SE03

Benefits of Image Based Bar Code Scanning
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Cognex Resources at the Expo

Sessions:
SE05 – Getting Started with DataMan Bar Code Readers – Hands On Lab

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Introduction to Industrial Barcode Reading
Agenda

- What is a barcode?
  - History
- 1-D codes
  - Types and terminology
- 2-D codes
  - Types and terminology
- Marking Methods
- Laser Scanning vs. Image-Based Reading
- Hardware and Software
- Communication
- Cognex ID Product Portfolio
Barcodes can provide visibility at every step of a given manufacturing process.
Read the news lately?
What is barcode reading?

- A barcode is a machine readable representation of data related to the object it is attached to.
- A barcode reader is used to read these codes in order to track the object throughout its lifecycle.
Where are barcodes used?

- The first product to ever be scanned was in 1974.
- By the 1980s, scanning for retail became worldwide.
- Today, codes can be both 1-D and 2-D.
Where are barcodes used?

- Food
- Packaging
- Medical & Pharmaceutical
- Electronics
- Automotive
- Aerospace
1-D Barcodes

Different types
Industry terminology
Common uses
Common 1-D Barcode Types

- UPC-A
- Code 128
- Codabar
- Code 39
- Interleaved 2 of 5
- Pharmacode
Linear Barcode Terminology

- Quiet Zone
- Guard Pattern
- Narrow Bar Width
2-D Barcodes

Different types
Industry terminology
Marking methods
Common uses
Common 2-D Codes

- **DataMatrix**
- **MaxiCode**
- **QR-Code**
- **Aztec Code**
2-D Code Terminology

- 24 square and 6 rectangular formats
- 3,116 numeric or 2,335 alphanumerical characters
- Error correction improves read rates
- Scalable
- Reading accuracy
  - 1 misread error in 10.5 million reads

Requires an image-based ID reader to decode
1-D Linear Barcodes

- Bars / spaces are measured to determine information
- The code is the key to a database

Stacked Linear Barcodes

- Can be read by laser and/or camera-based technology
- Relies on good print/edge quality for edge measurement

2-D Data Matrix Codes

- Cells code the data, based on their relative position within the matrix
- Requires a camera-based system to decode
- Provides error correction for greater mark durability
- Can encode in smaller areas

Each of the symbols pictured above represent 60 alpha-numeric characters.
Printing Methods: Printed Codes

1-D and 2-D Printed Codes

- Inkjet
- Labels
  - Most basic
  - Cost effective
  - Less flexible, pre-determined code data
2-D Direct Part Marking (DPM)

- Dot Peen
- Chemically Etched
- Laser Marked
DPM Best Practices - Mark Placement

Ideally mark should be in a clear, unobstructed location on the part.

A “quiet zone” of at least 3-4 cell widths should exist around the code.

When marking on a curved surface the code should be no larger than 16% of the diameter or 5% of the circumference of the part.
Module size (cell size) should be large enough to stand out against the surface roughness of the background.
DPM provides visibility at every step of the manufacturing process.
Quality Metrics

- Reference Decode
- Symbol Contrast
- Modulation
- Fixed Pattern Damage
- Axial Non-Uniformity
- Grid Non-Uniformity
- Unused Error Correction
Laser Scanner Technology

What is it?
How does it work?
Benefits
Limitations
Laser Scanning Technology

Target reflects light to photo cell

Photocell

Oscillating mirror

Laser

Barcode

Light Detector Signal

Digitized Signal

POWERED BY WERNER ELECTRIC
Benefits of Laser Scanners

Cost
• No image processor
• Uses oscillating mirrors

Speed
• Fast scan rates, some up to 2000 scans/sec

Decoding at long distances
• 6 to 24 inches away
• Long range can do multiple feet away

Most common and longest in use
Limitations of Laser Scanners

Hard to scan barcodes
- Poorly printed
- Defective / damaged
- Low contrast
- Specular reflections
- Narrow-heightened

Unidirectional scanning
- No omnidirectional (360°) or at least orthogonal (0° and 90°) reading
- Mounting and positioning constraints

Cannot read 2-D codes
Image-Based Barcode Reader Technology

What is it?
How does it work?
Image formation
Benefits
Limitations
What Is Machine Vision?

Can you calculate what this is?

Now maybe you can see it...

Here it is.

Code: MK2121-2086Q

Machine vision sees and interprets the world
Image-Based Barcode Readers: Image Formation

- Dark ink, light background—simple direct illumination
- DPM require more advanced lighting techniques
- Reader should have ideal focus settings
  - Lens advisor: S-Mount, C-Mount, Liquid lens

**Bright Field Lighting:**
High contrast labels & DPM parts

**Dark Field Lighting:**
Dot Peen & laser DPM

**Diffuse Dome:**
Highly reflective & curved surface DPM reading
Image-Based Barcode Reader Simple Set Up: Software

- Trigger button
- IN1 button
- Tune button
- Latest image
- Region of interest
- Context based help
- Read history
- Code information
- Connection status

Scripting

```javascript
function onResult (decodeResults, readerProperties, output) {
  // Converts read data to all upper case. Single code only
  output = decodeResults.toUpperCase();
  return output;
}
```
Imaging Advantages in Barcode Reading

Can read all codes—easy, well printed to difficult to read damaged codes
- Poorly printed
- Defective / damaged / voids
- Low contrast
- Specular reflections
- Short height
- Extreme perspective

Omni-directional reading

Performance feedback

Solid state design—no moving parts!
- More reliable than laser scanners

Can read both 1-D and 2-D codes
Omnidirectional Code Reading

Read barcodes in any orientation from 0° to 360°
Multiple Code Reading and Output Capability

Read multiple barcodes in a single image or a sequence of images.
See What The Reader Sees

195-10-198
Code 39, 1.81 PPM

03476710067
Code 128, 1.31 PPM
Communication Protocols

- Ethernet TCP/IP
- RS-232
- USB
- Keyboard-Mode
- Discrete I/O
- FTP
Integrating your Barcode Reader

PLC Integration
- Ethernet/IP : Allen Bradley
  - Add On Profile
- PROFINET : Siemens
- MC Protocol: Mitsubishi
- Modbus TCP : Schneider Electric

Storing Data to a Database
- Oracle
- SAP: Enterprise Resource Planning

Discrete I/O
Benefits of Image-Based Barcode Reader Technology

No Moving Parts
- Solid state device
- Longer life than laser scanners

High Read Rates
- Can read damaged/ properly marked codes
- Omnidirectional reading

Image Feedback
- Store No-Read images
- Find out why a code does not read
Why Didn’t Imagers Replace Lasers Earlier?

Cost
- Component costs for image sensors and peripherals have decreased

Size
- Highly condensed and integrated components are now available
- Integrated image-based barcode readers are now available at the size of small single line lasers (23.5mm x 27mm x 43.5mm)

Performance
- Image processing algorithms can now surpass laser scanner performance
What should you consider when selecting a Barcode Reader?

Read rates
- Best algorithms to decode 1-D and 2-D codes
- Reduce No-Reads and misreads

Durability/Life of reader
- Solid state device, no moving parts

Ease of setup
- User friendly software/tuning

Communication
- Need a reader that supports your facilities protocol
Best-in-class algorithms

Ability to read some of the hardest codes

- Codes on cardboard
- Codes marked with a marker
Read Rates

Best-in-class algorithms

DPM Codes
- Shiny material

Poor quality codes
- Small
- Low contrast codes
PowerGrid™ Technology

- Texture-based location algorithm
- Unique, inside-out approach to reading 2-D matrix and Direct Part Mark (DPM) codes
- For reading codes with significant finder pattern, clocking pattern, or quiet zone damage
Cognex Readers

Durability/ Life of Reader
- Solid state readers, no moving parts

Ease of Setup
- Easy tuning in software and hardware
- Liquid Lens technology

Communication
- Supports popular industrial protocols and communication protocols

Cognex Products
- Full line of handheld and fixed-mount readers
- Different price & performance options
DataMan Fixed-mount Barcode Readers

DataMan 503

DataMan 300

DataMan 200

DataMan 100

DataMan 60

DataMan 50
DataMan

2DMAX+

1DMAX+ with Hotbars

High Speed, Large Depth of Field

Modular Optics & Illumination

High Power, Compact Design

Xpand Technology

Powerful Decoding Software

Advanced Image Formation

Ease of Use

Intelligent Tuning

Industrial Protocols

Powered by Werner Electric
The smallest image-based reader

Best in Class 1-D and 2-D reading
Smallest high performance fixed-mount ID reader
Durable, solid state design

Features:
DataMan 50: USB & RS-232
DataMan 60: USB, RS-232 and Ethernet
752 x 480 resolution
Adjustable 3-position lens for different working distances
Several Models

**DataMan 50/60 S**
- Improved IDQuick for best in class 2-D reading
- 5 decodes/sec

**DataMan 50/60 L**
- 1DMax+ with Hotbars best in class 1-D barcode reading
- For oriented (ladder or picket fence) high speed 1-D barcode reading
- Up to 45 decodes/sec

**DataMan 50/60 QL**
- 1DMax+ with Hotbars best in class 1-D barcode reading
- For oriented (ladder or picket fence) high speed 1-D barcode reading
- Up to 45 decodes/sec
DataMan 300 Series

• **Performance**
  • 2DMax+ : best in class DPM reading
  • 1DMax+ with Hotbars: best in class 1-D barcode reading

• **Image Formation**
  • DataMan 303: 1600 x 1200 pixels
  • DataMan 302: 1280 x 1024 pixels
  • DataMan 300: 800x600 pixels
  • Flexible lighting & optics
    • Autofocus Liquid Lens, S-Mount, C-Mount
    • Blue, Red, Polarized Red, Infrared, White

• **Ease of Use**
  • Intelligent Tuning
  • Quick Setup
  • Separate buttons for Trigger and Tune
DataMan 300 Offers Flexible Optics

- M4 Mounting Bosses
- C-Mount Lens Mount
- IP67 Lens Cover
- Light Control
- M12 Lens Mount
- Variable Focus Control
Liquid Lens Technology

ELECTROSTATIC PRESSURE

WINDOW

INSULATION

METAL

OIL

OPTICAL AXIS

WATER

OIL

OPTICAL AXIS

WINDOW

INSULATION

METAL

ON

OFF
Flexible Lighting

- 8 independent lighting banks (Blue, Red, Polarized Red, White, IR)
Flexible Lighting – External

Ring light
Spotlight
Backlight
Low angle ring light
Other Lighting Vendors
Ease of Use: Installation, Set Up and Monitoring

Separate Trigger and Tune Buttons
  Tune – Optimize brightness, lighting, focus and decoding

5 Status LEDs
  Power
  Communication
  Good Read
  Network Status
  I/O Status

LED Bar
  Yield
The future of 1-D barcode reading

- 2048 x 1088 resolution (2.1 Megapixel)
- Over 120 reads per second
- 3.3 m/s transport speed
- 36 inch depth of field
- Synchronous multi camera operation

Handles the most challenging 1-D barcode applications including:

- High speed sorting
- 5-sided barcode scanning tunnels
- Large format presentation scanning
Cognex Handheld Barcode Readers
DataMan 8000 Series Readers

First handheld barcode reader with Liquid Lens technology
- Large focal length range
- Dual focus mode

Corded or Cordless

Interchangeable communication modules
- USB, serial, Ethernet, and wireless
- World’s first industrial handheld ID reader to support industrial protocols

Integrated illumination
- UltraLight technology for every application (8600 model)

Rugged readers designed for the factory floor
- 50 drops from 2 Meters
- IP65 rating
DataMan 8000 Series Readers

Variable working distance with Liquid Lens

Unmatched read rate with 1DMax and 2DMax

Rugged, industrial housing

Modular Communication Ethernet or RS-232/USB
Performance: UltraLight - Advanced Image Formation

Diffuse bright field illumination for labels and good contrast DPMs

Dark field illumination for dot peen and laser DPMs

Diffuse Off Axis illumination for curved surfaces and highly reflective surfaces

Quadrant control for surface texture

DataMan 8600
DataMan 8000 Offers Communication Modules

Field exchangeable communication modules
Future-proof for communication requirement changes

Modular connectivity options:
- Serial: RS-232 & USB
- Ethernet: FTP & TCP/IP, EtherNet/IP, PROFINET, MC Protocol, Modbus/TCP
8600 - THE best DPM reading capability with adjustable lighting, optics and high resolution sensor

8050X – for reading well-marked laser and dot peen codes like a label reader

8050 – for high speed 1-D and 2-D labels easier and at more angles
DataMan 8050 Series

Reading Performance
- 8050X – Robust 2-D DPM reading
- 8050 – High Speed 1-D and 2-D labels

Modular Design
- Interchangeable Communication Modules

Industrial
- Ruggedized Industrial Design
Robust reading performance on 2-D DPM

- Dot Peen
- Laser Marked
- Low Contrast
- Perspective
- Skew
- Damage
- Blur
- Non-Uniform Illumination
High contrast 2-D codes read quickly and easily

High speed 2-D algorithms read all types of 2-D barcodes even with:

- Perspective distortion
- Quiet zone violations
- Blurred codes
- Low contrast
- Damage
1DMax+ with Hotbars™ delivers incredible speed and robustness
Designed to read the most challenging 1-D barcodes

- Low contrast
- Blurred codes
- Quiet zone violations
- Damages / Voids
- Specularity
- Perspective distortion
What We Learned Today

Read Rates
DataMan barcode readers achieve the highest read rates with best-in-class software algorithms 1DMax+ with Hotbars and 2DMax+

Performance Feedback
Visualization enables you to understand why no reads or rejects occur and improve your processes

No Moving Parts
Solid state design ensure greater product reliability

Flexibility
Flexible lighting & optics enable you to configure DataMan products so you can achieve the highest read rates!

Ease of Use
DataMan readers offer easy integration and simple, fast deployment
Thank You!
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QUESTIONS?