

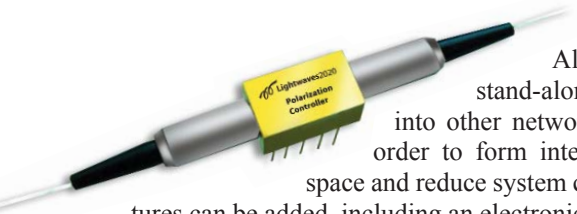
Lightvision

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Lightwaves2020's Liquid Crystal Based Polarization Management Products

Lightwaves2020 has developed a family of reliable, high-performance polarization management products that are designed to work together seamlessly within optical networks to control signal power and polarization. These products, which include VOAs, polarization controllers, single cell polarization converters and lossless polarizers, are all based on proven liquid crystal (LC) technology. Since LC operates as a variable waveplate, products based on this technology have long been recognized for their compactness, reliability and solid performance.

Lightwaves2020's LC based variable optical attenuator (VOA) provides smooth and continuous power adjustment within the optical network and has a wide wavelength range from the visible band to infrared. It can be designed to have a transmissive or reflective structure, enabling the power input and output to be either in the same or opposite directions.



Although the VOA can be used as a stand-alone component, it can also be embedded into other network structures, such as transmitters, in order to form integrated modules that save on system space and reduce system complexity. In addition, intelligent features can be added, including an electronic interface, digital interface and micro-processor, to enable remote control and monitoring.

The ultra compact polarization controller (PC) provides real-time control of the state of the polarization (SOP) of light waves in single mode optical fibers. It is used to convert any arbitrary input SOP to any designated output SOP. The PC's LC based design gives it many performance advantages and features, including: low loss; broadband capability; DC voltage control with low power consumption; low PDL and activation loss; a high extinction ratio; and pseudo-endless control. The PC has also been designed so that multiple PCs can be integrated into a single module to form a relay structure, which is necessary to support complicated adjustment schemes in some applications. Lightwaves2020's 2-cell polarization converter is used to convert any SOP to a linear SOP, while our 3-cell device can convert any SOP to any other SOP. Our 4-cell polarization converter has the same functionality as the 3-cell device while improving the tracking speed.

Lightwaves2020's single cell polarization converter changes linear polarized input light to trace a big circle on the S2S3 plane of the Poincare sphere. The PC can convert a linear SOP to one perpendicular to the original SOP with little loss and is also capable of converting a linear SOP to a circular one.

As an alternative to the polarization converter, Lightwaves2020 offers a lossless polarizer, which provides the same function as the polarizer with lower loss (~0.6dB).

Applications

LC VOAs

- Channel balancing in DWDM systems (pre-emphasis)
- Power equalization in optical add/drop modules and optical cross-connects
- Gain-tilt adjustment in EDFAs
- Power adjustment at receivers

LC Based Polarization Controllers (PC)

- PMD compensation
- Polarization generators
- Polarization multiplexers
- Polarization scramblers
- Polarization instrumentation

LC Based Polarization Converters & Polarizers

- Optical detector
- Optical components
- Optical testing sets
- Optical signal processing
- Optical fiber sensing



A Mature Manufacturing Process, High Yield and A Simple Writing Method Make Liquid Crystal An Attractive Technology Platform

Liquid crystal is a mature technology that has become almost ubiquitous since its inception 30 years ago. From notebook computers and flat screen televisions to palm computers and military hardware, they can be found standing up to the most punishing environments and providing excellent performance in applications where size is of primary concern. Why? Unlike tube-based CRT displays they are extremely compact, have higher definition, have no moving parts and are more reliable for long-term operation. And in the last ten years, they have become increasingly more affordable due to higher manufacturing yields as production techniques have been perfected.

Liquid crystal has more recently gained recognition in the telecom industry as a superior platform for optical power and polarization management, both for reasons similar to those in the display industry (compactness, reliability and manufacturability) as well as for the material's unique optical properties. Optical component manufacturers have been able to benefit from the manufacturing lessons learned in the display industry, which has enabled the development and fabrication of liquid crystal based optical components to advance rapidly.



In addition, the structure of liquid crystals used in optical components is far simpler than those used in the display industry, making them even easier and cheaper to manufacture and resulting in an extremely low

cost solutions for VOAs, Polarization Controllers Polarizers, etc.,

Manufacturability of LC Cells

Unlike other technologies used in optical components such as MEMS and AWG that require complicated and expensive fabrication foundries for automated manufacturing, the mass-production of LC cells is easily realized by using the

so-called printing process. A typical liquid crystal cell is produced by simply incorporating the LC material (either TN, STN, HTN or F-STN) between two glass substrates with ITO coatings on the internal glass surfaces. With the help of a printing machine like the one shown on this page, the aforementioned process can be completed in a second with well-controlled uniformity and high yield. A matrix of LC cells can be made each time. Currently more than 150 cells can be produced per lot with the potential of >1000 per lot by using a larger substrate mat.

Not only is LC cell fabrication based on an automated or semi-automated process, but the packaging procedures are also optimized for simplicity, stability and low cost. A very simple optical path design, which requires only a few parts for assembly and single-step alignment saves on labor time and costs. In addition, the low-cost TO can package simplifies the assembly structure and allows for laser welding. The precision positioning capability, accurate and stable bonding, and speed of the laser welding process dramatically improves the LC device's performance, uniformity temperature characteristics and labor time, resulting in high manufacturing yield and low testing costs.

From substrate to final product, large, complicated manufacturing equipment is not required to produce liquid crystals for telecom use. The result is very low fab investment and maintenance costs. In addition, since no exotic materials are used, the raw material costs are likewise low. All of these savings can be passed on to the customer, where cost-savings is of utmost concern.

Under stringent and efficient manufacturing processes, Lightwaves2020 is committed to provide LC related products with continuously improved quality and cost.



From
the publisher



Newsire

Celebrate Lightvision's Six Month Anniversary

This month's edition of Lightvision newsletter marks a significant milestone for us-half a year in publication and still going strong. You can celebrate with us by submitting your own comments and topic ideas to us via email, fax or letter and contribute to this important discussion which will help to determine not only the future of Lightwaves2020's products and product features, but to the future of the fiber optic industry as a whole. This is not just a lot of hype. Comments and ideas that appear here carry a lot of weight since hundreds of the fiber industry's top movers and shakers around the country subscribe to, read and actively contribute to Lightvision newsletter.



Unlike many of the fiber industry trade journals that give you only an overview of the industry and maybe some of its key technologies, Lightvisions provides you with an insider's view from the trenches right here beside Lightwaves2020, one of the technology leaders in the Silicon Valley. By reading Lightvision, you become privy to our thoughts and the technologies that we think are important, which can help you to spot the next industry trend long before other publications catch on. So come on, celebrate with us and join the Lightvision conversation!

You could provide your comments through the following ways:



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- Lightwaves2020 delivered four technical papers at the NFOEC 2003 tradeshow, which was held in Orlando, Florida from Sept. 7th to Sept. 9th. Although the exhibit floor experienced the same light attendance as last year, the papers were well received in the technical sessions, with attendees showing particular interest in Lightwaves2020's single cell polarization controller and its use in instrumentation, polarization multiplexing and military applications.
- Lightwaves2020 will deliver eight technical papers at the OECC 2003 tradeshow, which will be held in Shanghai, China from Oct. 13th to Oct. 16th. We hope to see you there!
- Lightwaves2020's Compact Coarse Wavelength Division Multiplexer (CWDM) just became smaller with the introduction of a new, more compact package. With dimensions of just 49.3 x 31.8 x 8.8mm, the module is now one of the smallest CWDMs available while exhibiting the same excellent performance as our previous CWDM.
- The company conducted its annual ISO 9001:2000 on-site surveillance audit from 10/6 to 10/7 and has passed with 100% conformity to the ISO 9001 Standards. From the start, Lightwaves2020 has worked hard to enhance customer satisfaction through the effective application of the ISO 9001 quality management system, including processes for continual improvement of the system and the assurance of conformity to customer and applicable regulatory requirements. The most recent audit verified that the quality system has been properly maintained over the past year.

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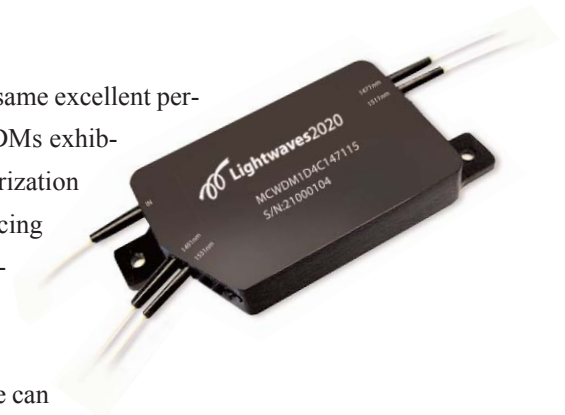
Lightwaves2020 Introduced an Ultra Compact CWDM

Lightwaves2020

Lightwaves2020's has reduced the size of its Compact Coarse Wavelength Division Multiplexer (CWDM) from 80 x 56 x 10mm to just 49.3 x 31.8 x 8.8mm. In addition, its overall shape has been changed from a crab-shaped design to a more rectangular structure to facilitate integration into optical systems. It is now one of the smallest CDWM devices on the market.

Despite this size and shape change, the CWDM provides the same excellent performance as our previous CWDM. The 4- & 8-channel CWDMs exhibit very low insertion loss, high directivity and low polarization dependent loss. With a pass-band of 13 nm and channel spacing of 20 nm, the CWDM module is an ideal match for non-temperature controlled lasers.

Operating independently of protocol and data rate, the module can be deployed in both metro and access networks. And, like all Lightwaves2020 products, it is built per Telcordia standard and the reliability tests are in progress.



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