



Machine Vision Systems

A Viable Solution



Why Inspect?

Confirm Correct Assembly

Has the product or piece part been assembled correctly.

- Safety Issues
- Fit-for-Purpose
- Correct Operation
- Machine Protection
- Accurate Supply

Product Identification And Orientation

What is the product and is it positioned correctly.

- Product Sorting
- Quality Issues
- Labeling
- Branding
- Marking
- Packaging
- Brand Presence
- Assembly

Security and Protection

Does the Product Match its Specification.

- Quantities
- Weights and Dimensions
- Security Markings
- Codes and Markings applied
- Warning Labels
- Brand Protection
- Recall Prevention
- Contaminants



An Inspection System Versus Manual Inspection?

Business Pressures

- Risk of Component Failure
- Returns from customers unacceptable
- Business relationships under strain
- Delivery fines from retailers
- Perceived under capacity
- Cost of manufacture
- Competitive nature of business
- Increased demand
- Production line runs faster
- Excess waste

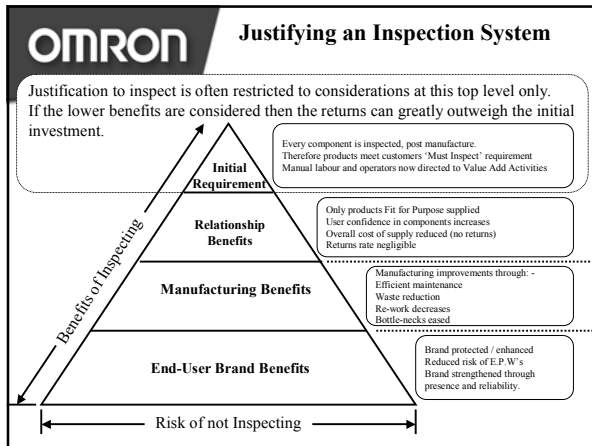
Inspection Required

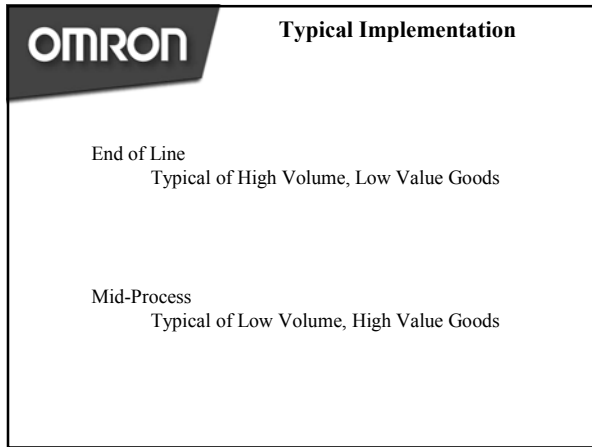
Manual Inspection

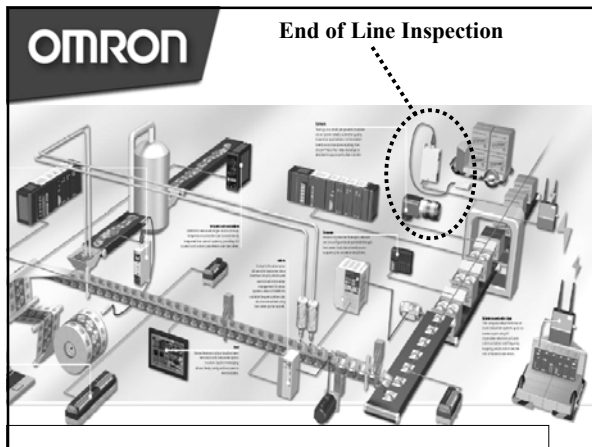
- Line operatives in place
- Labour cost now too high
- Diverts from value add activities
- Speed of production makes this type of inspection difficult
- Failures difficult to spot
- Unreliability

Automatic On-line Inspection

- Vision sensors are no longer complex
- Much lower hardware costs
- Engineering becoming comfortable with technology
- Very reliable
- Easily integrated with an existing control system
- Little user interaction required
- Vision systems are now fast enough for the modern production environment







OMRON **End of Line Inspection**

The diagram shows a flow from 'Production Processes' at the bottom, moving up to an 'End Of Line Inspection Station', and then to 'Retailer or End Customer' at the top. A feedback loop arrow points from the customer back to the inspection station. A callout box for the 'Retailer or End Customer' contains text about inspection specifications. Another callout box for the 'Manufacturing Domain' contains text about product value and inspection opportunities.

Now only products or piece-parts that are fit for purpose are supplied.

Retailer or End Customer

Inspection Specification
The Retailer / End customer is driving the specification for inspection. It is their demands that determine what to inspect and the pass / fail limits for the products.
The inspection is however, implemented in the manufacturers domain!
The opportunity is to specify in this domain while satisfying the ultimate requirements.

End Of Line Inspection Station

Manufacturing Domain
The finished product is low value and the volumes are high. It is a challenge to inspect at each process.
However, as inspection systems become lower cost, faster and smaller, the opportunities to inspect at each process is growing.
Manufacturers now have greater potential to reduce waste through the early identification of defects.

Production Processes

OMRON **Mid Process Inspection**

The image shows a machine with a conveyor belt and an inspection station. A callout box on the left contains text about inspection in the manufacturer's domain, reasons for pass/fail results, and the benefits of monitoring.

Inspection in the Manufacturers Domain
There are significant benefits to be had from inspecting at critical points during the manufacturing process.
Machine Builders have a role to play, in the design and fitting of systems such that they are truly part of a machines control system.

Consider the Reasons behind Pass / Fail Results
By considering the processes that a product has passed through before reaching an inspection station the results of the inspection can be apportioned to a physical action.

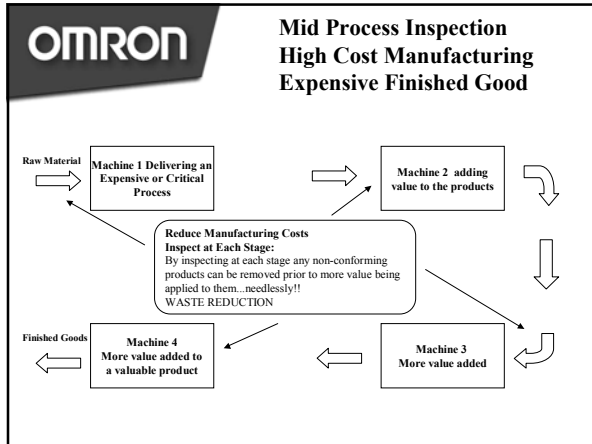
By monitoring and recording this information it is now possible to set-up actions, such as on-time maintenance that are triggered purely by monitoring the inspection systems outputs.

This is a significant benefit to the manufacturer as not only are the products produced fit for purpose, there are fewer failures and so the cost of manufacture is greatly reduced.

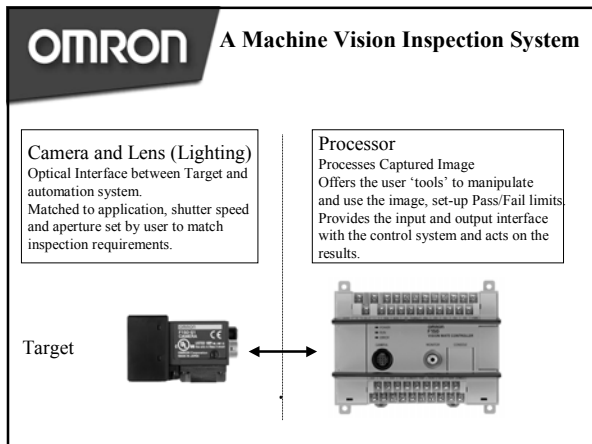
OMRON **Mid Process Inspection Heavily Utilised Machines**

The diagram shows a 'Bottle-Neck Machine / Process' with an arrow pointing to it from the left and another arrow pointing away to the right. A callout box labeled 'INSPECT HERE' points to the input of the machine.

INSPECT HERE
By pre-inspecting prior to the bottle-neck all non-conforming products can be removed before processing. This ensures that only fit-for purpose products proceed, maximising the machine! Increasing its throughput efficiencies.







OMRON Typical Hardware Interface Options

- PLC or Controller Connection
- Single and Multi-Camera Connection
- Networking Capability
- Intelligent Lighting Connection
- User Interface Options
- Self Monitoring and Diagnostics
- Saving, Recording and Sharing of Data
- Programming Tools

OMRON Integration Capabilities

- Machine Interface**
Remote access to search results, user adjustments and inspection image.
- Machine Control**
Ethernet
RS232 / 422
D-Net
Profibus
- Closed Loop Motion Control**
Vision is often combined with motion controllers. Vision provides the positional information and motion controllers respond.
- Multi-Drop Capability**
Control of multiple inspection stations with simple wiring.
D-Net
Profibus
- Information Distribution**
Performance, condition and status information as well as reject rates can be distributed to all interested stations.
D-Net, Profibus and Ethernet

OMRON Installation Considerations

- How to Illuminate
- Consistency
- Immune to Ambient Changes
- Self Monitor Light Levels

Lighting

Target

Installation

- Position
- Resolution Required
- Size (Camera Position)
- Repeatability
- Protection IP Rating
- Mechanical Protection
- Alignment Issues
- Focus Protection
- User Interface Requirements



User Programming Considerations

Inspection Tool

The vision system will have in-built search methods. These are selected for each individual application via simple menus.

Image Conditioning

Use in-built image conditioning tools to ensure that the captured image is Reliable, Robust and Repeatable

System Settings

There will be a requirement for the user to specify, through the hardware how the system is to be integrated with the control system.



User Programming Considerations

Inspection Tool

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Examples of Common Tools: -

- Grey Search
- Pattern Matching through Gravity and Area
- Blemish and Defect Detection
- Edge Tools for Measurements, Dimensions and Pitch
- Pixel Counting
- Rotation Searches
- Position Compensation
- Classification for Sorting
- Labeling or Blob Analysis
- Character Recognition...user defined
- Character Verification...system defined

All Can Be Combined Through Expressions



User Programming Considerations

Image Conditioning

Use in-built image conditioning tools to ensure that the captured image is Reliable, Robust and Repeatable

Examples of Image Conditioning Options: -

- Shutter Speed
- Light Control (Intelligent Lighting and Aperture)
- Filtering...Position Control
- BGS Levels...reduces background effect
- Edge Extraction
- Contrast Adjustment
- Image Sharpening / softening



User Programming Considerations

System Settings

There will be a requirement for the user to specify, through the hardware how the system is to be integrated with the control system.

Examples of System Settings: -

- Camera Settings
- Communication Requirements
- Output Options
- Display Options (User Interface)
- Operation Settings (Locking out menus for example)
- Date / Time Information
- Data logging and recording information



In Summary

Modern Inspection Systems: -

- Are low cost
- Do not require a PC
- Operate very fast
- Will datalog results
- Deliver real business benefits
- Self monitor and raise alarms
- Allow adjustment to be made remotely
- Can control multiple cameras
- Are simple to program
- Designed for the industrial arena
- Can be used to control the lighting
- Can pinpoint manufacturing hotspots
- Operate 24 hours per day, every day
- Will store many search programs
- Accept product changeovers, automatically
- Are supported by experienced engineers
