



**Intego**  
Vision Systeme

## OPAL Display Lens Inspection System

### Area of Application

Display lenses for mobile phones make high demands on the quality of production. Due to the low distance of observation and the regular use, even small defects can be easily detected by the customers. In the transparent part of the display lens, variable background illumination increases the visibility of the defects even more.

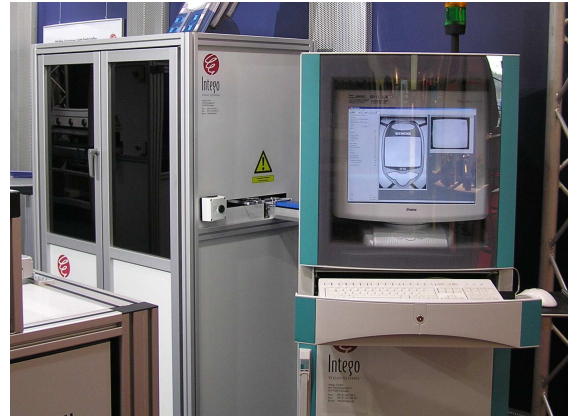
As a consequence, manufacturing defects have to be identified and the corresponding parts have to be removed. In order to keep error rates low, repeated errors have to be dealt with priority.



*Display lenses of mobile phones have to be fully inspected for production errors.*

The OPAL display inspection system offers a fully automatic check on production errors in display lenses. Defects from injection moulding, cleaning, handling and printing are all detected. The system is typically used in manufacturing cells at the injection moulding machine.

Display lenses are mostly manufactured in IMD-technology (two- or four-cavity moulds) and removed by a handling robot. A cleaning device removes dust and flakes from the IMD process. Subsequently, the OPAL system inspects the cleaned parts for remaining errors. With the testing results given, the handling robot selects the faultless parts and moves those lenses into trays or blister packs.



*The OPAL system can test one lens in two seconds.*

### Conditions for use

OPAL is suitable for use in highly automated display production lines, especially for telecommunications and medical applications. OPAL runs particularly efficiently if a product is in continuous production.

In order to prevent high pseudo error rates, contamination of the parts with dust and remains of the IMD foil should be excluded by using appropriate cleaning.

### Contact

#### **Intego GmbH**

Henri-Dunant-Str. 8  
D-91058 Erlangen  
Phone: +49-9131-61082-0  
Fax: +49-9131-61082-999  
Email: [info@intego.de](mailto:info@intego.de)

**Dr.-Ing. Thomas Wagner**  
**Dr.-Ing. Peter Plankensteiner**

## OPAL Display Lens Inspection System

### Components of the inspection system

The system consists of an image acquisition unit and an evaluation unit. The image acquisition unit contains two cameras and associated lighting systems. A linear transfer unit moves the jig with the parts to the various positions for inspection.

A computer system with machine interfaces controls the full inspection cycle and the communication with the handling robot. An attached user interface allows to alter inspection parameters, to monitor test results, and to generate complex statistical evaluations.

Variations in light conditions are compensated for by enclosing both cameras and illumination into a cabinet. Thus, no modifications need to be made to the environment.

### Inspection procedure

The linear axis moves the parts to be inspected into the two inspection positions successively.

During operation, the user can observe the momentary inspection status and the image of the part being processed on the monitor.

Once inspection has been concluded, the test results appear and are also transferred via the control interface to the handling system in order to initialize the picking out of defective parts.

The testing time for a standard installation is approximately 12 seconds for two parts. Speedup options for two seconds per part and options for fourfold moulds are available on request.

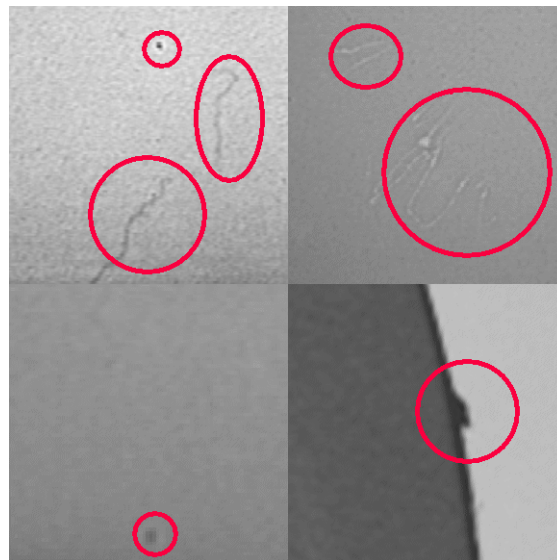
Sometimes, more than one moulding machine is in use or the cavity information has been lost during handling of the parts. In this case, special options still make it possible to generate statistical results for single machines and single cavities.

### Typical faults for optical inspection

The following categories of errors are especially relevant for the inspection of mobile phone display lenses:

- Black spots and inclusions
- Dust imprints
- Streaks
- Scratches
- Dimensional errors
- Printing errors (pad printing)
- Foil errors (IMD process)
- Cleaning errors, flakes (IMD process)

When an error is detected, a control signal is generated sorting out the part in question. An operator call can be initiated in case of on going errors (e.g. dust imprints). In addition, a statistical collation of errors offers information of improvement possibilities in the manufacturing process.



*Types of defects in the display inspection*

### Avoiding faults instead of detecting them

Immediate automatic fault recognition saves not only on the cost of inspection, but also serves to decrease fault rates. Fault sources are immediately detected and reported, allowing for instant shut down to rectify the fault's source.