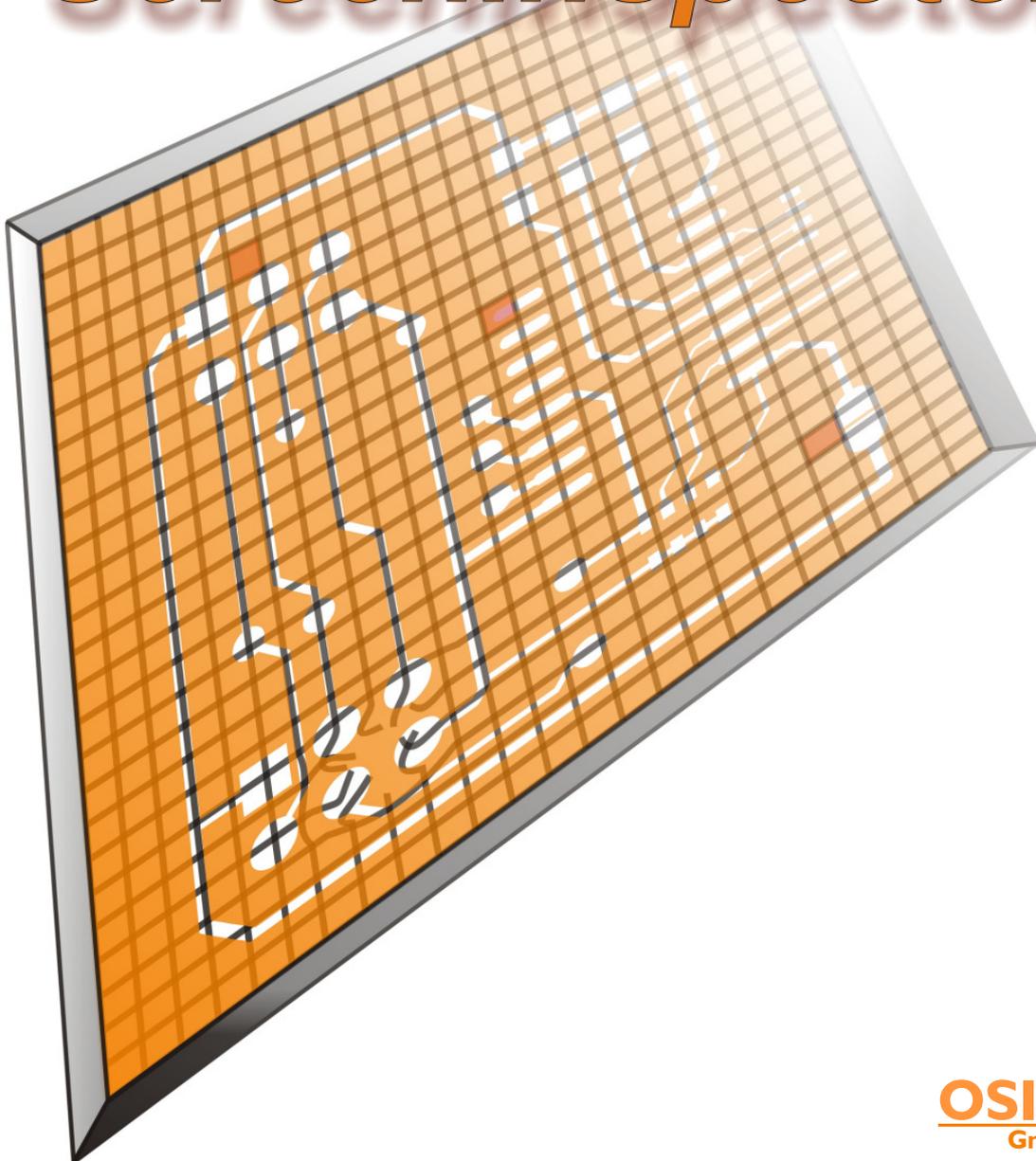

*Optical Inspection System
for Screens and
Screen Printing Masks*

ScreenInspector



Optical Sensor Technologies
for Inspection and Form Recognition

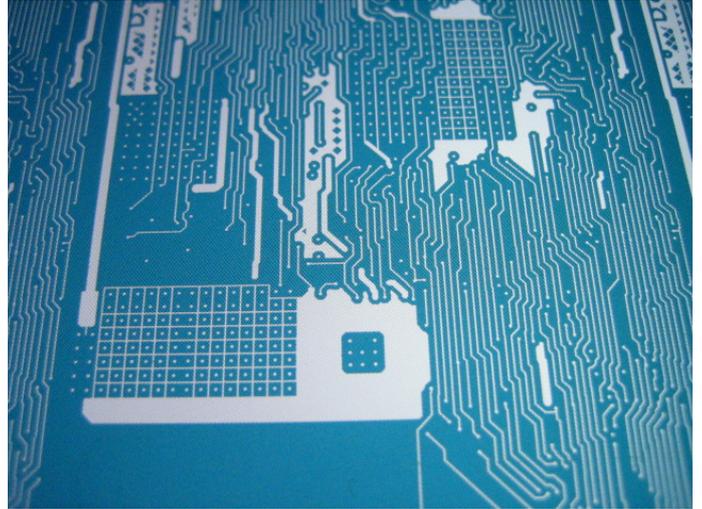
ScreenInspector - Application Areas and Key Advantages

The **ScreenInspector** is an optical inspection system for checking framed screens (wire, nylon mesh, etc.) and the applied screen printing masks.

Technical screen printing has become popular in modern production processes as a high resolution, fast and low cost printing and coating technology. However, checking of the screens and the masks is crucial to the quality of the end products, since even very small defects can lead to serious printing defects.

The **ScreenInspector** allows the fast, inexpensive quality control of the entire screen area and printed mask. By importing a CAD file with the mask data, it can precisely differentiate between the required mask, the open (unmasked) screen area and mask defects. This allows the detection of holes in the screen, foreign objects in the open screen area and mask defects such as pinholes.

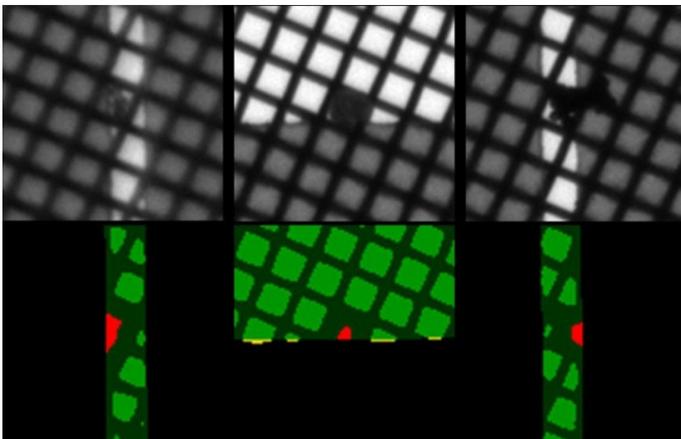
Another unique feature of **ScreenInspector** is the simulation of paint application on the underlying substrate when printing. A foreign object attached to the screen will only be reported as a defect if the amount of paint is insufficient to flow around and under the foreign object, thus leading to a gap in the printing (e.g. a gap in a printed circuit track).



In addition to the simulation of the paint application through the screen, the **ScreenInspector** features a high inspection speed and simplicity of use.

The main features are as follows:

- Automatic quality control of the entire screen and the screen printing mask
- Simulation of the paint application through the screen
- Minimum effort when setting up a new inspection
- High inspection speed
- Automatic calibration
- Automatic documentation of detected defects, deviation from tolerances and measured screen characteristics
- Display and highlighting in colour of detected defects and deviation from tolerances on the PC monitor
- Highlighting of detected defects directly on the screen mesh with a laser pointer for easy and fast follow-up corrections
- Suitable for use in clean rooms
- Low wear
- Long service intervals
- Compatible with remote support software



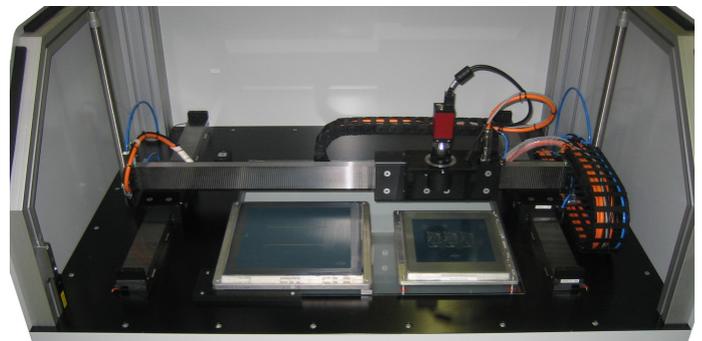
Typical defects at the edges of a screen printing mask which are reliably detected with the **ScreenInspector**. The three pictures in the top row show part of the original camera picture. The bottom row shows the analysed pictures with the detected defects marked in colour.

ScreenInspector - System Setup and Functionality

The **ScreenInspector** is designed as a complete, self-contained inspection system. Depending on the size of the screen to be inspected, it can be constructed as a cross table with two axes or as a gantry setup (one X axis and two Y axes, as shown in the right picture). Since typical screens for technical applications have mesh sizes of around 20-100 μm , the processing can only be done in a clean room. Thus the **ScreenInspector** is equipped with air-lubricated bearings for the axes and direct linear drives. This not only ensures a high dynamic response and thus high inspection speeds but also makes the system wear free.

The inspection starts automatically after positioning the screen and selecting the inspection parameters (inspection recipe) in the software. The camera takes the pictures using transmitted light. This makes the inspection indifferent to the screen or mask colour. Prior to scanning the screen step by step, the system automatically calibrates the image scale of the camera lens, determines the light intensity, measures the position of the framed screen and superimposes the CAD mask on the actual printed mask. The correct function

of the system is monitored by checking the camera lens and the light intensity prior to every inspection. This allows e.g. the aging of the lamps to be detected. Correlation of the CAD mask data with the current (printed) mask allows positioning inaccuracies to be compensated and ensures a high measurement accuracy. The defects detected during the inspection process are displayed on the PC monitor and are included in a defects log. At the end of the inspection process, the sys-



Using the **ScreenInspector** to inspect a wire screen for printing solar panels

tem grades the screen as PASSED or FAILED depending on the specified inspection parameters and tolerances.

After completing the inspection, the detected defects can be manually assessed with the help of the recorded camera images. Furthermore, each defect can be highlighted with a laser pointer directly onto the screen. This allows fast and easy localisation of the defects, e.g. for follow-up correction work.

In addition, a defects log and defects map are created. They can be printed out and attached to the screen as an audit report. The defects map allows employees and customers to assess the quality of the screen at a glance.

The logs can be archived on the PC and can be opened again later on any office PC, for instance in case of a customer complaint, using an offline log file browser.



ScreenInspector - Detectable Defect Types

Detectable Defect Types

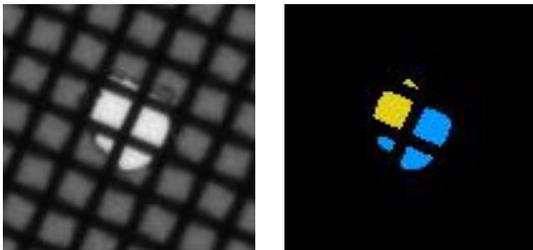
The standard version of the **ScreenInspector** checks the following parameters:

Mesh area and mesh angle (angle between the wires of the screen and the screen frame). The following defects in the screen and in the mask can then be detected by comparing the mesh parameters with the CAD mask:

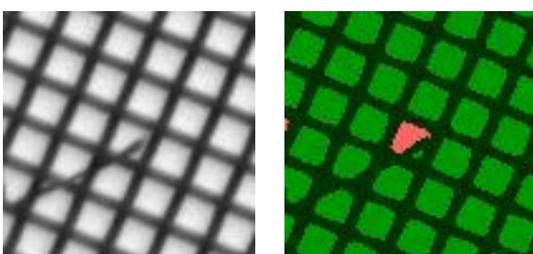
- Unexpected holes in the mask (mask defect)
- Open screen area expected (mask defect)
- Open screen area too small (mask defect)
- Mesh area too small (screen defect)
- Mesh area too big (screen defect)
- Foreign body (screen defect)

When a defect is found, its size will also be reported to allow the operator to estimate the severity.

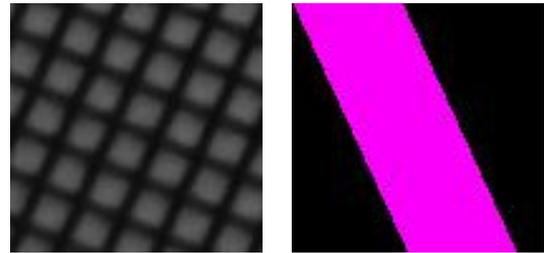
The minimum size and type of defect to report is specified in the inspection parameters (see Inspection Recipe).



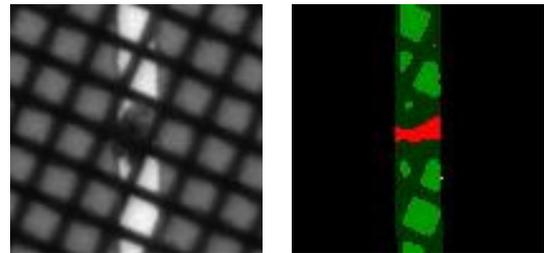
Defect type: Unexpected hole in mask



Defect type: Foreign body



Defect type: Open area expected (mask defect)



Defect type: Mesh area too small (foreign body)

Optical Resolution

The **ScreenInspector** uses a high resolution camera with a telecentric lens for capturing the images. This kind of lens allows precise and distortion-free pictures of the printed screen. The required resolution of the lens depends on the smallest structure of the screen that needs to be measured. The chosen resolution is inversely proportional to the field of view (picture area on the sampled material).

In turn, the time required to inspect the whole screen depends on the overall size of the screen and the field of view (how many pictures are required to capture the entire screen). The inspection of a screen with an area of 300 x 300 mm² and a mesh width of 67 μm using an optical resolution of 5.3 μm per pixel takes approximately 4 minutes.

Lenses	Lense 1	Lense 2	Lense 3
Field of view	8.5 x 7.1 mm ²	13 x 11 mm ²	22 x 18 mm ²
Resolution	3.5 μm/pixel	5.3 μm/pixel	18 μm/pixel

Relationship between field of view and optical resolution of the lens for three different lenses. Further lens types and resolutions on request

ScreenInspector - The User Interface

Inspection Recipes

Another important feature of the **ScreenInspector** is the easy administration of parameters for the screen mesh material, the size and position of the masked area and the required inspection tolerances, etc. The parameters are saved as records in an internal database as so-called inspection recipes and can be loaded again and/or edited by the operator at any time. This helps to automate the inspection process even further.

Nearly all of the parameters for the inspection recipes are specified in a single dialogue box (see below). In addition, 10 text fields with user-configurable names are provided for comments, etc. The user texts are included in the inspection log and can be used for further documentation of the screen parameters or the inspection process. The inspection recipes only need to be specified once, prior to the inspection of a new mesh material type.

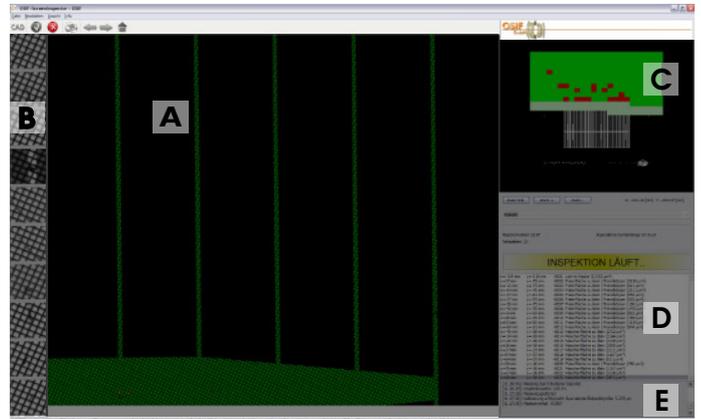
The saved inspection recipes can be loaded again to carry out further inspections with the same mesh material.

Dialog box for specifying the inspection recipes (mesh parameters, inspection tolerances, etc.)

User Interface

During the design of the user interface for the **ScreenInspector**, much emphasis was placed on the intuitive operation of the software. All of the steps are easy to accomplish, from entering the mesh and inspection parameters to

starting a new inspection job, displaying the detected defects and printing and saving the inspection log.



The main screen of the software is divided into five areas as follows:

Area A shows the current, already analysed camera image. Detected defects are marked in colour. Area B shows the last detected defects as an image. Area C shows the inspection progress, some measured values and the assessment (OK/FAILED). Area D contains the defect log and area E the system messages.

Status Pages

The **ScreenInspector** generates a status page in HTML format during the inspection process. It contains information on the product being inspected, the detected defects, total system hours, etc. and can be opened with a standard internet browser from any location within the companies local network (if the corresponding LAN access privileges are set). This allows access to information on the current inspection process from another location.

Custom Versions

Each customer has his own range of products and often unique manufacturing processes. Please get in contact with our engineers if you would like us to adapt our system to meet your production needs. For instance, the system could be extended with an automatic loading/unloading mechanism. We are happy to discuss your requirements and suggest a possible technical solution.

OSIF GmbH – Location



Train

From main train station by metro or by foot (3 min. walk, following the “Bahnhofstrasse” direction city centre) to “Kröpcke”. Then take line 4 direction “Garbsen” to station “Marienwerder/ Wissenschaftspark”. For about 500 m walk on the “Hollerithallee”.

Car

Exit the A2 at “Hannover-Herrenhausen”. Drive on the B6 towards “Hannover”. After crossing the „Mittellandkanal“, leave B6, turning left at the following traffic light.

Hanover Airport

We will pick you up from the airport (approx. 20 min).

We are looking forward to your visit!