Title: **Gocator Terminal Strip Application**

Purpose

This application note demonstrates the use of a Gocator 2030 to detect missing screws in terminal strips during their production process.

Equipment Used

Gocator 2030-2M-01
Terminal strip
Photocell

Sensor Features Used

External Digital Input (Trigger Input)
Height Profiling Tool
Digital Output

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1 Overview

This application note demonstrates how to use a Gocator to detect missing features in a terminal strip (Figure 1). Scanning is triggered by a photocell directly connected to the Gocator. Profile Measurement tools are used to detect the presence of the screws in the terminal strip. Defect parts are rejected using the digital output.

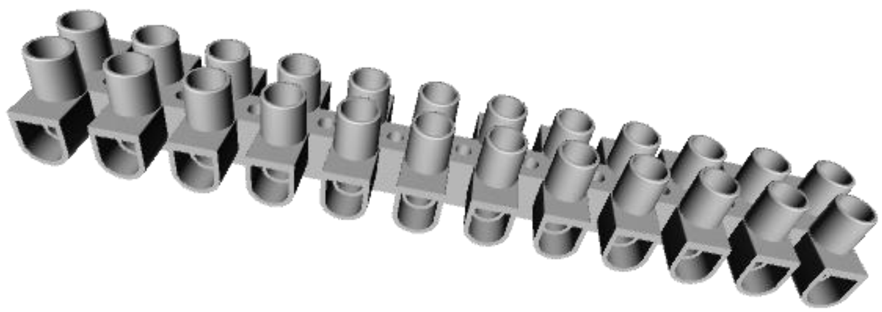

Figure 1. Terminal Strip

Figure 2 illustrates the dimensions of the terminal strip and the defect. The terminal strip is 19mm wide and the features 8 to 16mm high. The Gocator 2030 has a field of view (FOV) of 47mm to 85mm and a Z resolution of 0.008 to 0.018mm. Therefore, a Gocator 2030 can scan the entire target and has enough resolution to detect the missing feature.

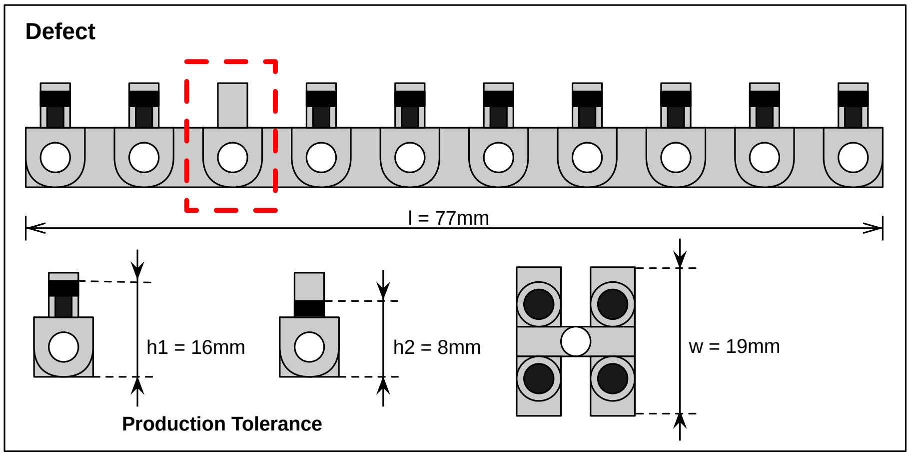

Figure 2. Defect Identification

Profiling is triggered by a photocell to ensure the height measurement is performed exactly at the center of each terminal strip section. Figure 3 illustrates the trigger signals generated by the photocell.

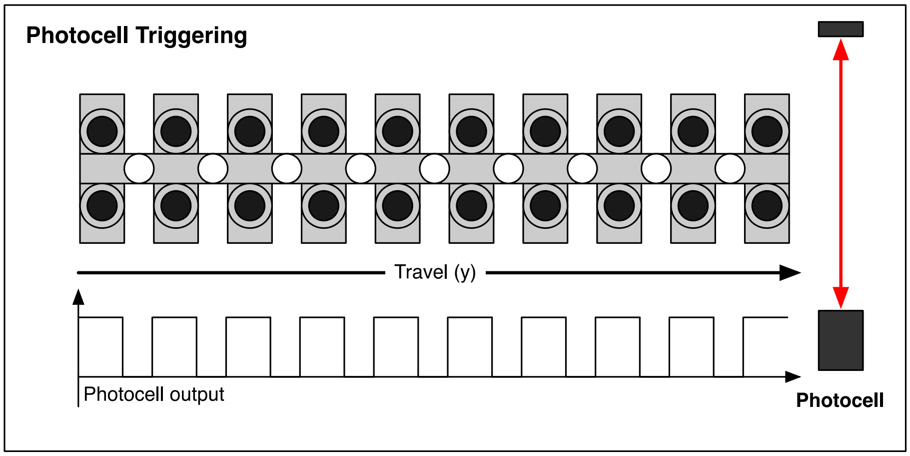

Figure 3. Photocell Triggering

2 Setup

The sensor is mounted above a conveyor belt so that the laser line is perpendicular to the travel direction of the belt and the measurement object appears at the center of the measurement range.

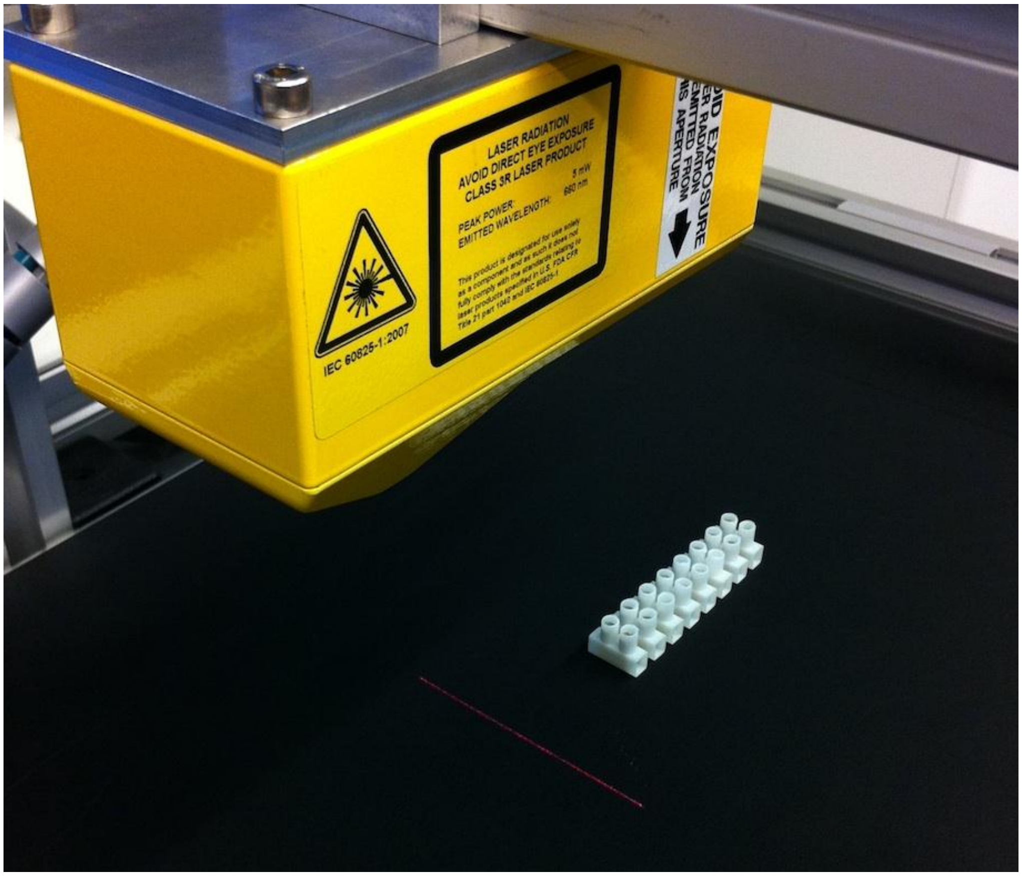

Figure 4. Measurement Setup

The position of the photocell is located such that the trigger signal is generated before the center of each terminal strip section reaches the laser line (Figure 4). The Trigger Delay parameter can be configured to compensate for offset between the photocell and the laser line in time (Figure 5).

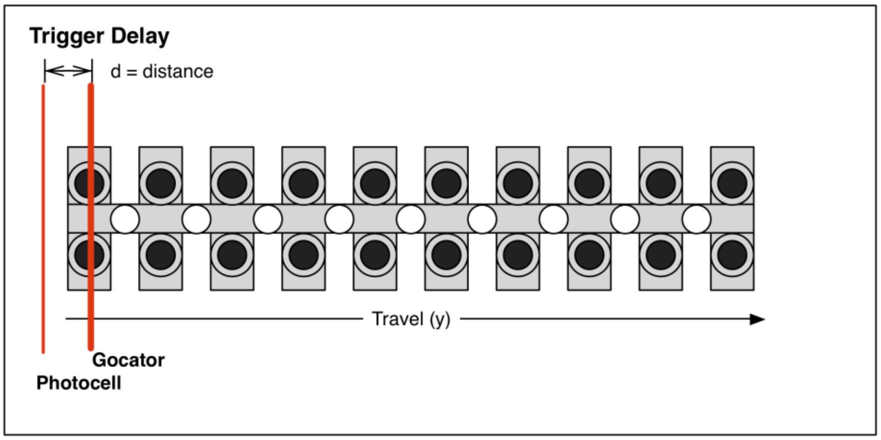

Figure 5. Trigger Delay

The delay is calculated by dividing the distance between the photocell and the laser line of the Gocator by the travel speed of the terminal strip. Note that the trigger delay must be smaller than the distance between 2 terminal strip sections.

2.1 Wiring

Figure 6 shows how the Gocator is connected to the external photocell, encoder and actuator. Refer to the Gocator user manual for the pin-outs of the connectors on the Gocator.

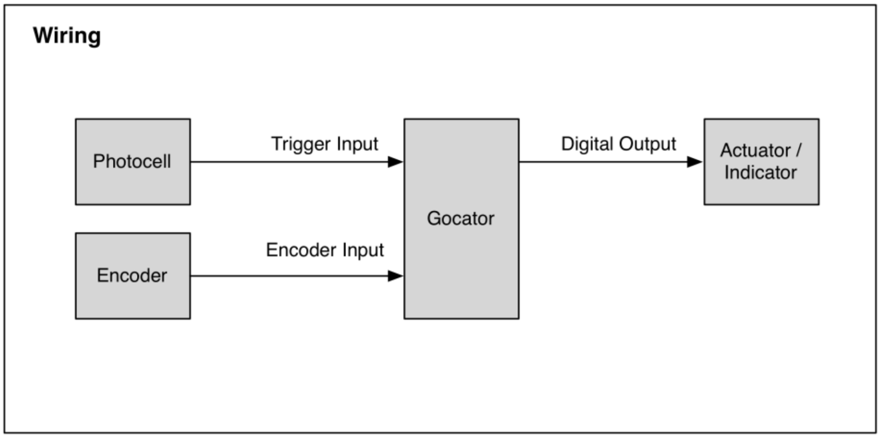

Figure 6. Wiring Diagram

After the Gocator is installed, the Gocator user interface can be used to setup the Gocator configuration for this application.

2.2 Laser Profiling Configuration

The Setup Page is used to configure the settings for laser profiling.

Menubar

Figure 7. Setup Page

The Setup Page allows users to configure the trigger source, exposure and active area. It also allows user to calibrate the sensor to compensate for inaccuracies in the mounting of the sensor.

2.2.1 Trigger Source

Gocator supports a number of methods to trigger a profile scan. Select External Input in the Trigger panel to acquire a profile on the rising edge of each trigger pulse. The trigger delay is configured to match the travel speed of the terminal strip on the conveyer belt. Data Viewer can display the profile data in real-time. It can be used to fine-tune the trigger delay by looking at the profile view while the terminal strip moves past the photocell.

Trigger source

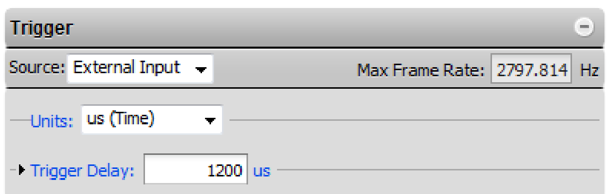

Figure 8. External Trigger Source

The maximum trigger speed depends on the maximum frame rate the Gocator can achieve. The maximum frame rate is reported in the Trigger Panel as shown above.

Metrics Panel

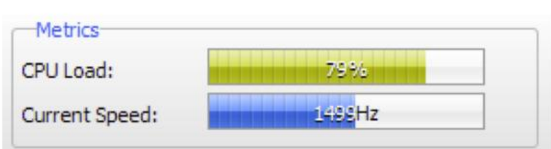

Figure 9. Metrics Panel

The Metrics Panel above the tool bar in the Gocator interface displays the CPU load and frame rate in real-time. Gocator will automatically warn the user if the trigger frequency exceeds the maximum possible frame rate.

2.2.2 Exposure

To achieve a good detection of the terminal strip the exposure parameter has to be set to a proper value. The “Auto Set” button allows automatic configuration of the exposure value.

Exposure Settings

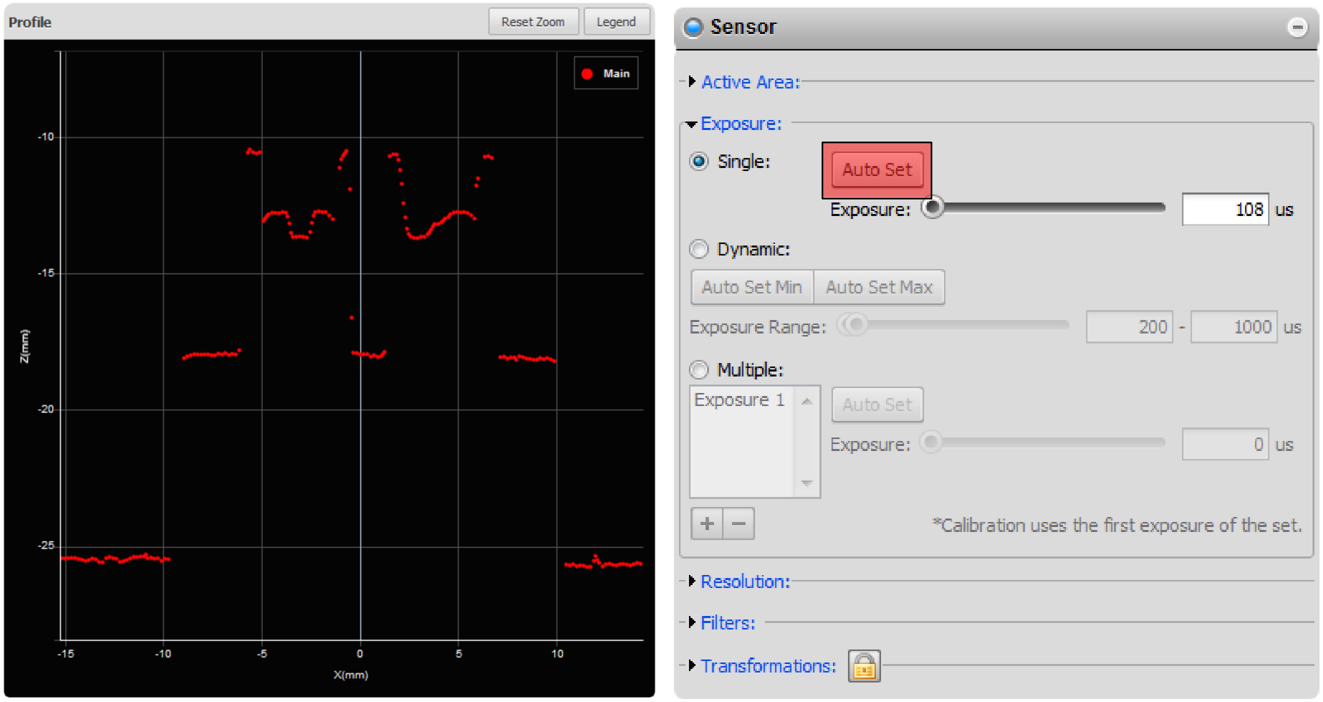

Figure 10. Autoset Exposure

2.2.3 Active Area

The active area defines the area that is actively scanned by the Gocator. It can be reduced (Figure 11) to increase the maximum frame rate and filter out unwanted objects that are outside the required field of view. **Figure 11** illustrates the reduced active area (area under the yellow box).

Active Area Settings

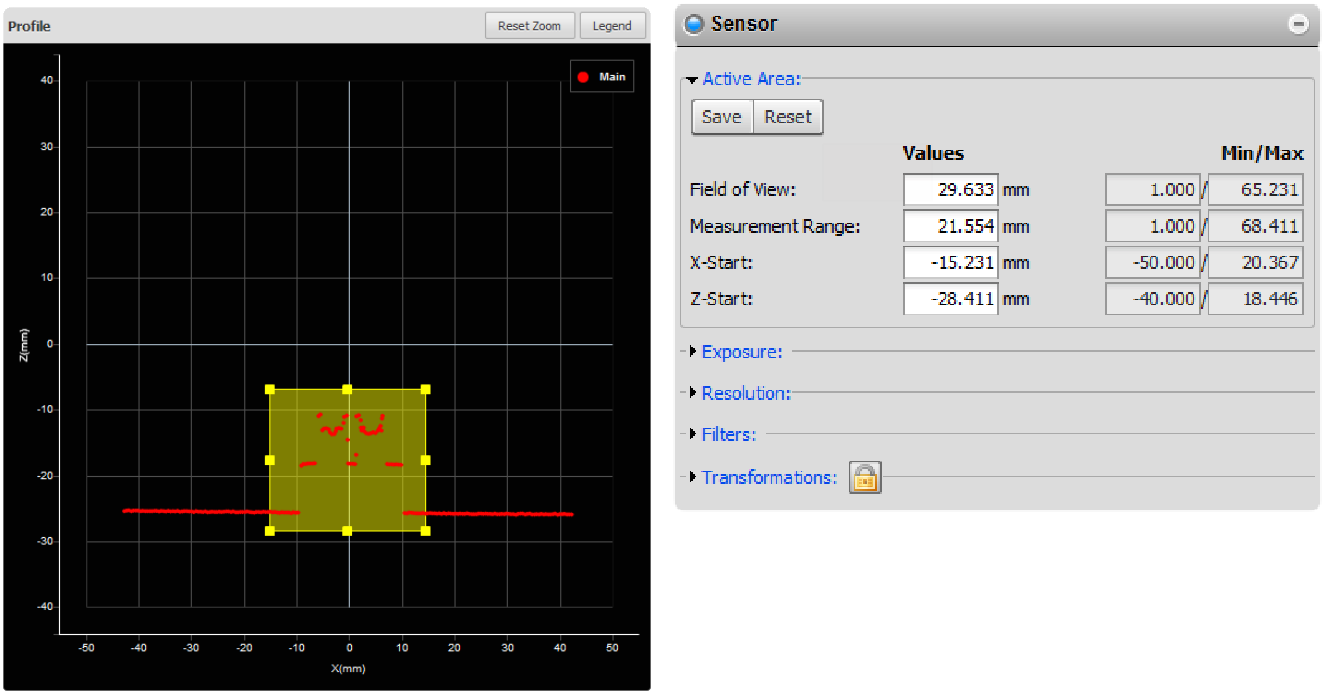

Figure 11. Setup Active Area

2.2.4 Calibration

Alignment calibration is used to remove tilt between the sensor and the conveyor belt. After performing calibration on a flat surface (terminal strip removed from field of view) the conveyor belt surface appears at a height Z=0 in the profile view. Any tilt between the sensor and the conveyor belt is eliminated.

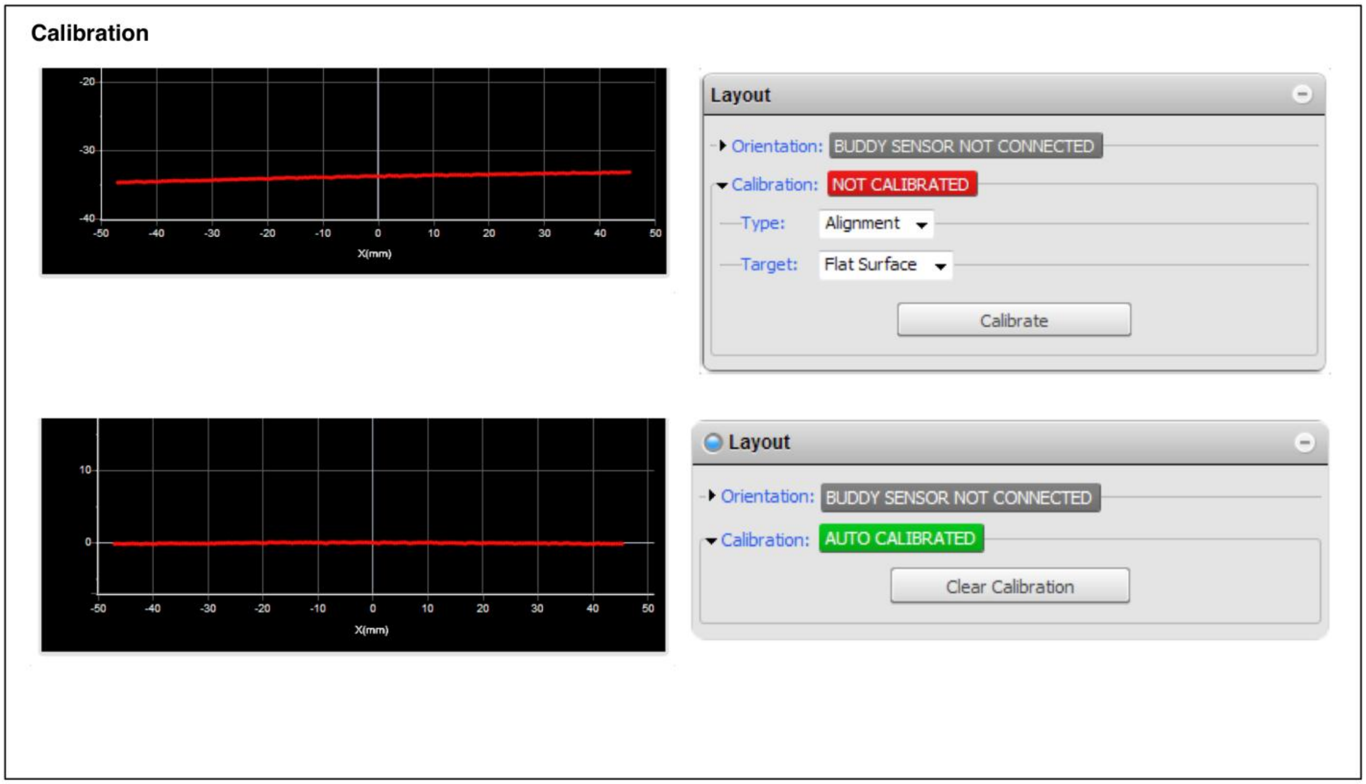

Figure 12. Calibration

2.3 Measurement

After laser profiling is setup, measurement tools can be added to detect missing screws. Measurements are added in the Measurement Page (Figure 13).

Figure 13. Measurement Page

Each terminal strip section contains two screws. To be able to detect if one of the screws is missing two height measurement tools are needed. Each height measurement consists of two search areas that define the features at which the height will be measured. The size of the search area is to match the manufacturing tolerance of the terminal strip.

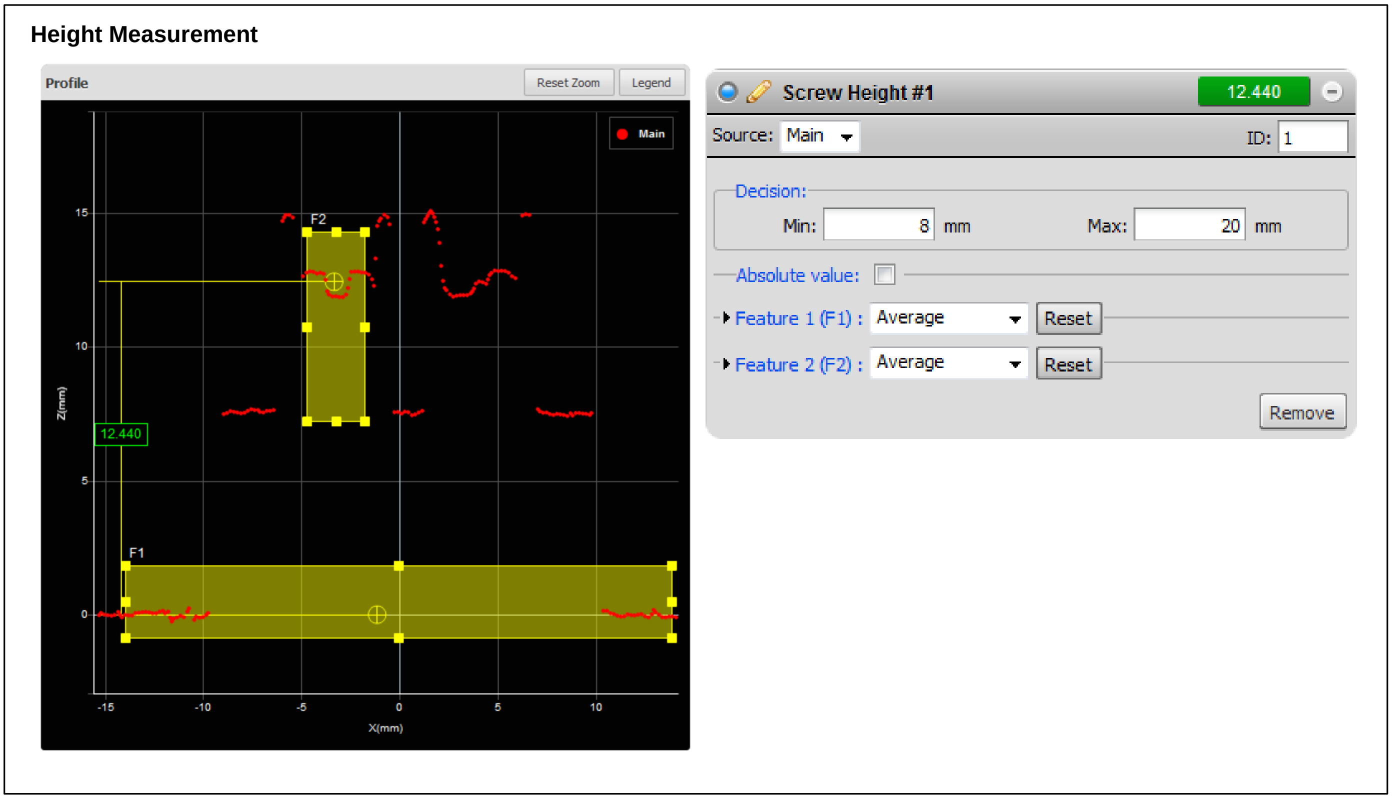

Figure 14. Height Measurement Tool Setup

The screw head is being searched for in area F2.

2.3.1 Measurement Results

Each measurement tool outputs a value and a decision. The *value* is the actual measurement. The *decision* is a boolean that can be true or false, depending on whether the *value* falls within the range defined in the "Decision" setting. When the feature is missing (e.g. no screw), the *value* is invalid and the decision is also false

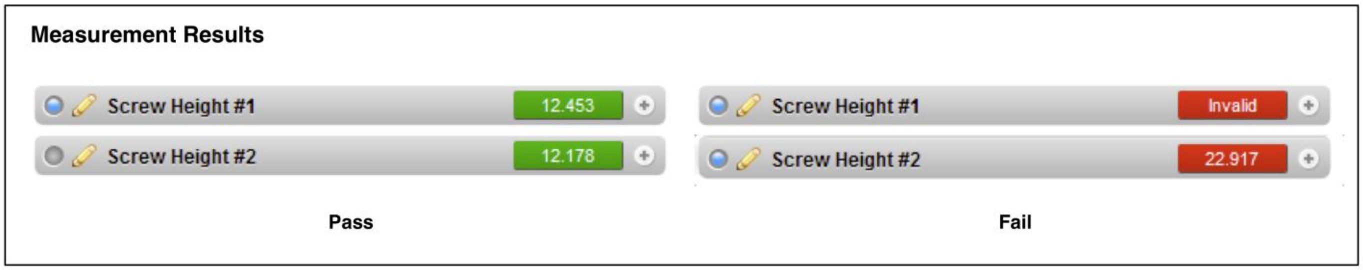

Figure 15. Measurement Results

To summarize:

a) The screw head is inside the range defined in the "Decision" setting. The *value* is a numerical result and the *decision* is **TRUE**.
b) The screw head is outside of the range defined in the "Decision" setting but still present. The *value* is a numerical result and the decision is **FALSE**.
c) The screw head is missing, the value is invalid and the decision is **FALSE**

2.4 Output Configuration

The Output Page controls the mapping between measurement results and the Gocator's output channels. Measurement results can be output through Ethernet, digital, analog and serial ports.

Figure 16. Output Page

In this application we want to put out a 3000us pulse on Digital Output 0 if both height measurements results fall within the decision range. To achieve this, select the measurements in the Digital Output 0 Panel, and set the signal type to "Pulsed". Set the pulse width to 3000us.

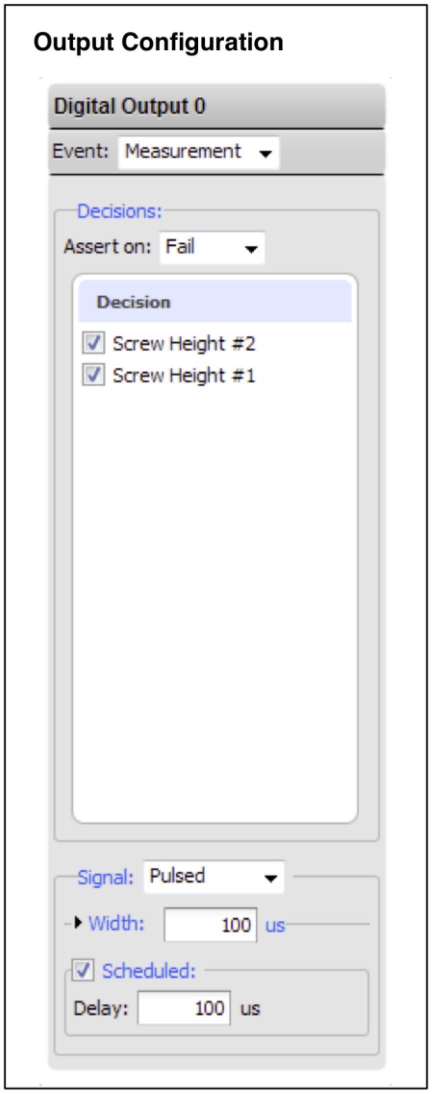

Figure 17. Digital Output Panel

Scheduled delay can be used to match the output timing to the location of a reject gate. The delay should be set equal to the distance between the sensor and the eject gate, divided by travel speed.

3 Operation

3.1 Dashboard

The Dashboard Page offers an overview of the sensor health and a summary of the measurement results.

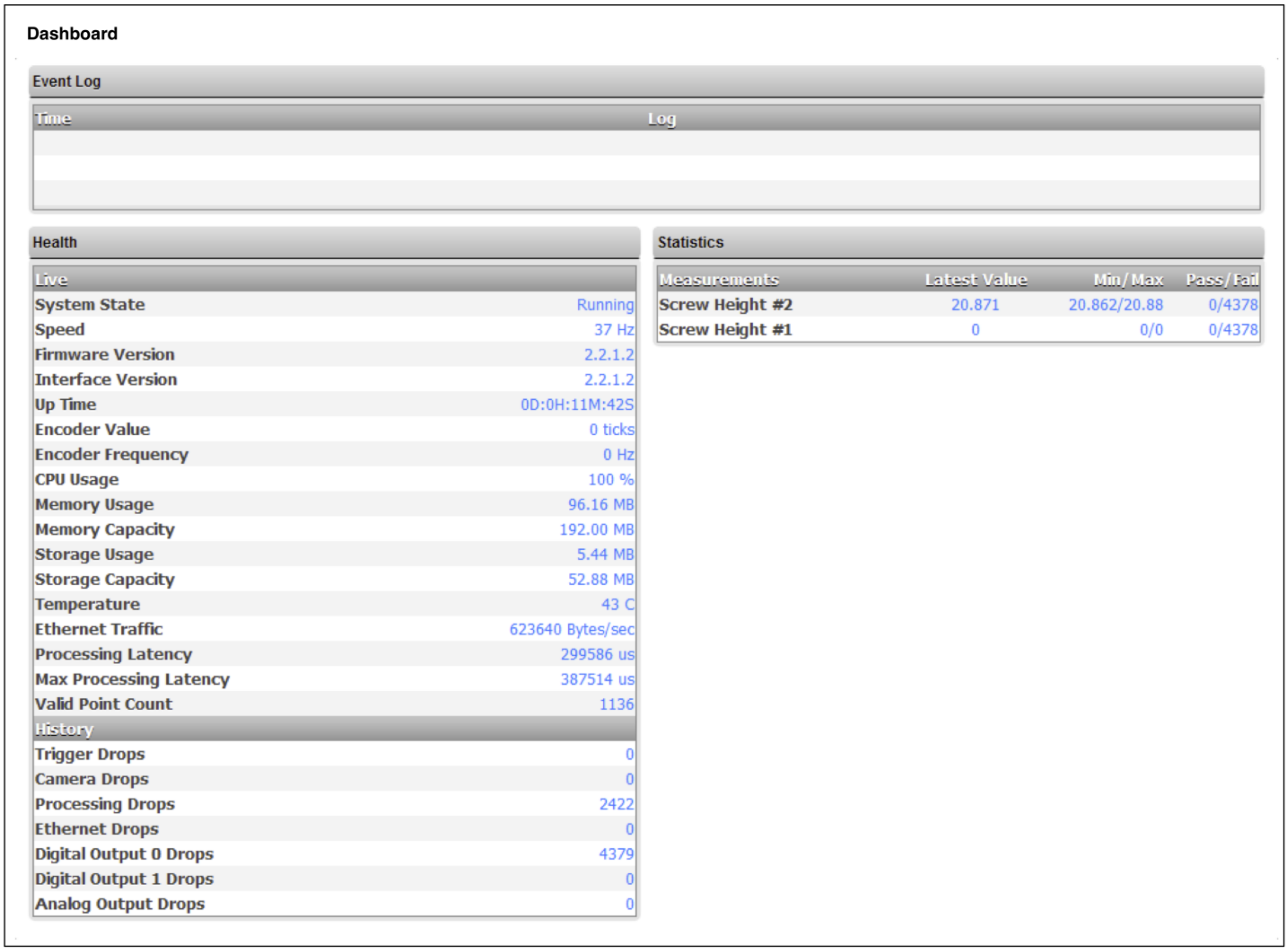

Figure 18. Dashboard

4 Conclusion

The Gocator can be setup to detect missing screws by configuring the profiling options, adding measurement tools and mapping results to the Gocator's digital outputs.