



## **ISM Integrated Scan Module**

Quality Assurance and Process Control  
for All Optical Disc Formats



ISM Integrated Scan Module

## DR. SCHENK DEFINES EVOLUTION

The ISM in-line scanner is a high-performance inspection and measurement system to accomplish automated quality assurance and production process monitoring for all optical media, including high-density formats like Blu-ray Disc and HD-DVD. Throughout the manufacturing process of prerecorded, recordable, and rewritable optical media, the ISM system inspects for local defects and irregularities, and measures mechanical and optical characteristics.

Close contact with replication line manufacturers ensures that the highly flexible and modular ISM system fits into all replication lines. Its fast and easy integration is appreciated by line manufacturers and end users alike. Moreover, due to its unmatched reliability, most customers select the ISM system as their in-line scanner of choice.

**Highest Sensitivity** 12 bit high resolution CCD line-scan cameras, with **closed loop control** of camera gain, feature 16 times higher resolution than conventional 8 bit cameras at consistent sensitivity.

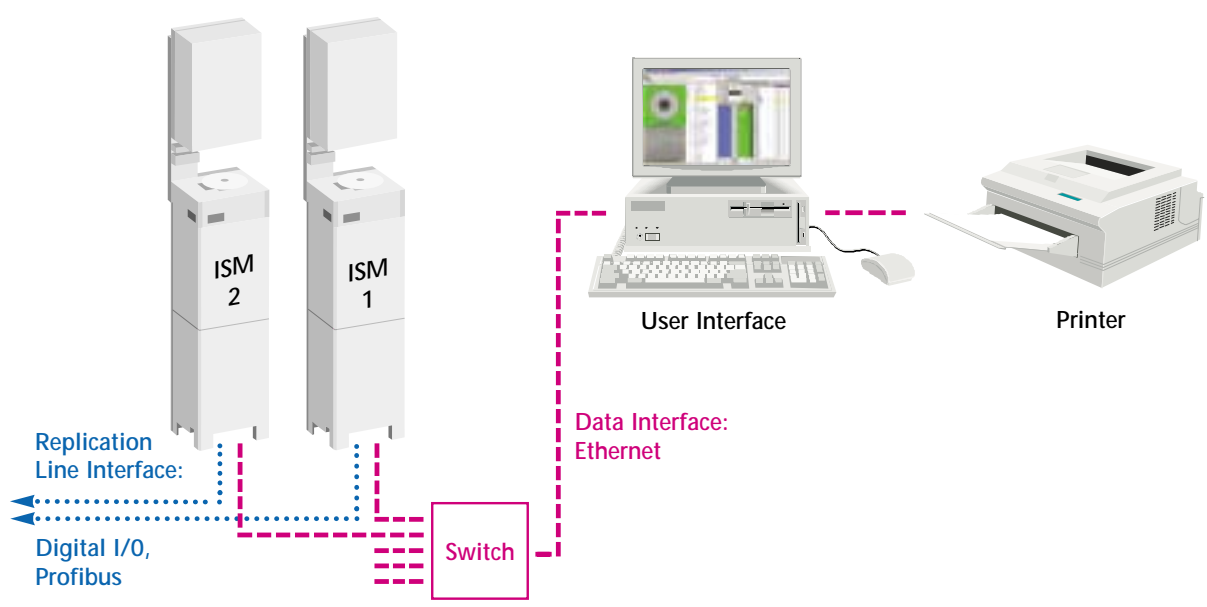
**Unmatched Reliability** Real-time operating system starts from **flash memory**, no hard disk with limited lifetime is required. An **embedded Linux operating system** ensures stable and continuous operation. Smart temperature management based on leading-edge electronics and low power LED illumination allows **lowest heat radiation**. Design rules which ensure that the ISM in-line scanner successfully reaches highest reliability and repeatability.

**Maintenance Free** **Closed loop control** of illumination power eliminates the need for re-calibration. Combined with longlife LED illumination, maintenance is negligible.

**Easy to Use** Well-known and proven user **interface VPC** is combined with an **instant classifier** for the detected defects. **Grayscale images** support an easy feedback for the operator.

**Faster than Ever** **Leading-edge evaluation electronics**, combined with compactness and ease of use, results in maximum processing speed and highest flexibility.



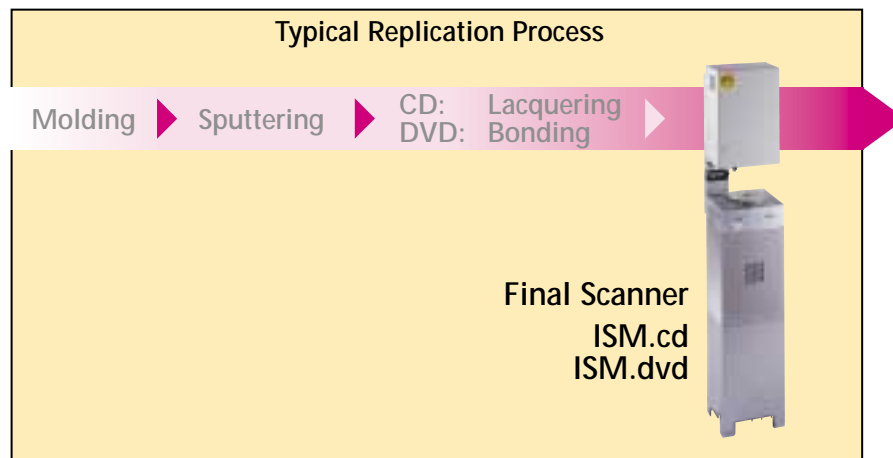


Integration of ISM Scanners into a Replication Line

## TECHNICAL DATA

Illumination	Low power LED	Lifetime > 5 years
Illumination for ISM.dye	Low power LED Low power Krypton illumination	Lifetime > 5 years Lifetime > 6 months
High Resolution CCD Line-Scan Camera	2048 pixel; 12 bit AD converter; ≤ 50 MHz pixel clock	Highest and consistent sensitivity over lifetime
Turntime	≤ 600 ms	Highest speed to meet lowest cycle times
Tangential Resolution	≥ 24 μm at radius 42 mm	
Radial Resolution	20 μm	
Replication Line Interface	Profibus, Digital I/O	Plug & play
Data Interface	Ethernet	Fast and flexible access to all inspection results
User Interface	Windows® based visualization software	Ease of use
Power Supply	100...240 VAC, 50...60 Hz, 200 VA	
Compressed Air Requirement	4.5...7 bar, 500 l/h dry and clean air	
Ambient Temperature	+ 10...+ 40 °C	
Laser Class	Class 1 LED product	

## IN-LINE SCANNER FOR PRERECORDED OPTICAL MEDIA: CD, DVD-5, DVD-9, DVD-10, DVD-14, DVD-18



### TREND-SETTING TECHNOLOGY FOR IN-LINE INSPECTION AND MEASUREMENT

Reliable quality assurance and process control for prerecorded CDs and DVDs requires the integration of Final Scanners into replication lines. The ISM.cd and ISM.dvd detect local defects at high speed, measure disc deformation with high precision, and, for the first time in industry, measure space layer and substrate thickness simultaneously, according to DVD-9 specifications. Additional features include detection of Focus Error, and Electrical Signal Testing, areas in which Dr. Schenk sets new trends in technology to ensure quality and support process optimization.

#### High Speed Inspection Technology

- Reliable detection of local defects including bonding gaps in reflection mode on final discs
- Double sided disc inspection of top and bottom half disc, e.g. for DVD-9, DVD-10, DVD-14, DVD-18
- Reliable detection of local defects on lacquering for CD

#### High Precision Measurement Technology

- Radial and tangential disc deformation measurement → 1000 measurement points per disc
- Simultaneous space layer and substrate thickness measurement  
→ in-line with DVD-9 specification

**Unique at Dr. Schenk**

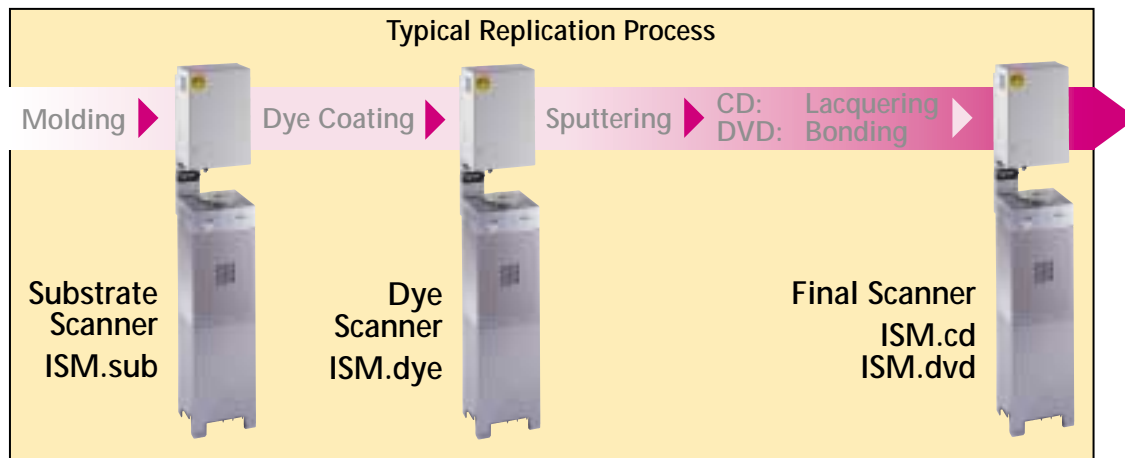
#### Optional Inspection and Measurement Channels

- Enhanced bonding gap detection with additional inspection channel for DVD-5, DVD-10
- Enhanced acceleration defect detection with additional inspection channel
- Reflectivity measurement over the entire disc
- Detection of resin overflow and shortage
- Crack sensor to detect cracks in the center hole area
- Barcode reader (single or double sided)
- Focus error – detection of abrupt local variations in space layer thickness
- ETI – the in-line DVD pick up head sensor for electrical signal testing in-line
- NetSis - Networking Schenk Inspection System

**Unique at Dr. Schenk**

**Unique at Dr. Schenk**

# IN-LINE SCANNER FOR RECORDABLE OPTICAL MEDIA: CD-R, DVD-R, DVD+R, DVD-R DL, DVD+R DL



## FIRST CHOICE OF ALL MAJOR REPLICATORS WORLDWIDE

Reliable quality assurance and process control for CD-R, DVD±R and DVD±R DL requires the integration of a series of dedicated ISM in-line scanner systems into replication lines. After molding, the Substrate Scanner ISM.sub inspects for local defects within and on the surface of clear substrates. The Dye Scanner ISM.dye controls the dye layer after the coating process. Finished discs are inspected by the Final Scanners. The ISM.cd and ISM.dvd detect local defects at high speed and measure disc deformation with high precision. A specific inspection solution is available for DVD±R DL, including a unique dye scanner capable of inspecting both half discs, L0 and L1. Fast response to market needs is just another reason why major replicators choose Dr. Schenk in-line systems.

### High Speed Inspection Technology

- Reliable detection of local defects in/on clear substrate in transmission mode after molding
- Reliable detection of local defects in/on substrate and in dye coating layer after dye coating
- Reliable detection of local defects including bonding gaps in reflection mode on final discs
- Reliable detection of local defects on lacquering for CD-R

### High Precision Measurement Technology

- Radial and tangential disc deformation measurement → 1000 measurement points per disc
- Dye density over the entire disc in transmission mode
- Dye density over the entire L1 half disc in reflection mode for DVD±R DL
- Inner and outer dye edge control

**Unique at Dr. Schenk**

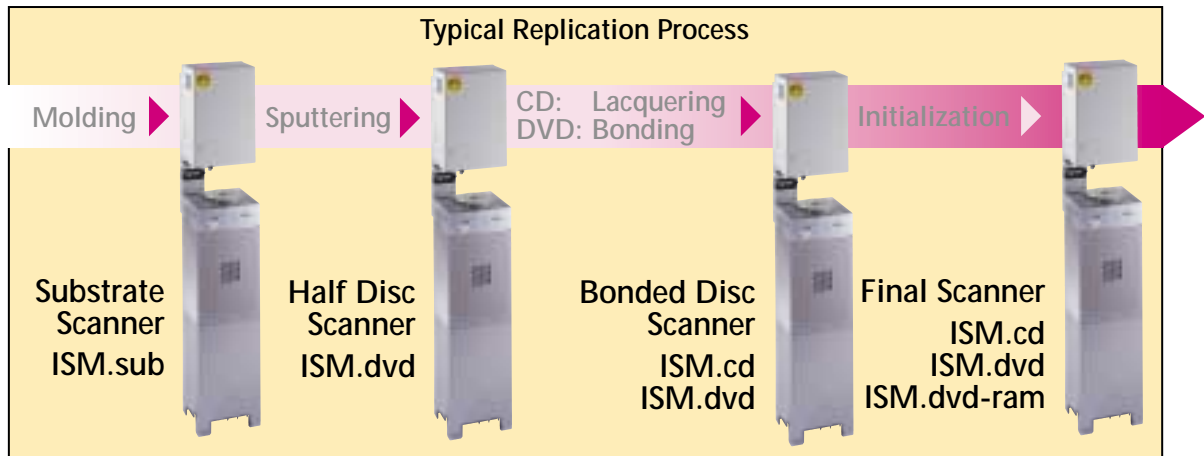
### Optional Inspection and Measurement Channels

- Crack sensor to detect cracks in the center hole area
- Dye splash detection
- Detection of resin overflow and shortage
- Enhanced acceleration defect detection with additional inspection channel
- Reflectivity measurement over the entire disc
- Substrate thickness measurement
- ETI – in-line DVD pick up head sensor for electrical signal testing in-line
- NetSis – Networking Schenk Inspection System

**Unique at Dr. Schenk**

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## IN-LINE SCANNER FOR REWRITABLE OPTICAL MEDIA: CD-RW, DVD-RW, DVD+RW, DVD-RAM



### INDISPENSABLE SOLUTIONS FOR ALL REWRITABLE OPTICAL DISCS

Reliable quality assurance and process control for CD-RW, DVD±RW and DVD-RAM requires the integration of up to four dedicated ISM in-line scanner systems into replication lines. After molding, the Substrate Scanner ISM.sub inspects for local defects within and on the surface of clear substrates. Half discs are inspected for local defects with the ISM.dvd after sputtering. The Bonded Disc Scanner ISM.dvd detects all local defects including bonding gaps after the bonding process. Finished discs are inspected by the Final Scanners. The ISM.cd, ISM.dvd, and ISM.dvd-ram detect local defects at high speed and measure disc deformation and reflectivity with high precision. Additional features include Layer Stack measurement and Header Evaluation for DVD-RAM, providing indispensable solutions for rewritable discs. Leading DVD-RAM manufacturers from Japan and Taiwan have accomplished extensive benchmark tests and, without exception, selected the ISM.dvd-ram for integration into their production lines.

#### High Speed Inspection Technology

- Reliable detection of local defects in/on clear substrate in transmission mode after molding
- Reliable detection of local defects on half discs in reflection mode after sputtering
- Reliable detection of local defects including bonding gaps in reflection mode on final discs
- Reliable detection of local defects on lacquering for CD-RW

#### High Precision Measurement Technology

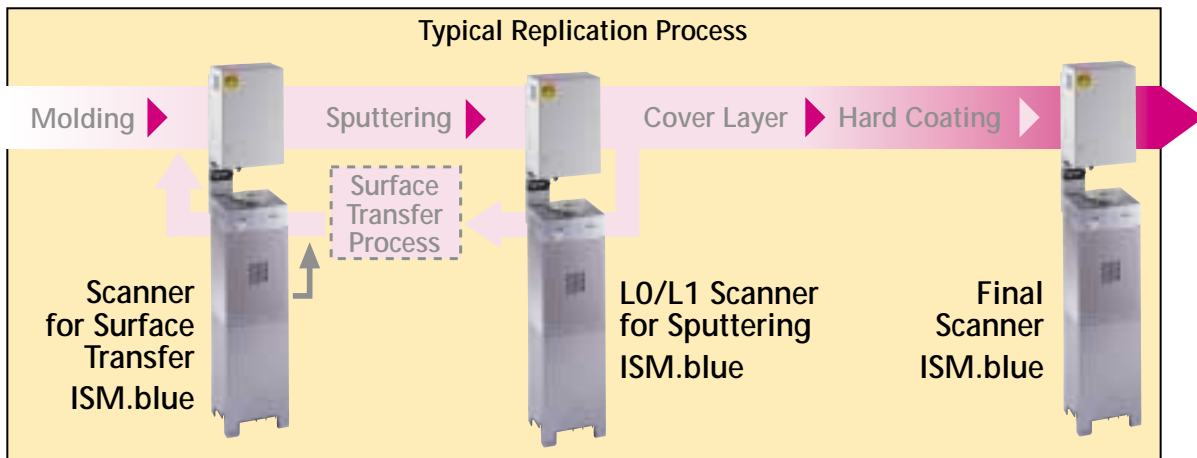
- Radial and tangential disc deformation measurement → 1000 measurement points per disc
- Reflectivity measurement over the entire disc

#### Optional Inspection and Measurement Channels

- Substrate thickness measurement
- Enhanced acceleration defect detection with additional inspection channel
- Detection of resin overflow and shortage
- Crack sensor to detect cracks in the center hole area
- Layer stack measurement
- Header evaluation for DVD-RAM
- NetSis – Networking Schenk Inspection System

**Unique at Dr. Schenk**

## IN-LINE SCANNER FOR HIGH-DENSITY OPTICAL MEDIA: BLU-RAY DISC, HD-DVD, ...



### ONE STEP AHEAD FOR THE CHALLENGING NEEDS OF HIGH-DENSITY DISCS

New high-density disc formats are based on blue laser technology, enabling a strong increase in recording density. The challenging needs of higher density prerecorded and rewritable discs make great demands on inspection and measurement systems. They must be much more accurate than for DVD, particularly the measurement of layer thickness requires a far higher precision. Dr. Schenk is one step ahead, supplying dedicated high performance ISM.blue scanners to leading disc manufacturers worldwide, supporting their very first pilot runs. The ISM.blue utilizes high resolution CCD line-scan cameras with up to 4096 pixels to accomplish double resolution for the accurate and reliable detection of local defects. Extremely high tangential resolution is available for the measurement of space layer and cover layer thickness, as well as for disc deformation. In addition, a large set of features are available to enhance the ISM.blue, according to every customer's specific needs.

#### High Speed Inspection Technology

- Reliable detection of local defects on layer L0 after sputtering
- Reliable detection of local defects after surface transfer process
- Reliable detection of local defects on layer L1 after sputtering
- Reliable detection of local defects in reflection mode on final discs

#### High Precision Measurement Technology

- Radial and tangential disc deformation measurement → 4000 measurement points per disc
- Space layer and cover layer thickness measurement → 1600 measurement points per disc

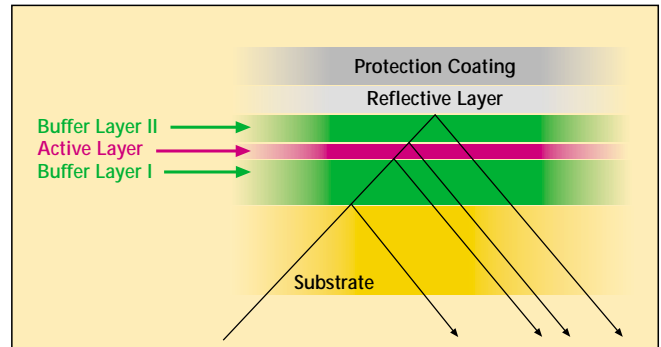
#### Optional Inspection and Measurement Channels

- Enhanced acceleration defect detection with additional inspection channel
- Reflectivity measurement over the entire disc
- Layer stack measurement
- Crack sensor to detect cracks in the center hole area
- Cover sheet eccentricity
- Barcode reader
- Header evaluation
- NetSis - Networking Schenk Inspection System

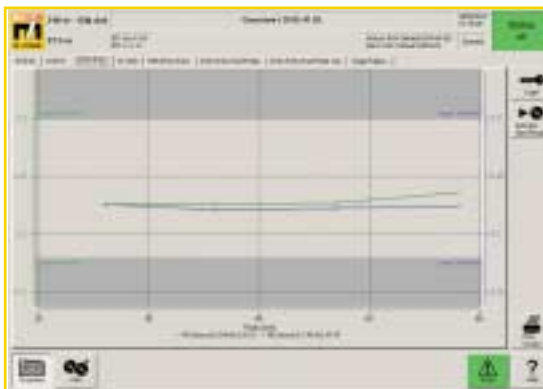
## DR. SCHENK UNIQUE & OPTIONAL FEATURES

### Layer Stack Measurement

For CD-RW, DVD±RW, and DVD-RAM a stack of thin layers with tight tolerances are sputtered onto a pregrooved substrate. The layer stack unit measures the different thicknesses of these layers simultaneously in just one turn on all non-initialized discs. In-line measurement of layer stack ensures product quality of every single rewritable disc.



Principle of layer thickness measurement



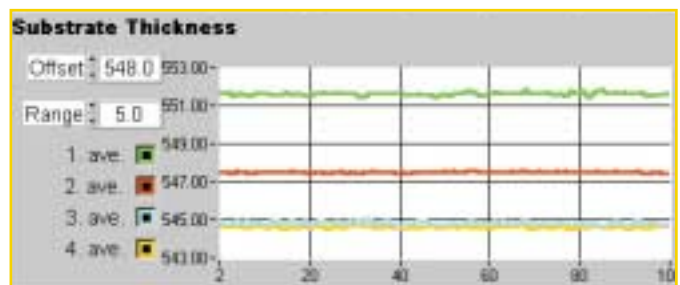
Reflectivities of layer L0 and L1 on a DVD+R DL

### ETI – Electrical Signals In-Line

ETI is a pick-up head integrated into the Dr. Schenk in-line scanner, that tests electrical signals on prerecorded and recordable DVDs. This bold new concept for the worldwide optical disc market complements off-line DVD electrical test drives by indicating problems, using electrical signals in real-time, during disc replication. An electrical test can now be performed on every disc in-line, e.g. to control the reflectivities of layer L0 and L1 on a DVD-9. In-line monitoring of the reflectivities of both layers is even more important for DVD±R DL, to achieve fast process feedback. The ETI feature demonstrates once again Dr. Schenk's leading position in bringing new testing concepts to the optical media industry. For the first time, inspection combined with electrical signal testing has been successfully integrated into the production process of leading disc manufacturers.

### Substrate and Space Layer Thickness Measurement

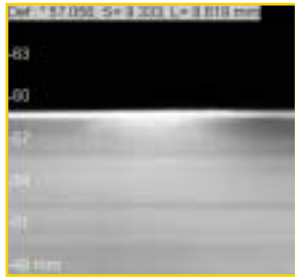
Measurement of substrate thickness on DVD-half discs or on bonded DVDs provides a continuous and immediate feedback on the injection molding process. Substrate and space layer thickness can be measured in-line simultaneously. This makes it possible to control the minimum substrate thickness, as well as the maximum substrate plus space layer thickness, according to the DVD-9 specification.



Substrate thickness at different radii

**Acceleration Defect Detection**

Rapid local deformations on a disc can cause the pick-up head of the player to lose its focus at faster speeds, being not able to muster the acceleration force required to follow the data surface. These so-called acceleration defects emerged with the launch of high speed CD-R, CD-RW, DVD±R and DVD±RW discs. Dr. Schenk responded to this need immediately by introducing two options for acceleration defect detection, applicable separately or in combination, that reliably detect all rapid local variations to ensure overall product quality:



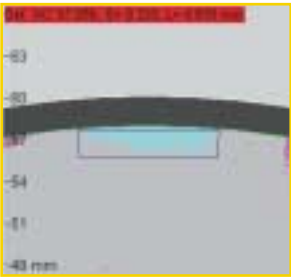
*Grayscale image of an AC-Defect*

**Acceleration Indicator Software**

The software feature evaluates the measurement data taken with the deviation unit on four defined radii, resulting in a clear indication of occurring acceleration problems.

**Acceleration Defect Channel**

An additional inspection channel accurately inspects the whole disc surface with high resolution. Local deformations are displayed as grayscale images and, in addition, classified as acceleration defects (AC-Defects), to reliably sort out bad discs.



*Associated binary image*

**Barcode Reader**

The barcode reader reads up to two barcodes on different radii of prerecorded optical discs, ensuring the correct assignment of both layers in-line, right from the first DVD manufactured. In addition, this option provides the reliable control of the complete order management of a replication line.

**Crack Sensor**

Molding and handling can produce cracks at the inner edge of a disc. In common use, sooner or later, it can cause the disc to break. The crack sensor detects these tiny defects, and reliably sorts out all faulty discs.



*Disc with crack*

## DR. SCHENK UNIQUE & OPTIONAL FEATURES

### Bonding Gap Detection

Bonding gaps can occur during the bonding of the two half-discs, which can interfere with the playability of a DVD. The only way to see a bonding gap in DVD-5 or DVD-10 with two metallized substrates, is to detect the deformation imposed on the metal layer. Dr. Schenk's accurate in-line detection method is highly sensitive to this metal layer deformation. Thus, bonding gaps with major deformations can be detected with the standard camera system of the in-line scanner. Far higher sensitivity is achieved with a special bonding gap channel for accurate detection of bonding gaps, even with the smallest deformations, in-line.



Grayscale image of a bonding gap



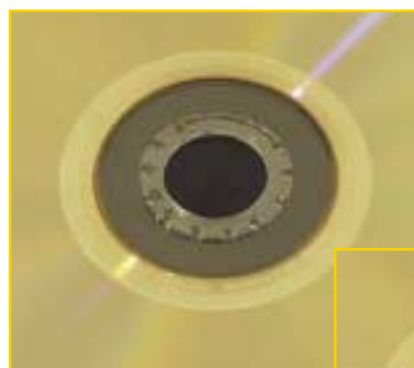
Disc with dye splash

### Dye Splash Detection

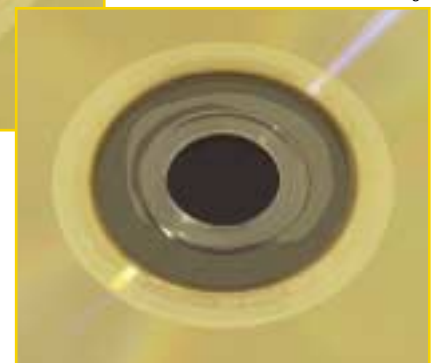
With the increase in volume of recordable CDs and DVDs, disc manufacturers are faced with the appearance of undesirable dye splashes at the inner clear center of a disc. Dye splashes can occur randomly during the dye coating process. Dr. Schenk quickly provided a solution to this need by the introduction of the dye splash option that reliably detects all stained areas, ensuring overall disc quality.

### Resin Overflow and Shortage Detection

Resin has to be stopped before the inner edge of the DVD, in a groove that serves this purpose. In many cases, resin overflow or shortage are only a cosmetic issue, and have no influence on the functionality of a disc. However, a DVD with a big resin shortage eventually breaks apart. Most manufacturers have already adopted this feature in their production, and find it indispensable.



Disc with resin overflow



Disc with resin shortage

**CDF – Critical Defect Filter**

A unique addition to the ISM in-line system is the new CDF standard feature. The hardware-based Critical Defect Filter reliably selects only critical defects. Irrelevant defects, like stamper pimples and mild orange peel, are ignored. The preset filter prevents an inspection overflow, as only critical

defects are selected for further processing. An easy adjustment of the threshold value ensures the adaptation to various specifications. This brand-new hardware feature allows for the very first time the differentiation between pseudo-defects and critical defects in real time. Even at highest defect sensitivity, the Critical Defect Filter ensures an extremely low false detection rate.

**NetSis – Networking Schenk Inspection System**

NetSis, a stand-alone software developed by Dr. Schenk, allows connection to different disc production lines via a remote station. Multiple scanners in various replication lines are monitored and operated from a central location. Scanner data are collected in real-time and maintained for statistical analysis, making NetSis an extremely effective tool for managing and improving overall production performance.



Networking Schenk Inspection System



Visualization Software VPC

**Visualization Software**

- Data Logger
- Defect Explorer
- Disc Recorder
- Grayscale Image
- Yield & Trend Bar
- Defect Statistics
- Disc Diagrams
- Machine Logs
- Virtual Keyboard
- Alternate Language Editor

**LASER CLASS**

Deviation Unit	ETI Unit	Crack Sensor	SLT Unit
Class 1 LED product	Class 1 laser product	Class 2 laser product	Class 1M laser product

Dr. Schenk GmbH, established in 1985, is an innovative high tech firm based in Munich, Germany.

For the second decade now, the range of products and services offered by Dr. Schenk includes comprehensive solutions for automated quality assurance and production process monitoring – areas where we continue to set new standards for the inspection of surfaces and the measurement of optical and mechanical properties, through the continuous utilization of the latest technical advances in optics and electronics.

The focus of all our activities is the perfect synergy between practical ideas and innovative solutions.

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