VitroLens
TECHNOLOGIES

PRIVACY GLASS TECHNICAL MANUAL

VLT-TM-001

Version 1.1

Released July 2026



www.vitrolens.com

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Using This Manual

Welcome to the **VitroLens Privacy Glass Technical Manual**.

This manual has been developed to help architects, designers, glazing contractors, electrical contractors, installers, facility managers, and service personnel successfully design, install, commission, maintain, and troubleshoot VitroLens privacy glass and privacy film systems.

The manual is organized to follow the typical life cycle of a project:

- **Section 1** introduces VitroLens Technologies and the purpose of this manual.
- **Section 2** explains the fundamentals of Polymer Dispersed Liquid Crystal (PDLC) technology.
- **Section 3** describes the available VitroLens product offerings and their typical applications.
- **Section 4** provides engineering guidance, including active area, technical edge zones, busbar selection, controller sizing, and wiring recommendations.
- **Section 5** covers receiving, installation, commissioning, and documentation procedures.
- **Section 6** provides operation, maintenance, and systematic troubleshooting guidance.
- **Section 7** summarizes the warranty and directs readers to the complete Limited Warranty included in Appendix A.
- **Section 8** contains reference information, engineering guides, and supplemental technical resources.

This manual is intended to complement approved shop drawings, project specifications, applicable building codes, and good engineering practices. It is not intended to replace the judgment of qualified design professionals or installers.

For project-specific questions, engineering assistance, or technical support, contact **VitroLens Technologies, Inc.**

Revision History

Revision	Release Date	Description
1.0	May 2026	Initial Technical manual release.
1.1	July 2026	Expanded engineering guidance, installation procedures, troubleshooting methodology, revised warranty structure, new appendices, and editorial updates.

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Section 1 - Company Overview

1.1 Purpose

This manual provides engineering, installation, commissioning, operation, maintenance, and troubleshooting information for VitroLens privacy glass and privacy film products. It is intended to serve as a practical reference for architects, glazing contractors, electricians, installers, facility managers, and service personnel.

The purpose of this manual is to provide guidance for the proper design, installation, operation, and maintenance of VitroLens products while promoting long-term reliability and optimum performance.

1.2 Scope

This manual applies to:

- Laminated PDLC privacy glass
- Retrofit privacy film systems
- Interior and exterior applications
- Single and multi-panel installations
- Standard and custom control systems

This manual should be used in conjunction with approved shop drawings, project specifications, and applicable building codes.

1.3 Intended Audience

This manual is intended for:

- Architects
- Glazing contractors
- Electrical contractors
- Low-voltage installers
- General contractors
- Facility managers
- Service technicians
- Building owners and operators

The information contained herein assumes that installation and electrical work are performed by qualified personnel familiar with accepted industry practices.

1.4 About VitroLens Technologies

VitroLens Technologies, Inc. specializes in electronically switchable privacy glass and privacy film systems for commercial, healthcare, hospitality, residential, government, and specialty architectural applications.

VitroLens products are designed to provide instant privacy while preserving open spaces and maximizing daylight. Systems are available in laminated, insulated, and retrofit configurations and may be integrated with a variety of control systems and building automation platforms.

When properly designed, installed, and maintained, VitroLens systems are intended to provide years of reliable service.

1.5 Technical Support Philosophy

Successful troubleshooting begins by proving what is working before assuming what has failed. Most service issues are related to power, wiring, controls, or installation practices rather than the privacy glass itself.

Proper documentation, voltage verification, and systematic troubleshooting greatly improve response time and service efficiency. VitroLens recommends maintaining accurate records of installation photographs, wiring diagrams, controller information, and commissioning data throughout the life of the project.

1.6 Contact Information

VitroLens Technologies, Inc.
Website: www.vitrolens.com

For technical assistance, warranty support, or product information, contact VitroLens Technologies and provide project information, controller information, photographs, and voltage measurements when applicable.

Section 2 - PDLC Technology

2.1 Introduction

Polymer Dispersed Liquid Crystal (PDLC) technology provides electronically switchable privacy by controlling the alignment of liquid crystal molecules suspended within a polymer matrix. When power is removed, the liquid crystal molecules scatter light and the glass appears translucent. When electrical power is applied, the molecules align and allow light to pass through the panel, producing a transparent state.

PDLC technology provides an alternative to traditional blinds, curtains, and shades while preserving open architectural spaces and maximizing daylight.

2.2 How PDLC Works

Privacy glass operates in two states. In the OFF state, liquid crystal molecules are randomly oriented and scatter incoming light, causing the glass to appear translucent. In the ON state, the liquid crystal molecules align with the applied AC field, allowing light to pass through and producing a transparent appearance. Switching occurs almost instantaneously.

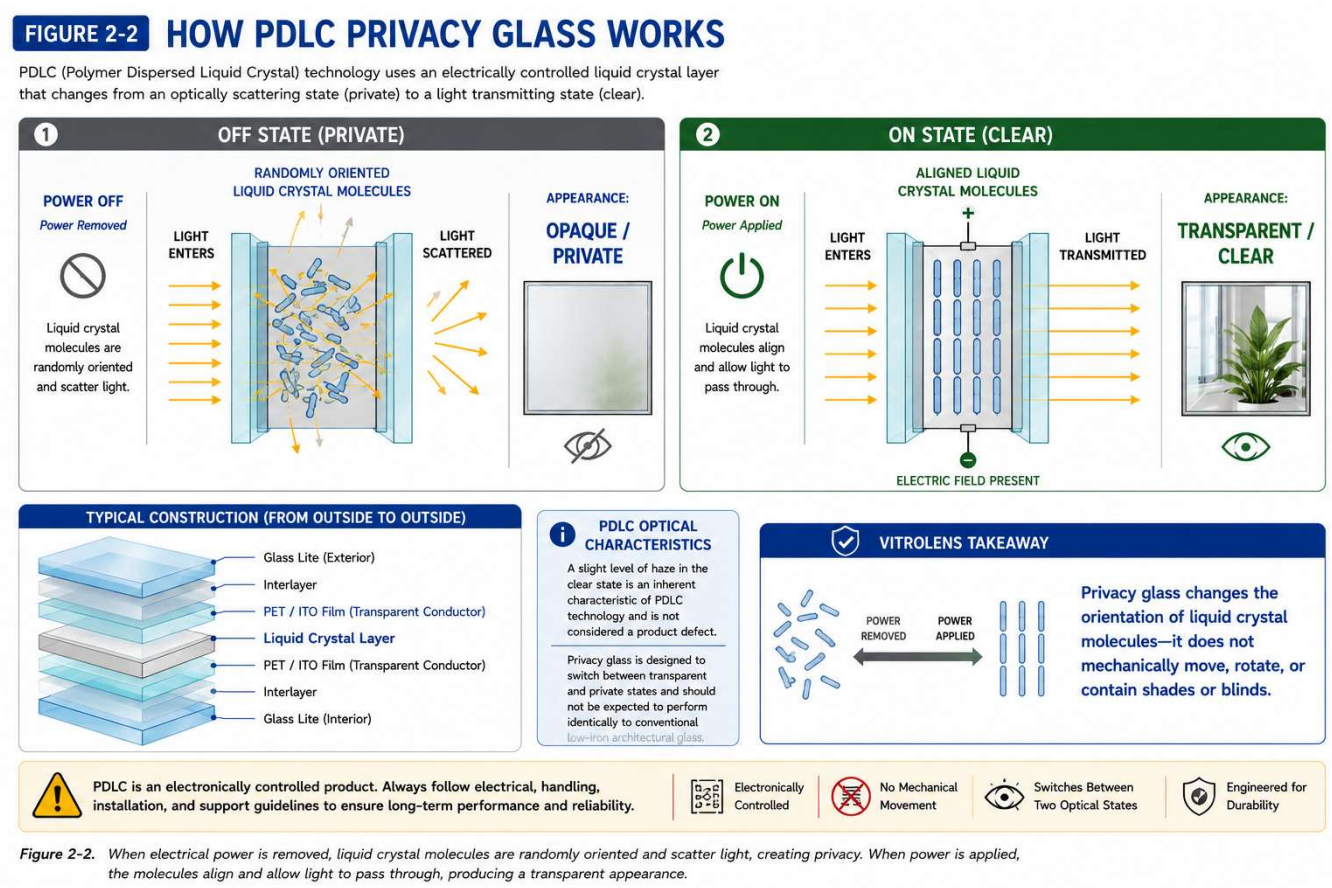


Figure 2-2. How PDLC Works. Application of AC voltage aligns liquid crystal molecules, allowing light to pass through the PDLC layer.

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2.3 Clear and Private States

Privacy glass provides two distinct operating conditions. In the clear state, the panel is energized and provides maximum transparency. In the private state, the panel is de-energized and scatters light to provide visual privacy.

Neither state is perfectly transparent nor perfectly opaque. A slight amount of haze is inherent in PDLC technology and should not be considered a defect.

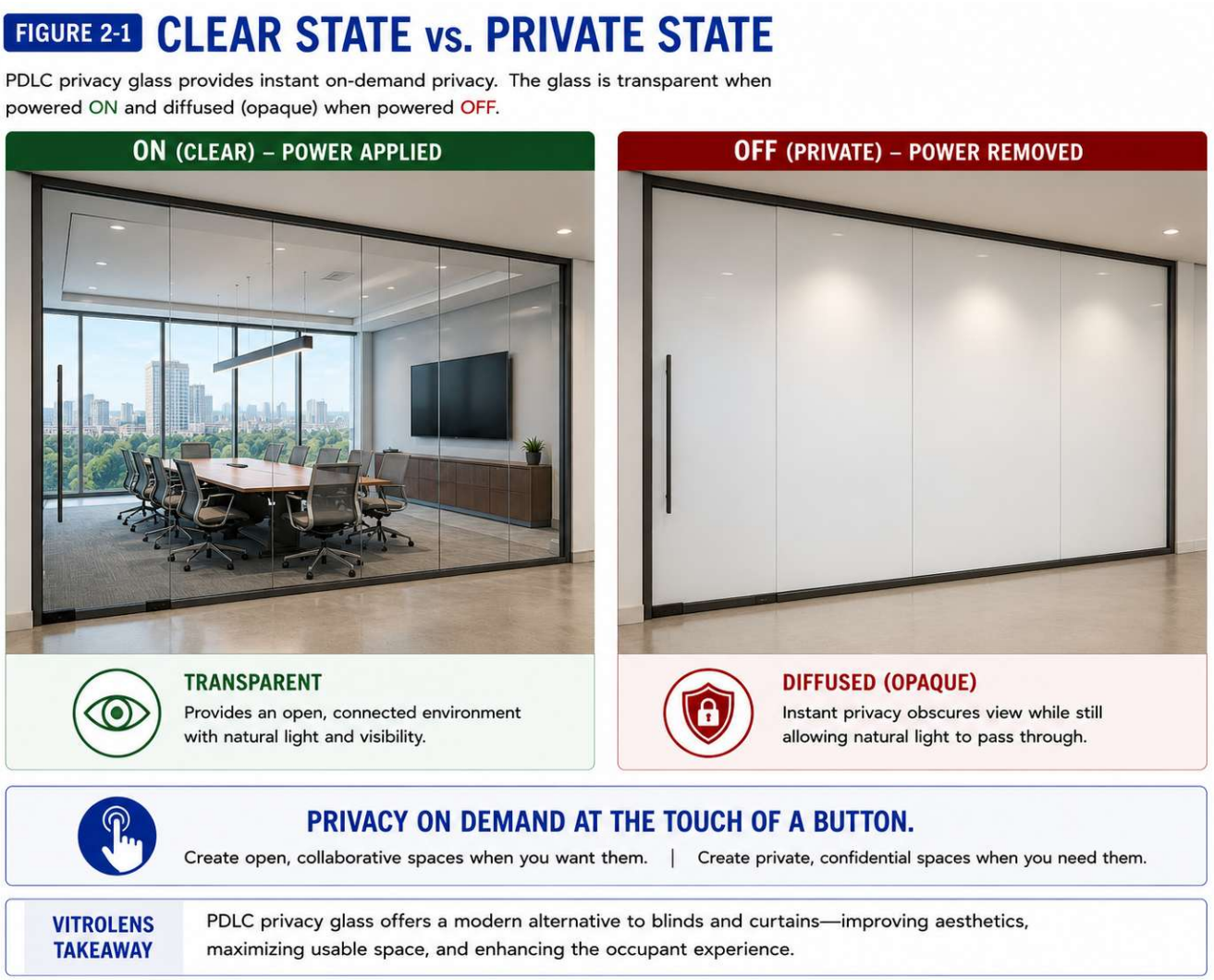


Figure 2-1. Clear vs. Private. Privacy glass transitions between translucent and transparent states through the application of electrical power.

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2.4 Haze Characteristics

A small amount of haze is a normal characteristic of all PDLC products. Haze levels may vary depending on viewing angle, ambient lighting, glass construction, film color, and the surrounding environment. Minor differences in appearance are normal and are not considered manufacturing defects.

2.5 Laminated Construction

VitroLens privacy glass consists of a PDLC film laminated between two pieces of safety glass. Typical construction includes low-iron tempered glass, PDLC switchable film, TPU/PVB/EVA interlayer, edge seal protection, copper busbars, and wire leads.

The active area is intentionally recessed from the edge of the glass to create a technical edge zone for electrical connections and lamination requirements.

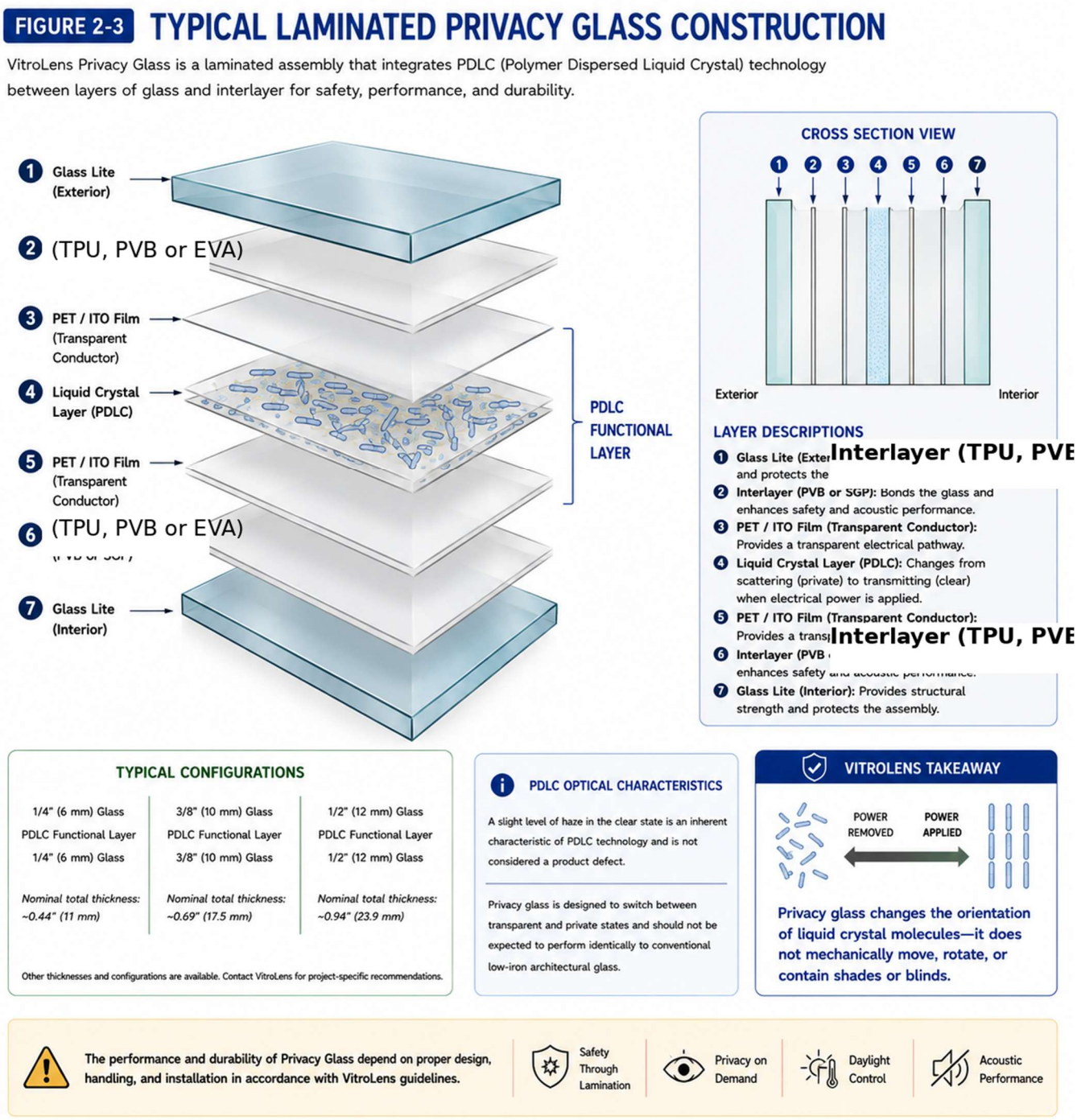


Figure 2-3. Laminated Privacy Glass Construction. Typical laminated privacy glass construction with encapsulated PDLC film and technical edge zone.

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2.6 Low-Iron Glass

Low-iron glass is standard for VitroLens privacy glass systems because of its superior optical clarity and increased visible light transmission. Advantages include reduced green tint, improved transparency, higher light transmission, and enhanced color neutrality.

2.7 Safety and Performance

Privacy glass may be supplied as laminated monolithic units, insulated glass units, tempered safety glass, or specialty constructions. Overall performance characteristics such as thermal performance, acoustics, solar control, and UV resistance are determined by the complete glazing system and not solely by the PDLC layer.

Section 3 - Product Portfolio

3.1 Overview

VitroLens privacy products are designed to provide instant electronically switchable privacy while preserving open architectural spaces and maximizing daylight. Products are available in laminated privacy glass and retrofit privacy film configurations to accommodate new construction and retrofit applications.

The appropriate product selection should be based on project requirements, environmental conditions, schedule, and budget.

3.2 Laminated Privacy Glass

Laminated privacy glass consists of a PDLC film permanently encapsulated between two lites of safety glass. Typical features include low-iron tempered glass, white PDLC film, TPU/PVB/EVA interlayer construction, concealed busbars and wire leads, instant switching, safety glazing construction, and monolithic or insulated glass configurations.

Laminated privacy glass is recommended for applications requiring the highest optical quality, durability, and long-term performance.

3.3 Retrofit Privacy Film

Retrofit privacy film is applied directly to existing glass surfaces and provides an economical solution when replacing glazing is impractical. Typical features include surface-applied construction, 1/8-inch setback from the glass edge, anti-scratch coating, standard white appearance, fast installation, and compatibility with existing glazing systems. Retrofit film is intended primarily for interior applications.

3.4 Laminated Privacy Glass versus Retrofit Privacy Film

Although both systems provide electronically switchable privacy, they differ significantly in construction and durability. Laminated privacy glass provides permanent encapsulation, superior optical quality, increased durability, safety glazing construction, and exterior/IGU capability. Retrofit privacy film offers lower installation cost, faster installation, use of existing glass, and minimal disruption to occupied spaces.

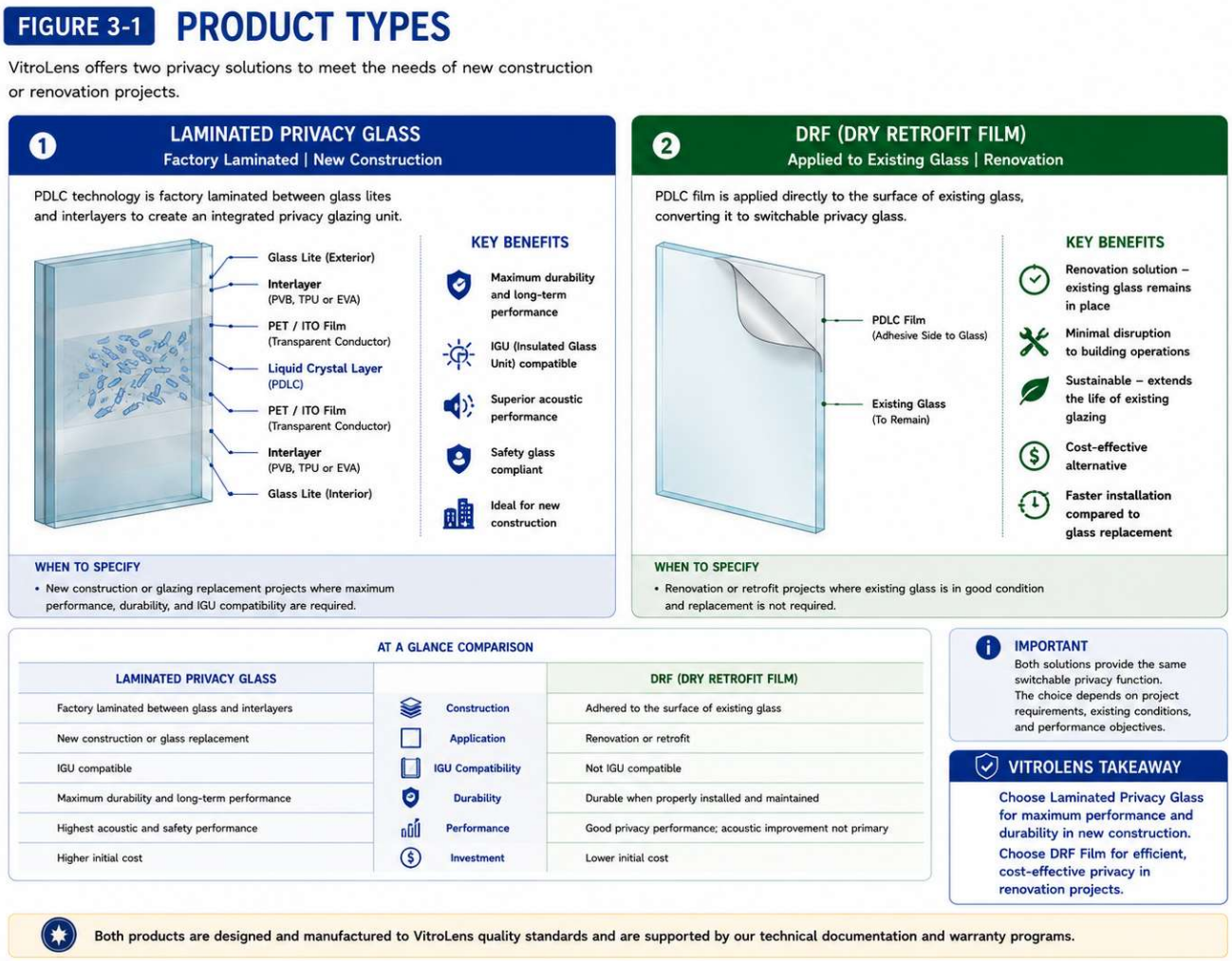


Figure 3-1. VitroLens offers two privacy solutions to meet the needs of new construction or renovation projects: Laminated Privacy Glass for new construction and DRF (Dry Retrofit Film) for renovation.

Figure 3-1. Laminated Privacy Glass versus Retrofit Film. Comparison of encapsulated laminated privacy glass and surface-applied retrofit privacy film systems.

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3.5 Typical Applications

VitroLens products are commonly used in conference rooms, boardrooms, executive offices, healthcare facilities, hospitality applications, and residential spaces.



Figure 3-2. Typical Applications. Representative applications for VitroLens privacy glass and privacy film systems.

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3.6 Product Portfolio

VitroLens products may be supplied as laminated privacy glass, insulated privacy glass units, custom engineered assemblies, retrofit privacy film, high-temperature privacy film, standard controllers, multi-zone controllers, dry contact interfaces, 0-10V control interfaces, and Lutron-compatible systems.

Complete systems should be coordinated with VitroLens during the design phase to ensure proper controller sizing and control compatibility.

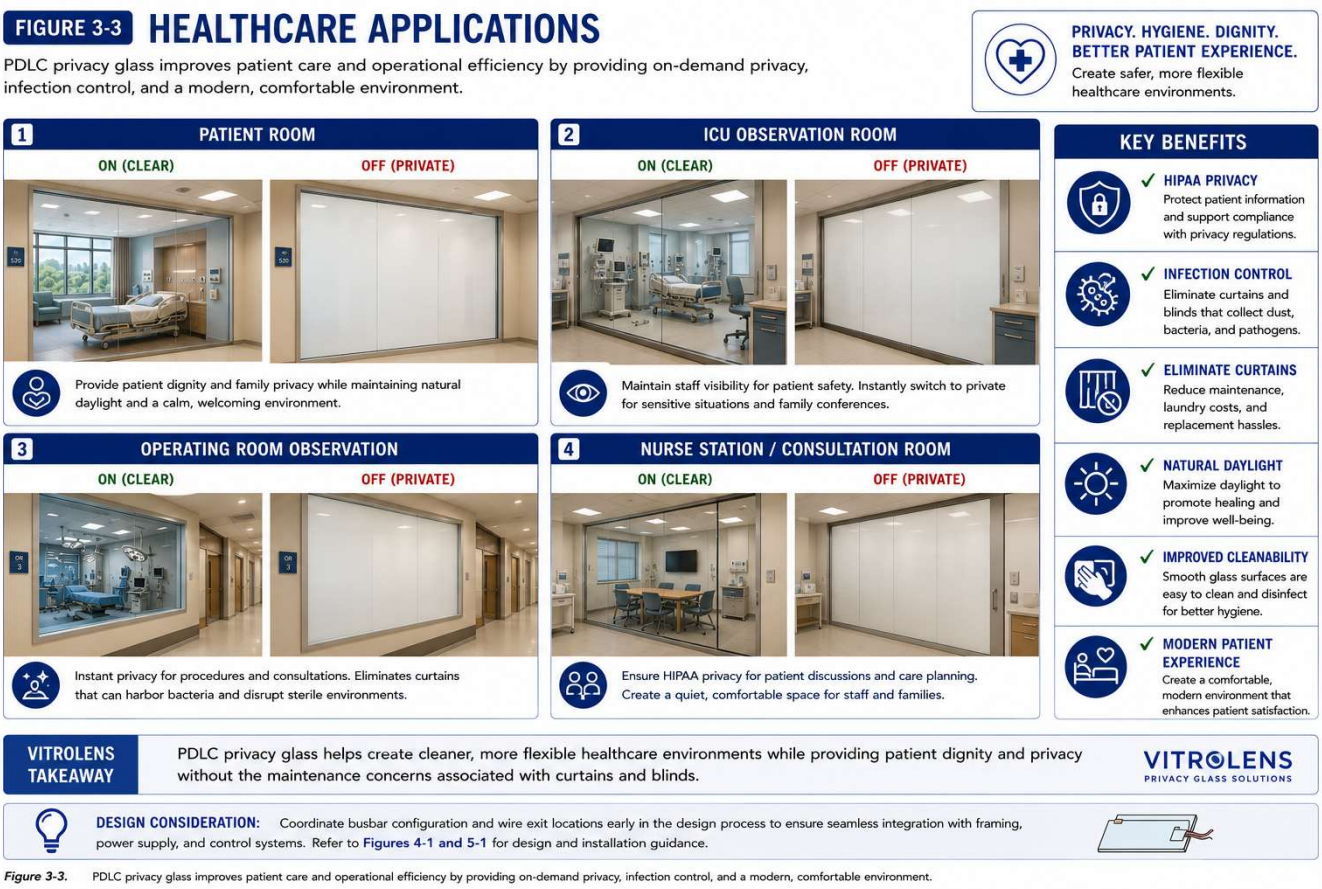


Figure 3-3. Product Portfolio. VitroLens product offerings and compatible control solutions.

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3.7 Product Selection Considerations

- New construction versus retrofit
- Interior versus exterior application
- Budget constraints
- Required optical performance
- Control requirements
- Installation schedule
- Long-term maintenance considerations

VitroLens recommends early project coordination to ensure proper product selection and system design.

Section 4 - Engineering

4.1 Introduction

Proper engineering and system design are critical to the long-term performance of privacy glass systems. This section provides guidance regarding busbar configurations, controller sizing, wiring practices, and system layout considerations.

Each project should be evaluated individually to ensure proper electrical performance, optical uniformity, and serviceability.

4.2 Active Area and Technical Edge Zone

Privacy glass contains an active area and a technical edge zone. The active area transitions between clear and private states. The technical edge zone is the perimeter area reserved for electrical connections, busbars, and lamination requirements. Designers should account for the technical edge zone when determining visible active area dimensions.

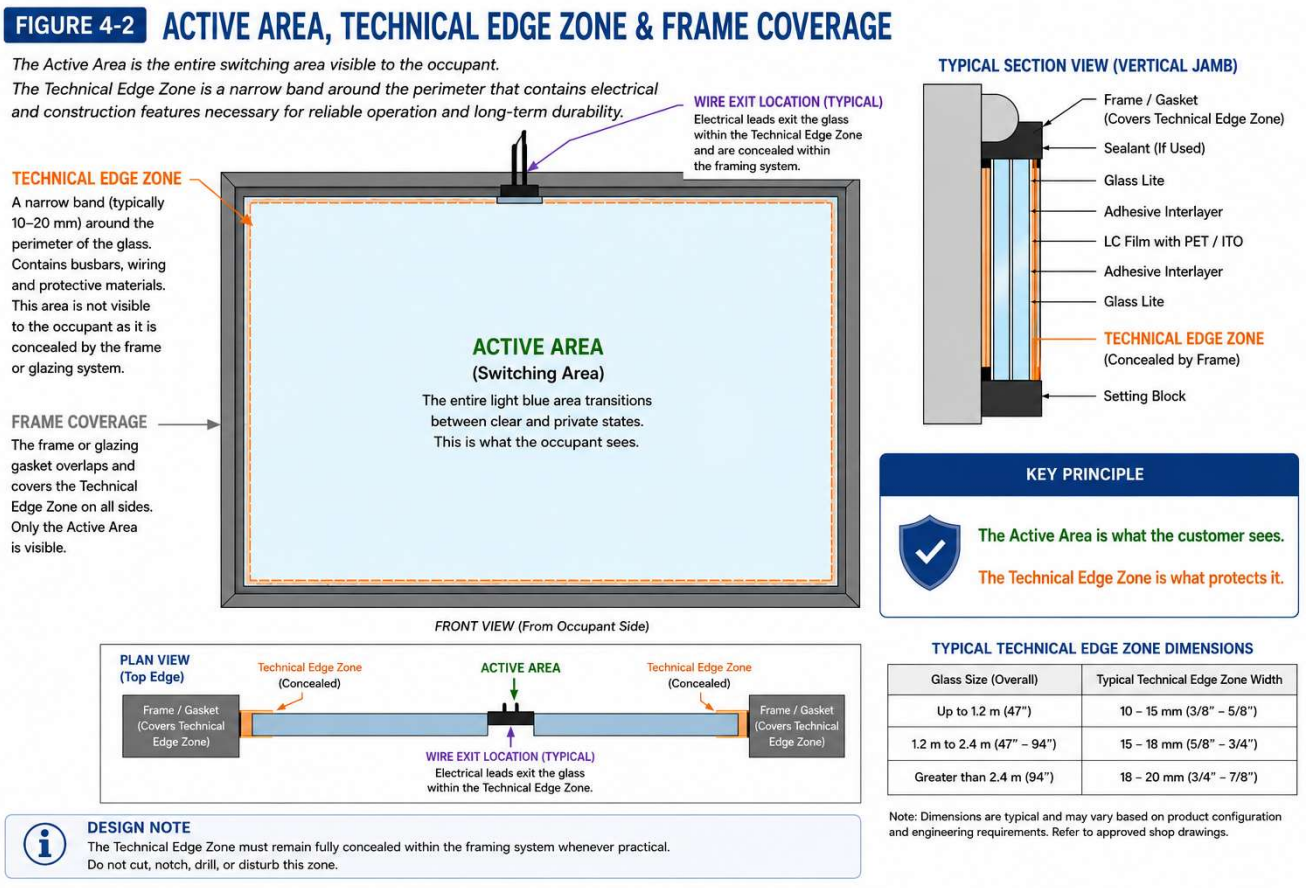


Figure 4-2. Active Area, Technical Edge Zone and Frame Coverage. The active area is the visible switching portion of the glass, while the technical edge zone contains electrical and construction features that are typically concealed within the framing system.

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4.3 Busbar Configurations

Busbars distribute electrical power across the PDLC film and are a critical element of system performance. Busbar selection is determined primarily by aspect ratio, active area dimensions, panel geometry, and voltage distribution requirements.

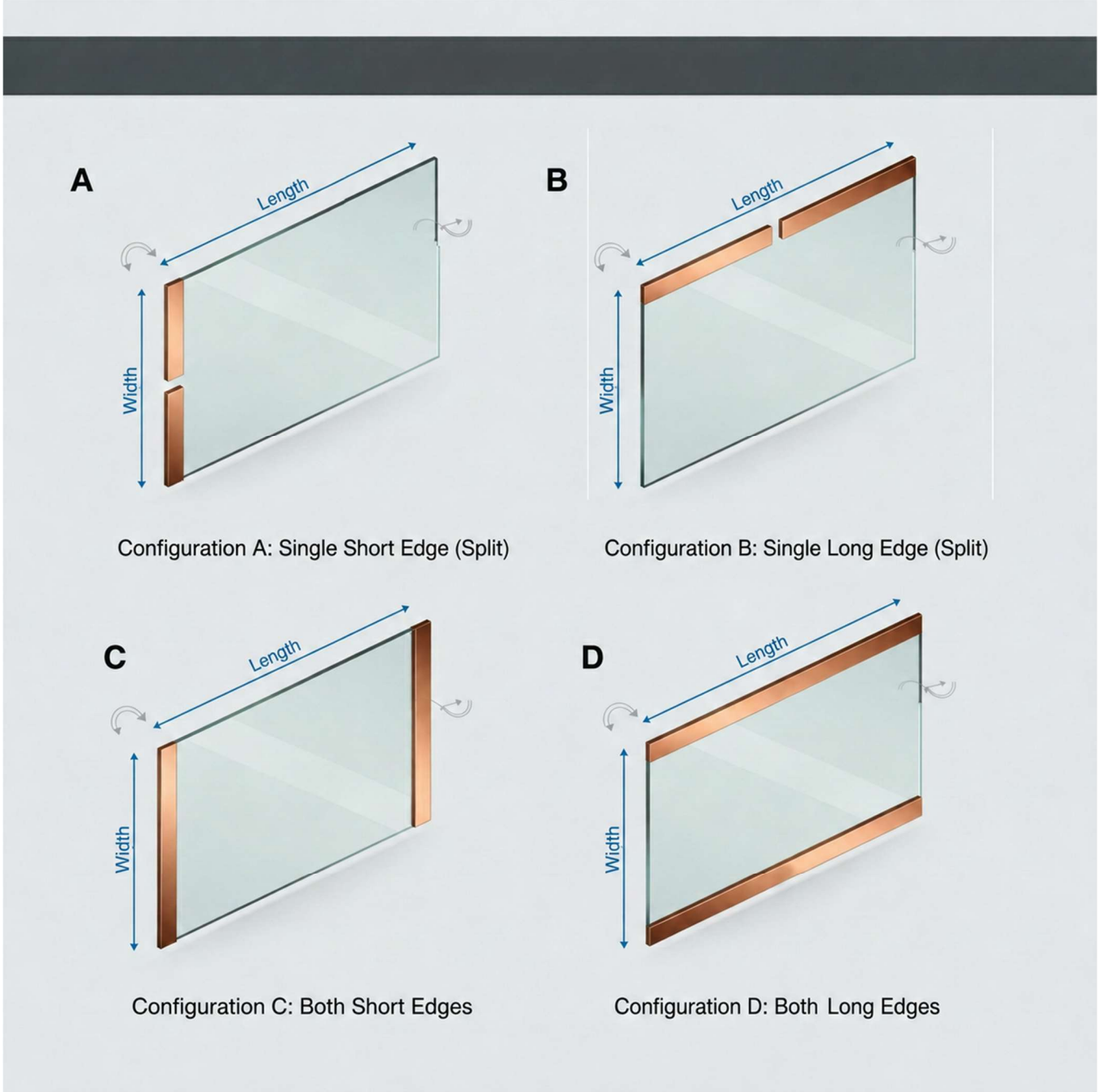


Figure 4-1. Busbar Configurations and Wire Exit Configurations. Standard busbar arrangements used to optimize voltage distribution and optical uniformity.

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4.4 Active Area vs. Glass Size

Overall glass size, active area, technical edge zone, and visible daylight opening are not necessarily the same dimensions. These relationships should be reviewed during design and shop drawing approval.

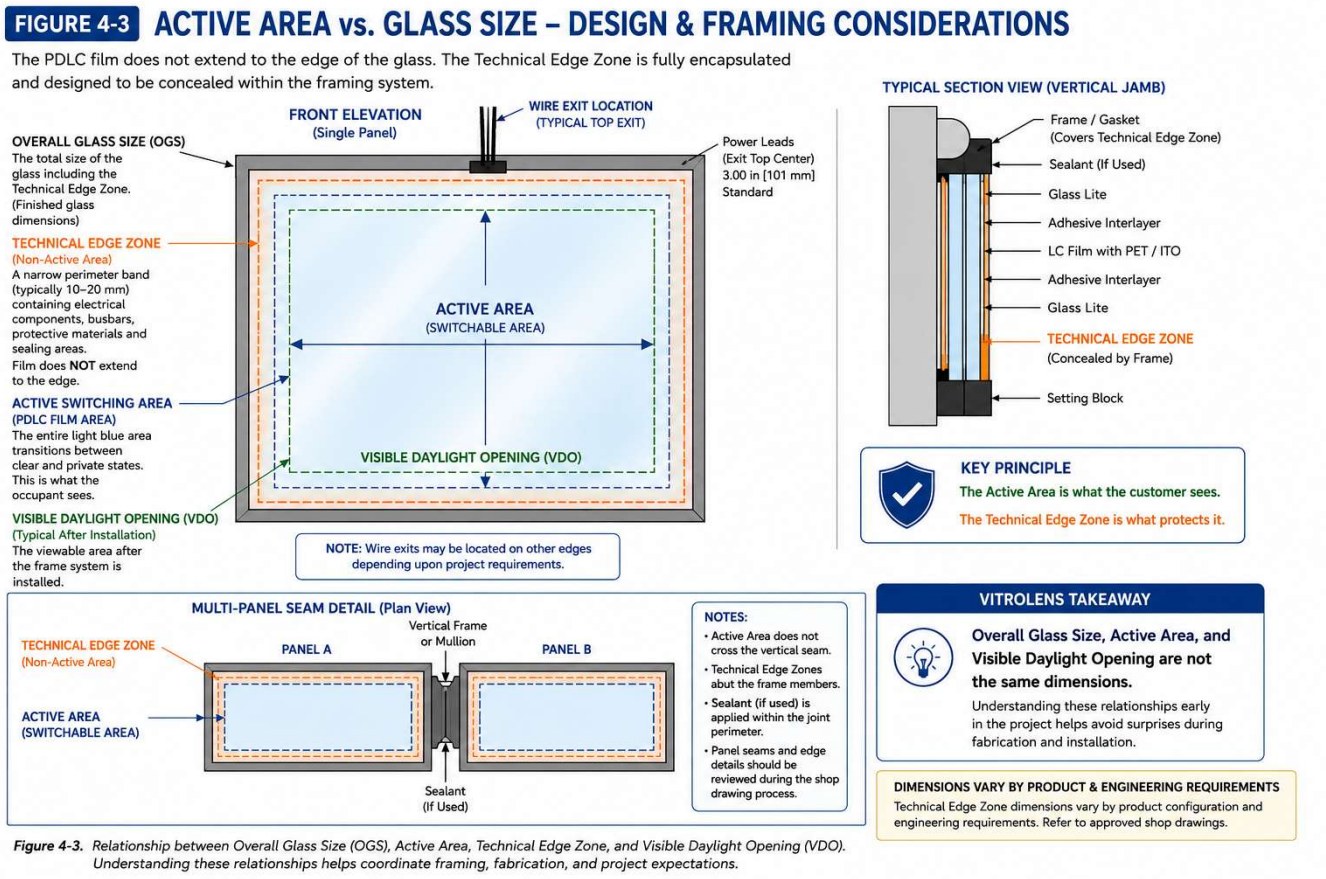


Figure 4-3. Active Area vs. Glass Size. Relationship between overall glass size, active area, technical edge zone, and visible daylight opening.

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4.5 Controller Fundamentals

Privacy glass controllers convert incoming line voltage into the low-voltage AC signal required by the PDLC film. Controllers should remain energized continuously unless specifically designed for alternate operation. Controllers may be integrated with wall switches, dry contact systems, building automation systems, Lutron control systems, and 0-10V interfaces.

4.6 Controller Selection and Sizing

Controller sizing is based upon total connected active area, application type, environmental conditions, desired operating margin, and control zones. Panel count alone does not determine controller count. Larger systems are often easier to troubleshoot and maintain when divided into multiple zones.

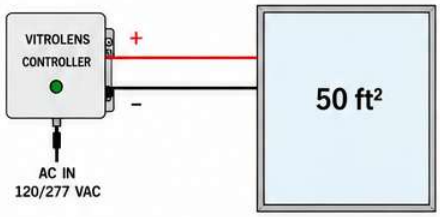
Consult VitroLens for controller sizing on systems exceeding 80 square feet or where multiple zones, long wire runs, exterior applications, or unusual switching requirements are involved.

FIGURE 4-4. CONTROLLER SIZING GUIDELINES

Controller sizing is based on total connected area and control zones—not the number of glass panels.

A SINGLE LITE

One controller – one zone

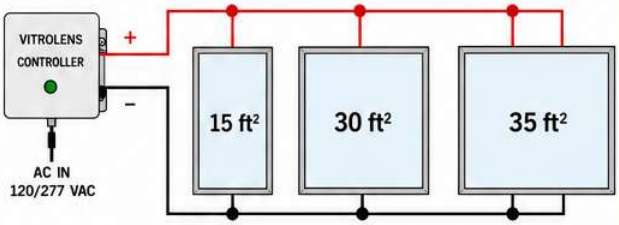


1 Controller
1 Panel
50 ft² total connected area

TYPICAL

B MULTIPLE PANELS – SAME ZONE

One controller – multiple panels wired in parallel



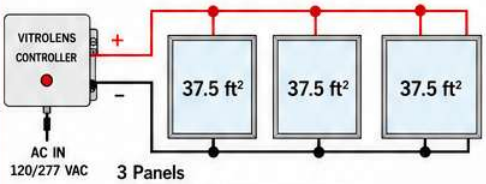
3 Panels (different sizes)
80 ft² total connected area

ACCEPTABLE

PANEL COUNT DOES NOT DETERMINE CONTROLLER COUNT.
The controller sees total connected square footage.

C LARGE CONNECTED LOAD

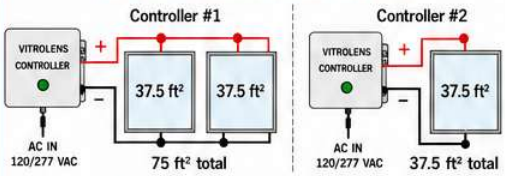
One controller not recommended



3 Panels
112.5 ft² total connected area

ADDITIONAL CONTROLLERS ARE REQUIRED.

BETTER APPROACH: DIVIDE THE LOAD

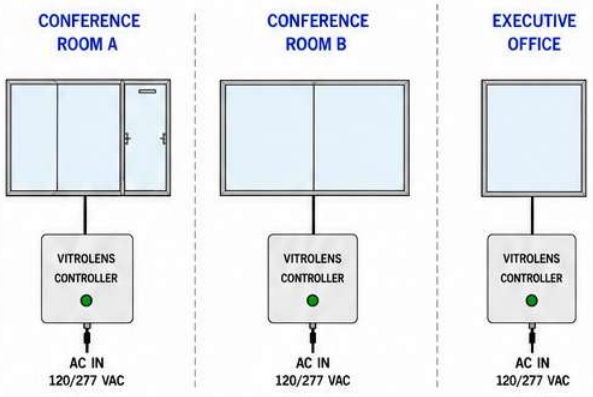


BETTER – 2 Controllers total
75 ft² + 37.5 ft² = 112.5 ft²

Large systems are easier to troubleshoot when divided into smaller zones.

D MULTIPLE ZONES

Each zone has its own controller



BENEFITS

- Independent control
- Easier troubleshooting
- Reduced connected load
- Simplified maintenance
- Simplified service

CONSULT VITROLENS

Consult VitroLens for controller sizing on systems exceeding 80 ft² or where multiple zones, long wire runs, exterior applications, or unusual switching requirements are involved.

CONTROLLER SIZING IS BASED ON:

- Total connected area
- Number of control zones
- Wire length
- Switching arrangement
- Interior vs. exterior application
- Controller model
- Environmental conditions

VITROLENS TAKEAWAY

The controller sees connected load—not the number of glass panels.
Controller sizing is based on connected load, control zones, wiring conditions, and project requirements.

PRINCIPLE

Large systems are easier to troubleshoot when divided into smaller zones.

NOTE: All square footages are examples. Actual controller capacity varies by product model, installation conditions, and system design. Consult VitroLens for project-specific guidance.

VITROLENS TECHNOLOGIES

Figure 4-4. Controller Sizing Guidelines. Controller sizing should be based upon total connected load and control zones. Large systems should be divided into smaller zones for improved reliability and serviceability.

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4.7 Wiring Recommendations

- 18 AWG stranded, two-conductor wire is recommended.
- Maximum recommended distance is approximately 100 feet from controller to glass.
- Soldered connections are preferred whenever practical.
- Do not splice conductors inside conduit runs.
- Protect conductors from sharp edges and mechanical damage.
- Install a grommet wherever wiring passes through a metal frame member.

4.8 Design for Serviceability

Controller locations should remain accessible after installation. Designers should avoid permanently concealing controllers, junction boxes, and electrical connections. Future maintenance and troubleshooting depend upon reasonable access to system components.

Section 5 - Installation

5.1 Introduction

Proper installation practices are essential to the long-term performance, reliability, and serviceability of privacy glass systems. This section provides recommended procedures for receiving, handling, installing, wiring, and commissioning VitroLens privacy glass and privacy film products.

5.2 Receiving and Inspection

All shipments should be inspected immediately upon arrival. Before signing the bill of lading, inspect crates for visible damage, photograph all sides of the shipment, verify quantities against packing documentation, note any visible damage on the bill of lading, and notify VitroLens immediately of any shipping damage.

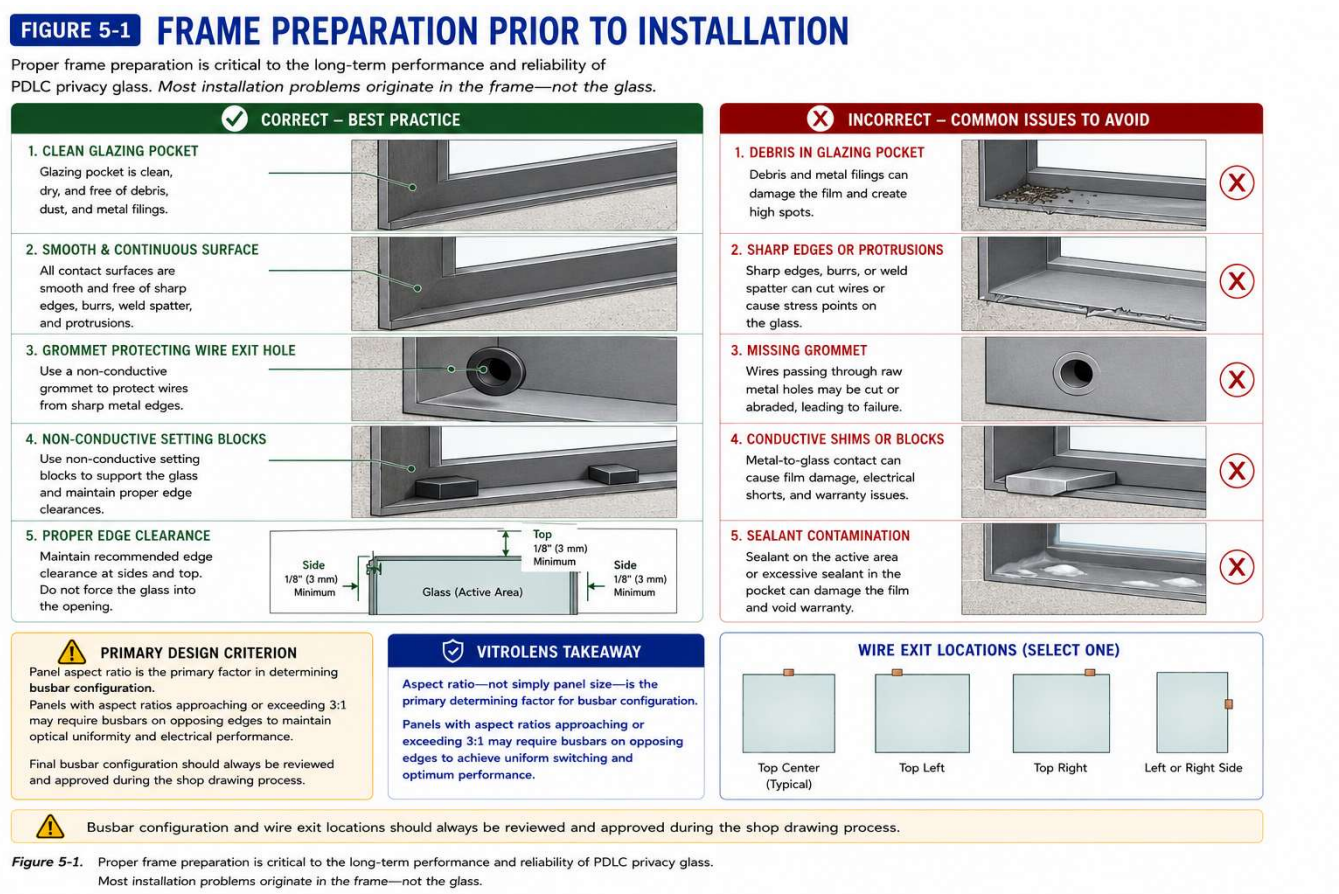


Figure 5-1. Frame Preparation Prior to Installation. Proper frame preparation before delivery helps avoid installation problems and unnecessary field modifications.

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5.3 Installation Sequence

VitroLens recommends a controlled installation sequence: receive and inspect materials, prepare frames and wiring paths, place setting blocks, install glass, route conductors, complete electrical connections, verify wiring continuity, energize the controller, and perform commissioning.

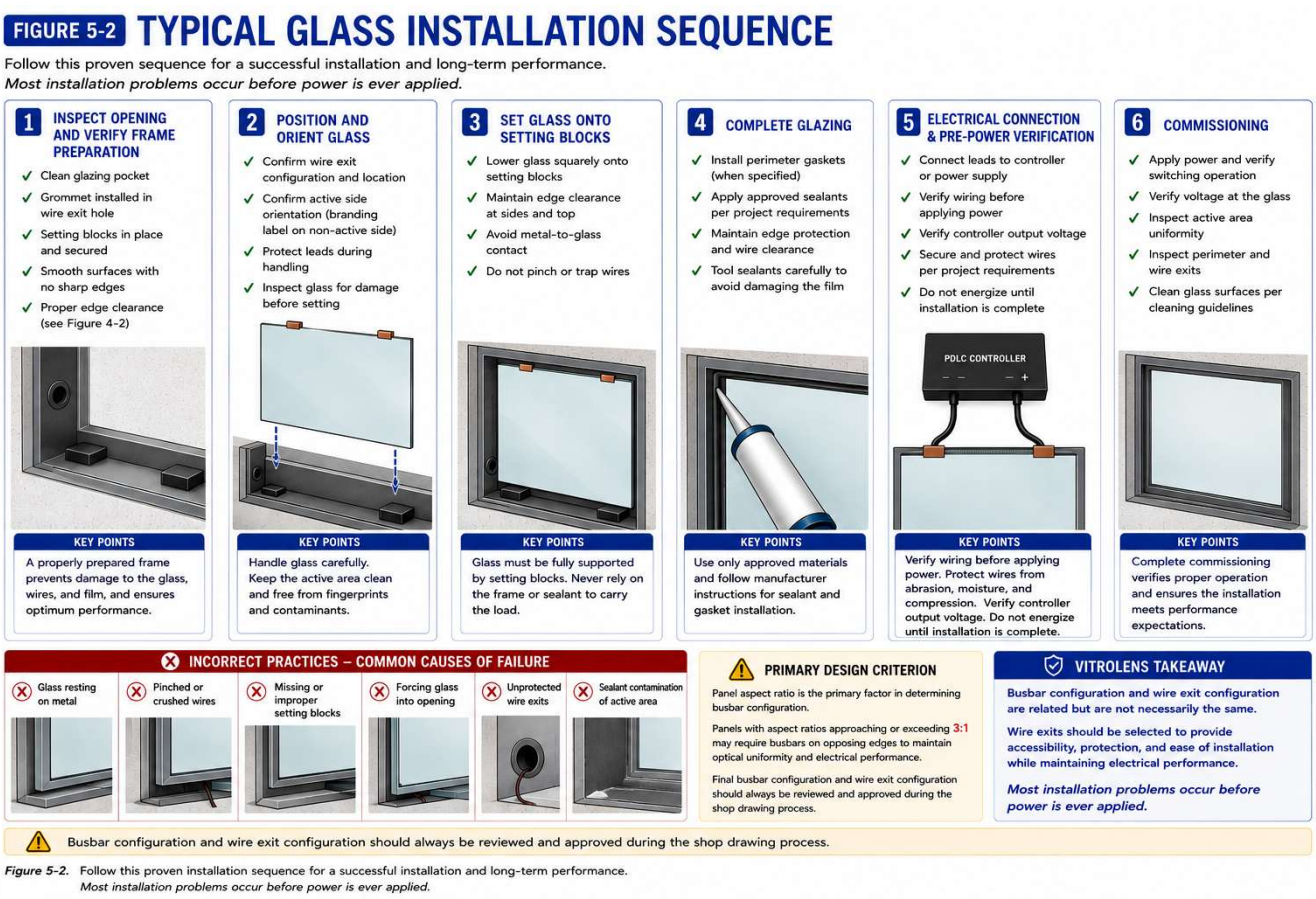


Figure 5-2. Typical Glass Installation Sequence. Recommended sequence for installation and commissioning of privacy glass systems.

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5.4 Wire Protection During Handling

Wire leads and backup leads must be protected throughout receiving, staging, installation, and commissioning. Tape and secure all wire leads immediately after receiving and throughout installation. Protect wire exits from impact and abrasion, keep leads insulated, and treat backup leads with the same care as primary leads.



Figure 5-3. Wire Protection During Handling. Primary and backup leads should be insulated, secured, and treated with equal care throughout receiving, staging, installation, and commissioning.

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5.5 Setting Blocks

Privacy glass should be supported on properly sized setting blocks. Setting blocks should be a minimum of 4 inches long, begin a minimum of 4 inches from the glass edge, and have a Shore A durometer of 90 +/- 10. Shared setting blocks are not permitted and the glass should never rest directly on metal or other hard surfaces.

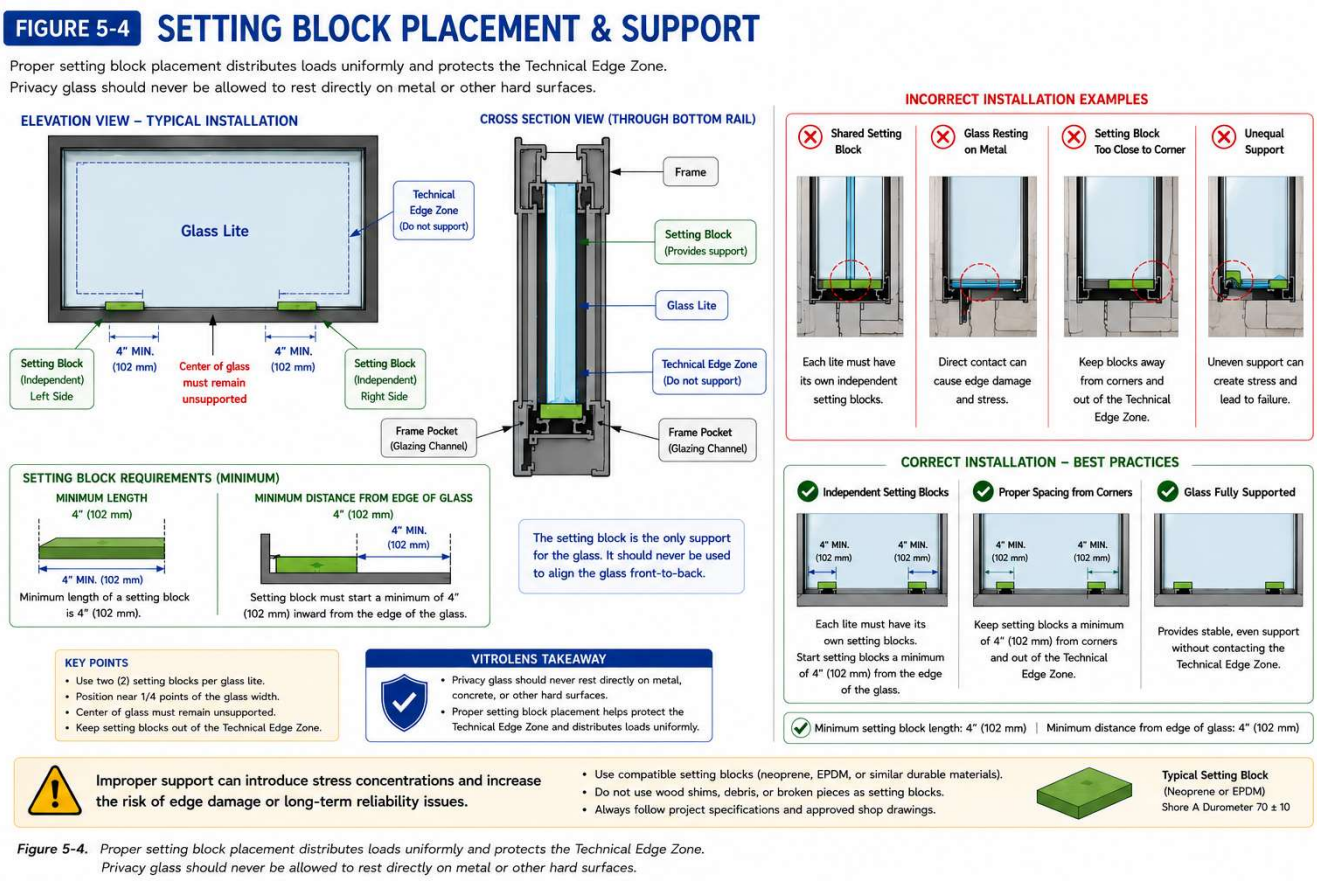


Figure 5-4. Setting Block Placement and Support. Proper setting block placement distributes loads uniformly and protects the technical edge zone.

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5.6 Voltage Verification at the Glass

Voltage measurements should be performed at backup wire leads or accessible splice locations. Do not assume voltage is reaching the glass simply because voltage is present at the controller. Normal operating voltage is typically 65-75 VAC. Measuring at the glass confirms continuity throughout the wiring system.

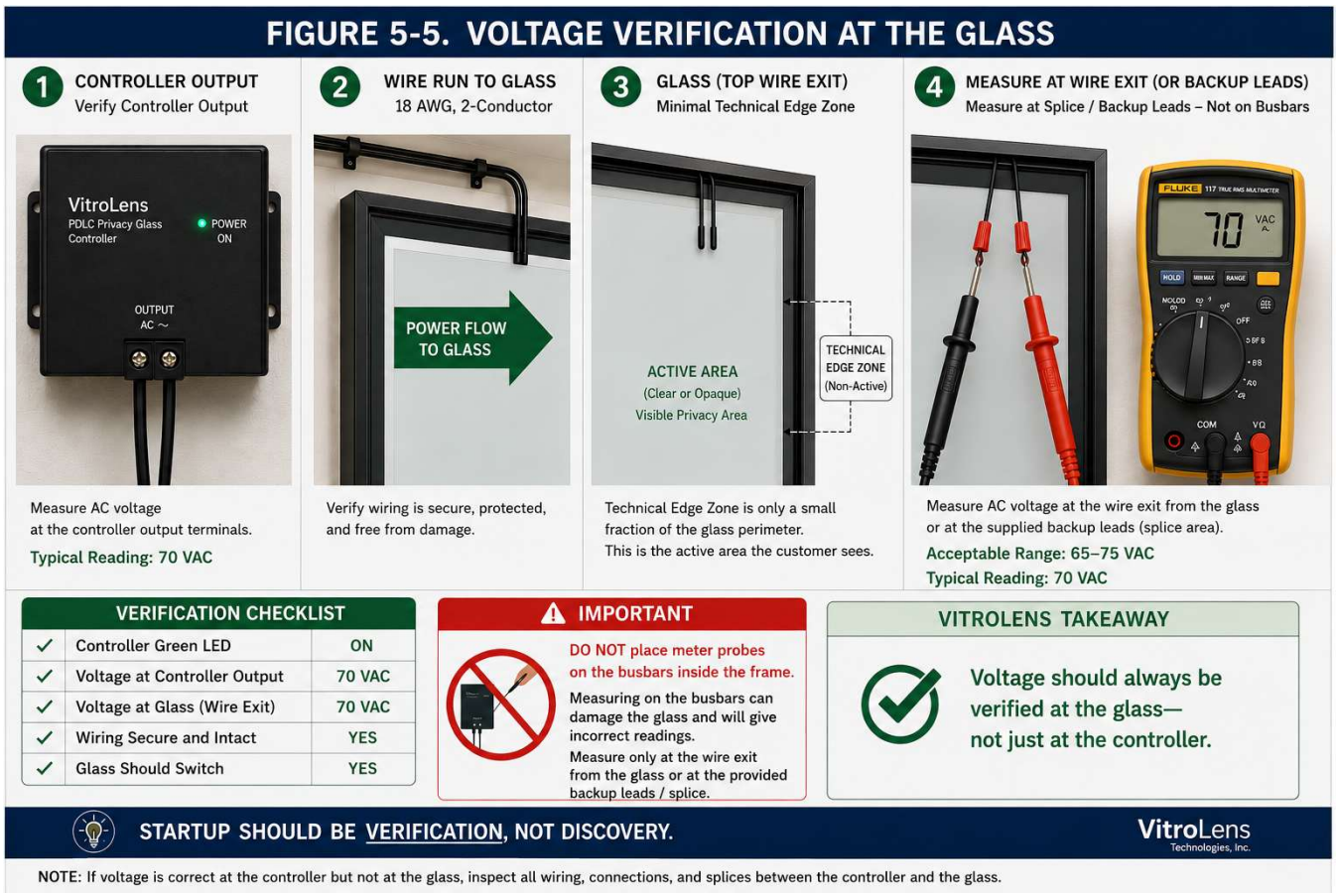


Figure 5-5. Voltage Verification at the Glass. Voltage measurements should be taken at backup leads or accessible splice locations to verify continuity throughout the system.

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5.7 Project Documentation

At project completion, VitroLens recommends retaining shop drawings, wiring diagrams, controller information, installation photographs, commissioning records, and voltage measurements. Documentation simplifies future troubleshooting and warranty support.

Section 6 - Operation, Maintenance & Troubleshooting

6.1 Introduction

This section provides recommended procedures for operating, maintaining, and troubleshooting VitroLens privacy glass systems. Most service calls can be resolved by following a systematic troubleshooting process. Experience has shown that the majority of field issues are related to power, wiring, controls, or installation practices rather than the privacy glass itself.

6.2 Operation and Maintenance

When operating properly, privacy glass should transition to transparent when energized and return to a translucent state when de-energized. Minor variations in haze and appearance are normal characteristics of

PDLC technology. Use mild soap and water, non-abrasive cleaners, and soft lint-free cloths. Do not use abrasive cleaners, razor blades, harsh solvents, or metal scrapers.

6.3 Troubleshooting Philosophy

Successful troubleshooting begins by proving what is working before assuming what has failed. VitroLens recommends the following sequence: verify power, verify controller status, verify controller output voltage, verify voltage at the glass, inspect wiring, and evaluate the glass last.

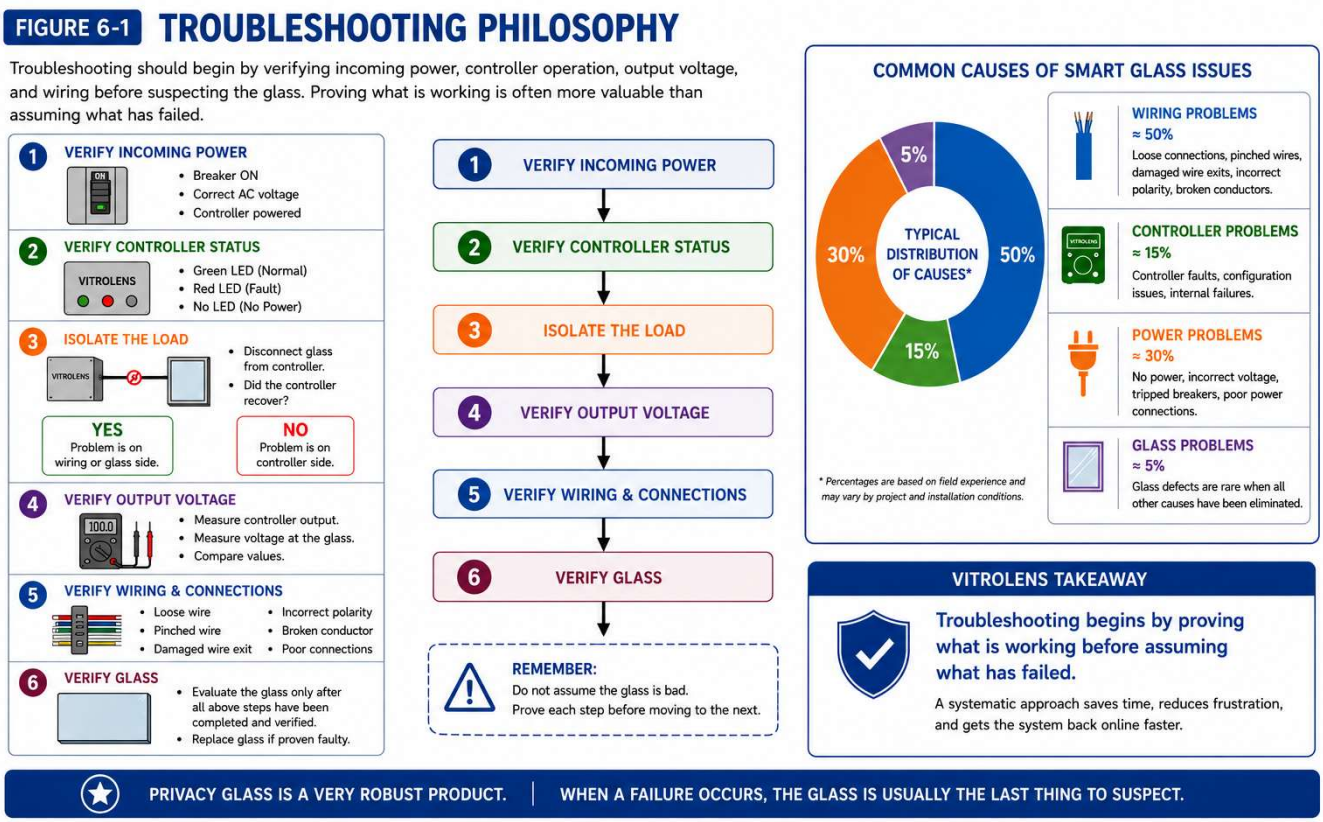


Figure 6-1. Troubleshooting Philosophy. A systematic approach simplifies troubleshooting and prevents unnecessary component replacement.

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6.4 Controller Status Indicators

A green LED indicates the controller is powered and no fault is detected, but it does not guarantee output voltage is present. Possible causes of no output with a green light include incorrect switch wiring, incorrect programming, wrong control method, or the relay not switching. A red LED typically indicates a short circuit, wiring fault, excessive load, or glass connection fault. No LED typically indicates no incoming power, an open breaker, blown fuse, or wiring issue.

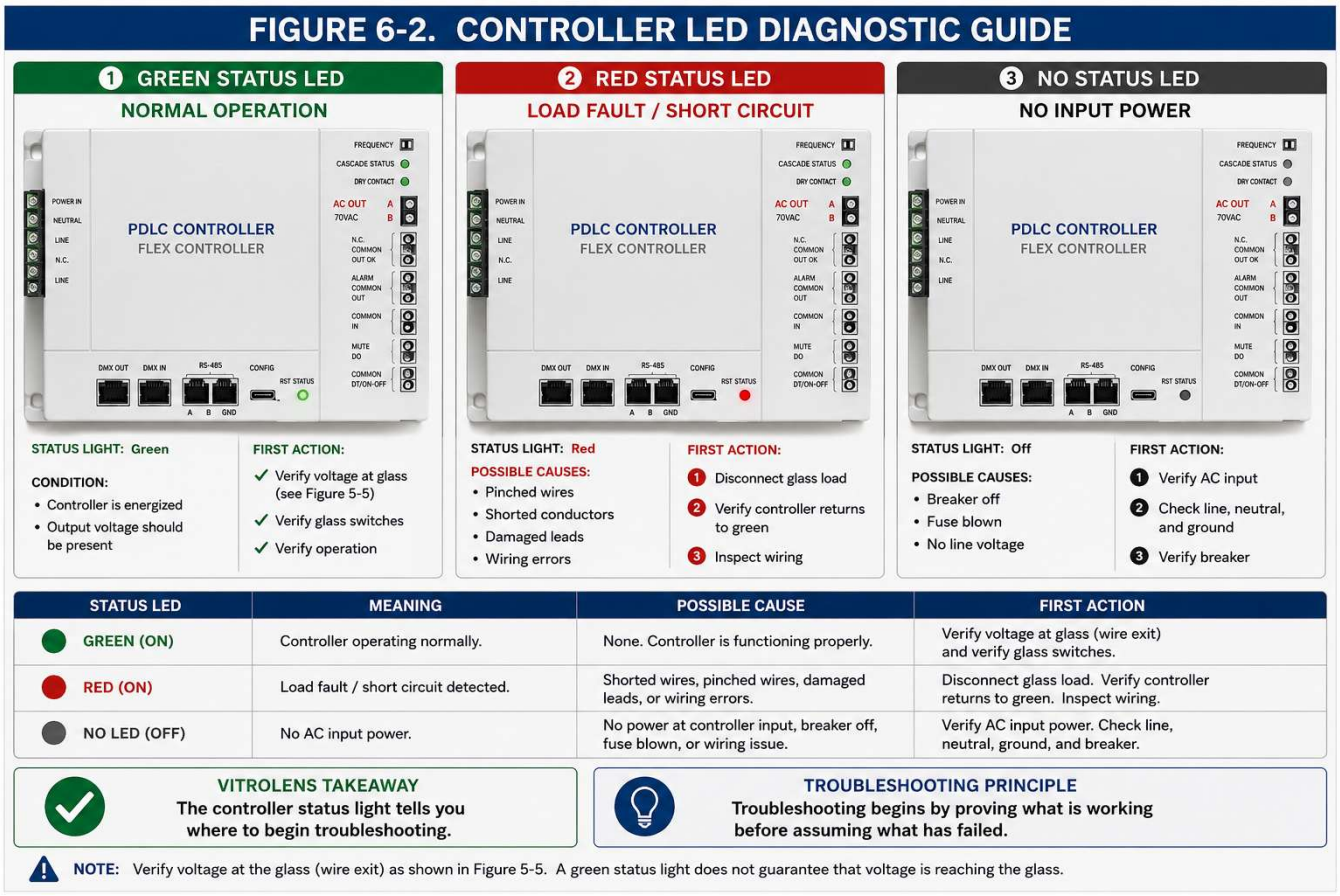


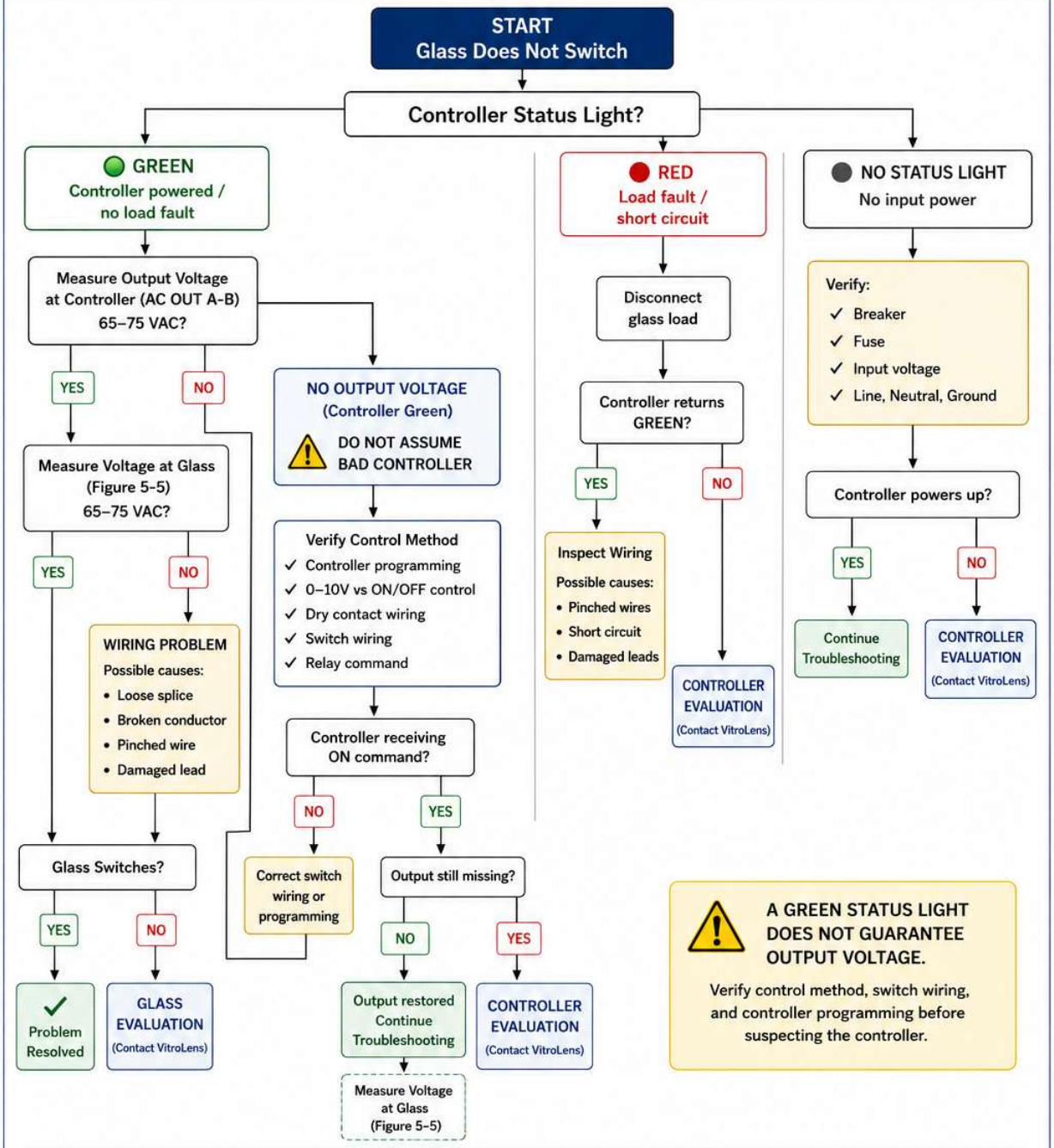
Figure 6-2. Controller LED Diagnostic Guide. Controller status indicators provide valuable information, but a green LED does not guarantee output voltage.

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6.5 Isolation Troubleshooting

Evaluate the system in order: controller, output voltage, voltage at glass, wiring, and glass. The privacy glass should be evaluated only after the electrical system has been verified. Systematic troubleshooting should always be performed before replacing components.

FIGURE 6-3. ISOLATION TROUBLESHOOTING FLOWCHART



TROUBLESHOOTING PRIORITY

1	POWER	Verify input power to controller.
2	CONTROLLER STATUS	Check status light (Green / Red / Off).
3	OUTPUT VOLTAGE	Verify 65–75 VAC output at controller and at glass.
4	WIRING	Inspect all wiring and connections.
5	GLASS	Glass evaluation (last to suspect).

VITROLENS TAKEAWAY

Privacy glass is a very robust product. The glass is usually the last thing to suspect.

TROUBLESHOOTING PRINCIPLE

Troubleshooting begins by proving what is working before assuming what has failed.

NOTE: Voltage verification at the glass (wire exit) is shown in Figure 5-5. Always use a true RMS voltmeter. Expected voltage is 65–75 VAC.

VITROLENS TECHNOLOGIES

Figure 6-3. Isolation Troubleshooting Flowchart. A systematic troubleshooting sequence helps isolate wiring, controller, and glass issues while avoiding incorrect diagnoses.

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6.6 Service Documentation

For technical support, provide project name, controller model, wiring information, photographs, voltage measurements, and a description of symptoms. Accurate information allows VitroLens to provide faster and more effective support.

Section 7 - Warranty

7.1 Warranty Information

VitroLens Technologies, Inc. provides a Limited Warranty for its privacy glass, insulated privacy glass units, privacy film, controllers, and related products.

The complete **VitroLens Limited Warranty** is included in **Appendix A – VitroLens Limited Warranty** and is incorporated into this manual by reference.

In the event of any conflict between this manual and the VitroLens Limited Warranty, the Limited Warranty shall govern.

For the most current warranty information, please contact VitroLens Technologies, Inc. or visit **www.vitrolens.com**.

Section 8 - Appendices

8.1 Appendix Overview

This section contains supplemental reference information intended to assist architects, designers, installers, electricians, and service personnel in the design, installation, commissioning, and maintenance of VitroLens privacy glass systems.

Appendix A

VitroLens Limited Warranty

The official **VitroLens Limited Warranty** is maintained as a separate controlled document.

For the current warranty terms, conditions, exclusions, and claim procedures, refer to the latest version of the **VitroLens Limited Warranty**, available from VitroLens Technologies, Inc. or at **www.vitrolens.com**.

8.2 Busbar Configuration Selection Guide

Proper busbar selection is essential for achieving uniform optical performance and consistent switching characteristics. Busbar selection should be based primarily on aspect ratio, active area dimensions, panel geometry, and electrical distribution requirements. Overall panel size alone should not be used to determine busbar configuration.

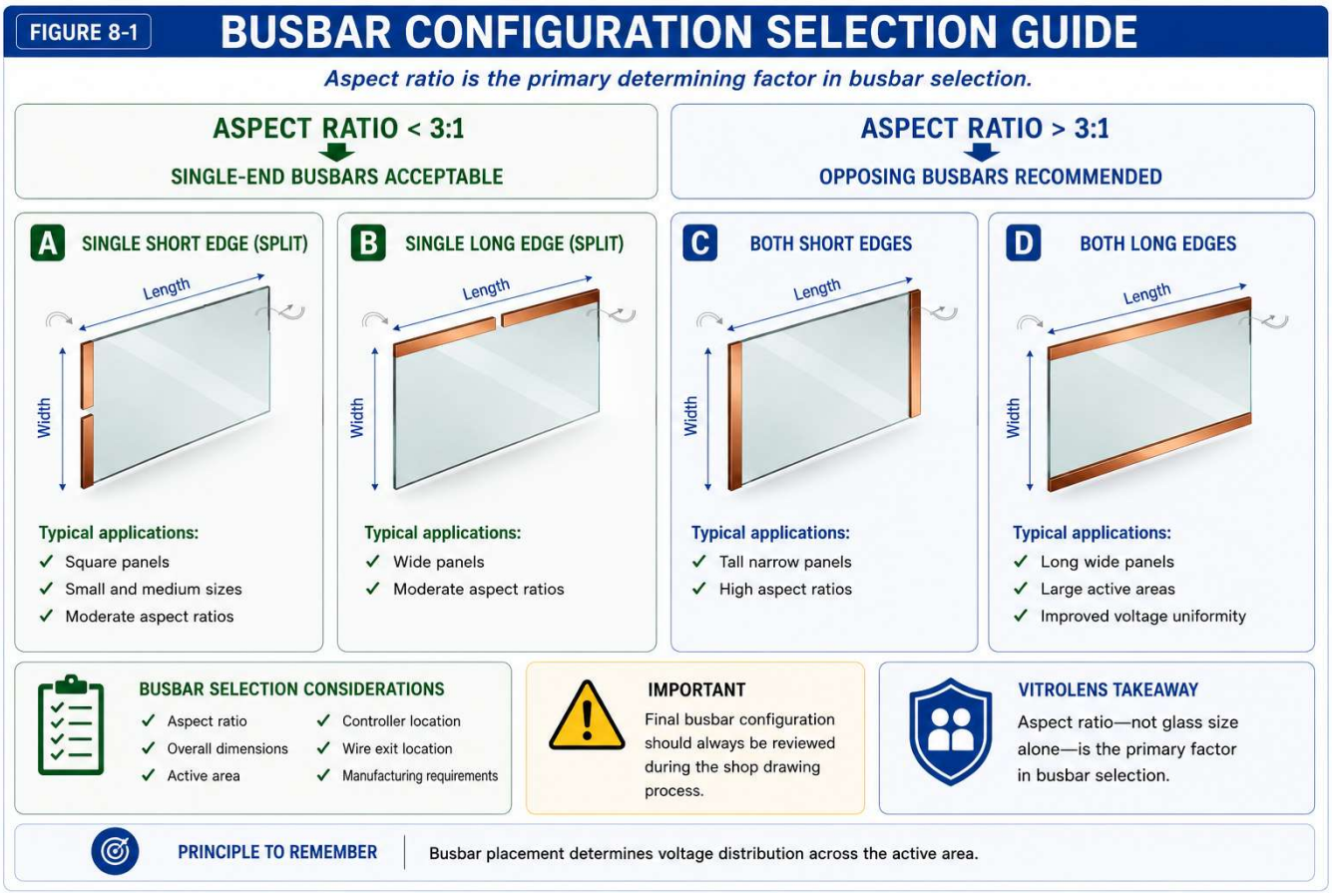


Figure 8-1. Busbar Configuration Selection Guide. Busbar configuration should be selected primarily on the basis of aspect ratio and active area dimensions.

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8.3 Wiring Reference

- Recommended wire: 18 AWG stranded, two-conductor cable.
- Maximum distance: approximately 100 feet from controller to glass.
- Soldered connections are preferred.
- Protect wiring from sharp edges, mechanical damage, and abrasion.
- Install grommets wherever wiring passes through metal components.
- Maintain access to controllers, junction boxes, and splice locations.

8.4 Controller Reference

Typical controller functions include AC voltage conversion, privacy glass switching, dry contact operation, 0-10V integration, building automation integration, and Lutron compatibility. Controllers should remain accessible throughout the life of the installation.

8.5 Voltage Reference

Typical operating voltage is 65-75 VAC. Troubleshooting measurements should be performed at the controller output, accessible splice locations, and backup wire leads. Voltage should be verified at the glass before evaluating the privacy glass itself.

8.6 Installation Reference Checklist

- Before installation: review shop drawings, verify dimensions, controller locations, and wiring paths.
- During installation: protect wiring, protect electrical leads, verify clearances, and follow approved procedures.
- During commissioning: verify controller status, switching operation, controls, and voltage at the glass.

8.7 Glossary

Active Area: The portion of the privacy glass that transitions between clear and private states.

Busbar: A conductive element used to distribute electrical power across the PDLC film.

Controller: A device that converts incoming power into the voltage required to operate privacy glass.

PDLC: Polymer Dispersed Liquid Crystal.

Technical Edge Zone: The perimeter area reserved for busbars, electrical connections, and lamination requirements.

TPU: Thermoplastic polyurethane interlayer used to laminate privacy glass assemblies.

8.8 Acronyms

Acronym	Definition
PDLC	Polymer Dispersed Liquid Crystal
TPU	Thermoplastic Polyurethane
IGU	Insulated Glass Unit
VAC	Volts Alternating Current
BAS	Building Automation System
STC	Sound Transmission Class

8.9 Recommended Project Documentation

- Approved shop drawings
- Wiring diagrams
- Controller information

- Installation photographs
- Commissioning records
- Voltage measurements
- Warranty documentation

8.10 Closing Statement

Privacy glass systems combine architectural glazing, electrical systems, controls, and specialized materials into a single integrated solution. Successful projects depend upon proper engineering, installation, commissioning, documentation, and maintenance. VitroLens Technologies, Inc. appreciates the opportunity to support your project and remains committed to providing practical engineering guidance, responsive technical support, and reliable privacy glass solutions.

Release Authorization

Need Assistance?

If you have questions regarding product selection, engineering, installation, commissioning, troubleshooting, or warranty support, **our technical team is here to help.**

VitroLens Technologies, Inc.

Technical Support

Email: **contact@vitrolens.com**

Website: **www.vitrolens.com**

Additional technical resources, installation guides, engineering tools, and product updates are available at **www.vitrolens.com**.

Our goal is to provide responsive technical support and practical engineering guidance to help ensure the successful design, installation, and long-term performance of every VitroLens privacy glass system.

Approved for Release

VitroLens Technologies, Inc.

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