# VERISENS®

## APPLICATION DESCRIPTION:

## *PRODUCT DETECTION, PACKAGE SIZE*



## BACKGROUND AND CONCLUSION

A major manufacturer of packaging equipment needs to detect the presence of product contained within a translucent bag. Additionally, the end of the patch needs to be detected. A portion of the patch fluoresces when exposed to ultraviolet light. Product within the bag can vary in size and shape. The patch is transparent to infrared light.



**FIGURE 1**

Figure 1 is a picture of the product within the bag. A portion of the bag is translucent (the "patch") and fluoresces under ultraviolet light ("UV"). The transparent portion of the bag does not fluoresce. Additionally, the "patch" is transparent to infrared light ("IR"). During production, the product within the bag rests upon a conveyor that is also transparent to IR. As the bag enters the detection station a photoelectric sensor detects the presence of the part. This report addresses the detection of the product with IR and the location of the end of the patch with UV using the same VeriSens® vision sensor.

There are three bags which are regularly used by the manufacturer. Only two types were available and their test results appear below. IR was not tested because the detection attributes of the VeriSens® is well known.

The testers arrived at the conclusion that both the product within the patch and the patch itself can be detected using one VeriSens® vision sensor.

# INSPECTION STATION OVERVIEW

Figure 2 is a concept sketch of the various detector components. As the product enters the inspection zone its presence is detected by a sensor. The sensor causes two images to be acquired sequentially, one with the product illuminated from above with UV and one from below with IR. The locations of both the product and the edge of the patch are calculated and sent to a PLC on the machine.



**FIGURE 2**
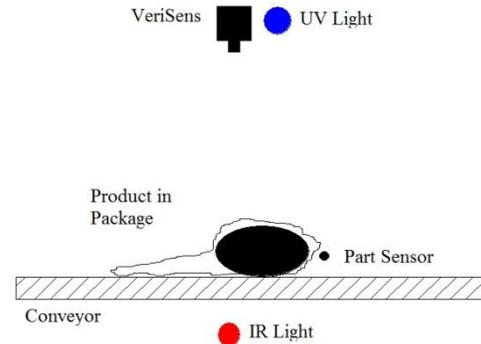
Testing was performed using a VeriSens with a 1.3 Megapixel sensor. Working distance was approximately 20"; a 6-15mm zoom lens yielded a Field of View (FOV) of 20" in the greater (y) dimension. Because this FOV can accommodate the larger bag it will also be suitable for the smaller.

VeriSens setup/ configuration are performed with a PC over an Ethernet connection. Once configuration is performed, the sensor operates as a stand-alone sensor and the PC is not required. Up to 255 configuration recipes ("jobs") can be stored on the sensor. VeriSens has 5 digital inputs and 5 digital outputs. These are used for such functions as image acquisition, job selection, part reject, etc.

## FOUR SETUP STEPS

The four steps to setting up VeriSens are:

1) Adjust Image
2) Check Features
3) Configure Interfaces
4) Activate VeriSens.

Each of these steps is described in detail below as applicable to this inspection application.

### STEP 1: ADJUST IMAGE

Step 1 is establishing proper part positioning and lighting. For this application it shall be necessary that the physical alignment among the lighting, the VeriSens and the part sensor be such that the edge of the patch and the product within the bag be within the FOV of the sensor. Although not required for the inspection, mechanical constraints on the machine dictate that the part be stopped when the inspection is performed.

Lighting for this inspection is twofold: UV from the top and IR from the bottom. The UV light source needs to be of sufficient intensity to illuminate the patch. For this application the light source was a UV LED

source from Metaphase Technologies. It is expected that the actual UV intensity specification shall be much greater, and sufficient to overcome any effects of ambient light. Should this prove not to be the case, however, provision must be made on the machine to shield from ambient light since the inspection methodology uses two light wavelengths precluding the use of band pass filters.

The IR source exists on the machine now and is known to be effective.
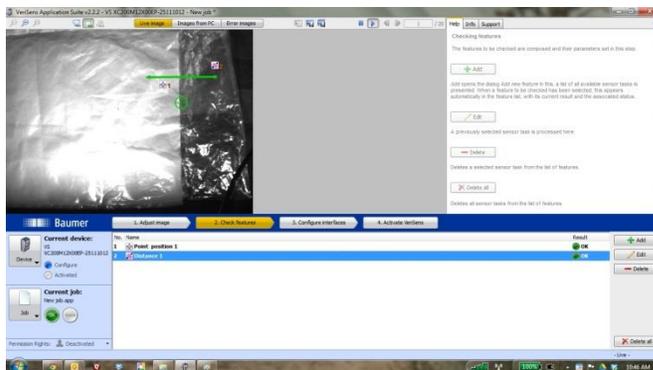
### STEP 2: CHECK FEATURES



**FIGURE 3**

Step 2 is where the proper software tools are selected to perform the inspection. The two samples had two different contrast levels, so there are two solutions described below. The methodology described for the translucent patch is the one that would apply in production because a more intense UV light could be applied.

Figures 3 and 4 illustrate the VeriSens software environment and the two different software tools applied.

In Figure 3, the translucent patch has considerable fluorescence and the edge of that fluorescence is readily detectable using an Edge Distance Tool. The value from this tool can trigger a digital output on the VeriSens to signal the PLC whether the patch edge is within an acceptable range.
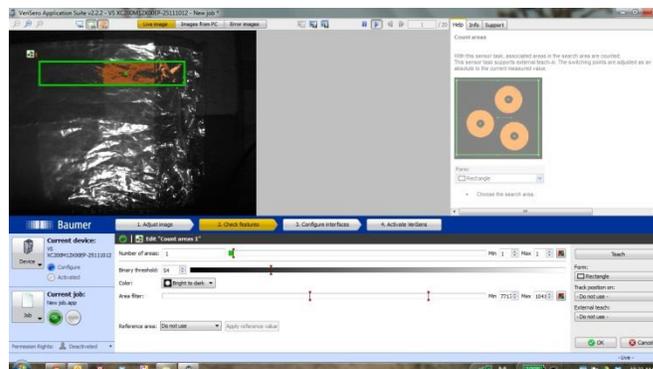


**FIGURE 4**

Figure 4 illustrates an alternative method in a lower contrast environment. In this case an area location tool was applied. The result in this case is not the edge of the fluorescence, but rather the centroid of the area. As in the sample in Figure 3, the value of this tool can trigger a digital output to the PLC, signaling a desired offset from the edge.

Note also in Figure 4 the spectral reflections emanating from a non-fluorescing portion of the bag. This is due to the sample having been repeatedly crinkled during transport and storage and is not expected to be present during production.

### STEP 3: CONFIGURE INTERFACES

Step 3 is to configure the outputs. As described in Step 2, one of five digital outputs can be assigned to provide a signal corresponding to an acceptable result from the software tool. Additionally, a TCP/IP connection can transmit an ASCII string to a supported device (PC or PLC) with the actual value of the software tool result.

### STEP 4: ACTIVATE VERISENS

Step 4 is to simply download the configuration parameters to the VeriSens®. The job may also be stored on the configuration PC prior to activation. Once activated, VeriSens functions as a stand-alone sensor and the PC can be disconnected.

## OPERATION

In normal operation, the part to be inspected travels into the inspection workcell where its presence is detected with the photoelectric detector. The IR light source is constantly illuminated and VeriSens acquires an image of the product within the patch and the patch, triggering the UV light upon acquisition. An area tool detects the presence of the product and an edge tool detects the location of the edge of the fluorescence. Digital outputs are sent to the PLC indicating whether the location and distance are within desired values.

## Deliverables (supplied by Solutions Provider)

A typical system would consist of the following:

- Baumer VeriSens® XC-100: VC XC100M12X00EP

- Baumer Connector Cable for power and I/O: ESG 34JP0200G Flying Lead

- Baumer Ethernet cable: KSG34A/KSG45AP0200G/E

- Metaphase UV light source: Note: ISO-6-UVL-SPEC used in lab. **PRODUCTION UNIT REQUIRED**

  **NOTE: STROBE CONTROLLER NOT REQUIRED- INCLUDED WITHIN VERISENS XC SERIES SENSOR**

- 5-6 mm lens (Edmund Optics, Schneider, or equivalent)

- Engineering and documentation (by others)

- Installation and training (by others)

A budget estimate for an inspection station such as this is approximately $5,000 US

# CONTACTS

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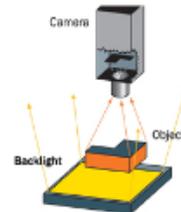
(215) 639-8699

Edmund Electro optics

 (856) 547-3488

www.edmundoptics.com

# GLOSSARY

**Back Lighting**  Lighting technique in which the light source and the camera are on the same side of the part to be inspected.

**Contrast**  Measured in grayscale (Black = 0; white = 255).

A minimum contrast must be present in order to differentiate a feature from its background.

**FIGURE 5: BACKLIGHT**

**Edge Detection**  A software tool that calculates the gradient location across a pixel matrix based upon the difference between the grayscale values. Typically, a nearest line fit is calculated across several pixels within the maximum gradient and this line is determined to be the edge.

**Feature Extraction**  The ability of machine vision software to separate a feature from its background and determine some attribute (area, brightness, etc.)

**Front (or Top)**

**Lighting**  Lighting technique in which the light source and the camera are on the same side of the part to be inspected.
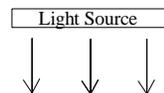
**Optical Character**

**Recognition (OCR)**  The ability of machine vision software to determine the value of a string of previously unknown characters.

Camera

Light Source

Part

**FIGURE 6: FRONT LIGHTING**

**Optical Character**

**Verification (OCV)**   The ability of machine vision software to determine whether or not the value of a string of previously taught characters matches the current image.

**Resolution**   Measured in Units of measure per pixel.

Field of View ÷ minimum number of pixels on the sensor. For example, a 1" FOV with a VGA sensor has a resolution of approximately .002"

Resolution = FOV/pixels Resolution = 1"/480

Resolution =.002"/ pixel