INNOPTEC

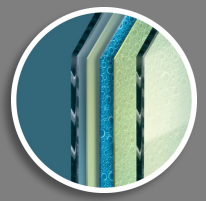
INNOVATIVE OPTICAL TECHNOLOGIES

REVERSE MODE film

for Glass Lamination

ENGLISH

RM LPF | Reverse Mode Laminated PET Film[General specifications - V. [01-01]



Cut-to-size sheets
Technical and overall specs

LPF Film | Liquid Crystal Electro-optical Film
REVERSE MODE FILM
Product Specifications for Construction Industry

ENGLISH RM LPF | Reverse Mode Laminated PET Film[General specifications - V. [01-01]

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Chapter 1

Construction Parameters

The film consists of **two outer layer of polyester film (PET)**, coated on the inside surfaces with a transparent conductive layer. A layer of **REVERSE-PDLC** is sandwiched between the two PET film supports.

Total Thickness
270 (+/-10) µm

Dimensions:	
Maximum Width of the active area	Up to 1450 mm*
Length of the active area	as standard from 1000 to 3000 mm

Shrinkage value post glass lamination at 115°C:

- Film width 1200mm: Lenght (<0,1%) – Width (<0,1%)

Copper busbar tape could be subjected to light wavy effect after glass lamination in oven.

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Chapter 2

Electro-optical Properties (20°C) – Average values

Off-state – Transparent State	
Total transmission	88% (+/- 5%)
Direct transmission (1° collecting angle)	80%
Haze	10%
Off-axis haze (45°)	10%

On-state (60 V AC, 50 Hz, sine wave) – Opaque state	
Total transmission	60% (+/- 5%)
Direct transmission (1° collecting angle)	5%
Haze	92%
Power Consumption	3 - 5 W/m^2

Response Times	< 0,5 sec

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Chapter 3

Operative ranges

Operating Voltage
45-60Vac (50-60 Hz, sine wave) Max: 65Vac (50-60Hz, sine wave)

Use Temperature Range
from -10° to +60 °C

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Chapter 4

Electrical bus bar application

Standard application

Electrical bus bars are placed along sheet edges of the panels.
Sketch list of possible bus bar layout is reported on next page.

Innoptec will propose you the most appropriate set up in terms of effectiveness and safety.

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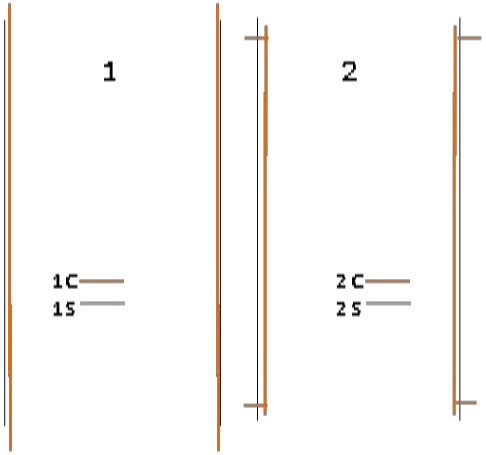
Technical and overall specs

Busbar sketch list 1/3

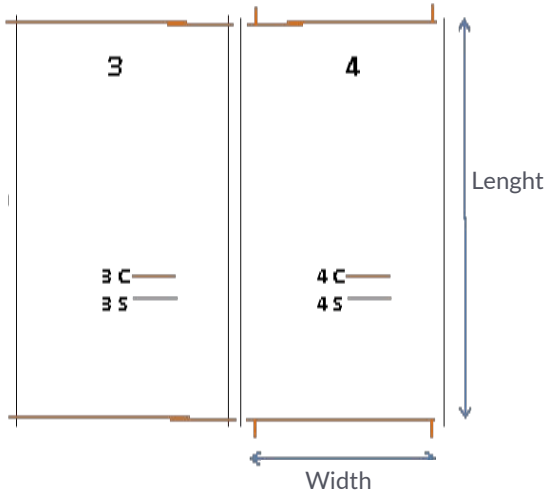
Busbars can be realized in two different tape colors

Copper — or Tinned copper

On both long edges
Max lenght =
5000 mm



On both short edges
Max lenght =
3200 mm



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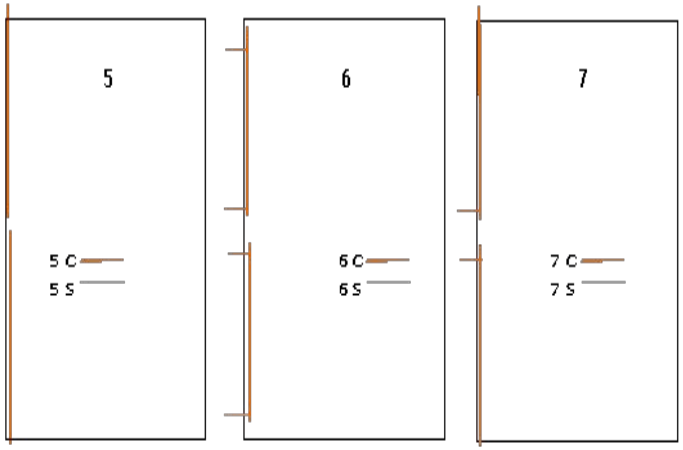
Technical and overall specs

Busbar sketch list 2/3

On one long edge
Max lenght = 2700 mm



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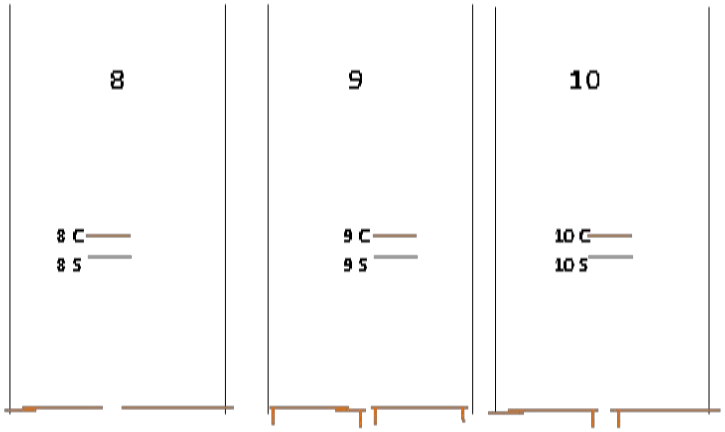
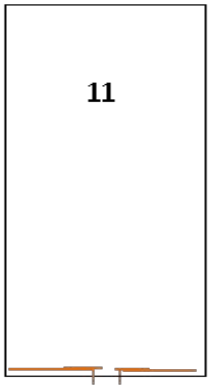
Technical and overall specs

Busbar sketch list 3/3

On one short edge
Max lenght = 2700 mm



For A3/A4 samples



Note:

- Copper busbar tape on long edges of nHS film could be subjected to light wavy effect after glass lamination in oven.

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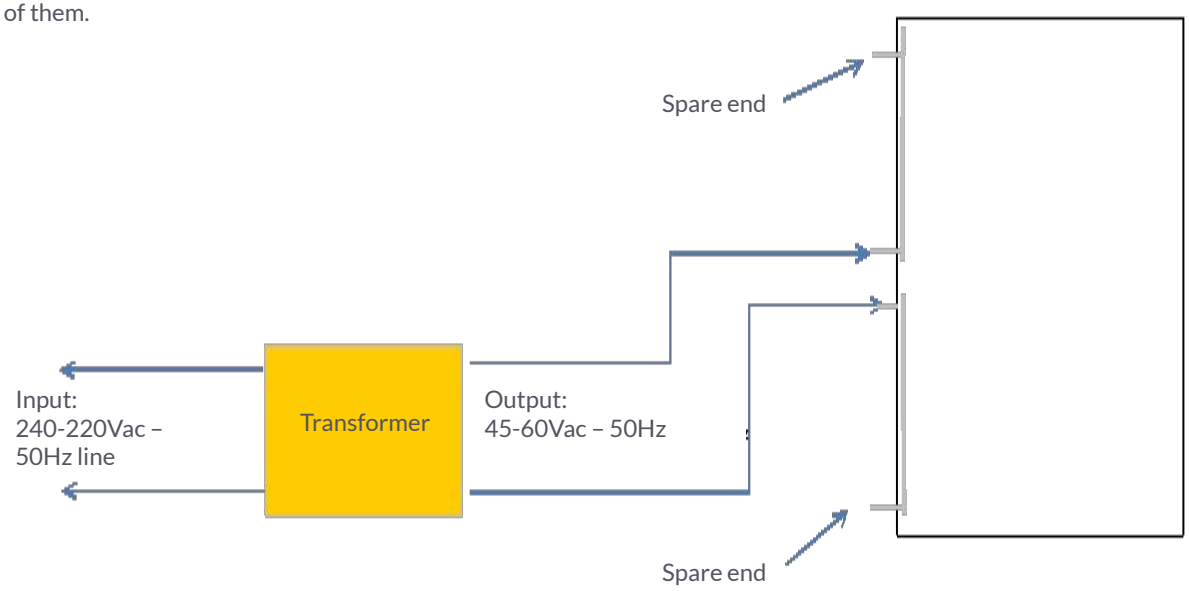
Technical and overall specs

Wiring diagram examples 1/2

Each busbar has two ends.
Wire can be joined on only on one of them.
The other one end is a spare end.



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Technical and overall specs

Wiring diagram examples 2/2

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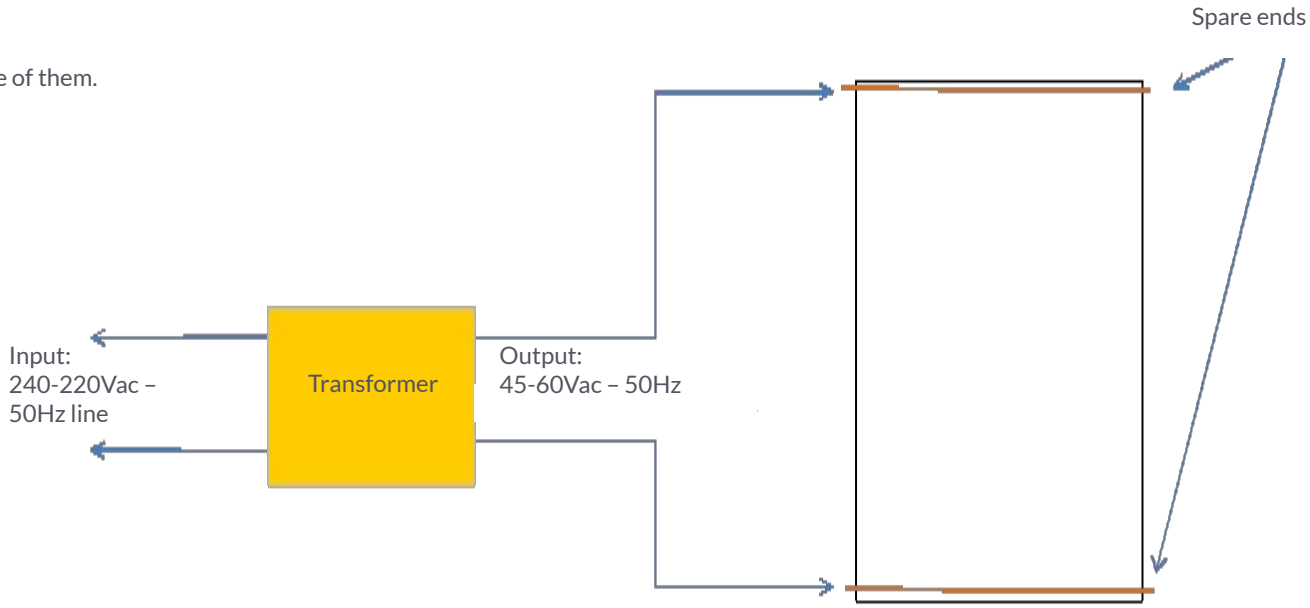

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Technical and overall specs 1/3

Innoptec manufactures a LPF/PDLC electro-optical film to be used in the architectural field (for interior, or slightly exposed positions if not protected). Please refer to Innoptec for advice in case of exterior use; used in Insulating Glass only if very experienced laminators are involved and having the switchable laminated glass as inside pane of the Insulating Glass Unit. All film is preliminary electrically tested before shipment.

1_Product supply conditions

Dimensions
The standars film width available in Innoptec is 1450mm.

Innoptec carries sufficient inventory for quick deliveries. Sheets with smaller width with respect to above standards, could have slightly higher quotation.

Quality release limits
Inspection conditions:
- **Distance** = 1 m - perpendicular view
- **Back Lighting:** 300 – 500 Lux / white light (400-700 nm)
- **Inspection time:** 10 seconds per sqm.

Single spots smaller than 1 mm are considered acceptable.
Other optical non uniformities are not considered defective if they result invisible at above inspecting conditions.

Electrical connections
(bus bars) are obtained by cutting sheets to the right size and subsequent bus bars application. The price of this work is included in the invoiced surface. Sheets cut to particular rectangular or other shapes , with or without bus-bars, can also be supplied on request, at a case by case pricing.

Voltage Drivers/Transformers
The Innoptec LPF film works at 60 or 45Vac/50Hz.
We can supply many transformers based on the square meters required (to be referred to EU area, made according European standards (CE) and to be used where the voltage line is 220-230Vac-50Hz sine wave).
Different voltage driving solutions are also available on request (remote control – dimming - etc.).

Voltage drivers TDS available on request

Note
1. Voltage Stabilizer (UPS systems): All the voltage systems must be protected with an UPS system in order to avoid sudden voltage variations.
2. The voltage input to voltage systems must have a DC component lower than 1 Volt.

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Technical and overall specs 2/3

2_Notes for processing and manipulation

- Masking film removal should be made with care and in dust-free environment.
- The removal should be made by slowly peeling off the masking film starting from a corner.
- ⚠ **Note:** Do not remove the transparent protective tape present on the copper of the busbars applied to the film.
- Max temperature for glass lamination is 115°C
- **Allowed interlayers for glass laminating process** are PU or EVA or Ionomeric sheets. PVB is to be used after preliminary validation test.

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Technical and overall specs 3/3

3_Warranty

- **After lamination:** In case of demonstrated failure of Innoptec Switchable film after lamination, latest within two years from delivery date, the maximum compensation will be free of charge replacement of the area of lost film.
  Black spots (caused by short circuit) appearing after lamination will not be considered Innoptec failure, as film is 100% electrically controlled before shipment. Innoptec warns laminators to use adhesive interlayers not containing migrating plasticizers as they may cause the film to become clear and therefore not anymore capable of switching. PVB is to be used after preliminary validation test.
- **After installation:** Considering that framing, installation, on site electrical wiring are not under its control, Innoptec is in principle not available to consider warranty on Product framed and/or or installed in the field.

- Unproper framing may pinch the laminate, bend it due to not planar frames, causing switchable film detachements or delaminations. Innoptec furthermore wants to stress that Buyer should inform customers not to use adhesives and sealants containing migrating, low molecular weight components (like plasticizers, liquid stabilizers, residual solvents, monomers) and to avoid contacts with oils and greases as they will, sometime after lamination or laminated glass sealing, damage the liquid crystal compound, resulting in clear spots and loss of switching capability in the damaged area.

- Oily wood frames should be protected by a reactive paint (Polyurethane or Epoxy) to prevent oils or rosins to migrate into the switchable film.

Usable neutral sealant
Among neutral sealants Innoptec customers experienced good results by using:

- Alcosil by Zucchini
- 791T by Dow Corning

Sealant for insulating glass unit: Dow Corning 3793 Black

ALCOSIL (by Zucchini) - 791T (by Dow Corning)

Low modulus neutral silicone sealants. High movement accomodation and good adhesion onto most of
building materials, glass, metals, painted surfaces, marble, clean concrete. Excellent weather resistance as well as to sunlight in a wide temperature range.

- **Applications:** Suitable for glazing windows, skylights, curtainwalls, for perimeter joints of door and window frames made of metal, PVC and wood
- **Packaging:** Cartridge 310 ml
- **Colours:** Translucent – White

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Safety Information

IMPORTANT: Please read these instructions fully before installing or operating

IMPORTANT: Installation must be made by qualified personnel.

IMPORTANT: Innoptec liquid crystal film must be driven with CE marked transformers with a maximum output voltage of 60Vac.

All Innoptec transformers have the following safety features:

- Short-circuit and Overload protection
- Insulation **Class II**
- **CE** Mark
  - 2006/95/CE – (LVD) LOW VOLTAGE DIRECTIVE of 12/12/2006
  - 2004/108/CE – (EMC) ELECTRO MAGNETIC COMPATIBILITY
  - 2006/42/CE – MACHINE SAFETY

Furthermore, they comply with the following directives:

• EN 61558-1	Safety of transformers, reactors, power supply units and combinations.
• EN 61558-2-4	Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers for general applications.

- Wiring and electrical connections must be made by qualified personnel according the local regulations.
- Periodically check the good condition of the cables and connections.
- Use only neutral silicone sealants.
- Keep a safety distance of 2-3mm from the edge of the film to the edge of glass.
- Do not use water or liquids with solvent on the liquid crystal film.
- Before cleaning, unplug main power of transformer.
- We recommend placing the electrical connections on the upper side of the glass.
- Be sure that the INPUT voltage correspond exactly to the specifications given on the supplied power supply units.
- Provide appropriate ventilation to power supply units.

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Warnings and general disclaimer

Above indications represent the best result of **Innoptec** experience in the field of its Switchable film use and of Innoptec lab experimental activity. It is not Innoptec responsibility to decide the film processing conditions and final use practices and setup in order to obtain the best result. Anyhow Innoptec is available to make its experience available to customers facing specific cases and problems.

Furthemore is Buyer responsibility to check whether the use of the Switchable film abides by any safety regulation prevailing in any country where it will be installed alone or in combination with other materials. It is also Buyer responsibility to ascertain whether the application or design of final goods containing the Innoptec Switchable film may infringe third parties rights covered by patents, trademarks and any other type of intellectual property.

By signing order confirmations Buyers of **Innoptec** film keep the same harmless of possible claims and indemnification requests raised by persons or organizations in connection of above Buyer responsibilities.

On receiving the film:

1. Inspect carefully the packages before accepting them: if there is a damage, even if it appears as a minor scratch, or detached tapes, or lack of label and/or accompanying documents, refuse the delivery or accept it with reserve to ask for damages. Take good quality pictures. In case of delivery refusal drop immediately the claim with the forwarder. Report the case, with pictures, to Innoptec within the same dates as above.
2. If delivery has been accepted, open carefully and check for internal damages: in case of damages to the goods, send immediately a fax or email with good quality pictures to the forwarder with reference to the acceptance reserve. All claims have to be completed latest within one week after refusal or accepted delivery.
3. Innoptec will not accept any claim for any damages to the film after masking film removal.

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