Automation Enhances Telecommunications Components

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A growing demand for telecommunications modules has led to automated alignment and fixing processes to replace manual techniques.

Automatisierung verbessert Komponenten für die Telekommunikation

Eine steigende Nachfrage nach Telekommunikations-Modulen hat dazu geführt, daß automatische Justier- und Befestigungsprozesse die manuelle Handhabung ersetzen.

L'automation améliore les composants des télécommunications

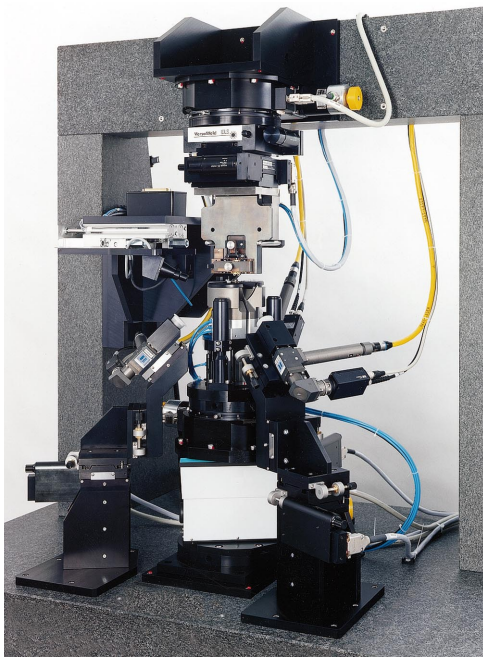
Pour faire face à la forte demande en télécommunication, les techniques manuelles ont été remplacées par des procédés automatisés d'alignement et de montage.

L'automazione ottimizza i componenti per le telecomunicazioni

La crescente domanda di moduli ottici per telecomunicazioni ha portato a processi di allineamento e fissaggio automatico, in sostituzione delle tecniche manuali.

Optical communications links are based on laser sources and detectors, the interfaces between electrical and optical signals. They typically are housed in butterfly modules, but coaxial and dual in-line-type housings are also common. These components can operate under harsh conditions for many years.

Besides electronic circuitry, a typical transmitter consists of a diode laser with an optical isolator, a lens and a fibre pigtail. During production, these components are positioned and affixed by laser welding or gluing. Traditionally, alignment and affixation tasks are performed manually. However, the growing demand for telecommunications components makes manual production inefficient. Increased quality, reliability and data control need an automated alignment and welding system that can produce in volume and improve yield.



The VersaWeld from Electronik Laser System GmbH is an automated multiaxis alignment and welding system used to manufacture components for telecommunications.

Flexible, durable manufacturing system

Elektronik Laser System GmbH has developed VersaWeld, an automated system for telecommunications component production. It is designed for prolonged use, and the operation software accounts for the specifics of industrial processes.

Because the parts to be aligned are small, grippers and movement systems were developed to grasp affixing parts and the fibre. The resolution of the mechanical motion axes is better than 50 nm, which allows the parts to be accurately positioned. Also, all mechanical moving parts are designed to ensure continuous production. Although the tooling and the grippers are package-specific, the tools and instruments can be exchanged. This modularity allows one machine to produce different housings. It also allows switching among production processes for transmitters and receivers.

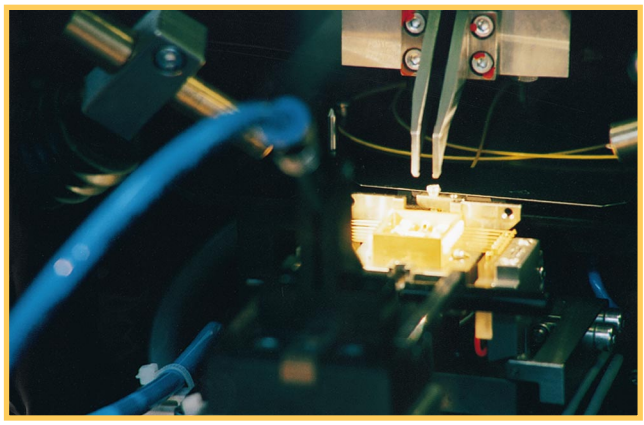
To switch from manufacturing one device to another, the operator selects the corresponding software-defined production process. Changing the type of device can take a few minutes to a few hours depending on the hardware to be exchanged. This quick changeover enables small lots to be manufactured.

Aligning and securing components

To align a transmitter module, the system continuously measures the emission of the diode laser component at the free end of the fibres to determine coupling efficiency. Alignment can take minutes depending on the complexity of the design. The tolerances of the mechanical housings, as compared with the optical axis of the diode lasers, vary from part to part. Therefore, a machine vision system pre-positions the housing. This eliminates or reduces blind searches for first light.

After the system locates the light in the fibre,

Reprinted from the April/May 2000 issue of EuroPhotonics **© Laurin Publishing Co. Inc.**



A gripper places a fibre ferrule inside a butterfly housing.

alignment routines determine the optimum coupling position. The movable parts are then affixed using an Nd:YAG solid-state laser. The energy absorbed by the parts and the housing introduces thermal stress, which can deform the housing. To minimize this, the laser energy is adjusted to guarantee a well-performing welding joint without introducing unnecessary heat. The energy is regulated using a high-quality welding beam and focusing optics to achieve the optimum spot diameter. The spot welds are placed symmetrically to reduce thermal influence.

This process compensates for the stress introduced by the welds, so the deformation of the structure is nearly zero. Assuming a perfect balance between the laser beams and optimum alignment, postwelding treatment is unnecessary.

The spot-weld quality is monitored by CCD cameras on the welding optics. The welding laser includes a pilot laser beam, which simplifies positioning the spots and the development of the welding process. In addition, the spot welds can be viewed to determine optimum welding parameters.

Another way to manage the welding process uses the radiation from the melted material. This signal and the backscattered laser radiation are monitored to regulate the process.

Besides pre-positioning the devices and checking the spot welds, machine vision can integrate optical character recognition and bar-code reading into the process. Combined with data management capabilities, device-specific data can be retrieved from or transmitted to a database, enabling the automation of process steps and the monitoring of information.

VersaWeld is a Class 1 laser system for production environments and complies with safety regulations. The system is compact, with a footprint of approximately 1×1 m, which saves cleanroom space and eases integration into production lines. Consequently, this is a step toward a fully automated production line for electro-optical transmitters and receivers. □