VeriStrand - Automated Cable Inspection System (ACIS)

Where Vision Meets Precision

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Background

Strands Products Inc. is a company that manufactures custom mechanical wire and cable assemblies. The VeriStrand Automated Cable Inspection System (ACIS) is a fully automated cable measurement and sorting platform designed to replace Strand Products' manual caliper-based inspection process. The system was developed to provide a compact, accurate, and repeatable computer-vision solution that reduces inspection cycle time, improves measurement traceability, and minimizes operator-dependent variability.

ACIS integrates six primary subsystems: tray infeed, conveyor, cable press, dumping hook, vision system, and automated sorter. Together, these subsystems enable continuous handling, inspection, and classification of cables with minimal human intervention. By combining mechanical automation with real-time vision-based measurement, ACIS improves consistency, efficiency, and reliability within the cable inspection workflow.

Overview/Design Specs

To define the goals in this project, there were 3 engineering characteristics that were focused on. These defined the desired result of the automated cable inspection system.

Needs	Engineering Characteristic	Target Specification	Minimum Specification
Within Tolerance	Camera Calibration (in.)	0.001"	0.002"
Accuracy of Rejection	Percent Accuracy (%)	99.5	99
Capacity	# of cables a day	240	24

Figure 1: Project Specifications

Cables with swaged components outside of the required tolerances were provided by Strand Products to use for measuring the accuracy of the camera system. The cable analyzed is provided below:

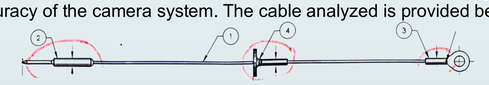


Figure 2: Cable with Highlighted Swaged Components

There are 3 main swaged components that are inspected: two eyes and a t-pin. Due to error in fabrication, these swaged portions must be inspected in bulk. The expected tolerances are:

Swage #	Acceptable (in)	Swage #	Acceptable (in)
1	0.174 ± 0.004	3	0.112 ± 0.005
2	0.149 ± 0.002	4	0.111 ± 0.002

Figure 3: Expected Swage Tolerances

Final Design of the ACIS

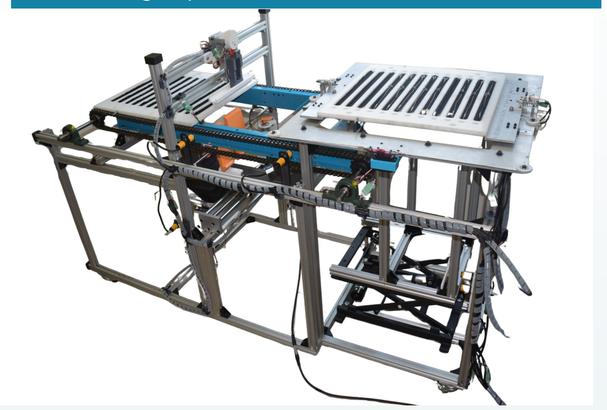
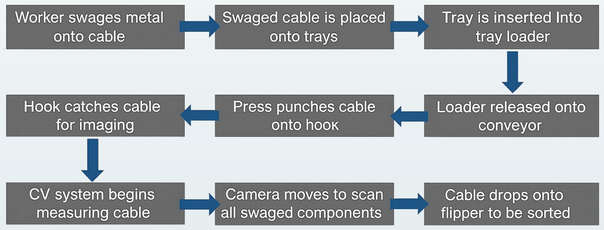


Figure 4: Entire Assembly of ACIS



Camera Calibration

The desired output of this test is to see if the Keyence camera is calibrated correctly to determine the swaged dimensions accurately and consistently.

Position correction is utilized to orient the cable horizontally and centered in the camera's view for more precise measurements.

Without this accuracy, the entire system output will be incorrect and unusable.

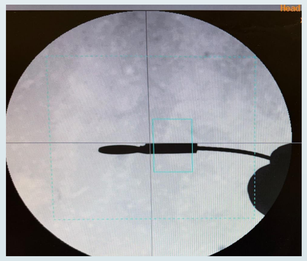
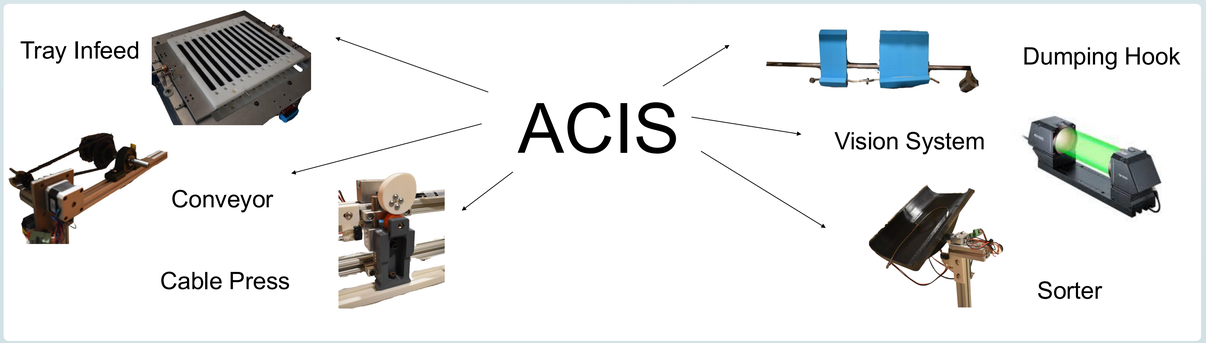


Figure 5: Keyence Camera Position Correction



Controls

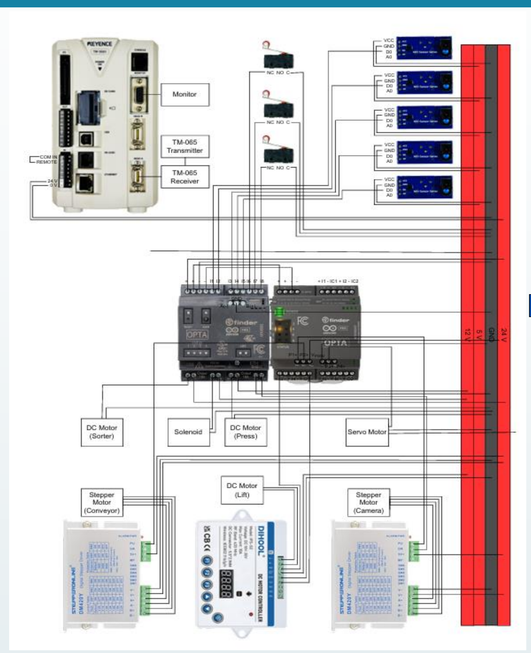


Figure 7: Electric Box Wiring Schematic

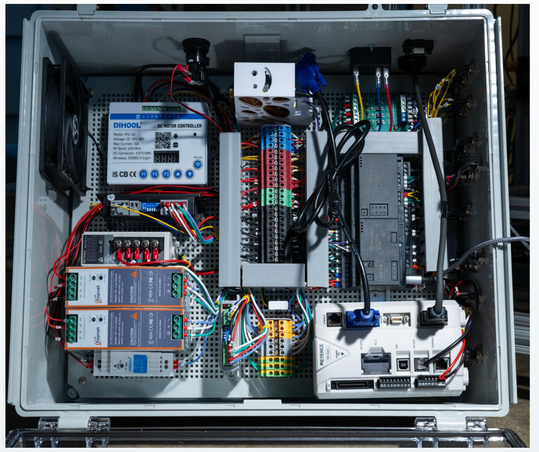


Figure 8: Complete Electric Box

Results

To determine whether our target specifications were met, we compared the accuracy of measurement between manual inspection with calipers and our Keyence system. Our results show that there is a close relationship between the two data points.

Therefore, we can conclude that our system accurately verifies the inspection process with a high percentage.

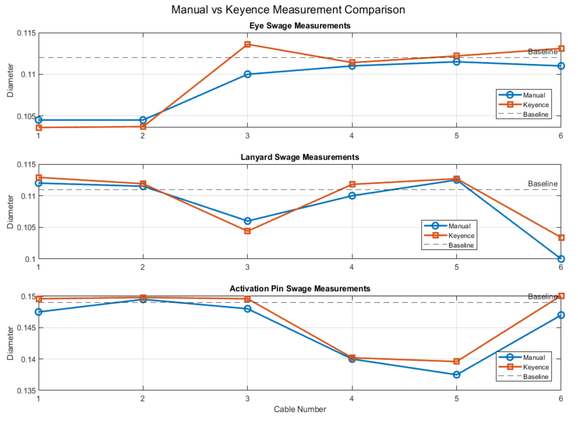


Figure 6: Data Representation on Manual v.s. Keyence Measurement Comparison

Conclusion

The ACIS system was developed with two primary objectives: to verify cables in less time and with greater accuracy, and to create an automated process that allows workers to focus on other critical tasks. The results from the ACIS system at VeriStrand demonstrate that both of these objectives were successfully achieved.

Through the Keyence camera calibration results, we were able to confirm that the computer vision system produces measurements comparable to those obtained using manual calipers, which is the current verification method used at Strand Products. The calibration and testing results also showed that the system consistently operates within the required minimum specification constraints. This allows us to conclude that the ACIS system can accurately identify both pass and fail cables manufactured at Strand Products.

In addition to improving measurement accuracy and consistency, the ACIS system introduces a fully automated workflow that significantly reduces the need for continuous operator involvement. This automation enables workers to step away from the repetitive and time-consuming inspection process, allowing them to dedicate their time to other essential areas of production. Overall, the ACIS system demonstrates an effective combination of precision, efficiency, and automation for cable inspection and verification.

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