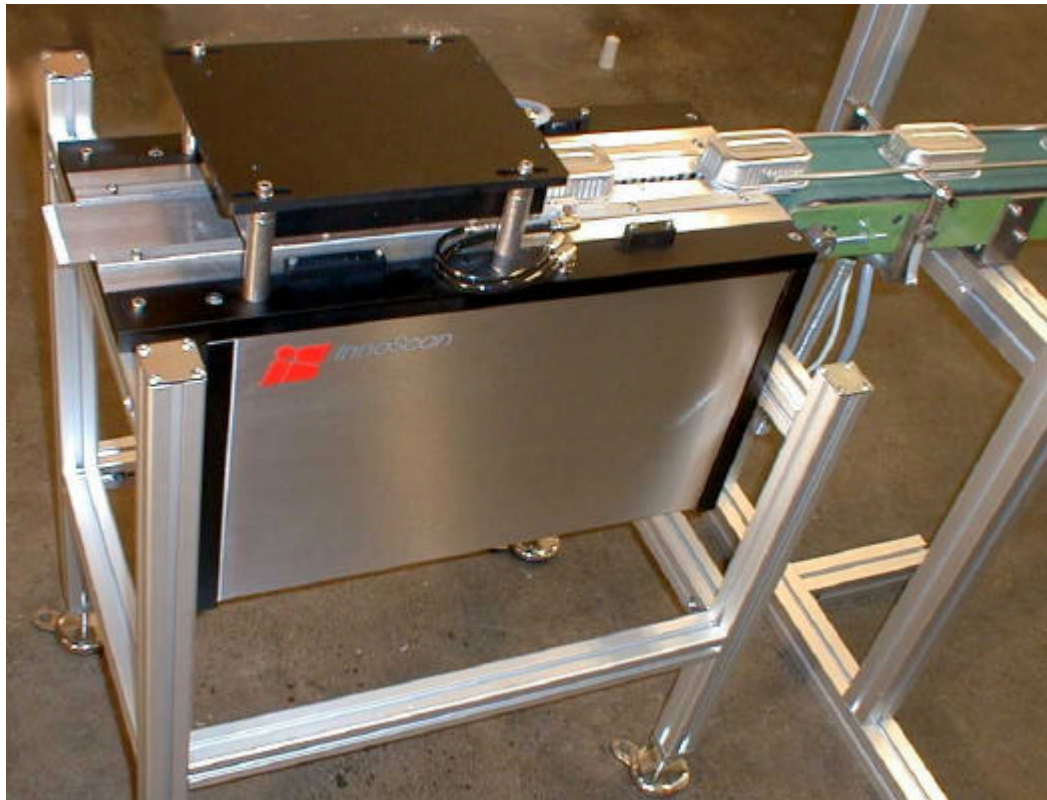




OptoScan 7000

Modular in-line leak detection for shallow cans



- 100% quality control - every can tested
- Compact - flexible module
- Fits directly in a conveyor or track work
- Fast on-line inspection at press speed
- High sensitivity
- Does not rely on total sealing
- Side stackable - any number of parallel lanes
- Automatic rejection of leaking cans

Introduction to OptoScan leak detection

Manufacturers of two-piece cans experience from time to time difficulties with leaks.

Most of these leaks are positioned in those areas of the can where the biggest material displacement takes place - notably on corners for square cans and on sidewalls/bottom edge for round cans.

Pursuing the causes of leakers shows a number of different contributors:

- Impurities stemming from the rolling process may be hidden in the stock material.
- Other local in-homogeneities such as scratches, indentations may be present on the stock.
- Variations in the forming properties of the stock material.
- Lacquer and in particular multicolour decorations contain impurities or drops, often from the drying oven.
- State of wear, lubrication and adjustment of tooling.
- Shape dependence of the can (round, square, height etc.)

Experience shows that there are large variations in the flaw rate, depending on how well the above mentioned influences can be controlled.

Immediately after change of tooling the flaw rate can be extremely high - 1 in 10.000 or even more, indicating that running small batches is more susceptible to producing failures, because adjustment and fine-tuning of the process requires the process to be ongoing.



Picture 1: Samples of food cans including thin wall aluminium foil cup.

For a well controlled production of decorated aluminium 1/4 club cans, one failure rate recorded over a long period varies between a maximum of 0.016% on a batch of 100.000 cans and a minimum of 0 (nil) on 1 mill. cans with an average of 0.0018% on 36 mill. cans.

Notably these are figures obtained when the OptoScan system has been used to pick out the leakers, and following inspection of the reason for each particular leaker corrective action has been taken to optimise the process!

In a well run production plant where only SPC (statistical process control) based on a sampling scheme is used, an upsurge of leakers in the production may never be found. Instead it is more likely to be found during the filling process and returned as a customer complaint.

Even worse it might end up with the consumer, giving rise to serious liability implications.

Compact in-line inspection module

The OptoScan 7000 leak detection module for cans was designed for compactness, ease of integration into any production line, requiring no special transport.

The inspection is based on the well proven OptoScan 5000 detection system originally developed for multiple lane EOE leak detection and applied directly on the conversion press taking advantage of the indexed motion of transfer system.



Picture 2: Two special modules side-stacked to inspect cans fed bottom-down from DRD press.

The compact can inspection module accepts cans directly from a conveyor or track work - inspects them - and discharges directly to downstream conveyor or track work.

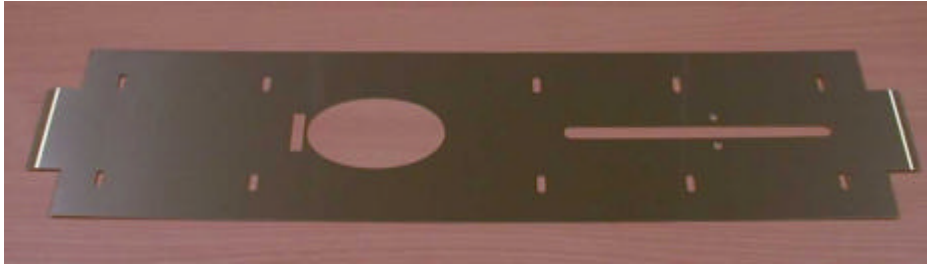
Cans are accepted by guide-rails and fed forward by a belt brush, driven by a brush less servo drive, to the inspection mask, arrested momentarily by a high speed electronically controlled stop, inspected and accelerated to the downstream line or diverted by the rejection device if a leak is detected.



Picture 3: Belt-brush drive feeding cans to the point of inspection. (Right to left)

Cans must normally be fed bottom up to the module.

Can height change requires no adjustment for cans fed bottom-up.



Picture 4: Examples of masking plate, which is the sole format part required for size change.

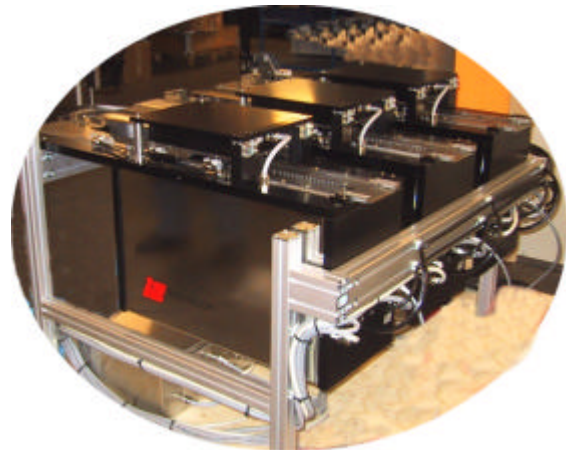
Size change is easily done by exchanging the inspection masking plate and repositioning the feeder guides and air drive to the new size.

The inspection module requires this one only change part to inspect a different size can. Exchanging this size part can be done within minutes.

It is adaptable to all common can shapes and sizes.

Modules may be side-stacked giving as many parallel inspection stations as required by the number of lanes on the press to which it is attached.

Each inspection module is essentially autonomous and will function on its own without a OptoScan PC attached. The OptoScan PC may be substituted by a laptop PC when equipped with a CAN bus interface and SW package where connection is only for set-up and service needs.



Picture 5: 3 side stacked modules in common frame.

Interlocking with the press will halt the press and an alarm will be activated (blinking warning light, siren etc.) if a light source fails, or if the OptoScan for some reason is not operational.

A bypass mode may be invoked to pass cans directly through the module.

The basic control design has a number of self-monitoring features that report to the OptoScan PC, featuring a high level of information about its internal status to an operator or service person.

The light source over the can under inspection can be raised exposing the feeder and inspection mask when cleaning eventually is required.

Modules are mounted in flexible aluminium frames which can optionally be fitted with wheels or other customer specific details. The junction box that holds power supplies and terminal blocks etc. is normally mounted on this common frame.

Modules are connected through a robust industrial network to the OptoScan PC. The OptoScan PC provides a permanent operator interface for setting up the modules, monitoring the process, logging/printing/up-loading of production data and has helpful menus for service personnel.

The OptoScan PC may be shared between as many modules as is practical, or omitted entirely once the system has been set up if cost is of utmost importance.

Rejection system

The exit end of the inspection module is provided with a reject system to divert leaking cans into a funnel leading downwards for collection in a box below the module.

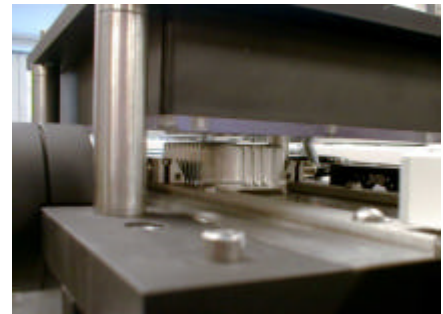
The reject system is based on controlled timing of a pneumatic blow-off nozzle.

Timing and electrical control is integrated in the module, and the reject has a detector to positively verify that a rejected can is actually dumped.

Optical inspection

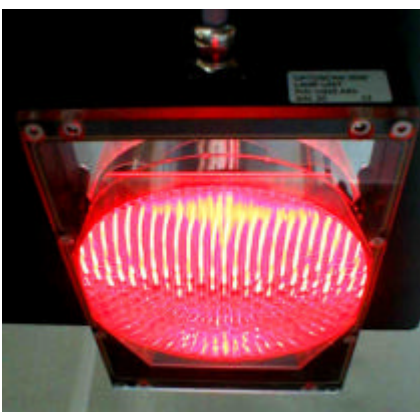
The basic inspection principle is an optical transmission measurement, whereby a strobed light source delivers an intense illumination to one side of the can, while a high sensitivity light detector "looks" at the other side to detect any light transmitted through a possible hole.

The occasional hole where a clear lacquer film stays intact will also be detected as opposed to systems based on vacuum or pressure.



Picture 6: Can under inspection. Viewed from exit side.

The sensitivity of such an optical system is normally limited by the amount of interfering light from the ambient - sun, fluorescent lights etc. - reaching the detector or the surface being inspected.



Picture 7: Lamp unit viewed from below.

Each OptoScan sensor head is in fact a complete compact vision system operating autonomously.

This makes the OptoScan principle unique compared to other optical leak testers, since compensation measurements are included, which minimize the influence from the ambient.

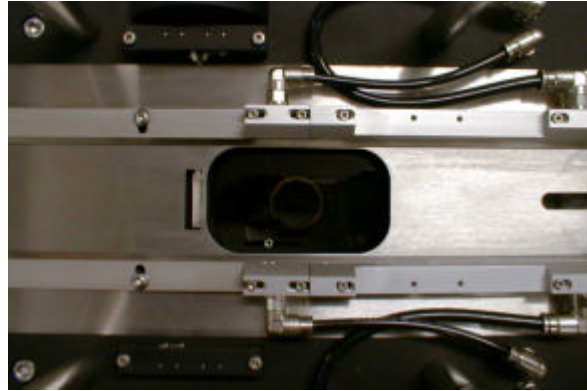
Because imaging is employed in this process the compensation also takes into account the morphology of the surface being inspected as well as non-uniformities and temperature drift in the camera sensor.

Light sources are based on solid state LEDs (light emitting diodes), with their long life time.

Employing this technique achieves a very high and consistent sensitivity that can be maintained with-out relying on wear-prone mechanical seals as competing optical and pressure systems do.

Neither the sensor input window nor the exit surface of the solid state light source needs frequent cleaning.

Placing specially prepared cans with calibrated holes in the inspection stations enables the operator to check the system sensitivity.



Picture 8: Point of inspection with lamp unit removed showing side guides and air nozzles for ejection.

Sensitivity

The basic OptoScan 5000 detection system is specified and factory tested to detect min. 95% of all occurrences of a calibrated 5 μm hole on easy open ends of 73mm diameter.



Picture 9: Can with calibrated 50 μm hole placed in corner.

The definition of sensitivity is closely related with the *False Reject Rate* FRR- meaning: how many good ends will be falsely rejected when operating at the specified sensitivity.

Specifying sensitivity is only meaningful when at the same time listing the accompanying *False Reject Rate* - since detecting an even smaller hole is quite possible, if a higher FRR is acceptable.

The factory FRR at a sensitivity of a 5 μm hole is typically 5 in 10^6 (0,0005%).

When applying the OptoScan 5000 to can inspection the sensitivity is different for holes in the bottom of the can and on the sidewalls.

Bottom holes may be detected down to 5 μm (0,0002") sidewall holes to 50 μm (0,002").

Very large can sizes may result in reduced sensitivity.

The sensitivity is monitored during production by inserting specially prepared cans with calibrated holes laser punched in a stainless steel foil attached to the can.

The operator can then verify on the OptoScan PC the amount of light being detected.

OptoScan PC

The OptoScan PC is based on InnoScan's totally sealed heavy duty industrial PC, expanded with special communication hardware and SW. This provides a good operator interface since it contains a long-life flat panel colour display to present production data, trend curves, calibration values, and system status information.

The operator is presented to screen menus based on the familiar Windows operating system.

The OptoScan PC can be yoke-mounted in a floor stand or wall mount to give good operator access.

An isolated printer port is provided for connection of a printer when a hard copy of production data is required. Uploading of production data via a serial connection or Ethernet is another option.



Picture 10: Controller on floor stand

Front panel keys allow the operator to enter the necessary commands.

The OptoScan PC has accessible screen menus to aid initial configuration of the equipment and diagnostics to help service personnel.

Screen menus can be switched between a primary language (local) and a secondary language.

All set-ups are stored when the equipment is powered down.

The *operation menu* records and displays as standard per lane:

- number of inspected cans
- number of accepted cans
- number of rejected cans

- these counters can be reset.

- fault rate

- a trend curve may be initiated which logs and displays the measured light-levels from the last 1000 cans.

- display status for: lamps, CANbus, 24V power supply

The *statistics menu* present a screen listing:

- start time, stop time, threshold, inspected cans, accepted cans, rejected cans
- in tabular form or as histogram.

The *calibration menu* present a screen where:

- signal level from a calibrated hole placed in the inspection station is displayed
 - threshold for rejecting cans can be set according to signal level (sensitivity)
- the menu is protected by password.

The *service menu* has facilities to:

- set/reset rejecters
 - switch lamps on/off
 - display lamp currents and lamp temperatures
 - display logical states of interface signals: alarm and inspection trigger
 - reject cans on a selected lane
 - set/reset all actuators inside the feeder
 - display status for all sensors inside the feeder
- the menu is protected by password.

A telephone modem and remote SW connection is offered as an option, enabling InnoScan to get direct access to the OptoScan PC for detailed first class service assistance should the need arise.

The *settings menu* is accessible only via a password and is used only in connection with installation and initial set up of the process line.

It also contains the following features:

- Reject trend monitoring with alarm may be invoked to ensure that a systematic error is detected and reported
- rejection of a configurable number of cans until press is at stable speed
- activation or deactivation of lanes as required

Flexibility is available to meet in the future the ongoing trend towards more speed, more lanes, and CIM related demands for automatic acquisition of production data such as:

- total production/lane/shift/batch
- number of rejects/lane/shift/batch
- total press up-time/down-time
- operator registration
- quality documentation - print out
- automatic transfer of data via network to plant host

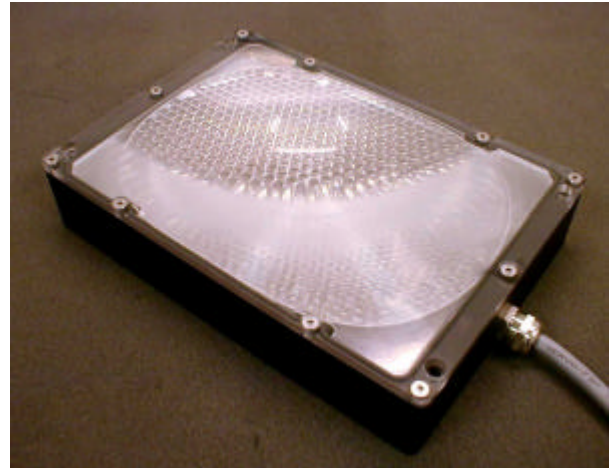
- for options of this kind please contact InnoScan.

Light sources

The lamp units each contain a dense matrix of hundreds of solid state light emitting diodes - LEDs - plus special optics to focus the light onto the entire surface to be inspected.

Control electronics is integrated in the lamp housing to ensure constant light output with changing temperature.

The electronics also monitor the current of each individual LED, and in the event just one single LED should fail, inspection will be halted, an alarm output set and the error cause will be displayed on the OptoScan PC.



Picture 11: Sealed lamp unit with Lexane window.

The actual layout and size of a lamp unit depends on the physical outline of the can(s) to be inspected.

Rack, enclosures and connectors

The basic module is constructed from stainless steel and anodised aluminium in sufficient dimensions to maintain high precision and resist wear and tear over a long life time. At the same time it is designed for maximum flexibility with the aim of being able to adapt to any type of can and conveyor system.

Lamp units have solid aluminium boxes with a thick Lexane window and are totally sealed.

The camera sensor is housed in aluminium cases with fittings protecting the optics. The input to the detector is further protected by an integral Lexane window to keep contamination low.

A junction box containing power supplies and terminal blocks for rerouting signals is also stainless steel with metal glands.

The OptoScan PC enclosure is a totally sealed IP65 stainless case with industrial type connectors. The accompanying floor stand is also stainless steel.

The OptoScan module is therefore mechanically, optically, as well as electronically a very rugged design, insensitive to environmental interference.

The module of course complies with international safety and EMC standards including those relevant for CE marking.

Technical Specifications

Module:

Size : 800x273x340 mm (LxWxH) app.

Weight : 20kg app.

Supply Requirements : Compressed air; vacuum.

OptoScan PC:

PCI6000 industrial computer in IP65 stainless steel cabinet, equipped with a flat panel screen, that may be placed on a floor-stand, or suspended in a wall-mount yoke.

Connectors : PCI6000 standard connectors are D Sub IP65 protected.
All other connectors are industrial types.

Capacity : 16 lanes.

Utility slot : 1 slot available for a full length standard PCI accessory card.

Ports : 2 RS232/RS422/RS485 optoisolated serial ports.
1 optoisolated parallel printer port.
Ethernet.
CAN bus interface.

Size : 502x423x150 mm (WxHxD) app.

Power : 115/230 V AC 50/60 Hz single phase (L/N/E).
100 Watts maximum app.

Temperature : 5 - 40 Deg. C ambient operational.

Option 1 : Remote support through telephone line.
Program and modem unit supporting local telephone standard.

Option 2 : Screen menus in local language.

Option 3 : Laptop PC. IBM PC including special communication hardware and software.

Sensor head:

- Sensor : CMOS type. All image processing contained in the sensor head.
- Sensitivity : 5 µm diameter hole in line of sight - qualified in testjig at factory.
- False reject rate : App. 5 in 10⁶ - at sensitivity of 5 µm.
- Size : 112x69x53 mm (LxWxH) - excluding optics.

Lamp module:

- Power : 24V DC/1.25 - 4A - depending on can size.
- Size : 250x170x50 mm (LxWxH) - can size dependent.

Junction box:

- Power : 230V AC/400W.
- Size : 600x300x160 mm (LxWxD) - installation dependent.

Press interlock:

- Alarm Signal : Provision of 24 VDC/2 Amp for activation of external warning signals or halting of the press.

Rejection device:

- Type : Blow-off device.
- Actuator : Pneumatic nozzles.
- Required power : 6 Bar compressed air.

Calibration cans:

- Cans : Specially prepared cans with calibrated hole.
Detailed specification available on request.

Floor stand:

- Type : Floor stand with yoke mount for OptoScan PC.
- Height : 1,2 mtr to mounting bushings of OptoScan PC.
- Option : Wall-mounted yoke for OptoScan PC.

Profile

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Company description

InnoScan K/S, founded in 1988, specializes in high-tech inspection systems for automatic quality control for pharmaceutical vials and ampoules, as well as dedicated inspection systems for easy-open ends and shallow cans for the can making industry.

Facilities

Third quarter 2004 InnoScan moved into a brand new headquarter with offices, laboratories, production and assembly facilities covering an area of 1700 sq m. InnoScan handles in-house multi-disciplinary development and design of mechanics, optics, lightning, electronic hardware and software under strict quality control.

Products

The company's main products for the can industry are optical leak detection systems. The OptoScan 5000 for on-press EO-end testing. The self-indexing stackable OptoScan 7000 modules for DRD cans and the OptoScan 6000 for direct clamping to a DRD press outlet.

Recent developments

A new CMOS sensor is used in the most recent OptoScan 5000 Leak detection system for EOE's giving increased sensitivity even at 800 st./min. Also the modular concept for leak testing DRD cans where a small flexible single-lane module receives square, round, or oblong cans from a conveyor or track work - inspect for leaks - and send them on.

Services

- InnoScan provides full engineering support including installation, commissioning and running in.
- Standard products are customer adapted as required.