbles (under 5mm) should outgas within 72 hours. Larger persistent bubbles mean trapped contaminants. Mark, lift carefully from the nearest edge, clean with lint-roller tape, reapply with squeegee. If the film has been bonded for more than 14 days, it may not lift cleanly — accept it as is.
Hazing or "cloudy" appearance when powered on	Either a dirty glass surface (specks visible) or moisture has penetrated an unsealed edge. Check edge sealant

Symptom	Likely cause & what to do
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integrity. If moisture is the cause, the affected area may not recover — replacement film required.

Film delamination at edges

Caused by moisture ingress at unsealed edges or by physically pulling/scraping the edge. Cannot be repaired in the field. Apply edge sealant immediately to halt further spread; plan for replacement if spread continues.

Yellowing over time

Caused by sustained UV exposure or by leaving the film in the powered-on (clear) state for more than 72 hours continuously. Always cycle the film off when not actively needed. UV-blocking outer glass extends life dramatically.

Remote/app not responding

Controller-side issue, not the film. Check the controller's status LED. Re-pair the remote (hold the controller's reset button for 5 seconds, then press a button on the remote). For the WiFi app, factory-reset the WiFi module and re-onboard via the Clearshift app.

One panel out of multiple stays frosted

That panel's wiring is interrupted. Trace its dedicated pair of wires back to the junction box. Test continuity. Re-crimp any suspect joins.

When in doubt, call. Trade support: **04XX XXX XXX**, Mon-Fri 7am-5pm AEST. We'd rather spend ten minutes on the phone with you than have you spend two hours guessing. Photograph the issue, have the panel serial number ready (printed on the film and on the shop drawing).

Care & warranty.

What to tell your client when you hand over the job.

Cleaning the installed film

- **Always power off** before cleaning. Wait until fully dry before powering back on.
- **Use a soft microfibre cloth** lightly dampened with 70% IPA. Never spray cleaner directly onto the film — apply it to the cloth first.
- **Wipe gently** in straight overlapping strokes. Do not scrub.
- **Avoid:** water, ammonia-based glass cleaner, abrasive cloths, paper towel, anything metal.

Operational guidance for the end client

- **Don't leave the film powered on (clear) for more than 72 continuous hours.** The PDLC interlayer needs to cycle. Continuous power-on can shorten lifespan and cause yellowing.
- **Avoid prolonged direct UV exposure.** The film blocks UV but is itself sensitive to it over years. Outer glass with a UV-blocking coating extends life significantly.
- **Don't drill, screw, or attach anything through the film.** Any penetration breaks the conductive layer.
- **Don't apply other films, decals, or window treatments over the smart film** without checking with us first.

Annual maintenance check

Recommended once a year, particularly in bathrooms and other humid environments:

- Inspect edge sealant for cracks, gaps, or missing sections. Re-seal as needed with non-acid silicone.
- Visually check for any new bubbles, hazing, or yellowing.
- Verify the controller is functioning and the transformer is not running hot.
- Test all switching modes (on, off, remote, app).

Warranty

Clearshift offers a **5-year warranty on the film** and a **2-year warranty on the controller and transformer** from the date of dispatch, subject to:

- Installation by a competent installer in accordance with this manual.
- Mains-side connection by a licensed electrician under AS/NZS 3000.
- The serial number on the film not being removed or defaced.
- The film not being subjected to physical damage, modification, or improper cleaning.
- The film not being run in the powered-on state for more than 72 continuous hours.

The warranty does not cover: damage caused by improper installation, electrical surges or wiring errors, moisture ingress at unsealed edges, physical damage, modification of the film, or use outside the conditions specified above.

To claim under warranty: email **trade@clearshift.com.au** with the serial number, dated photographs of the defect, and a brief description of the issue. Replacement film will be cut and dispatched within the lead time stated at the time of the claim.

Australian Consumer Law Nothing in this warranty excludes, restricts, or modifies any consumer rights that apply under Australian Consumer Law. Our goods come with guarantees that cannot be excluded under the ACL.



TRADE SUPPORT

Stuck? **Call us.**

Trade line 04XX XXX XXX

Email trade@clearshift.com.au

Hours Mon-Fri · 7am-5pm
AEST

Web clearshift.com.au

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Smart film is a 60V AC switched electrical product. Mains-side connection to the transformer must be performed by a licensed electrician under AS/NZS 3000. Always isolate before working on the electrical components. Clearshift is not responsible for installation errors, electrical work performed by unqualified persons, or damage resulting from non-compliance with this manual.