

# PRODUCT TECHNICAL MANUAL

**POLYTRONIX, INC.**

manufacturer of

**POLYVISION™**

Switchable Privacy Glass

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Richardson, TX 75081

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# POLYVISION™

## Switchable Privacy Glass

Polytronix Polyvision™ Switchable Privacy Glass is a robust product that when properly installed and operated will provide many years of service. Polytronix provides a 3-YEAR Limited Warranty of the Polyvision™ Switchable Glass Panels. This warranty applies to product failures resulting from manufacturer's workmanship or defective materials. Selection of hardware and installation are the responsibilities of the Purchaser.



### CAUTION - READ THIS FIRST!

**DO NOT ATTEMPT TO INSTALL THE POLYVISION™  
PANELS ON A LIVE CIRCUIT!**



**ATTENTION!!**  
**CAREFULLY READ ALL INSTRUCTIONS**  
**BEFORE PROCEEDING**



**FAILURE TO COMPLY WITH THE MANUFACTURER'S RECOMMENDED GUIDELINES  
MAY VOID MANUFACTURER'S WARRANTY**

### USE ONLY NON-ACIDIC SEALANTS

Use only neutral cure (non-acidic) silicone sealants. Using any other sealants other than the recommended types may cause permanent damage.

*See recommended sealants table in the glazing section. (page 16)*

# POLYVISION™

## Switchable Privacy Glass



Polytronix, Inc. provides wiring diagram examples for the operation of Polyvision™ Switchable Glass Panels, however Polytronix, Inc. assumes no liability for the wiring of any products and recommends that the Purchaser or Purchaser's designated agent consult with a licensed electrician for compliance with area Building Codes and professional electrical system wiring.

Polyvision™ Switchable Privacy Glass Panels are designed for commercial and residential application using 120 VAC primary power and a minimum of 15 Amp Circuit Breaker, equipped with ground fault circuit interrupter (GFCI) protection for operation of the Power Supply and Timer.

Combined Polyvision™ Switchable Privacy Glass Panels not to exceed sixty (60) square feet when powered by a single Polytronix, Inc. provided power supply (Model LHA-666501000).

UL System Approval is available through the Underwriters Laboratories (UL) Field Evaluation of an Electrically Controlled Glass Panel System at the Customers option and expense.

**GLASS PANELS MUST BE TURNED OFF  
A MINIMUM OF 4 HOURS EVERY 24-HOUR PERIOD**



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# POLYVISION™

## Switchable Privacy Glass

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### COMPANY PROFILE

**FOUNDED:** 1980

**EMPLOYEES:** 100+

**LOCATION:** Richardson, Texas (U.S.A.)

**BUSINESS:** Design, manufacture, and market standard and customized liquid crystal displays (LCD)

**MAJOR PRODUCTS:** Specialized/Customized liquid crystal displays and devices  
Avionic cockpit displays, modules, and subassemblies  
OEM LCD Glass and Modules

Polymer-Dispersed Liquid Crystal Displays (PDLC)  
Polyvision™ Switchable Privacy Glass/Film  
POLYMAGIC™ LED Glass/Film

**DEVELOPMENT:**

Obtained license from Kent State University in 1988  
Developed reliable formulations and processes  
Designed specialized equipment for production  
Commercialized PDLC film in 1990  
Commercialized PDLC glass in 1994  
Low Haze version in 2005  
Wide Angle version in 2007  
Low Voltage version in 2009 (U.S. Patent# 7,837,897)

**APPLICATIONS:**

Bathrooms/Shower enclosures  
Conference rooms  
Clinics  
Hospital (nurseries, emergency rooms, ICUs, operation rooms)  
Hurricane resistant windows  
Optical shutters  
Projection displays (REAR PROJECTION ONLY)  
Residential enclosures  
Security windows  
Skylights  
Energy efficient enclosures



# POLYVISION™

## Switchable Privacy Glass

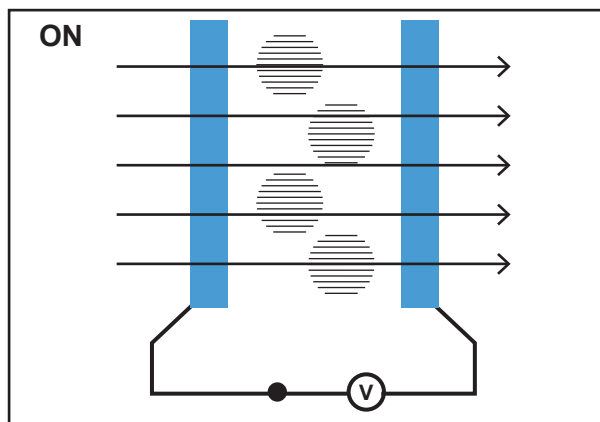
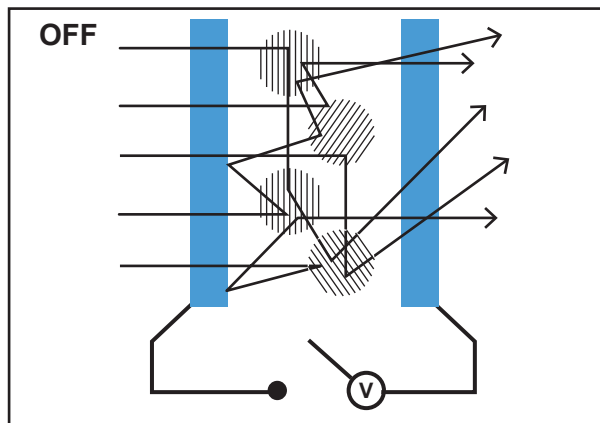
### TECHNOLOGY

#### PRINCIPLE:

When the power is off, the liquid crystal molecules are randomly oriented that scatters incident light and Polyvision™ becomes translucent.

When electricity is applied, the liquid crystal molecules line up, the incident light passes through, and Polyvision™ looks clear.

#### PDLC Light Scattering Mechanism



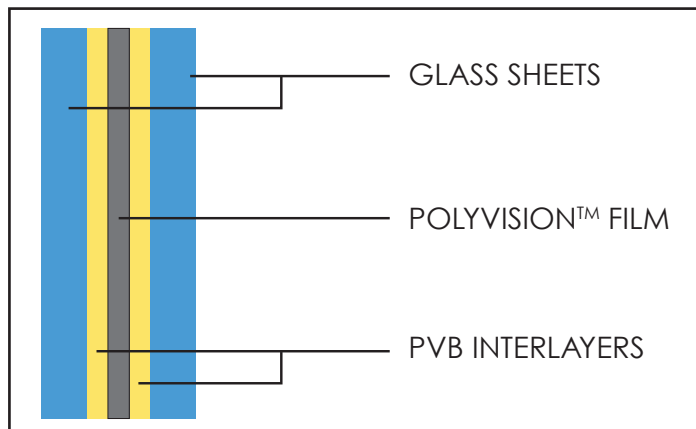
# POLYVISION™

## Switchable Privacy Glass

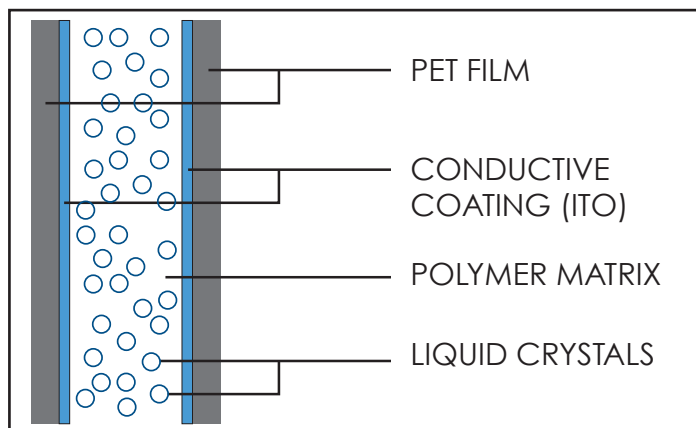
### MANUFACTURING

Polytronix is the only switchable privacy PDLC film and glass manufacturer in the United States. Polyvision™ was field tested and found to last for more than 10 years indoors.

The Polyvision™ Privacy Film is made of two layers of transparent conductive films sandwiched with PDLC material. The film is then laminated between two pieces of glass. When electricity is applied to the film the liquid crystals line up and the window is clear. When the power is turned off, the liquid crystals return to their normal scattering positions and turn the glass from clear to translucent.



The liquid crystal privacy glass is constructed in a way similar to the construction of laminated glass. The outside skins are made up of glass (normally 5 or 6 mm annealed glass) each side, then a PVB interlayer is inserted on each side to trap and hold the liquid crystal privacy film.



The liquid crystal privacy film is made up of electrically conductive coatings, a polymer matrix and liquid crystals. This film has electrical wiring to be connected to a transformer to supply power for the “on” (clear state) mode.

# POLYVISION™

## Switchable Privacy Glass

### TECHNICAL DATA

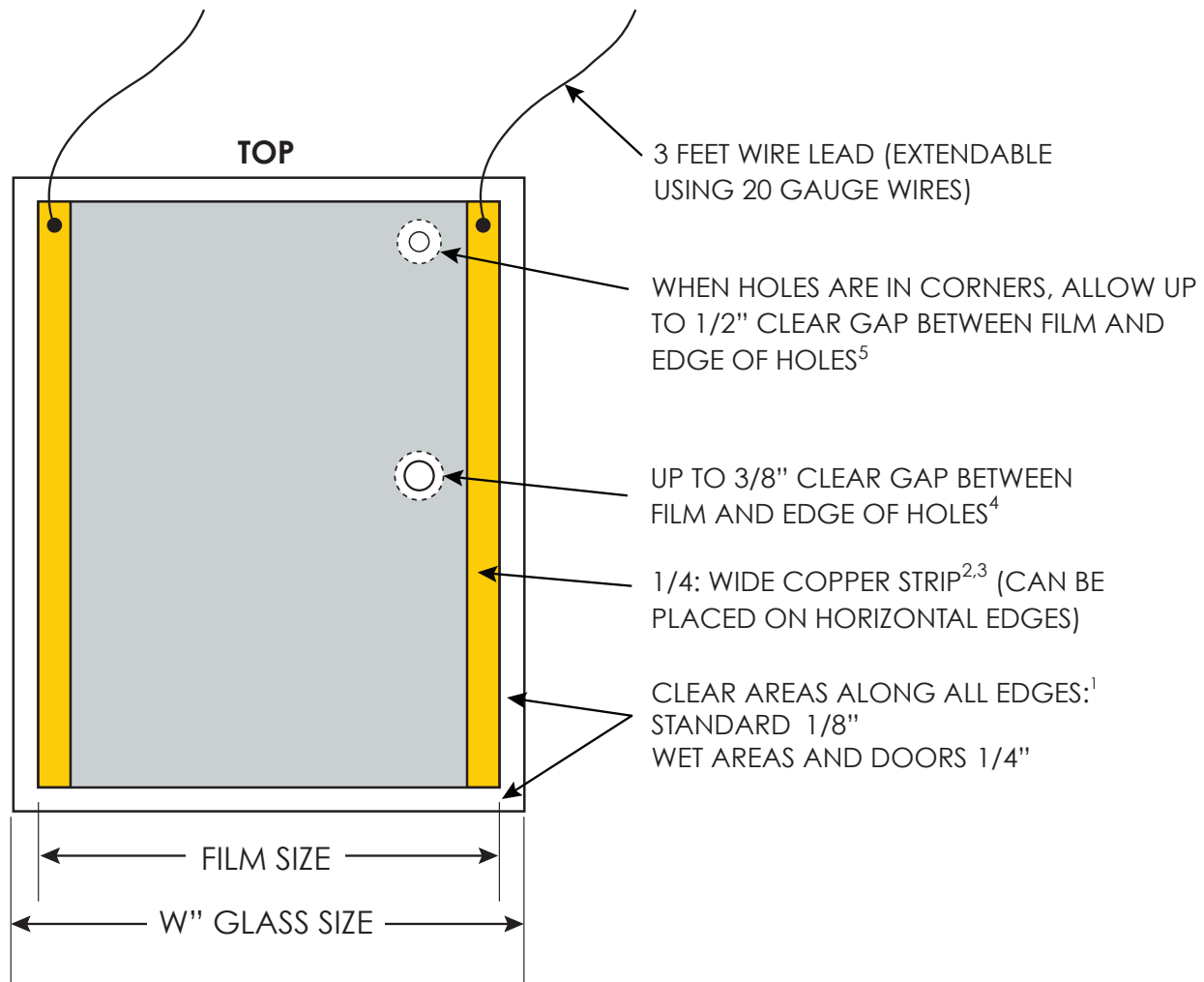
<b>GLASS COLOR:</b>	Clear, Bronze, Gray, Green tint	
<b>GLASS TYPE:</b> (All laminated)	Annealed, Chemical-Strengthened, Tempered (Safety Glass)	
<b>THICKNESS:</b> (Standard)	Interior/Door	9/16" (14 mm)*
	Exterior	1" (25mm) insulating glass unit (IGU) (3/16" tempered outer glass + 3/8" airspace + 7/16" clear laminated Polyvision™ glass)
	<i>*Other thicknesses available based on the application. (5/16", 7/16", 13/16")</i>	
<b>SIZE (max):</b>	72" x 120" (1828 mm x 3048 mm)	
<b>SHAPE:</b>	Any shape, including holes anywhere	
<b>TEMPERATURE:</b>	Storage	-20°C to 70°C (-4°F to 158°F)
	Operation	-10°C to 60°C (14°F to 140°F)
<b>ELECTRICAL:</b>	Driving voltage	65 ± 5 volts AC
	Current	less than 20 mA/ft² (215 mA/m²)
	Power	less than 0.5 watt/ft² (5 watt/m²)
<b>SWITCHING TIME:</b>	Approx. 100 milliseconds at room temperature	
<b>OPTICAL:</b>	Haze	approx. 7%
	Transmission (visible)	approx. 75%
	View angle	approx. 150°
	Scattering effectiveness	approx. 1 inch
	Solar Heat Gain Coefficient (SHGC)	off-state <0.10 on-state 0.40-0.60
<b>LIFE:</b>	Greater than 10 years (indoors) (when used, installed, and stored properly per the usage, storage and installation specifications referenced herein)  Claim is supported by manufacturer's testing data	



# POLYVISION™

## Switchable Privacy Glass

### SAMPLE PANEL



#### NOTES:

1. There will be about 1/8" clear visible area along all 4 edges. The clear visible area is transparent all the time. For wet areas and doors, visible areas will be 1/4".
2. The width of the busbar (copper strip) is 1/4". The busbar can be placed along the long or short edges.
3. Edges where the electrodes are placed (vertical edges in the above drawing) have to be covered by min. 1/2" (3/4" recommended). Cover min. 1/4" for other edges.
4. Off-centered holes will have a displacement of 3/8".
5. Holes in corners are displaced up to 1/2" due to more film shrinkage in corners.



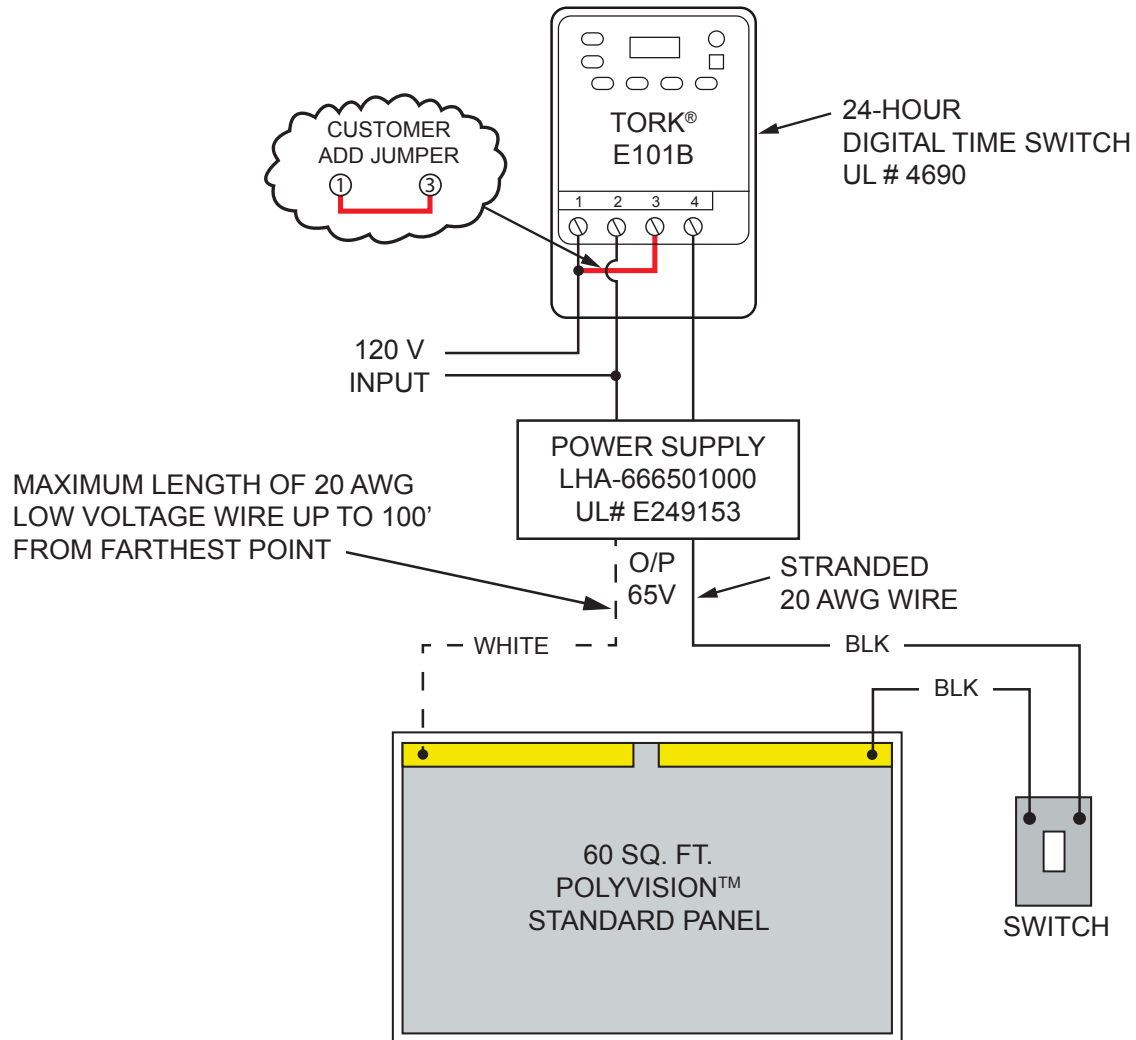
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# POLYVISION™

## Switchable Privacy Glass

### SINGLE PANEL WIRING EXAMPLE

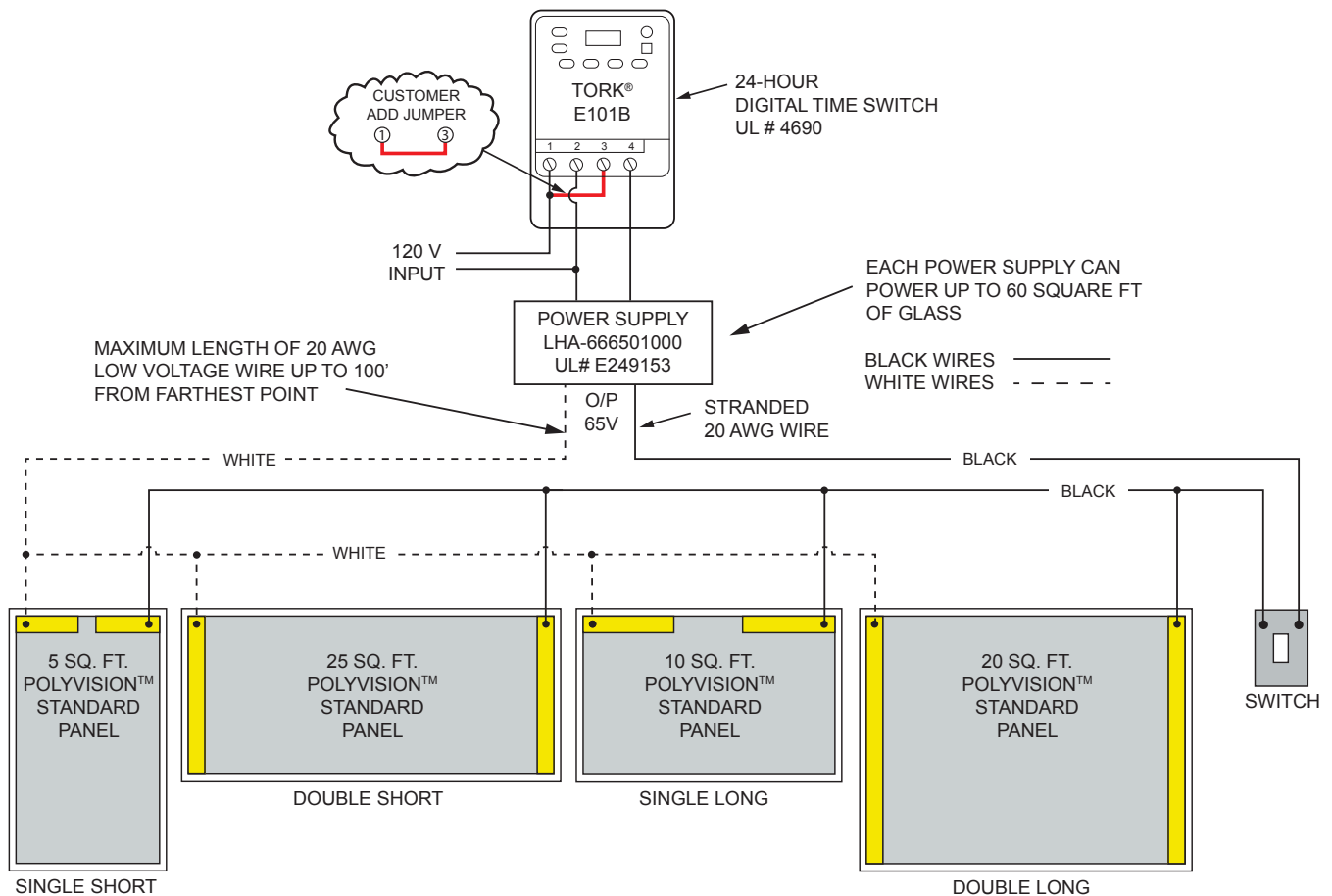


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### MULTI-PANEL WIRING EXAMPLE



Each panel will have black and white wires. The position of yours may be in a different location than pictured above depending on design requirements.



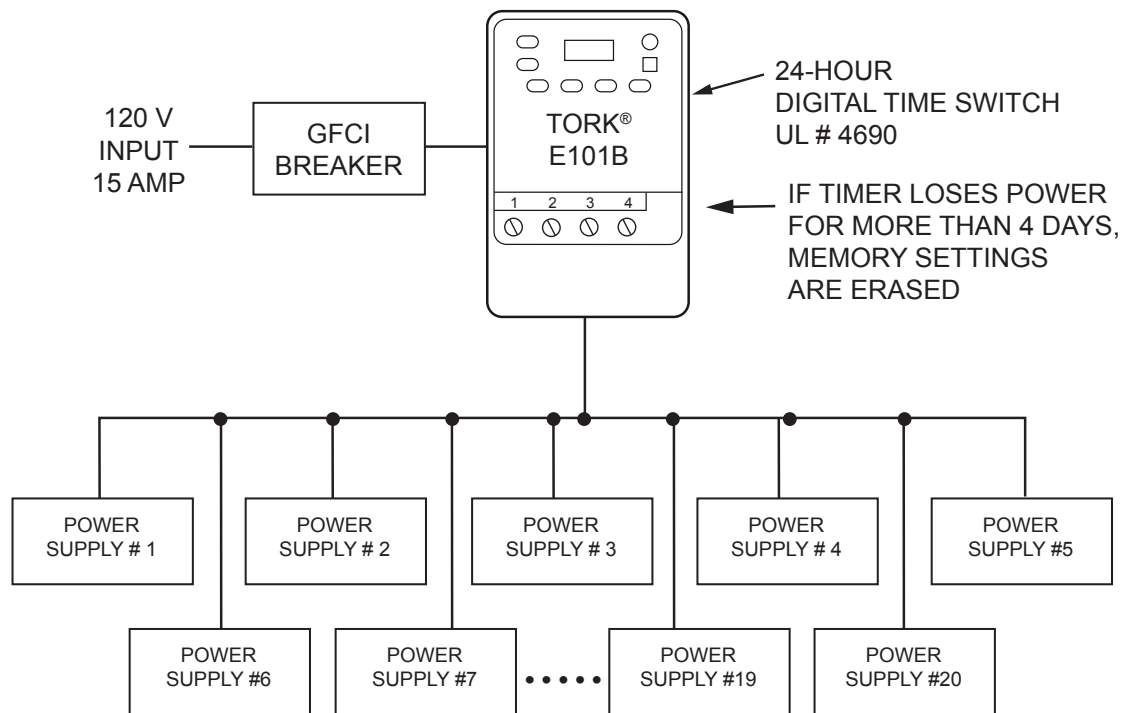
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### DIGITAL SWITCH TIMER and POWER SUPPLY EXAMPLE

#### REPRESENTATION OF BASIC TIMER AND POWER SUPPLY HOOKUP

ONE TIMER MAY BE USED FOR UP TO (20) POWER SUPPLIES



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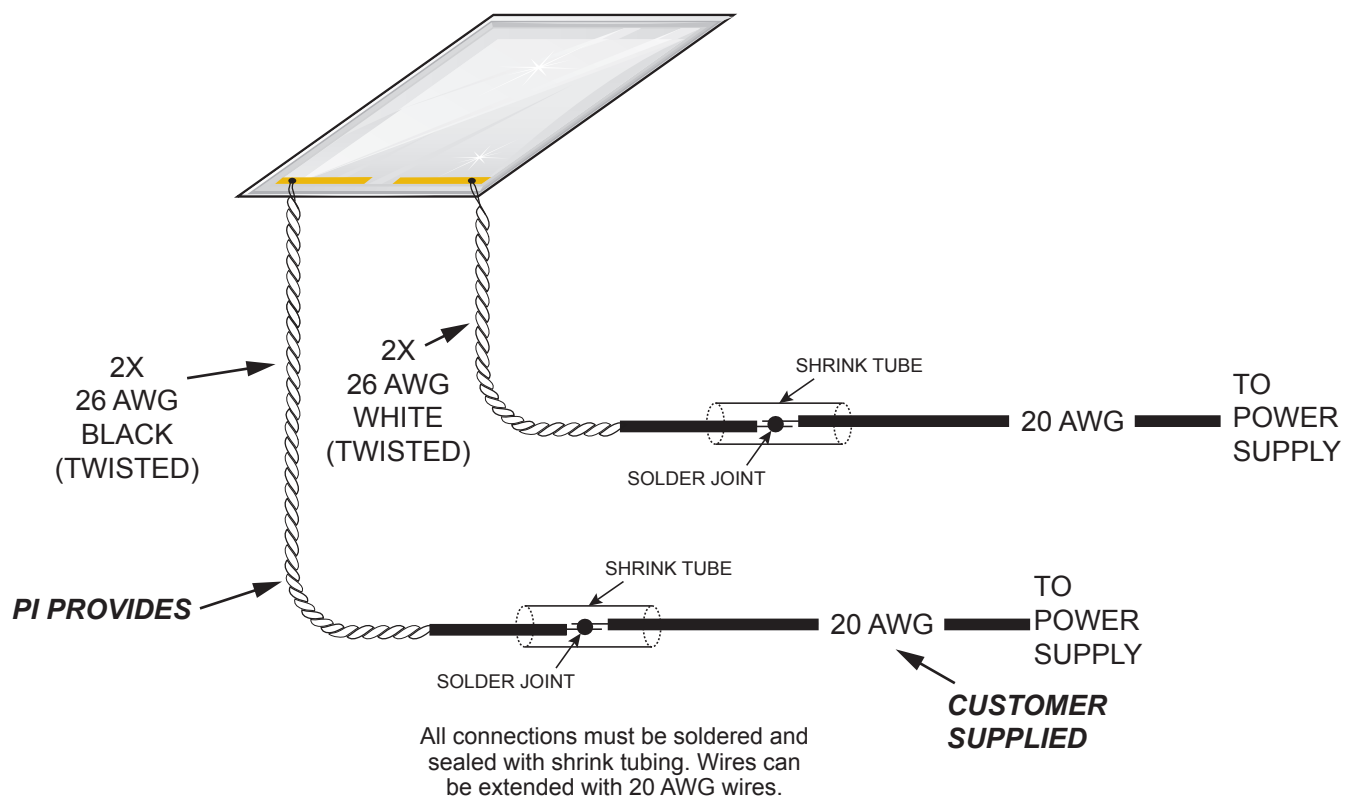


# POLYVISION™

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### EXTENDED WIRING MAXIMUM LENGTH 100'

ROUTING FOR EXTENDING WIRES TO DESIRED LENGTH  
NOT TO EXCEED 100 FT FROM THE FARTHEST PANEL



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### GENERAL ELECTRICAL INFORMATION

- Selection of all hardware and/or fixtures used in the installation of PDLC products is the sole responsibility of the Purchaser.
- Required Materials:
  - Door: header, footer, power transfer and wire access.
  - Window: sash, frame, power transfer and wire access.
- Inspection: After preparation of the glazing system, clean glazing channels, stops and rabbets to receive the glazing materials to ensure proper seating of Polyvision™ glass panels.
- The mounting and installation of the Polyvision™ power supplies and timers should be performed by licensed electricians and must conform to the local electrical code.
- Most Polyvision™ power supplies are placed below the ceiling in utility closets within 100 feet from the farthest electrified panel.
- The installation of a Polyvision™ panel without following manufacturer's recommended guidelines can lead to unsafe conditions and/or cause permanent damage to the panel.
- This product may be installed in either a residential or commercial environment.
- Install only on a GROUNDED 120 VAC circuit protected by 15A fuse or breaker. The circuit must also be protected by a ground fault circuit interrupter (GFCI).
- The Polyvision™ power module circuitry is rated for a maximum continuous output of 1.0 amp. If the installation requires the operation of more than 60 square feet of glass surface from a single switch, the switch lines from multiple power modules may be ganged together.
- Installing a single pole switch on the switch wires is considered standard, however remotes can be used.
- Do not connect any other devices or products to the output of the Polyvision™ power supply.
- There are no serviceable parts or replaceable parts within the Polyvision™ power supplies.
- Approved regulated power supplies should not exceed 65VAC output.
- Caution must be taken to prevent damage to Polytronix provided wiring or wiring insulation. Do not seat Polyvision™ panel on Polytronix provided wiring.

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### GLAZING INFORMATION & RECOMMENDED STEPS

#### Inspection and Preparation

- Inspect each piece of glass immediately prior to start of installation.
- Do not install switchable glass that is cracked, chipped, or broken.
- Do not install Switchable Glass that has damaged wires or busbars.
- Before installation, inspect busbars and wires to confirm there is no damage to the insulation. Exposed busbars or wires that contact any metal frames will cause damage to the transformer and glass panels.
- Before turning on the power, test resistance reading between the metal frame and electrode and make sure that the resistance reading is infinite. Otherwise, check short location and insulate electrodes from metal frames.
- Polyvision™ uses less than one watt per square foot in the “ON” (clear) state. No electricity is consumed in the “OFF” (translucent) state.

#### Surface Conditions:

- The purchaser must examine the areas and conditions under which the installation and wiring will be performed. Correct conditions are critical to the timely and proper completion of this work. Do not proceed until unsatisfactory conditions are corrected. Refer to ‘ASTM Glass and Glazing Standards for the Building Industry’ for the applicable and satisfactory conditions.
- Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the hardware manufacturer’s requirements.

#### Recommended “Glazing” Guidelines

- Locate sill setting blocks of standard width and thickness at quarter points of ALL switchable panels.
- Setting blocks must be used to avoid contact with all hard surfaces. Setting blocks should be 80-85 shore A.
- Panels should be free floating and non-load bearing; Maintain 1/8” (2.9mm) spacing between panels and all hard surfaces.
- The edges of the switchable panels must not be subject to any standing water.
- Polyvision™ panel WILL NOT be given a permanently etched safety certification or tempered bug label unless specifically directed by the Architect.
- Polyvision™ panels can be butt glazed using a recommended minimum 7/16” thickness panel.
- Refer to applicable local building codes for design load requirements regarding interior glazing.
- Glazier must place electrical connections properly to allow access by an electrician.
- Structural Silicone Glazing: Polyvision™ panels should NOT be structurally silicone glazed.



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### GLAZING INFORMATION & RECOMMENDED STEPS

#### Glazing – Sealants

- The switchable panels should be sealed from moisture along all edges. Any skips in the sealant bead may lead to staining of the switchable panels.
- Care must be taken to observe the condition of the sealant throughout the useful life of the sealant. Sealant must be replaced if it becomes moldy or mildew stained, or if the sealant fails to provide an adequate moisture barrier to the switchable panel.
- Sealants must be neutral cure.

#### Recommended Neutral Cure Sealants

Exterior	Interior	Dry	Wet	Butt-Joint	In-Channel	Windows/Doors
Dow 795	X	X	X	X	X	
Dow 991	X	X	X	X	X	
Dow 995		X	X			X
Dow 1199 (clear)	X	X	X	X	X	X
Schnee-Morehead SM5731		X	X			X

#### Maintenance and Cleaning:

- The purchaser must examine the areas and conditions under this product will be used.
- Cleaning of the glass during the subsequent weathering period is necessary.
- Abrasive cleaners should never be used on the surface especially if it has a reflective coating.
- Clean the Panels with a mild soap or very weak acid (vinegar) applied with a soft, clean, grit-free cloth.
- The glass and framing should be rinsed immediately with water and the excess should be squeezed away from the glass, taking care not to contact the glass with any metal parts. The framing should be wiped dry.

#### Storage:

- Glass edges may sustain damage due to careless handling at some point between manufacture and installation. Handle with care!
- If the glass is to be stored on the job site or in warehouse conditions, proper blocking and protection should be maintained at all times.
- As with other flat glass products, the Polyvision™ Panels must be stored where the relative humidity is less than 80% to prevent the glass from staining. The glass temperature should be held nearly constant to prevent moisture condensation on the Panels. Storage temperature range is –4 – 158°F (–20 – 70°C).
- The crate of Panels should be kept in an upright position or tilted at 5° – 7° from vertical at all times using broad, sturdy uprights to support the weight of the crate.

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# POLYVISION™

## Switchable Privacy Glass

### FEATURES AND BENEFITS

#### Features:

- Privacy and security with architectural integrity
- Visual attention to interior and exterior design
- No distracting shutters and drapes
- Beauty and Functions Combined!

#### Customer Benefits:

- Saves energy by using natural lighting while maintaining privacy
- Environmentally-friendly by:
  - Reducing fabric wastes used to make curtains/drapes
  - Eliminating the need for projection screens and dry erase boards
- Very low power consumption (equivalent to a clock radio)
- Blocks over 99% ultraviolet light
- Safety Glass: All panels meet safety glass requirements

#### Highest Quality Product:

- Leading manufacturer in Polymer Dispersed Liquid Crystal (PDLC)
- Continuous manufacture operations for over 30 years

#### Qualified Laminators in both East and West coasts

- Lower shipping costs to customers

#### Customer Services and Technical Support:

- Quick response to customers' needs
- Field supervision when necessary

#### Mailing Address:

Polytronix, Inc.  
P.O. Box 833024  
Richardson, TX 75083-3024

#### ISO 9001 Certified Company



### CLARITY STANDARDS & GUIDELINES

**CLARITY STANDARDS** – all photos were taken at the same distance and angle for a precise measurement of lighting conditions. **Architects & Designers: NOTE: As demonstrated below consider the placement of any lighting near the privacy glass.**

#### 1- Worse Lighting Conditions

Lights that are only on the outside of the conference room will cause an imbalance in light intensity. This will increase the haze.



#### 2- Better Lighting Conditions

Lights on the outside of the conference room are higher in intensity than on the inside. This will result in a slight haze.



#### 3- Best Lighting Conditions

Lights on the inside of the conference room and outside are evenly balanced in intensity and sufficiently diffused at appropriate distances.



#### 4- Low Haze in Dark State (all lights OFF)

No lights on the inside or outside of the conference room will result in little haze.

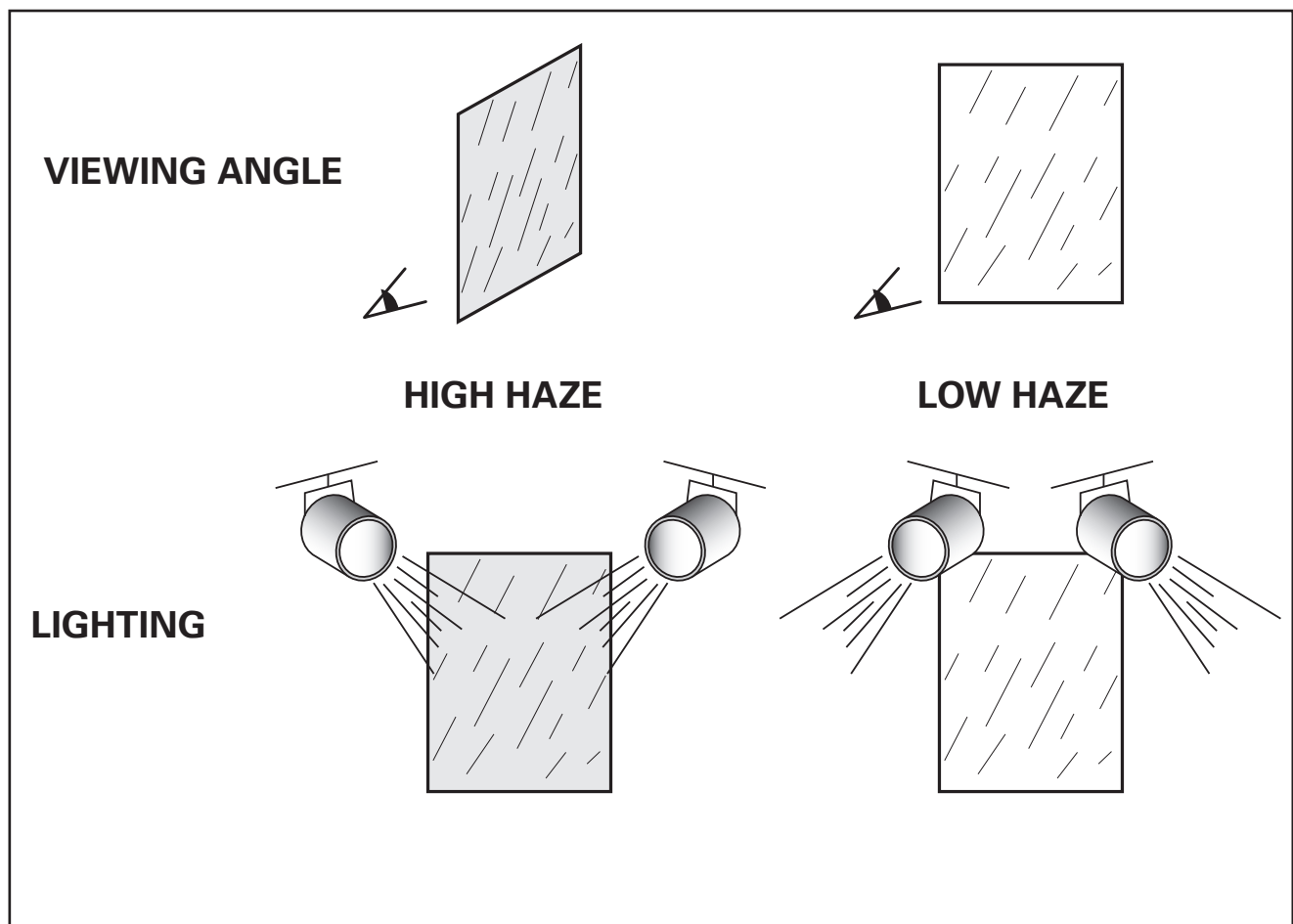




### HAZE FACTOR CONSIDERATIONS

All Polyvision™ Film/Glass are rigorously inspected for quality and clarity. Because Polyvision™ Film/Glass contains liquid crystal (LC) material, it inherently possesses some level of “haziness” and would not exhibit the same level of clarity as regular float glass. Therefore, it is NOT recommended to butt-joint Polyvision™ glass with regular float glass or to put side by side.

In addition, the inherent haziness is increased at wider viewing angles and with big disparities in light intensities (see diagram below). This phenomenon is normal because Polyvision™ Film/Glass is a light diffuser and will change in haze at varying viewing angles and lighting conditions.



# POLYVISION™

## Switchable Privacy Glass

### PROJECT / USER'S LIST

END USER	APPLICATION	GLASS CONTRACTOR/ARCHITECT
Three Strikes Production	XXX2 (Hollywood Movie)	Three Strikes Production
CBS	Big Brother 5	Dave's Glass
IBM, Boulder, CO.	Command Center	Hillcrest Glass
AT & T, Murray Hill, NJ	Audio/Video Presentation Area	Galaxy Glass
Albert Einstein Hospital, Sao Paulo, Brazil	Intensive Care Rooms	Udiness Industria E Comercio Ltda
Edwards & Terry Law Firm, Corpus Christi, TX	Conference Room	Barcom Commercial/Scott H. Johnson AIA & Design Assoc.
American Nevada, Las Vegas, NV	Board Room	Fitzgerald Glass/Gensler & Asso.-Houston
Atlantic Studio, Atlantic City, NY	Presentation Studio	Mattel Toys/Evan Mower
Baptist, Nashville, TN	Conference Room	Infrastructure
Exchange Resources, Rutherford, NJ	Conference Room	Engineering Specialty Products
Hughes Galaxy Latin America, Long Beach, CA	Command Center	Heinaman Contract Glazing/ Crosby Group, M.E. Engineers
Lehman Brothers, New York, NY	Conference Room	County Glass & Metal/Salsano Fahim Architects
Lockheed Martin	Conference Room	Lockheed Martin
North York General Hospital ON, Canada	Emergency Room	Stanley Access Technologies
Nations Bank, Nashville, TN	Conference Room	Infrastructure
Pulp Studio, LA, CA	Various applications	Pulp Studio, LA, CA
S P Telecom, Denver, CO	Audio/Video Presentation Area	Centere Constructions/KDC Arch
Saunders & Schmieller Law Offices, Silver Spring, MD	Office Entrance	Paul Gaiser Architects
Standard Micro Systems, Hauppauge, NY	Conference Room	Lynbrook Glass
Triodyne/Goldberg, Chicago, IL	Office Windows	Mangrum Glass
Washington Hospital, San Jose, CA	Operating Room	Cline & Assoc./Collier Bldg. Spec.