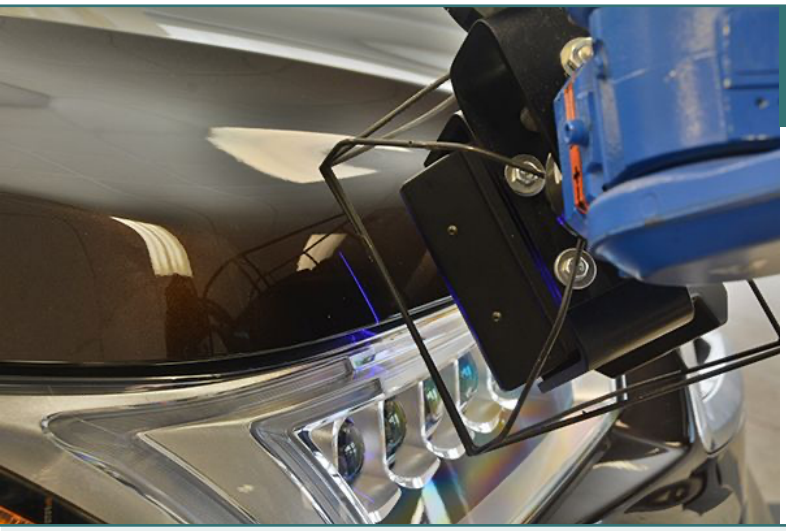
LASER GAUGE



WHITE PAPER

Automated Gap / Flush Measuring System for 100% Inspection

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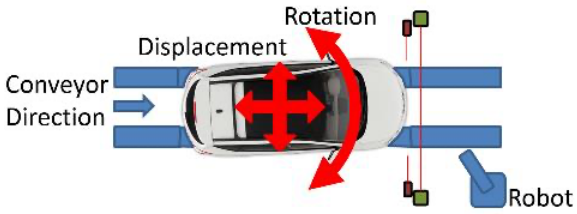
WHITE PAPER

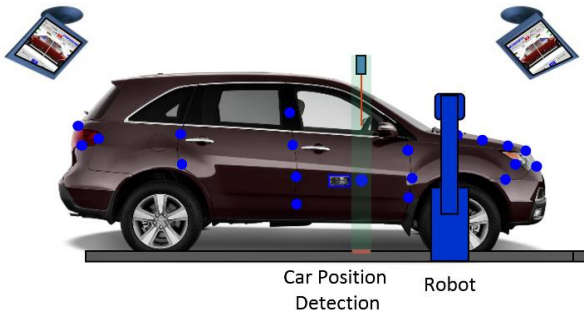
Automated Gap / Flush Measuring System for 100% Inspection

For over 20 years, LaserGauge® has worked with automobile manufacturers to improve build quality by providing LaserGauge® gap/flush measurement systems for 100% inspection on their final assembly lines. The handheld inspection systems have been effectively utilized to improve build quality and consistency on the automobiles but were subject to abuse and wear because of normal wear-and-tear or mishandling of the equipment. To mitigate this risk and decrease downtime, an automated, EOAT (end-of-arm-tooling), non-contact method that can work consistently, tirelessly and with minimal risk of physical damage was needed. LGAutomation is the answer to this.

OVERVIEW



LGAutomation is a robot-driven automated inspection station for 100% gap/flush measurement on the final assembly line. Integrated into the manufacturing line by plant personnel or independent robot integrators, the EOAT sensor system automatically acquires fit and finish measurements on a vehicle in real-time on a moving line using proven, flexible measurement methodologies. To eliminate any requirement for a stop station or to "pin" the automobile in a known location, a vehicle tracking subsystem tracks the position and orientation of the automobile for real-time robot path correction to ensure that the measurements are taken in the same position each time, regardless of the automobile's position.



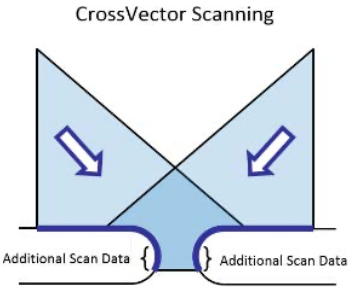
LGAutomation utilizes one robot on each side of the vehicle for left/right side inspection. More robots/sensors can be added as necessary if more measurement points are needed or if the two-robot configuration is unable to keep up with the line speed. Robots can be floor- or gantry-mounted as needed to access the desired measurement locations.

LASERGAUGE MEASUREMENT SENSOR - RS763

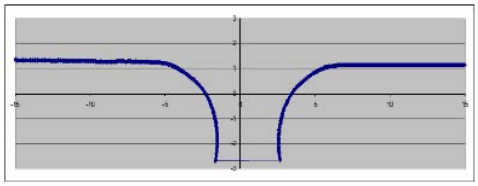
LGAutomation is built around the advanced LaserGauge RS763 Cross-Vector Smart Sensor. This measurement sensor is a self-contained EOAT measurement subsystem that does not require external hardware for measurement. It communicates back to the robot using an Ethernet connection and can utilize most industrial network protocols (e.g. Profibus, DeviceNet, Modbus TDP, etc.).

Automated Gap / Flush Measuring System for 100% Inspection

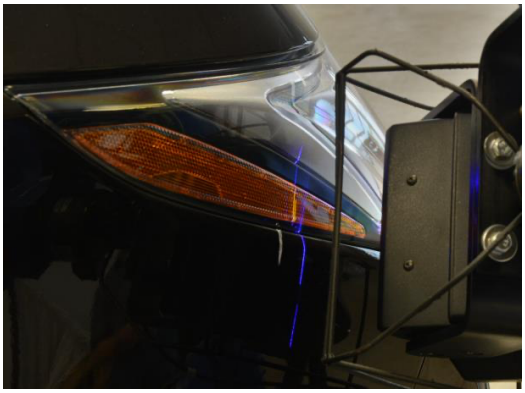
The RS763 uses the Cross-Vector scanning technique that gives precise edge/surface scanning capability unmatched in accuracy, speed and flexibility. The angular scanning of the edges, as illustrated to the right, allows it to see "around" the edges to give more defined edge data for better measurements. No movement of the sensor is required. Because of this the measurements can be acquired very quickly, typically less than 1 second per measurement.



In addition to the Cross-Vector scanning capability, the RS763 utilizes blue-laser scanning technology and advanced signal processing algorithms. This allows the sensor to scan almost all surfaces on an automobile: body panels, headlamps, tail lamps, window glass and chrome. No other gap/flush system has the blue laser Cross-Vector capability.



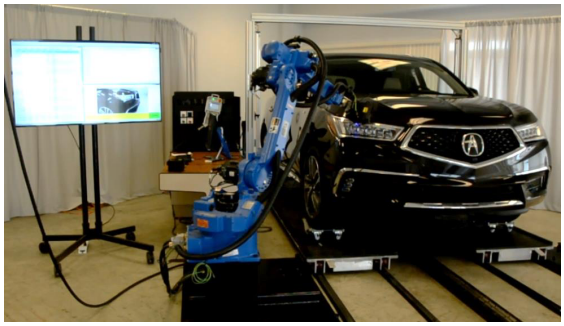
Scanning on Head Lamp



Scanning on Taillight

SYSTEM TESTING

To put the system to the test, a major automobile manufacturer provided their requirements for an automated inspection system. Specific points/point types were identified and a vehicle was specified and provided for this test. A conveyor system was configured by Origin for development and testing of the LGAutomation system. It consists of a single robot (only one side was measured), a chain-driven conveyor and a robot subsystem. The speed of the conveyor was set to simulate a final line with a 60 second cycle time. This photo shows the system as-configured.



The test configuration also provides a way to change the vehicle orientation/position to simulate variations in automobile placement on the final line. Testing was performed within a ± 3.5 degree position window. Conveyor speed was set to the maximum to simulate an actual factory conveyor line.

A variety of points were selected for repeatability testing: body-to-body, body-to-headlight, body-to-sidelight, body-to-chrome, body-to-tail light, and tail light-to-tail light.

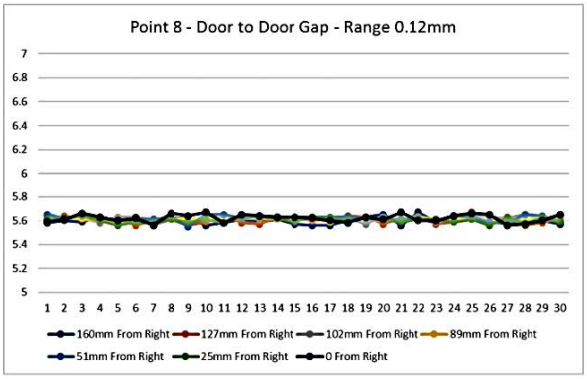
Data was taken at 7 different vehicle positions/angles, with 30 scans per position for a total of 210 scans (18 points/36 characteristics per scan) or 7560 characteristics. Our repeatability goals for these points were as follows:

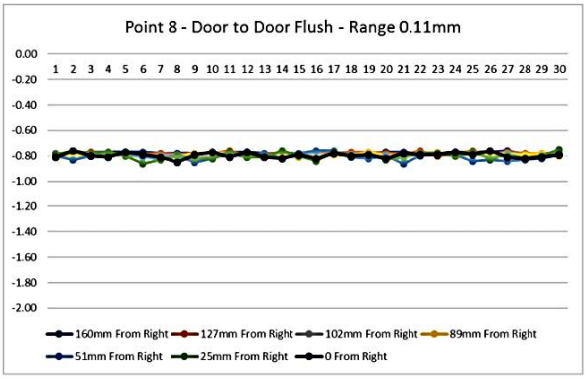
- Body-to-body range: ±0.1 mm
- Body-to-headlamp range: ±0.15 mm
- Body-to-tail lamp range: ±0.15 mm

TEST DATA

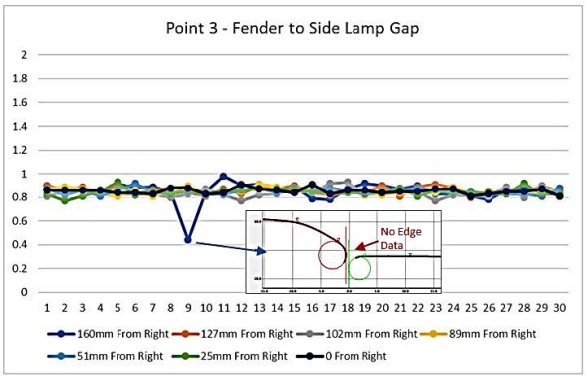
Detailed results for every point are beyond the scope of this white paper but a summary plot will show the performance of the system. Here are the results for 4 different gap/finish types. All measurements are in millimeters. All plots have a y-axis range of 2mm.

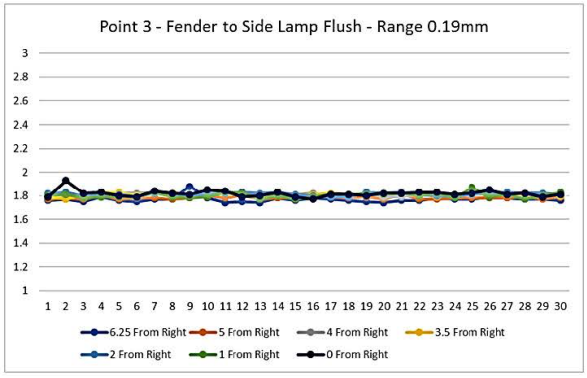
Body-to-Body:



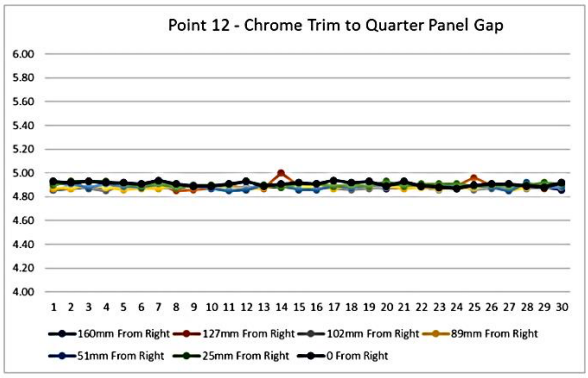


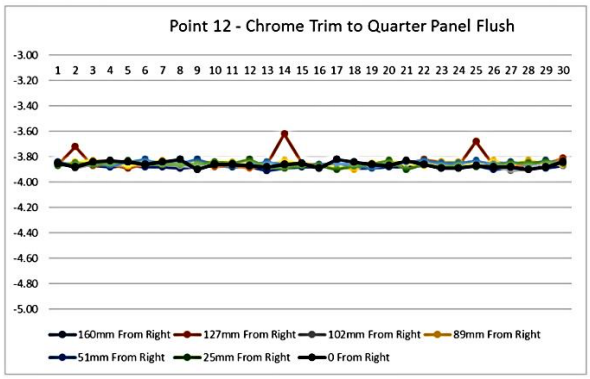
Body-to-Side Lamp: 1 Outlier



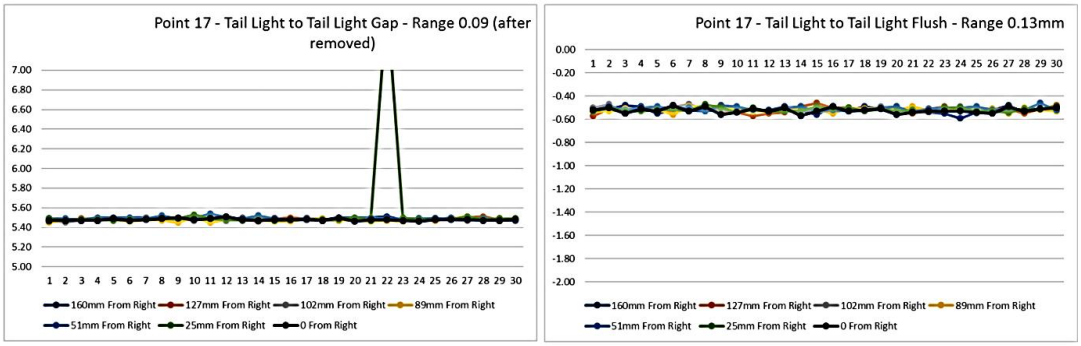


Body-to-Chrome: 3 Outliers



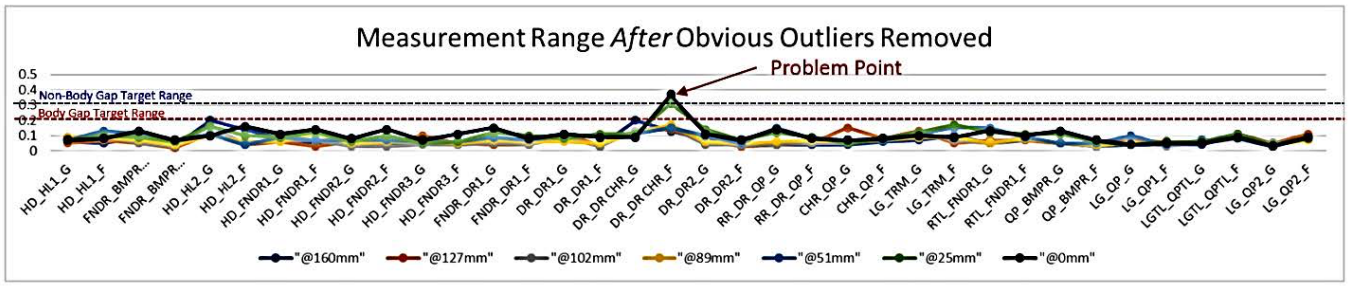


Tail Lamp-to-Tail Lamp: 1 Outlier



In total, 7 outliers were identified out of the 7560 measurement characteristics acquired during this testing. In each case, the outlier would easily be rejected using scan validation criteria that is set in the sensor firmware. This validation was turned off for this test so that the root cause of the errant points could be ascertained.

Once the outliers were removed, the complete summary plot for all 7560 points is shown:



There was one "problem point" identified. This problem point was a very difficult chrome to chrome surface with other material attached to the edges. A custom algorithm is being developed to return accurate and repeatable measurements.

SUMMARY

The measurements acquired with LGAutomation fell well within the automobile manufacturer's repeatability requirements on all gap types/configurations. The system was tested in 7 different vehicle positions/angles. Each run measured 36 different characteristics (18 points per run). There were 30 runs for each of the vehicle positions. In all of that testing, only 7 outlier points were identified, or ~0.1% of the values. Every outlier would be easily rejected using one of the following methods:

- Scan validation settings
- Reasonable limits in the measurement routine
- Correction of Virtual Gauge (or measurement algorithm) - 3 of the 7 fall into this category

Follow-up verification by the manufacturer at Origin's facility on two separate occasions confirmed the test results documented in this paper.

As is evident, LGAutomation is a viable solution for real-time online gap/flush measurement inspection on a moving line. Using manufacturer tested and approved LaserGauge measurement algorithms, this system provides a tireless solution for 100% automobile inspection.

To see how LGAutomation can work for you, contact us for more information.