Ensure 100% Traceability and Quality of Your Products using Omron Microscan Automatic Identification and Machine Vision Systems

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Agenda

- Automatic Identification and Machine Vision Tool Set
- Traceability
  - Automatic ID Code Types
  - Code Marking Methods
  - Code Reading
  - Code Verification
- Machine Vision Inspection
  - Presence/Absence
  - Color ID/Color Match
  - Count
  - Measurement/Gauging
  - Assembly and Assembly Verification
  - Defect Detection
AutoID and Machine Vision Basic Toolset

- Read Codes
- Read Text
- Verify Code Quality
- Verify Text Quality
- Presence/Absence
- Count
- Measure
- Locate
- Color Detect
- Logic

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Traceability

**Strategy**
- Mark all parts with codes
- Enables automation
- Build a complete manifest of what goes into a product
- Track from cradle to grave

**Requirements**
- Marking
- Mark quality verification
- Reading
- Data recording

Blade Runner Trivia – Who made the Replicant snakes?

Abdul Ben Hassan
Code Marking Types

- Human Readable Codes
  - OCR-A
  - OCR-B
  - SEMI-OCR

- Machine Readable Codes
  - 1D Bar Codes
  - 2D Symbologies
  
  Highest read reliability
Traceability
Traceability

- **Track**
  - In house
  - Part tracking
  - Process control
  - Process optimization

- **Trace**
  - Part Genealogy
  - Defective Part Tracking
  - Spill Containment
  - Selective Recalls
  - Anti Diversion
  - Counterfeit Prevention
  - Nabbing replicants
Code Marking Methods

- **Labels** – Ink Jet, Laser, Thermal
  - Example images showing labels with printed text and codes.

- **Direct Part Marks** – Laser, Dot Peen, Ink Jet
  - Example images showing direct part marks on various materials.
Direct Part Mark Application Examples
Automotive Applications

- Engine component traceability
  - Head and block traceability
  - Assembly error proofing
  - Selective pairing of components

- Transmission components traceability

- Fuel injector traceability

- Catalytic converter traceability

- PCB traceability

- Final assembly and WIP verification
Code Readers

- Handheld label reader – HS 21
- Handheld DPM (Direct Part Mark) reader – Mobile Hawk
- Fixed mount label and DPM reader – MicroHAWK ID20, ID30, ID40
- Fixed mount vision system with reading – MicroHAWK MV, HAWK MV
AutoID and Machine Vision Basic Toolset

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Code Verification – Check the handwriting

- Marking processes drift from nominal settings ultimately leading to unreadable marks
- Verification allows adjusting of marking process **before** unreadable marks are made
- Verification is metrology tool to ensure consistent mark quality
- Verifier can tell not only that mark is readable but also how close it is to edge of readability that it is
Code Verification

- **Offline** or **Inline** symbol verification
  - Verify or validate the symbol immediately after printing
  - Deviate from the standards if process or circumstances require
  - Provide results that correlate directly with ISO standards

- **Verification** ensures that EVERY product ships with a good quality symbol despite the fact that every marking system will degrade over time

Without verification, some “bad” parts escape into the process. With verification, we prevent bad marks from ever being made.
ISO15416 - 1D Label Verification

- ISO 15416
  - 1D on Labels
  - Requires even illumination
  - Requires good lens with high MTF
ISO 15415

- 2D on Labels
- Requires even illumination
- Requires good lens with high MTF

Modulation
ISO 29158 - 2D DPM Verification

- ISO 29158
  - Direct Part Marks
  - More forgiving spec
  - Requires application specific lighting
Direct inkjet printing is economical

But the results are not always pretty

No reads at big retail customers result in fines for each unreadable code

Inline verification after printing ensures NO bad symbols ship
Code Verifiers

- **Offline**
  - Handheld label and DPM verifier – LVS-9580, LVS 9585
  - Desktop Verifier – LVS-9510

- **Inline**
  - Fixed mount inline verifier – MicroHAWK MV, HAWK MV-4000
Code Verification at the printing source
Optical Character Verification

- **Show and Go Tool** - Validate printed text by training on a good sample
- Detects common printing problems and provides pass/fail output

Symbols are compared against trained golden symbol

Symbols are rejected if the total residue exceeds the set tolerance

Optional tests for Largest single defect, character breaks, contrast, and blurriness
Optical Character Verification - Example

Pad Printing OCV on ICs
AutoID and Machine Vision Basic Toolset

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Full Machine Vision Smart Cameras – MicroHAWK MV
Brand New High Performance Camera

HAWK MV-4000

- 8 Models
  - MV-4000-03, Mono, 0.3 MP
  - MV-4000-03C, Color, 0.3 MP
  - MV-4000-13, Mono, 1.3 MP
  - MV-4000-13C, Color, 1.3 MP
  - MV-4000-20, Mono, 2.0 MP
  - MV-4000-20C, Color, 2.0 MP
  - MV-4000-50, Mono, 5.0 MP
  - MV-4000-50c, Color, 5.0 MP
# HAWK MV-4000 Light Kits

<table>
<thead>
<tr>
<th>Light Kits</th>
<th>Description</th>
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<tbody>
<tr>
<td>98-9000120-01</td>
<td>Kit, bracket, MAX 300 to HAWK MV-4000</td>
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<tr>
<td>98-9000121-01</td>
<td>Kit, bracket, DOAL to HAWK MV-4000</td>
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<tr>
<td>98-9000122-01</td>
<td>Kit, bracket, Ring 60/70 to HAWK MV-4000</td>
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<tr>
<td>98-9000123-01</td>
<td>Kit, bracket, Ring 100 to HAWK MV-4000</td>
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<tr>
<td>98-9000137-01</td>
<td>Kit, Smart Series, Pharmalite, HAWK MV-4000</td>
</tr>
</tbody>
</table>
Presence/Absence of Critical Parts and Features

- **Count Pixels**
  - Within range of grayscale intensity
  - Edge pixels (brightness invariant)

- **Tolerance**
  - Compare count to min and max values

- **Output**
  - Pixel count
  - Pass/Fail
Presence/Absence using Color

- **Color ID**
  - Determine color from library of colors

- **Color Check**
  - Compare color to one specific color

- **Tolerance**
  - Compare pixel count to min values

- **Output**
  - Color
  - Count of pixels
  - Pass/Fail
Count

- Locate features
  - Shape based
- Tolerance
  - Compare count to min and max allowed values
- Output
  - Count
  - Locations
Count

- **Locate features**
  - Blob based
  - Select based on min and max size of blob

- **Tolerance**
  - Compare count to min and max values

- **Output**
  - Count
  - Locations
Measurement

- Locate features
  - Lines
  - Points
  - Circles
  - Patterns

- Measure
  - Line to Line
  - Point to Point
  - Point to Line

- Calibration
  - Convert pixels to real world units

- Tolerance
  - Compare to min and max values

- Output – OK/NG
Location and Guidance

- Train a pattern
- Return X, Y, Theta
- Add encoder based offset for “pickup down the belt”

**Intellifind Tool**
- Edge Based Pattern Matching
- Allows 360 degree rotation
- Allows scale changes
- Lighting invariant
- Finds patterns amongst clutter
Assembly

- Train pattern of points on each part
- Compute offset of part 1 to blueprint
- Compute offset of part 2 to blueprint
- Compute offset part 1 to part 2
- Output X, Y, Theta to assemble part 1 onto part two
- Uses “rigid body fit” algorithm
Defect Detection

- Often difficult – Defects similar in size and shape to allowed features
- Highly dependent on lighting to create contrast
Defect Detection – Lighting Dependency
Defect Detection – Using OCV

- OCV is not just for characters
- OCV can be used for individual shapes or symbols
- OCV computes difference between trained and inspected shape
- OCV combined with color checks is very powerful
Wrap Up

- Modern Machine Vision Systems contain tools for
  - Automatic Code Identification
  - Code Verification
  - Machine Vision

- Traceability is a Strategy that involves
  - Picking the correct code types
  - Picking the correct code marking methods
  - Code Reading
  - Code Verification

- Traditional Machine Vision is used for
  - Presence/Absence
  - Color ID/Color Match
  - Count
  - Measurement/Gauging
  - Assembly and Assembly Verification
  - Defect Detection
Last Trivia Question

- What is a Machine Vision Engineer’s favorite quote from Blade Runner?

  - I just do eyes!

HAWK MV-4000
Coming in Dec 2017!
Thank you!

For more information... visit booth number

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Thank You!

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