

Glass Inspector

Products catalog

Artificial Vision System for
Glass Quality Control

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What is Glass Inspector® and how does it work?

Defects in flat glass, whether they are origin defects (such as bubbles or inclusions) or production defects (such as scratches, spots or coating defects, are a problem that is usually detected too late during the manufacturing process.

Glass Inspector® with proper lighting and processing, performs an **online inspection of glass pieces**, detecting defects without interrupting manufacturing. With this information, we ensure that defective glass does not continue in the production process and thus the costs derived from these defects are minimized.

Glass Inspector® **points out the defect directly onto the glass**, this helps the operator to make a quick decision: correct the defect or remove the defective piece of glass.

Technical characteristics:

- Maximum line speed: **40 m/min (131 ft/min)**
- Maximum resolution: **0.04 mm²/pixel** (0.000062 in²/pixel)(*)
- Maximum glass dimensions: no limit.
- Detectable defects: **bubbles, inclusions, scratches, stains, layer defects, fingerprints, water drops**, etc.

(*) The minimum detectable defects depend on the type of defect, the minimum resolution and the type of lighting applied.

Ease of integration:

Glass Inspector® integrates easily into any horizontal or vertical manufacturing line. You do not need to modify any element and it does not occupy any space at the back of the manufacturing lines.

Complete solution: Detection and signaling directly on the glass

Glass Inspector® is a complete solution for detecting and signaling of defects. Thanks to the patented Smart Pointer System (**Patent P201030605**), the operator quickly and easily locates the defect and decides whether to intervene to correct it or dispose the defective piece.

Glass Inspector® includes a **traceability system** that can be linked to a bar-code reader.

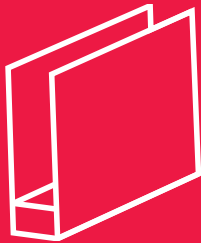
Personalized service:

Glass Inspector® is configured according to the requirements and specifications of each installation, each manufacturing line and each client.

Please contact the technical and commercial team of Glass Inspector for a personalized project.

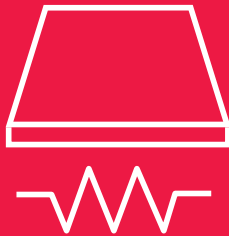
PRODUCTS

Glass Inspector® is intended for use in the manufacture of double glazing, tempered glass, laminated glass and glass for photovoltaic applications.



VERTICAL Glass Inspector

Due to its ease of installation, it can be placed in any existing insulating glass production line or in a new one. The **Vertical Glass Inspector**® can also be installed on any vertical line of flat glass manufacturing such as CNC edgers and drills.



HORIZONTAL Glass Inspector

Horizontal Glass Inspector® has been designed to be installed on laminated glass manufacturing lines. After the detection of a defect, the Horizontal Glass Inspector makes it easier for the operators to identify it and to decide the type of intervention to be carried out. The system records the images of 100% of the pieces.



Glass Inspector 4D

Due to its ease of installation, it can be installed in any existing tempered glass oven or in a new one. The **Glass Inspector 4D**® analyzes and measures: optical distortion, anisotropy, flatness and the presence of white haze.



VERTICAL GLASS INSPECTOR®

Vertical Glass Inspector® is designed to be integrated into:

- Double glazing manufacturing lines.
- Vertical glass machining lines.

100% Quality Control: The main function of the Vertical Glass Inspector is the real-time quality control of all processed glass, including both inspection (passed/failed) and interface with the operator to facilitate the making decision: correct the defect or remove the defective piece of glass.

Essential complement for automation: The manufacturing lines in a glass processing plant are becoming more automatic and faster. Therefore, it is necessary to incorporate artificial vision equipment that enables manufacturing not to stop except for the strict necessary time when the Glass Inspector detects a possible problem. System reliability and future access to pieces of glass images for traceability depend on the Glass Inspector.

Smart Pointer Patent: Glass Inspector has patented the defect position signaling system since 2010 (**Patent ES2388631**). With the help of two arrays of polychromatic LEDs, it is very simple and intuitive to check the defects detected and thus make the most appropriate decision.

Interface and warning: Glass Inspector artificial vision systems incorporate an user interface where it is very quick to identify the magnitude of a defect. The three main magnitudes are: contrast, dimension and area. These magnitudes are presented in the user interface, as well as an image of the defect found, with the lighting with which it was detected.

TYPES OF ILLUMINATIONS:

GIMASTER detects defects using two types of lighting:

- **Dark-field** lighting
- **Diffused back-light** lighting

With these two illuminations, all the most common types of defects are detected: stains, scratches, bubbles, inclusions, fingerprints, dust, other adhesives, etc.

Glass Inspector Master is designed to be integrated into manufacturing lines of double glazing, tempered glass, laminated glass and glass for photovoltaic applications.

GI PREMIUM incorporates a third lighting:

- **Reflex** lighting

With reflex lighting we can detect layer defects in low emissive glass and low emissive glass with solar control.

DIMENSIONS, RESOLUTION AND SPEED

Necessary space: 3 cm (1.18 in).

Maximum dimension: 3.21 m (10,53 ft).

Resolution: 0.04 mm²/pixel (0.000062 in²/pixel) (*)

Speed: 40 m/min (131 ft/min) (*)

(*) It can be manufactured with higher speeds or lower resolutions. Please contact our commercial team for further information.

HORIZONTAL GLASS INSPECTOR®

Horizontal Glass Inspector® is designed to be integrated into

- Laminated glass manufacturing lines.
- Glass screen printing lines.

100% Quality Control: The main function of the Horizontal Glass Inspector is the real-time quality control of all processed glass, including both inspection (passed/failed) and interface with the operator to facilitate the making decision: correct the defect or remove the defective piece of glass.

Essential complement for automation: The manufacturing lines in a glass processing plant are becoming more automatic and faster. Therefore, it is necessary to incorporate artificial vision equipment that enables manufacturing not to stop except for the strict necessary time when the Glass Inspector detects a possible problem. System reliability and future access to pieces of glass images for traceability depend on the Glass Inspector.

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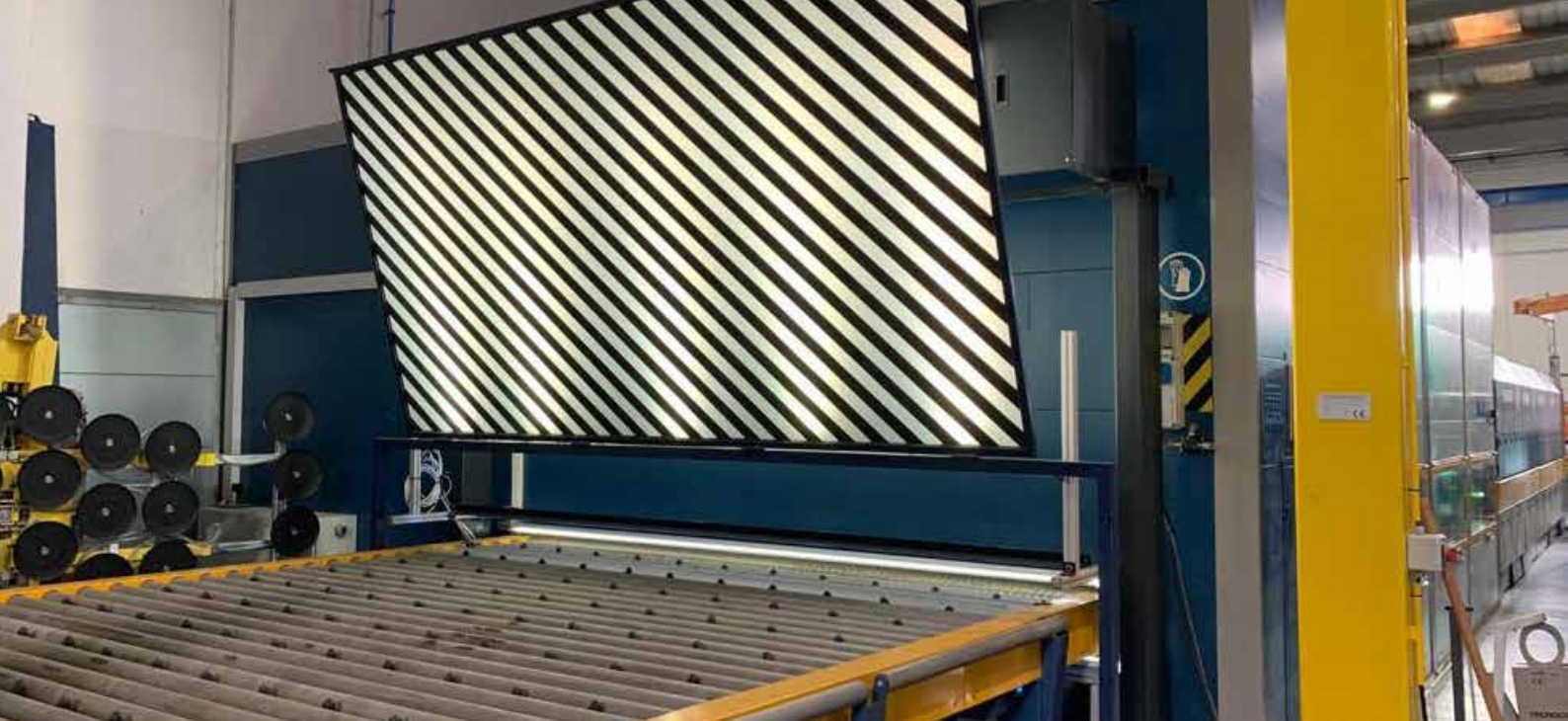
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GLASS INSPECTOR 4D®

Glass Inspector 4D detects and measures the following 4 defects that occur during glass tempering process:

White haze:

When certain parts of the glass lean against the rollers more than others while it is being tempered, microcracks appear in the glass. These microcracks look like a diffuse shadow called "White haze".

With a darkfield lighting it is possible to highlight those defects that are seen with a dark background when they are illuminated intensely. The image is shown on the screen with increased contrast so that the operator can easily see both the dirt and the "white haze".

Iridescence/Anisotropy:

Iridescence or "leopard spots" occur due to the anisotropy of the glass.

Through the appropriate combination of polarizing and retarding filters, an image of the glass is taken where each level of anisotropy is represented by a color. The unit of measurement is nanometer and the system is designed taking compliance with the **C1901-21** standard as a criterion.

The system is calibrated using standards of known anisotropy.

Optical distortion:

By comparison with patterns of the reflected image, the optical distortion produced by lack of flatness in the glass is measured. The result is given in diopters (a diopter is the distortion created by a

radius of curvature of one meter). The resolution of the system is 0.002 diopters.

Flatness:

Glass Inspector 4D makes a 3D reconstruction of the glass. The result is the depth of the valleys generated in the rollers ("rollerwave"). The precision in short sections is 0.1 mm.

Adaptation to the Standard:

Glass Inspector 4D has the flexibility to adapt tolerances to existing or future standards.

Report generation:

Reports are automatically generated and saved on disk. They can be integrated with manufacturing software directly by date and by manufacturing time or enter the unique barcode identifier of each piece of glass.



Anisotropy
control

Detectable defects at working speed

Glass surface contamination

Defects on the glass surface can be removed by proper cleaning.



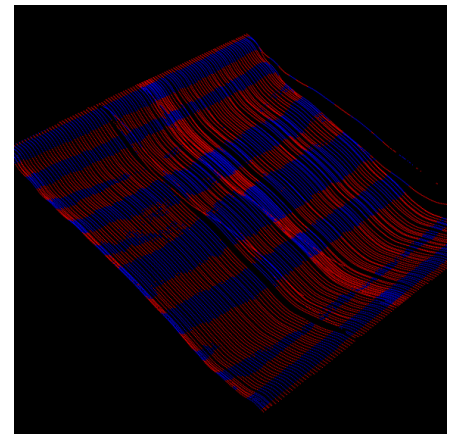
Damaged glass surface

Physical damage on the glass surface is mainly caused by its handling in the factory (cutting tables, edgers, etc.).



Interior glass defects

The defects found inside the glass have not been caused by handling (bubbles, inclusions, etc.)



Layer glass defects

Damage or defects in the glass layers are difficult to detect without the help of artificial vision equipment.



Anisotropy, Distortion, Planimetry, White haze

The tempering process produces observable and measurable optical effects under certain conditions.

GLASS INSPECTOR CLOUD: We have designed a service for traceability of the analyzed glass. Glass Inspector Cloud is a web service in the cloud that allows you to store, query and process images and data captured by Glass Inspector in the different lines that each company has.



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