# Privacy Solar Smartglass™
## Technical Handbook


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## INTRODUCTION

Smartglass International is leading worldwide manufacturer of electronically switchable glass supplied to the commercial, hospitality, healthcare, transport, security and industrial sectors.

Our vision is to create beautiful environments, challenge the existing architectural status quo through the ever-changing developments in technology and what's achievable with our product. This vision informs all aspects of our work, from our dedication to excellence, to our passion for high quality and openness to innovation. Our no-compromise attitude to quality and customer focus is the foundation for our commitment to creating products and experiences of real and lasting value.

Intelligent technology, advanced features, innovative solutions and quality are what set us apart.

## WHY SMARTGLASS?

We have successfully worked with and supplied to prestigious clients, World renowned architects and landmark projects throughout the World and have built an enviable reputation for:

**Quality Products.** Our products are designed to be not only aesthetically pleasing but also essentially functional and easy to use. The expectations raised by a strikingly individual appearance must be completely fulfilled in terms of high quality performance in all areas when the Smartglass system is used. Excellence in providing the consumer with the highest pleasure in both ownership and use rests on the highest quality standards employed through the design and manufacturing processes.

**Innovation.** Through extensive investment in research and development, Smartglass International continually pushes the boundaries to bring new and innovative products to its customers.
Design. Our design team will work with the client, their architects and design teams, in order to guarantee the products supplied are fit for purpose and are optimally designed in terms of quality, regulatory compliance, safety, aesthetics and function.

**Customer Focus.** We strive to offer our customer a level of service that matches the unprecedented focus on quality and finish of our products. Following design, delivery and installation of your purchase the Smartglass International product and service guarantee ensures that service and support is always close at hand. Taking care of you and your products is our main ambition. Should you need support for your products, we will do our utmost to help you as quickly and efficiently as possible.

**Flexibility.** We strive to be as flexible as possible in order to understand and enhance the customer experience. Frequently competitors cannot supply certain configurations which we will supply to exceed the clients requirements.
Beware of cheap imitations. Our Smartglass products have set the standards in this industry. Many other companies will look to achieve the same results; however the quality of opacity, longevity of function and customer service that Smartglass offer their customers remains unrivalled.

**Lead time.** Through in house control of the manufacturing and quality processes, lead times generally range from 4 to 6 weeks from receipt of order. Our goal is to deliver a quality product on time.

**Environmental Policy.** We work continuously to minimise the effects of greenhouse emissions on the environment. Equal priority is given to finding a balance between the needs of the environment and the consideration given to our products quality, economic value, aesthetic value and life span. Our products ultimately reduce greenhouse emissions by enabling users to reduce peak electrical demands on lighting and cooling. Our production processes are carried out in a sympathetic manner with a view to maximising recycling and minimising energy consumption and waste.

## CERTIFICATION, DURABILITY & TESTING

As our Smartglass products are laminate glass they offer exceptional strength and safety. They meet and in some cases exceed the following standards. Proof of certification is available upon request.

BSEn 12150:2000 - Glass in Building - Fragmentation Test
BSEn 12600:2000 - Glass in Building - Pendulum Test
BSEn 60529:1992 - Ingress Protection, awarded IPx7 rating.
EnISO 12543-4 - Humidity and Boil Test

Our products also conform to the electrical standards

BSEn 7671 - Electrical installations in Buildings
HD 60364-7-701 - Installations containing a Bath or Shower
BSEn 61558-2-4 - Our Transformers meet this standard

UL & cUL Accrediation
UL 962 - Household and commercial furnishings
CSA C22.2 No. 0-10 - General requirements Canadian Electrical Code – Part II

Tested in excess of 4 million switch cycles in-house without any change in appearance.

## MANUFACTURING

The production team at Smartglass International uses a combination of experience, technology and skill to manufacture each Smartglass panel to the highest levels of quality. Each Smartglass panel is handmade & bespoke for the clients requirements.

All of the materials used in the production process are of world class standard and while expensive; these materials ensure premium quality in the finished product.

Each Smartglass panel is assembled in a climate-controlled, clean room environment. Production employees are empowered to strive for world class manufacturing standards and individually sign off each bespoke made panel after manufacturing and testing.

After manufacturing, cleaning and wiring, each Smartglass panel is fully tested and inspected before packaging.

All panels are bespoke and cannot be cut after manufacture.

**Note:** This product has a Black Ceramic Painted Border around the full perimeter. See page 5 for details.

# Privacy Solar Smartglass™

## OVERVIEW

Privacy Solar Smartglass™ is a unique glass solution that allows users to instantly block out 99.9% of light that passes through a window. As an alternative to blinds or curtains, Privacy Solar Smartglass can be used in commercial or residential applications to instantly control the atmosphere of a room by immediately plunging the space into darkness.
Privacy Solar Smartglass™ is a dual-interlayer laminate (DIL) that combines cutting edge film and glass lamination processes to create a product that is re-defining what is possible within glass technology. We use a combination of both our Privacy and Solar films to create our Privacy Solar Smartglass panels. Through the use of these two layers of film within one laminate panel, Smartglass International has created a product that can rapidly switch from transparent to 99.9% light blockage in a matter of seconds also with the added option of having multi function so to achieve 4 separate switching modes.

Mode 1 – Privacy 'Off' Solar 'Off' (Blackout)
Mode 2 – Privacy 'On' Solar Off (Light control only)
Mode 3 – Privacy 'On' Solar On' (Transparancey)
Mode 4 – Privacy 'Off' Solar On (Privacy Control only)

### Typical Wired Smartglass Panel

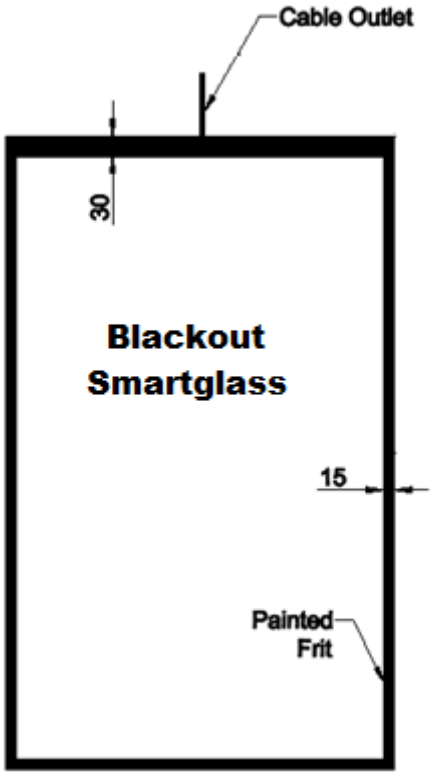


## CONFIGURATIONS

**GLASS COLOR:** Clear, bronze, grey, green, blue tint.

**GLASS TYPE:** Toughened, Low Iron as standard. Also available: heat strengthened, Fire-rated, curved, bullet-resistant, tinted, heat soak tested.

**THICKNESS:** Standard sizes: 13mm or 15mm
Exterior standard: 31 mm Insulated Glass Unit (IGU)
6mm Solar Control glass + 10mm Argon Cavity + 13mm Privacy Solar Smartglass™ panel




**PAINTED BORDER (FRIT):** For manufacturing reasons and to improve the performance of the product all Solar Smartglass panels (single or double glazed) have a pinted border on all 4 sides. This broder is typically 15mm on the non-electrode edges and 30mm on the electrode side (see sketch) This painted border is usually black to match the colour of the glas s but can be painted to any RAL colour, subject to approval.

**SIZE:** Maximum 1000 mm x 3200 mm

**RATIO:** Maximum Ratio Width: Height approx 4:1
(Without applying bus bars top and bottom or on 2 opposing sides)

**WIRING:** Double insulated 0.5mm² dual core flex standard 4 meter. Longer wires can be supplied upon request. Exits glass top centre of panel unless requested otherwise .
Solar Layer – Black Cable
Privacy Layer – White Cable

**SHAPE:** All shapes and curved available, including holes drilled.
A minimum of 1000mm Radius is applicable for Toughened Bends (Curved Smartglass)

**ENVIRONMENTAL:** Storage / Operation -10$^{O}$C to 55$^{O}$C

**SIZE TOLLERENCE:** ± 3 mm on OA size and ± 0.5 mm on thickness

**BOWING TOLLERENCE:** ± 3 mm per linear meter

**ELECTRICAL:**

| | | |
|---|---|---|
| Driving voltage: | | 70VAC Privacy Layer<br>110VAC Solar Layer |
| Current | : | approx 200mA/m$^2$ |
| Power: | | approx. 14Watt/m$^2$ |

**SWITCHING TIME:** Approx. 1/10 second at room temperature

**LEADTIME:** 6 to 8 weeks

**WARRANTY:** 5 years

## OPTICAL & SOUND PERFORMANCE

| | Mode 1 | Mode 2 | Mode 3 | Mode 4 |
|---|---|---|---|---|
| **Visible Light Transmission** | 0.5% | 0.8% | 45% | 26% |
| **Clarity** | 0% | 20% | 60% | 4% |
| **UV Transmission** | 0% | 0% | 0% | 0% |

Values are nominal (+/- 5%) and are dependent on glass configuration used. The above figures are recommended for guide purposes only.

| Glass Thickness | Decibel Rating |
|---|---|
| 13mm | 37db |
| 15mm | 38db |

## HAZE

It should be noted that Privacy Solar Smartglass is *not* as optically as clear as normal float glass. The colour of the product will always have a blue tint also a haze in the form of clouding in the glass is considered normal and is unavoidable due to the nature of the product makeup. It should also be noted that ambient lighting conditions will have an effect on haze levels, direct artificial lighting onto Privacy Solar Smartglass should be avoided. It is essential that the end client understands that a degree of haze and tint will be present and will not be considered as a reason for exchange or refund.

## OPERATION

Privacy Solar Smartglass is operated by applying 110V AC to the Solar Smartglass layer and 70VAC to the Privacy layer within the single glass product. This voltage is controlled via power controllers. When a current is applied to the glass the user can opt for either Mode 1, 2 or 3 depending how the wiring and switching is installed. Mode 4 is achieved with both power supplies switched off.

The 70VAC control will give you Privacy when switched off (fully opaque) or transpareceny when switched on.

The 110VAC control will give 99% light blocking when switched off (dark Blue Tint) or transparecney when switched on.

## MAINTENANCE

Smartglass panels are designed to be switched on and off regularly. Smartglass International recommends that panels should be left in the 'Off' position (Opaque / Dark Tint) for an average of 6hrs/day .

This is so as to allow the molecules to regularly return to a state of random arrangement and not become polarized to a rigid position, even when not charged.

Failure to do so may affect performance and invalidate the warranty – Smartglass recommends the electrical contractor installs a timer relay / module to ensure the Smartglass panels receive the recoemmended rest period.

This is application / useage dependent and the final product construction also needs to be taken into consideration. Should this be of a concern please contact your local representative to discuss in further detail.

# ELECTRICAL INSTALLATION

## SUPPLIES NEEDED

Installation of Smartglass panels requires the following items:

A 16 AMP (minimum) Residual current device (Rcd) with Miniature circuit breaker (Mcb) or a Residual current circuit breaker with overload protection (Rcbo) must be used along with a fused spur at the connection point for the panel for localised isolation. – Rcd / Mcb Rating dependent on installation requirements – Toatl Load being supplied for number and quantity of glass panels.

A wall mounted switch, 230VAC 50 Hz (installer/owner supplied). Alternatively an rf signal wireless control switch can be supplied, contact us for more information.

Smartglass panels may be connected in parallel up to 12 square meters total area per single 300VA transformer.

Bespoke electronic control systems can be used in conjunction with our power transformers, systems such as Creston, Lutron, Rake etc. Please contact our offices for more information.

**Note: Larger Power Conditioner / Transformers can be supplied to power larger areas of Smartglass – specification agreed at time of order.**

## INSTALLATION REQUIREMENTS

As with any electrical device, Smartglass must be included in the electrical layout for each project. E.g. Position of spurs, switching layout, containment (conduit, trunking and connection boxes etc). The installation must meet all local rules and regulations. Also any metal frames which could come in to contact with the wiring of the panel ***must*** be bonded. Smartglass International is not responsible for these layouts however we can be contacted for further information.

## POWER TRANSFORMER / CONTROLLER DETAIL

Short circuit proof, over voltage protection and DC blocking electrical controller with multiple configuration options for switching.
High Voltage Switch - Control commands are performed by switching AC 220V Line to input terminals
Dry contact control Interface – This feature requires only external dry contacts or regular wall switch for operations. The advantage of this approach is that the control wires do not carry any voltage.
**WARNING: The transformer must be installed by the electrical contractor in an easily accessible and well ventilated area. They must be installed into a suitable enclosure supplied by others.**

**Electrical Specification**
Primary 0-2200V ±10% @ 50/60Hz.
Secondary 70VAC Sqaure Wave 25/30/32/50/60HZ (Adjustabel Frequencey)

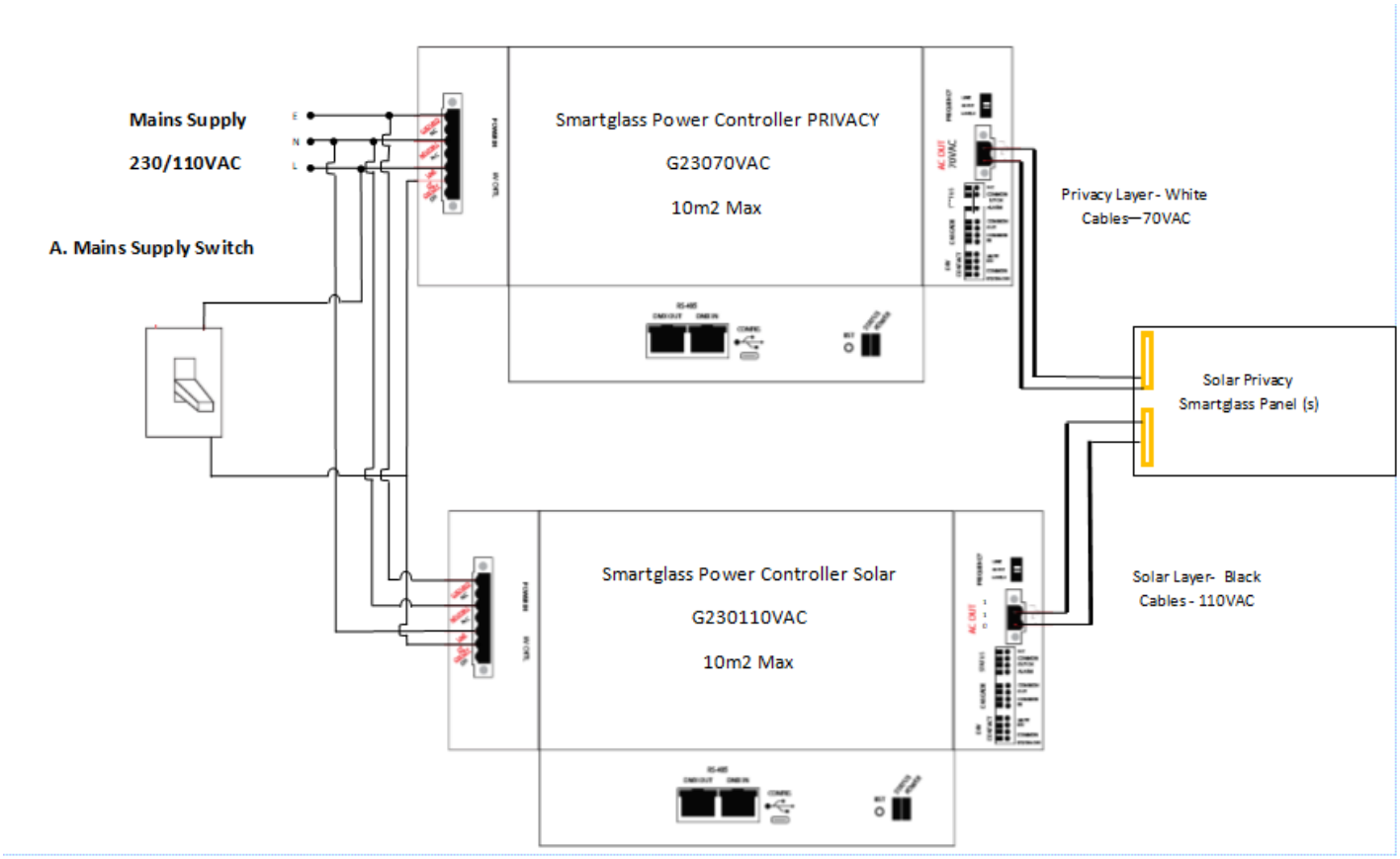
| | | | | | Switch Method | | | Dimensions (MM) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Product Code** | **Name** | **Primary** | **Secondary** | **m2** | **Dimmable**** | **Dry Contact** | **HV Switch** | **Length** | **Width** | **Height** |
| G23070VAC | Smartglass Flex Controller | 220VAC | 70VAC /110VAC | 10 | Y | Y | Y | 165 | 104 | 35 |
| G23070VACM | Smartglass Mini Controller | 220VAC | 70VAC | 4 | N | Y | Y | 145 | 100 | 32 |

**Flex Controller Dimmable Option is not a standard item

# Wiring and Installation

## WIRING DIAGRAMS

### Hardwired wall Switch Example




### For alternative switch method wiring diagrams please contact Smartglass representatives.

## WIRING & TESTING

Smartglass International requires that all Smartglass electrical installations be completed by a **licensed electrician, and in compliance with all local rules, legislation and regulations.**

Before installation, inspect bus bars, electrode leads and wires to assure insulation. No exposed bus bars, electrode leads, or wires should contact any metal frames that will damage the transformer and possibly the Smartglass. All metal frames ***must be earthed***.

When connecting multiple Smartglass panels, they should be connected in parallel with the transformer. Insure that the transformer "in" connects to 230V AC and "out" connects to Smartglass panel. The output voltage will be approximately 70-110VAC
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.

**NOTE: Ensure not to conduct an insulation resistance test with a fault voltage upon Smartglass. This will permanently damage the Smartglass and will void your warranty.**

Smartglass uses approximately 714W/m² in the "on" (translucent) state. No electricity is consumed in the "off" (opaque / dark) state. Smartglass can be controlled with a single or multiple switches, radio remote control, photo-sensor, infra red detector, etc.

**NOTE: It is vital for correct operation that the switch/remote receiver is positioned on the mains voltage before the transformer/power conditioner. Failure to correctly install the switching mechanism may cause irreparable damage to the Privacy Solar Smartglass.**

To replace the transformer fuse, ensure the mains supply is switched off and take care when opening the power transformer, allow a few minutes to cool down. Internal electronic parts may be very hot, this is normal. Only open the power transformer in the areas noted safe for opening, never attempt to open the sealed body of the power transformer.

**Warning: Do not substitute a higher fuse rating! Fuse rating is critical to properly protect Smartglass panels. A spare fuse is included on the inside cover of the power transformer supplied and additional fuses can be ordered from Smartglass International if required.**

## GLAZING GUIDELINES

## INTERIOR GLAZING

Smartglass panels can be butt glazed. Long edges will be polished giving an even vertical finish. Panel thickness will vary depending on several conditions including the height and span of the glazed area. We will advise minimum glass thickness for manufacturing considerations but it is for the client to ensure that glass thickness is suitable for purpose and complies with all local building codes.

## OPERABLE WINDOWS & DOORS

Doors and windows can be glazed with Smartglass. The requirement to get the power cable from the glass to the frame of the opening mean that adapted pivots, hinges or connectors must be used. The use of patch fittings is also possible subject to discussion with Smartglass International.

Cable connectors will be used to protect wires travelling between the door and frame where the wiring is then connected to the transformer/ power conditioner. Please ask us for further details if required.

## INSTALLATION

Clients and their installers should inspect each piece of Smartglass immediately prior to start of installation.
Do not install items which are improperly sized, have damaged edges, or are scratched, abraded, or deficient in any other manner.
Do not remove labels where provided by Smartglass until so directed by Architect, client or site manager.
If the installer has any questions or concerns please immediately contact your local Smartglass representative.

## FULLY FRAMED FIXED FRAMES

As standard, the power supply cable for the panel is at the top centre of the panel, therefore a hole must be drilled through the head of the frame to allow for cable routing. The hole must be completely deburred and a bushing or grommet fitted to prevent cable damage.

**Setting blocks used should be of standard width and thickness of all glass panels, as per glass and glazing federation guidelines.**

**For applications with more than one single glazed panel per frame, panels can be jointed using a selection of dry joint profiles or silicon as supplied by Smartglass International, see note below.**

## GLAZING METHODS

**Wet Glazing**: Never use putty or glazing compound to glaze Smartglass. Edges of Smartglass panel are to be protected using Flowstrip edge tape,(FDP792 Superior F.R.G. Edge Tape). Only use non-acetic sealants, (Soudal Sillirub 2 or Dow Corning 791), supplied by Smartglass International

**Exterior Applications:** Insulated Glass Units made with Smartglass can be installed as per normal glazing with the exception of accommodating the unit wiring. The Smartglass panel must be fitted as the interior panel. Smartglass is suitable for glazing to steel, timber, aluminium and UPVC framing systems.

**Butt-Joint Glazing:** Smartglass panels can be butt-joint glazed in interior applications (Long edges polished recommended). The joint can be silicone (only use silicone supplied by Smartglass International )or dry joint as required.

## SILICONE

Smartglass International only recommends **SOUDAL SLIRUB 2 or Dow Corning 791** as the sealant for use in butt-joint glazed Smartglass panel systems. Use of any other type of silicone sealant will void warranty.

Structural *Silicone Glazing: Insulated glass units manufactured with Smartglass should not be structurally silicone glazed unless agreed in advance & in writing by Smartglass International.*

## FRAME DESIGN

Frame edge clearance and face clearances may be used, except the edge bite must be 10 mm minimum and framing must include a hole of sufficient diameter to pass wires through. To maintain a proper seal against the infiltration of water and air adequate bite and sealing is required.

Inadequate clearance for the edges can cause damage due to glass-to-metal contact. Minimum edge clearances should allow for a tolerance of ±1.5mm. This should only be increased if the surrounding materials tolerances are difficult or impossible to control.

## DOOR DESIGN

There are several options for using Smartglass in doors including top and bottom rails and conventional patch fittings. Please contact us for further information.

### Door handle detail

Back to Back pull handles are used as standard on Smartglass doors, ensure the pull handles you are using will cover the hole in the LC Film, this is generally 10mm wider diameter all round than the bore hole in the glass for the pull handle fixing bolts.
If the door is required to be a single action lockable door, Smartglass recommends a Studio 85 locking latch with roses and a Studio 85 strike box ( Or Similar ). Allowances will have to be made for the difference in height between the door and the panel with the receiver to ensure they line up correctly.

### Cable routing detail

When using a framed door system, you have to remember that the wiring must make its way from the glass out of the door frame. Smartglass recommends that a concealed door loop is used. The cable can then be passed through the stile of the door – door loop – door frame and then continued on to the ceiling void and transformer.

# SHIPPING AND RECEIVING

## SHIPPING

Where applicable we manufacture shipping crates for all individual customer orders. These crates allow for protection of glass in transit, but correct handling methods should be observed when off-loading. ***Note:*** It is the responsibility of the client to off load glass deliveries unless otherwise agreed prior to dispatch.

For overseas customers, specifying whether the freight should be shipped via Air or Sea is necessary. Where available, it is recommended to have the clients own agent to take care of the shipping and customs clearance issues. We can do so, at additional cost.




## RECEIVING

Before signing for and accepting the shipment from the carrier, inspect the crate(s) for any visible damage.

If damage to any of the panel(s) is found, the shipping documents should be so noted and the driver's signature obtained as a witness. You should inform Smartglass International immediately of any damaged panels. Photographs should be furnished within 24 hours. A freight claim should be filed to the carrier as early as possible.

When lifting the crate the forks must be in a central position and the crate must be fully supported. Do not attempt to lift the crate unless it is evenly supported.

## UNCRATING

Ensure the crate is on a level surface. Before removing the lid unscrew screws which are holding the lid down. Be careful to lift the lid off the crate level on all corners. Remove straps holding panels on. Remove the panels carefully, one at a time, using the appropriate lifting methods.

**Warning: Loose cables from Privacy Smartglass panels are not to be used for lifting, moving or positioning the Privacy Smartglass panels. Ensure not to snag cables whilst lifting.**

## STORAGE

Glass edges frequently sustain damage due to careless handling at some point between manufacture and installation, Handle with care. If the Smartglass 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 Smartglass panels must be stored where the relative humidity is less than 80% to prevent the Smartglass from staining. The Smartglass temperature should be held nearly constant to prevent moisture condensation on the panels. Storage temperature range is -20 +50 °C (-4° +122°F). The crate 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. Alternatively the SmartGlass should be stored on a glass "A" frame in a position free from obstruction, traffic and danger.

**Note: Smartglass panels can be heavy at approximately 27.5 kg/m2. Please be careful and take the weight loads into account when moving and storing.**

## UNEXPECTED BREAKAGE

"Unexplained" glass breakage may occur after all precautions have been taken. Such breakage is beyond the control of the manufacturer and therefore not warrantable. This includes but is not limited to the following items

Thermal stress
Glazing system pressures
Damage during glazing by others
Handling and storage problems
Excessive wind loads
Objects and debris striking the glass
Damage by persons/objects at the construction site

## WHAT TO EXPECT IN YOUR SMARTGLASS SHIPMENT?

Packing List
Smartglass Panels
Remote Control (if applicable)
Transformer (s)
Silicon tubes (Qty agreed upon placement of order)
(only Silicon supplied by Smartglass International is permitted to be used on panels)
Any other associated items on your Proforma Invoice

Any missing items must be notified within 12 hours of Smartglass Delivery Arrival, should missing items be notified outside of this then they will be fully chargeable.

## MAINTENANCE

Once the glass is installed, the glazing contractor should make provisions to ensure that glass surfaces are protected from possible damage caused by the construction practices of other trades.

Special care must be taken during the initial cleaning, cleaning during the construction or when surfaces are severly soiled, in order to prevent marking or damage to the glass surface from abrasive contaminants.

In the event that the glass surface becomes heavily contaminated, the glass should be blown down with low pressure air or an electric blower to remove as much contaminant as possible. Any remaining surface contamination should be removed by gently flicking the surface with a soft bristled cleaning/dusting brush. Care must be taken to ensure that any remaining abrasive materials do not become trapped and dragged across the surface.

Once this has been carried out and for routine cleaning the glass surface should be cleaned with a soft IPA wipe and/or a PH neutral, non-abrasive liquid glass cleaner sparingly applied to a lint free, clean soft cloth.

Do not allow any metal or hard parts of the cleaning equipment to have direct contact with the glass surface.

**Remember; Smartglass is an electrical product, never attempt to clean Smartgalss with a wet cloth and bucket or other window cleaning technique which drenches the surface of the glass. This may cause irreparable damage to the produce and will invalidate the warranty.**

Daily maintenance is generally as simple as keeping the Smartglass clean. Regular cleaning with **neutral** materials is recommended for optimum performance. In external windows soapy warm water performs best. Soft coated glass should be cleaned very carefully following the manufacturers own instructions. Use professional glass cleaner or a reputable cleaner.

In addition to keeping the glass clean, it's recommended that **the glass be switched off for roughly 4hrs per day**. It is essential to regularly allow the molecules in the film to return to a state of random arrangement and not become polarized in a rigid position, this keeps the Smartglass functioning at its optimal performance and guarantees the longevity of the product.

**Annual checks:** The client should check that all wiring is in good condition, framing materials are free of any damage and that the transformer and switch are in good visible order. The areas adjoining the Smartglass including walls, ceilings and floors should be checked for structural integrity, excess humidity and temperature. Should any of these items appear unusual the client should immediately notify the original supplier / installer / contractor or Smartglass International.

## TROUBLE SHOOTING

Privacy Solar Smartglass operates at 70-110VAC VAC and 50/60 Hz. Higher voltages and frequency may cause permanent damage.

Electrical service must be performed by a qualified electrician who has read and understood this document.

Switch the power ON. Verify that the Smartglass panel switches. If one or more Smartglass panels are not operating, check the following

1. Check the circuit breaker to verify power. If there is not power from the circuit breaker, reset or replace the circuit breaker.

2. Visually check the condition of all wiring and that connections have not been broken.

3. Check the switch to verify power. If there is no power from the wall switch check the connection or replace the switch.

4. Check input to the power transformer of affected panels to verify power. If there is not input power to the power transformer, check the wiring between the wall switch and the power transformer for damage and continuous current flow.

5. Check output from the power transformer of affected panels to verify power. If there is no output power from the transformer, the fuse may have blown. Replace fuse with the same size and specifications which is available at electronic supply shops such as RS. Each transformer contains a spare fuse inside the protective cover.

## If in any doubt, please contact us to resolve your issue.

# Diamond Switchable Glass Ltd t/a Smartglass International

## Terms & Conditions of Sale

**1. Price**

a. All quotations are valid for a period of 30 days from the date of issue. If subsequent amendments and revisions are put forward, new revised quotations must be produced to supersede the original.

b. All quotations are subject to confirmation in writing by the Diamond Switchable Glass Ltd upon receipt of the order from the Purchaser. Any discrepancies between the quotation and the order will be notified to the client in writing, generally in e-mail format, and the revised price agreed prior to acceptance of the order and receipt of the deposit.

c. All quotations for installation are based on a daily rate that assumes completion of set out with uninterrupted access to site. The installation quotation is also subject to a site survey carried out by a representative of Diamond Switchable Glass Ltd or an approved Smartglass Partner Company

**2. Delivery**

a. Time of delivery shall not be included in the essence of the contract, nor shall the Purchaser have the right to make it such. Whilst every endeavour will be made to adhere to the quoted / agreed delivery date and time for the programme, Diamond Switchable Glass Ltd shall under no circumstances be liable for any costs, including indirect or consequential loss due to delay in delivery, shortages of material, labour or any other cause whatsoever.

**3. Post-Delivery Storage**

a. Smartglass is an electrical product and needs to be stored in appropriate conditions. Immediately following delivery the glass must be stored in a dry, well ventilated place where the temperature does not fall below O degrees C or rise above 50 degrees C. Smartglass must be stored away from water and strong magnetic fields.

**b. The maximum interval between delivery to customer and final installation of Smartglass is 30 days from date of delivery. Failure to install and commission the Smartglass panels within a 30 day period will result in warranty being void. Diamond Switchable Glass Ltd will not accept any responsibility for product malfunction where the interval between delivery and final commissioning exceeds 30 days.**

**4. Payments**

a. All payments shall be made at the time specified within the quotation / contract document. The order value to be paid will be that specified in the face of the contract or calculated in accordance with the formula therein. The amount payable shall not be subject to any discount, Main Contractors Discount (MCD), or set off charges, except with express prior written agreement from Diamond Switchable Glass Ltd.

b. Payments that are not received within 30 days from date of invoice will be subject to the additional charges as set out in the European Communities: "Late Payment in Commercial Actions" Regulations 2002.

**5. Delivery Terms**

a. In the case where goods are exported, or sent by independent freight carrier, whether arranged by Diamond Switchable Glass Ltd, or others, the Purchaser agrees to comply in all respects, with the freight carrier's terms & conditions of carriage for notification of claims, loss, or damage in transit. If damage has occurred, the Purchaser must notify both the freight carrier and Diamond Switchable Glass Ltd immediately and document proof of damage prior to unpacking completely.

**6. Certificate of Conformity**

Diamond Switchable Glass Ltd shall not supply certificates of conformity as standard, unless specifically requested by the Purchaser at the time of placing the order. Diamond Switchable Glass Ltd reserves the right to charge a fee for any certification supplied.

**7. Glass Certification - CE Marking**

All Toughened Glass is produced to BS EN 12150 standards. It has been impact tested by an Independent Test Laboratory in accordance to BS EN 12600 standards.

The Smartglass lamination takes place in a controlled environment and has been independently tested to conform to the EN-ISO 12543-4 standards.

**8. Insurance**

All goods that are purchased from Diamond Switchable Glass Ltd are insured under the Diamond Switchable Glass Ltd Transit Insurance Policy until they are signed for on arrival by the Purchaser.

**9. Retention of Title**

a. The goods shall be at the Purchasers risk from the time of delivery or collection.
b. In spite of delivery being made, ownership of property in the goods shall not pass from Diamond Switchable Glass Ltd to the Purchaser until the contract value has been paid to the full, inclusive of VAT, where applicable.
c. Until ownership of property in the goods passes to the Purchaser in accordance with clause b. (above) the purchaser shall hold the goods and each of them on a fiduciary basis as bailee for Diamond Switchable Glass Ltd.
d. Until such time as property in the goods passes from Diamond Switchable Glass Ltd, the Purchaser shall, upon request, deliver up such of the goods as have not ceased to be in existence or resold, to Diamond Switchable Glass Ltd. If the Purchaser fails to do so, Diamond Switchable Glass Ltd may enter upon any premises owned, occupied or controlled by the Purchaser, where the goods are situated, and repossess the goods.
e. The Purchaser shall promptly deliver the prescribed particulars of this contract to the Registrar in accordance with the companies act. Without prejudice to the other rights of Diamond Switchable Glass Ltd, if the Purchaser fails to do so, all sums whatever owing to the Purchaser, and Diamond Switchable Glass Ltd shall forthwith become due and payable.

**10. Jurisdiction & Liability**

a. The Purchaser accepts that any claim in respect of this or any contract, claim, action or dispute resolution with Diamond Switchable Glass Ltd, shall be governed by the jurisdiction of the courts of the Republic of Ireland.
b. In the event of a failure of the glass, the maximum that Diamond Switchable Glass Ltd may be liable for is the gross sale price less the VAT. They will in no way be held liable for any consequential loss as a result of the product malfunction.

**11. Subsequent Orders**

The Purchaser agrees that these conditions of sale shall bind any subsequent orders and business with Diamond Switchable Glass Ltd unless expressly excluded or varied in writing by Diamond Switchable Glass Ltd.

**12. Free Issue Materials**

Diamond Switchable Glass Ltd will not accept liability for damage / breakage of free issue glass or other materials supplied by the Purchaser. The Purchaser will issue all replacement materials free of charge when requested.

**13. Condition of Supplied Panels**

a. **It should be noted that Privacy Smartglass is NOT as optically clear as normal float glass and that there will always be an element of haze within the switchable glass panel. This will not be considered a fault or constitute reason for return or refund. It should also be noted that ambient lighting conditions will have an effect on visible haze and that direct lighting onto the switchable glass panel should be avoided as this will accentuate the haze level; as will viewing the switchable glass from an oblique angle. To minimise the appearance of haze a tinted glass (bronze, green, blue, grey) can be used instead of clear glass. It is important to be aware that SMARTGLASS SOLAR and BLACK-OUT products have a blue tint in the transparent state. This occurs due to the chemistry of the switching molecules. Potential purchasers of these products need to consider this before placing orders.**

b. Diamond Switchable Glass Ltd promises that all products will be sold of merchantable quality, fit for purpose and as described. Caveat emptor, the purchaser is responsible for ensuring that the goods they are purchasing are the goods that they expect to receive.

c. Diamond Switchable Glass's ***Privacv Smartglass™*** panels will have a clear border from the edge of the glass to the switchable area of up to 5mm in width on the long edges, 10mm on the short edges and 15mm on the bus bar edge, this will always remain in the clear state with power on or off. This is the industry standard and will not merit cause for rejection.

d. Diamond Switchable Glass's ***Solar Smartglass™*** & ***Blackout Smartglass™*** panels will have a painted frit border of 20mm around three edges with a 30mm border on the busbar edge.

e. During any inspection for clarity of the switchable glass panels, the distance between the eyes of the inspector and the film should be 1000mm. The angle of the glass surface and the eyes of the inspector should be 90° (+ / - 10°). At inspection, the ambient brightness of the environment should be 300-500 Lux and the visible spectrum range should be between 400nm-700nm.

f. **Permissible spot or scratch defects in the vision area:** Visual imperfections will only be considered as unacceptable when visible from a distance equal to or greater than 2 metres from the surface of the glass.

Any defect less than or equal to 1.0mm is permitted

g. **Wave distortion or rippling effects:** In certain lighting conditions and environmental surroundings a wave pattern may be observed in items reflected in the switchable glass. This can occur in either the on or off states. The visual clarity of items viewed **through** the glass is unaffected and it is not considered a fault.

**14. Silicone**

All acidic and many neutral-based silicones are extremely hazardous to switchable glass products and can cause de-lamination and irreversible damage. In any instance that silicone is to be used; only the Diamond Switchable Glass Ltd Approved Silicone that has been expressly specified for use by Diamond Switchable Glass Ltd in conjunction with its switchable glass product may be used. The use of any other silicone will invalidate the warranty and may cause harm to the switchable glass panels.

**15. Installation / Fixings**

a. Any installation carried out by Diamond Switchable Glass Ltd does not include the final electrical connections made to the mains 22O/24OV power supply. This must be supplied by a fully-qualified electrician that is appointed by the Purchaser.

b. Diamond Switchable Glass's switchable panels can be fitted into UPVC, Steel, Aluminium or Timber frames. Where switchable panels are fitted into timber frames, the section of this frame must be formally approved by Diamond Switchable Glass Ltd prior to installation, or the warranty may be invalidated. All Joinery and framework that Diamond Switchable Glass's switchable panels are installed into must meet the GGF Official Standards. Failure to meet these standards may result in the invalidation of the warranty.

c. Where door mechanisms / fixings such as door handles, pivots, strike boxes, locks etc. are to be fitted to the Smartglass panels, care should be taken when fitting, as any excessive pressure will cause irreversible damage around the fixing area such as de- lamination or clearing of the liquid crystal. In these circumstances, this will not be covered by the Diamond Switchable Glass Ltd warranty unless expressly approved prior to installation.

## 16. Operations and Maintenance

a. Smartglass International's switchable glass panels are designed to be switched on and off regularly. Diamond Switchable Glass Ltd recommends that panels be **LEFT IN THE OFF POSITION FOR AT LEAST 6 HRS/DAY** (i.e. no current going through the panel). Failure to do so may affect performance and invalidate the warranty.
   This point is application / useage dependent and the final product construction also needs to be taken into consideration. Should this be of a concern please contact your local representative to discuss in further detail.
b. Once installed correctly, maintenance of the Diamond Switchable Glass Ltd switchable is similar to any glazing solution. Regular cleaning is advised to keep the glass operating at its optimum clarity.
c. It is recommended that all consumable items (i.e. the power transformer, the remote control switch and receiver etc.) are checked annually and serviced if there is any fault to be found.

## 17. Warranty

a. In the event that the materials supplied by Diamond Switchable Glass Ltd develop a fault which is considered to be due to bad workmanship or material fault within the warranty period, Diamond Switchable Glass Ltd will repair or replace at their discretion, such items to the original supply specification. Diamond Switchable Glass Ltd will not be held responsible or accept any costs incurred by others which are associated with access, removal or replacement of the goods.
b. Due to the manufacturing techniques and materials used, each batch of PDLC is manufactured individually. If a Smartglass panel is replaced under warranty supply it may be possible that the new product may have a difference in appearance. This could be in both the 'on' and 'off' states of operation in comparison to the original panels supplied on the project. This is not considered a fault of Diamond Switchable Glass Ltd and as such not a reason for further rejection and replacements.
c. Spontaneous Glass breakage following receipt and acceptance of Smartglass Delivery is not covered by any warranty
d. Where glass is replaced under warranty only the period remaining from the original warranty applies to the replacement glass.
e. Please see Diamond Switchable Glass Warranty Document for further information.

## 18. Product Data

The Smartglass Handbook which is available upon request from our office, or available for viewing on our web-site, should always be reviewed by the customer for specific instructions on the products.

## 19. Design

Diamond Switchable Glass Ltd reserves the right to modify the design/ materials of its products at any given time with just cause without notification to the client beforehand. While all efforts will be made to keep customers fully up-to-date of any changes to the production, this will not give the client any right of complaint.

## 20. Tolerances

A bending/bowing tolerance of up to 3mm per meter in glass length is accepted as being within tolerance and will not be cause for rejection or be considered as defective.

## 21. Force Majeure

Diamond Switchable Glass Ltd shall not be liable or deemed to be in breach of any agreement by reason of any delay in performing any of its obligations of these terms and conditions if the said delay is due to Force Majeure or any causes beyond the reasonable control of Diamond Switchable Glass Ltd.

**22.Termination/ Cancellation**

Any order received and accepted by Diamond Switchable Glass Ltd cannot be cancelled by the Purchaser, unless agreed in writing by Diamond Switchable Glass Ltd on the condition that the Purchaser indemnifies Diamond Switchable Glass Ltd, in full against all costs, losses, expenses, damages or charges incurred as a result of the cancellation.

**23.Intellectual Property**

The Purchaser shall indemnify Diamond Switchable Glass Ltd against any loss, costs, damages, charges and expenses incurred as a direct result of the work infringing the rights of any third party.

**I have received, read and accepted the terms and conditions for supply of Switchable Smartglass from Diamond Switchable Glass Ltd t/a Smartglass International**

**Signed** ……

**Name (Block Capitals)** ……

**Position** ……

**Company Name** ……

**Date** ……

## WARRANTIES

Smartglass International warrants that the physically tangible hardware products delivered should be free from defects in materials and workmanship, assuming normal use, for a period of five years from the date of invoice unless otherwise specified.

Smartglass International's sole obligation and clients sole remedy in the event of breach of warranty is to repair or replace the defective products. The distributor/customer should promptly notify Smartglass International of any defect in products delivered there under, and upon obtaining a return authorisation should ship the defective goods to Smartglass International for analysis unless otherwise agreed.

Smartglass International will bear the expense to repair or replace the products supplied but will not accept any costs incurred by others which are associated with, access, removal or replacement / installation of the goods.

Smartglass International is not responsible for products damaged by external events such as, but not limited to catastrophe, incorrect silicone use, improper use, or maintenance or use of unauthorised parts.

The installer shall warrant for five years the satisfactory performance of the window or partition installation which includes window, framing, glass glazing, anchorage, and electrical work as detailed by the specifications and approved drawings.

Consumable items, such as, but not limited to, transformers, remote control switches or any other type of switches will be warranted for a period of 2 years from the date of dispatch. In the event any of these items require replacement, these will be issued from Smartglass International as Free Issue for installation by others. Note: this does not include for replacement items such as fuses.

It should be noted that there will always be an element of haze within the Smartglass. This will not be considered or constitute reason for return or refund.

"Unexplained" glass breakage may occur after all precautions have been taken. Such breakage is beyond the control of the manufacturer and therefore not warrantable. This includes but is not limited to the following items

- Thermal stress
- Glazing system pressures
- Damage during glazing by others
- Handling and storage problems
- Excessive wind loads
- Objects and debris striking the glass
- Damage by persons/objects at the construction site

## CE COMPLIANCE

smartglass

We Norbridge Developments Ltd t/a Smartglass International of Lebrocquy Ave, Park West, Dublin 12, Ireland provide the following conformity statement for:

**Product Code: 101/223**

**Name: Privacy SmartGlass**

CE

**Product Type: Electrically Switched Privacy Glass**

In line with the EC Directive
89/106/EC
And in line with and meets the standards listed below.

- IEC/EN-952
  Glass for Glazing
- IEC/EN- 6262/6206/6180/5516
  Safety Glazing (Where Applicable)
- IEC/EN 60529:1992 IPX7
  Temporary Immersion
- IEC/EN 12600 1B1
  Glass In Building Pendulum Test
- IEC/EN 12150 Part 1
  Glass in Building Fragmentation Test
- IEC/EN 1279
  Hermetically sealed flat Insulating Glass Units (Where Applicable)
- IEC/EN 476
  Fire Resistance (Where Applicable)
- IEC/EN 1863
  Heat Strengthened Glass (Where applicable)
- IEC/EN 14449
  Laminated Glass and Laminated Safety Glass

**CE:12**