Automating Fiber Optics Using NI PXI™, Motion, and Vision

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The Challenge: Developing a flexible telecom manufacturing test system that LightPath scientists could use throughout their company – from R&D to the production floor.

The Solution: Integrating an automated PXI-based test system that technicians can easily change and update across the enterprise as test requirements change.

While many fiber optics parts are still hand assembled, the Albuquerque division of LightPath Technologies designed an integrated, automated approach to produce collimators, which are gradium lenses fused to fiber-optic cable that help direct light. The performance and reliability of these intricate parts are integral to the overall performance of telecom systems.

We built a flexible, PXI-based test system to use across our enterprise.

One of the main benefits of our system is that we could develop a custom solution with all the tools we needed, from motion, to vision, to data acquisition, gaining test flexibility and reliability in the process.

With an automated system approach, we gained efficiency, producing more collimators in less time. We decided to base our system on the PXI platform along with MXI™-3 for additional slot capability, and included National Instruments motion, vision, DAQ, signal conditioning, and LabWindows™/CVI, a component of Measurement Studio™. With these systems, technicians could perform various positioning, fusing, and cutting tasks required in the collimator manufacturing process.

From the R&D Lab to the Production Floor

We developed our first system in the lab, and still use it today for making tweaks and enhancements to our factory floor system. Building these complete systems goes quickly, and building them on PXI proved seamless.

The production floor, housed in a clean room environment, has an array of workstations with extra space for additional machines. The PXI chassis holds machine vision (IMAQ), motion control, DAQ, and GPIB hardware. Two monitors, driven by a computer, display the visual results. The motion controllers, cameras, and signal conditioning are housed in a black box, which also contains all the mechanical equipment used in the manufacturing process.

The fusing machine works by threading fiber-optic cable down from a large spool to small roller blade wheels, using motion control to fine-tune the cable position. From there, a laser welds the cable with the lens – this patented laser process takes about a minute per collimator. NI vision products ensure precise alignment between the lens and the laser. The entire system uses three cameras along with two different vision boards. A digital camera and board combination looks at the beam coming out of each collimator, then performs feedback diagnostics and obtains quality control on the end product. This quality check ensures that the system spots any defects up front.

Other CCD cameras look at the angle between each fiber and lens combination, measuring and adjusting the angle to see if it lies within certain tolerances. LightPath has set up process control parameters for this system, determining what is acceptable and what is not. IMAQ hardware and software ensure that these parameters are met.

Data acquisition boards perform diagnostic tests on the overall system, including measuring encoder feedback, digital I/O for the relays, and performing other measurements to ensure the process lies within the accepted parameters.

Similar System Performs Polishing

A second system using motion, vision, and data acquisition, based on the machines used in the production floor, performs coating and polishing functions on the lenses before they reach the automated test process. We found it simpler to borrow the technologies we had already invested in our manufacturing test stations to perform the required polishing tasks. The polishing system is also incredibly fast, taking only about three seconds per lens to position, move, and inspect each part.

Ease of Integration

One of the main benefits of our system is that we could develop a custom solution with all the tools we needed, from motion, to vision, to data acquisition, gaining test flexibility and reliability in the process. If we need to make changes to the system, we can do them from a central office, making it easy to perform tweaks on-the-fly. Throughout the system development, we have improved our control and completed a system that is robust and solid.

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