ACELABS
SYNCRO GROUP

In **partnership** with
CUGHER

PQVS

Print Quality Vision System

PQVS is an automated system for verifying print quality on glass, suitable for both screen printing and digital printing. It is designed for use in automotive, home appliance, and architectural applications but can also be utilized to ensure print quality on other rigid materials, both transparent and opaque, such as polycarbonate or aluminum.

OPERATING PRINCIPLE

PQVS employs ultra-high-resolution linear cameras capable of capturing images of the print with exceptional detail. The system is also equipped with a set of illuminators specifically designed for optimal defect detection.

MAIN FEATURES

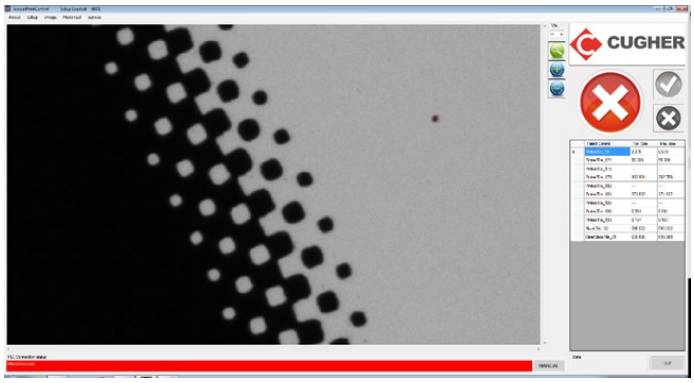
INSTALLATION

The system can be installed at the center of the precision conveyor, provided there is adequate open space to accommodate the cameras and illuminator. The system is offered in four standard sizes commonly used by automotive glass manufacturers: 1000 mm (for sidelites lines or home appliance), 1300 mm (for backlites lines), 2000 mm (for standard windshields lines), and 2600 mm (for large windshields lines). Custom sizes are also available upon request. Typically, the glass is positioned with the long edge leading.

RESOLUTION

The system offers a resolution of 80µm (300 DPI) @2600mm and can accurately verify the quality of the design, detecting circular dots as small as 0.15 mm². It is capable of identifying any “slavering” or “widening” of design details caused by excess ink from the screen. The system can also detect issues such as faded dots, pinholes, or missing parts of the design, promptly alerting the operator to investigate potential causes, such as insufficient ink, dried ink on the screen, or other related issues.

Different sensitivity zones can be defined across the entire glass surface, allowing for higher sensitivity settings in specific areas such as logos, barcodes, and other critical elements. All regions of the glass will be inspected and compared against the tolerances specified in the glass inspection recipe.



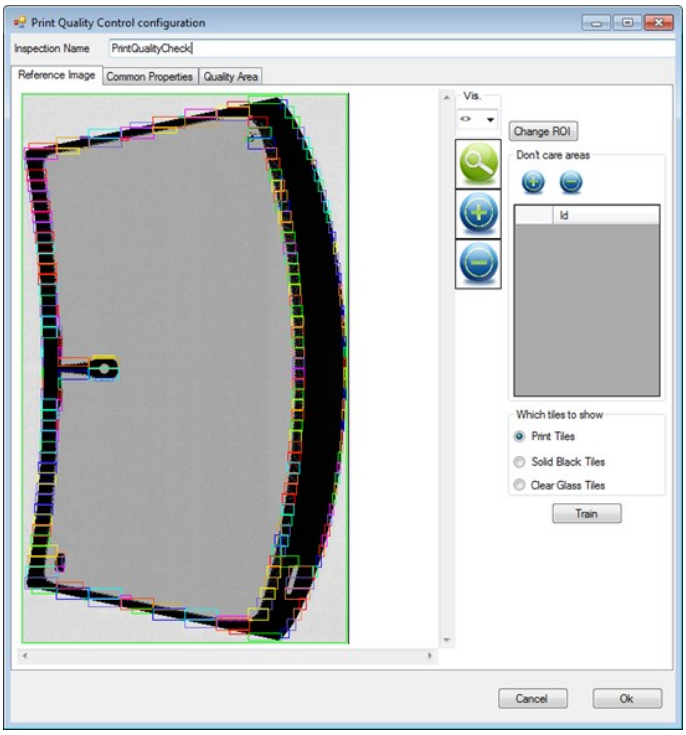
The proposed solution involves the use of two high-resolution monochromatic linear cameras, each with 16,384 pixels. These digital cameras scan the printed glass line by line as it moves along the conveyor. The complete image of the glass can be captured in just 0.6 seconds, depending on the conveyor’s speed.

An innovative lighting system is strategically positioned to ensure optimal lighting conditions for the cameras, enhancing image quality and accuracy.

Another optional metrological control for measuring the print-to-edge distance on rectangular glass is available. This option requires the addition of two cameras positioned vertically along the edge parallel to the direction of movement, controlled by an axis.

With this option, highly precise measurements can be performed, often required by end customers, to determine the exact position of the print relative to the edge of the glass.

MAIN FEATURES



Training an inspection setup involves configuring the print quality control after generating the overall model of the glass. The glass surface is automatically divided into small sections based on the detected patterns, which include printed designs, solid black areas, and clear glass regions.

AUTOMATION AND REJECTED PARTS MANAGEMENT

The system can verify the print's position relative to the glass edges by measuring specific points, allowing it to perform corrective actions. It can automatically send signals back to the printing machine to adjust the screen position as needed. This feature enables automatic, limited screen adjustments based on an optimal print alignment.

Additionally, the software can communicate with the printing machine's PLC, sending predefined signals to activate specific functions.

Depending on the line configuration, rejected parts can either be sent directly to manual inspection for further verification or to a dedicated stacker designed to hold rejected items for later review. At the end of the production batch, the operator can retrieve the parts from the stacker and inspect them individually.

Faulty areas and the acquired image can be displayed on a large 42” high-resolution monitor (optional). The good glass image, used during the recipe creation phase, can be overlaid for comparison. The operator can navigate across the entire glass surface and, if necessary, zoom in on selected areas to analyze image details.

INSPECTION RECIPE AND CONTROLS

Once an image is captured, it is analyzed using a specially designed inspection recipe that is created during an initial setup. This setup is based on a reference image, which serves as a "master" for comparison. The reference image can be generated either from a physical sample of a "good" glass or from the digital file (in raster or vector format) used to produce the printing screen. The image processing is managed by a dedicated computer system.

During this process, you can define various defect thresholds that determine if the glass will be accepted or rejected. The system automatically divides the reference glass image into specific areas such as 'Near Border,' 'Dot Printing,' 'Black,' and 'Clear Glass.' For each of these areas, the operator can set different defect tolerance levels, allowing for precise quality control tailored to different parts of the glass.

Additionally, with an optional software package, you can activate special inspection controls for specific features. These include:

Fiducial Marks: Ensuring accurate alignment during subsequent processes.

Special Symbols: Checking for the correct placement and appearance of custom symbols.

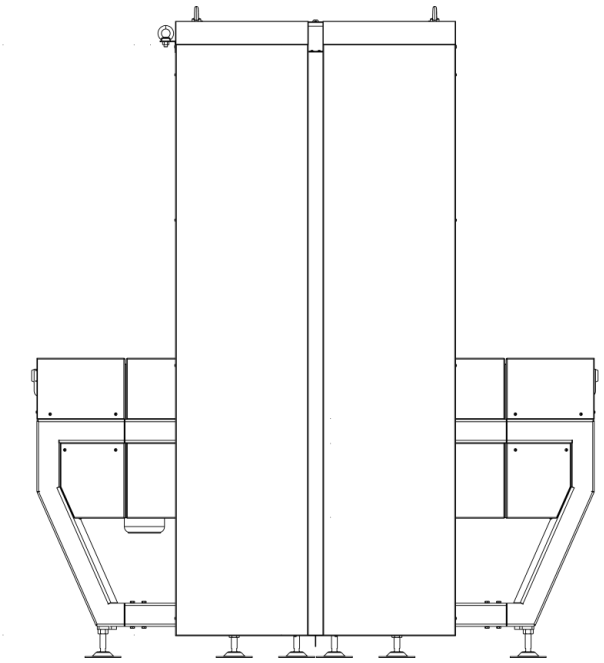
ISO Barcode/Data Matrix Verification: Ensuring barcodes and data matrices meet industry standards.

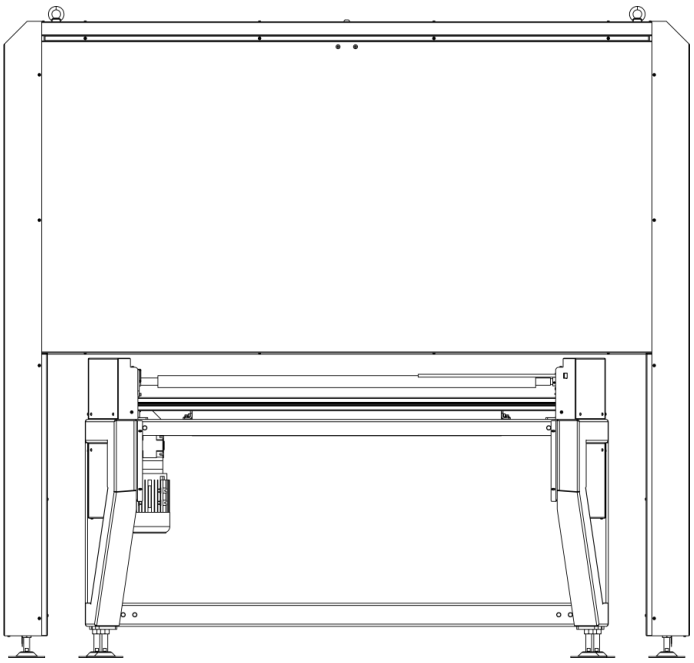
Optical Character Verification (OCV): Verifying that printed text is correct and legible.

Another optional software package allows for the implementation of algorithms to inspect electrical lines printed on the glass. This feature is particularly useful for verifying the integrity of printed circuits, such as backlights, antennas, heaters, or sensors. The software can detect broken or faulty lines (e.g., those whose width exceeds specified tolerance limits) and even identify short circuits in the printed paths.

Moreover, with an additional software option, metrology algorithms can be used to measure and verify the outer dimensions of the glass. This includes checking the width, height, and radii, as well as the positioning and diameters of holes, ensuring that all measurements adhere to the design specifications precisely.

TECHNICAL DATA





Defects	Detection Limits
Enamel point	Yes – 0,15 mm Ø
Printing Hole	Yes – 0,15 mm Ø
Printing Border Defect	Yes +/- 0,10 mm
Screen Position "Distance to the glass border"	Yes 0,01 mm
Printing Border Defect " Edge to Edge"	Yes +/- 0,15 mm
Missing/Additional Dots	Yes – 0,25 mm Ø
Dot Diameter Variation	Yes +/- 0,12 mm
Dot Shapes	Yes
Logo Position	Yes 0,01 mm
Logo presence/absence	Yes
Logo over/under paint.	Yes
Characters Recognition	Yes
Logo Angle	Yes – arctan 0,01mm
Logo printing inspection	Yes

Typical Minimum Defect Size @ 2600 mm glass

Phone: +39 02 45506488 **info@acelabs.it**