Automated Optical Test

Introduction

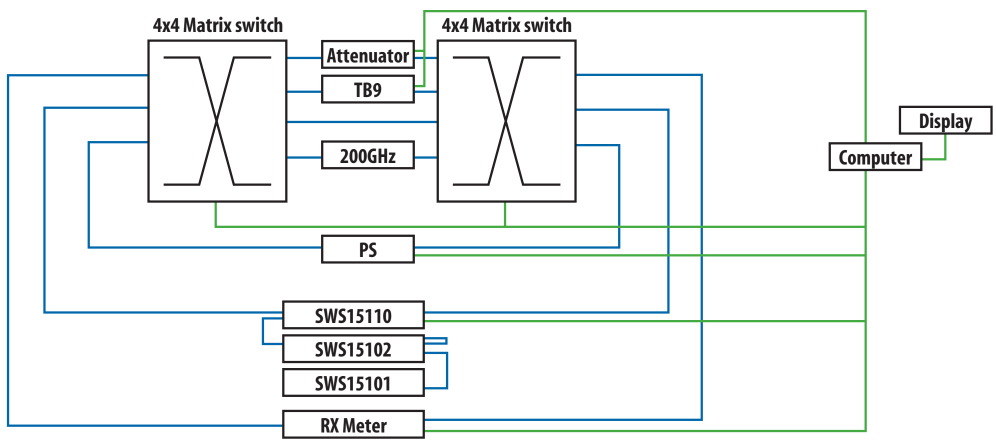
New paradigms in production processes will be required to achieve the yield, efficiency and cost targets demanded by fiber optical component and module customers in the future. Certainly, assembly process and base physics vary dramatically from fiber Bragg gratings, thin film filter, planar waveguides or even MEMS based devices. However, the base requirements for their passive optical characterization are essentially the same. Loss, dispersion, back reflection as a function of wavelength and polarization remain key. Fiber optic components are also similar from the perspective that the automation of fiber handling and fiber reconnection is a key barrier to truly hands-off production.

Clearly, JDSU is uniquely positioned to deliver all of the product elements required to build next generation automated test systems. Consider the test power and flexibility achieved by combining the capabilities of the Swept Wavelength System, PDL Multimeter and our industry standard Backreflection Meter with our proven and reliable SC, SB or Polatis Matrix switches. The result is a truly state-of-the-art automated test system which delivers improved measurement performance and a better return on your investment through increased throughput. A simple example is shown below.

Before you invest in your next production ramp, consult with your JDSU representative and let us help you select the best products and architecture to achieve your desired measurement resolution, production through put and cost objectives. With our well-documented and tested software drivers we put in you the best position to achieve the test system you need.

Example Architecture

One example of a novel parallel-automated system is shown below.



As shown above, by using two truly no blocking Polatis series switches, an independent test head can be provisioned to every device. When a particular test is completed, a new test head can be allocated when available, without disrupting another test that may still be in progress. Viewed another way, as soon as a test head is available, it can be immediately used somewhere else. In contrast, for the same number of devices in process, a pure linear production line would have much more equipment operating for only a fraction of the time.

Example of Through-Put and Cost Analysis

As an example, it is possible to imagine the following component production process.

Process Step	Time [a.u.]
Fabrication	Unit time: 8
Verification	Unit time: 2
Packaging	Unit time: 12
Final Testing	Unit time: 4

Steady state throughput is achieved in the Cross-Connect Configuration with 13 active device positions. One could also add a double buffer scheme and increasing the number of positions to 15. By doing so you can effectively allow for the connection of a new device and the removal of a completed device without disrupting the flow. The break down of the sites would be as follows.

Test Head Function	Number
Fabrication	4
Verify	1
Packaging	6
Final test heads	2
Loading/ unloading	2
Total number of Active Slots	**15**

In this scheme, a device would be completed every 2 units of time. If the production automation was achieved with 2 simple 1xN switches (in our case two 1x4 switches) it can be shown that a unit is produced every 12 units of time as the production flow is gated by the packaging step. Therefore 6 lines would be required to produce the same output.

Assume that the cost per test head is the same. It can be shown then that in the 1XN architecture 42 pieces of equipment would be required (including the switches and device interfaces) as compared to 30 pieces in the cross connect implementation. This represents cost savings of 29%. In addition, space utilization has improved as well. In the cross connect example, equipment utilization increases from an average of 25% to 100%. The reduction in test equipment also reduces upgrade and maintenance time.

Of course, another option is the complete removal of the switches and a return to manipulation of the device from station to station. In the case of 1x2 devices, this would require 24 connections per device as compared to 3 for the automated cross connect system. Assuming on our scale that a reconnection required 0.5 units of time (as compared to virtually zero for the switch), the production times without any switch would stretch to 14 time units with the same amount of equipment as the cross connect example. In this case, 7 full lines would be required to match the production time.

Conclusion

Instrumentation switches are an enabling technology for optical component production. When a careful analysis of the full fabrication process is done, an opportunity for a major improvement in production efficiency can be achieved through the use of optical cross connects.

When implemented properly, the switches offer a way to minimize manual intervention, provide true parallel processing and substantially increase test instrumentation utilization. As with all switch implementations, care must be taken to properly assess the full measurement error budget.

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