

Scan-system

for welding and bonding
of power electronics

The RAYLASE logo features a stylized red and black graphic above the word "RAYLASE" in a bold, sans-serif font.

RAYLASE

THE POWER OF WE

Which scanning system is suitable for the welding and bonding of power electronics?

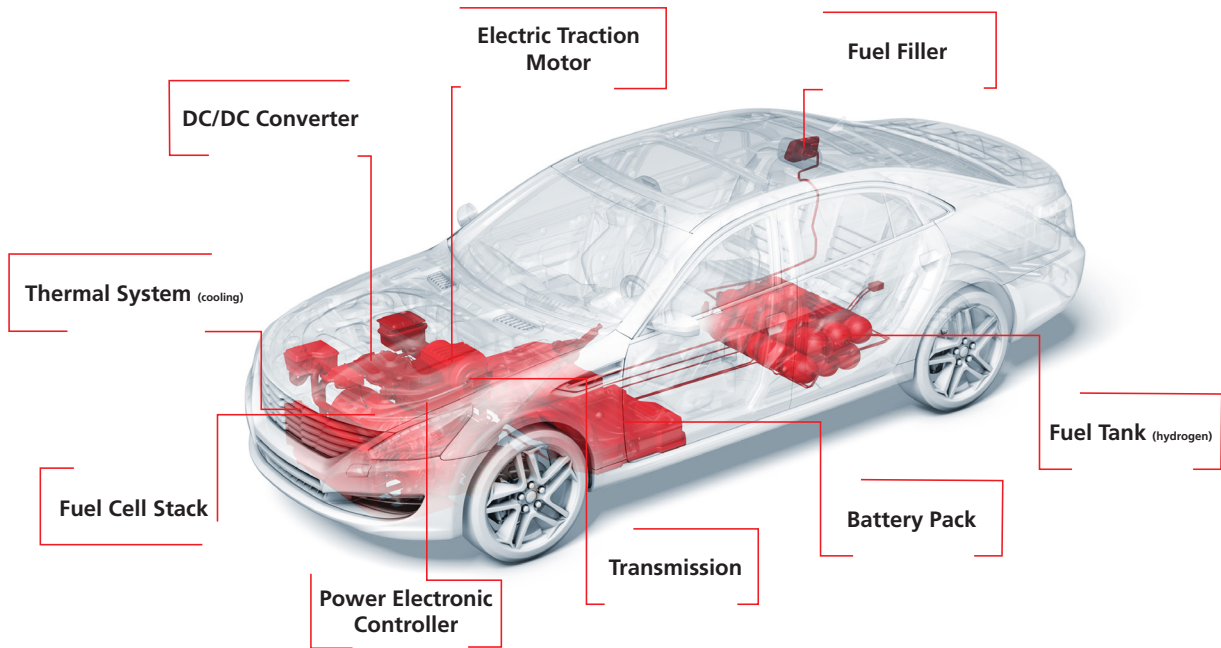
In power electronics, the electrical energy of electronic components is controlled, converted or connected. Power electronics are also required wherever electricity is used to move weights and loads. Examples include cranes, elevators, forklift trucks, automated storage solutions and transport vehicles (such as ships, trains, planes etc.) and, in particular, electronic drives.

THE BENEFITS OF LASER TECHNOLOGY FOR POWER ELECTRONICS

Modern laser technology, with its beam deflection units, makes a major contribution to the manufacturing of power electronics. Innovative laser deflection units have an im-

pressive array of benefits to offer, in particular during the cleaning, cutting, connecting and welding stages of production in the large industrial growth markets of automation and electromobility.

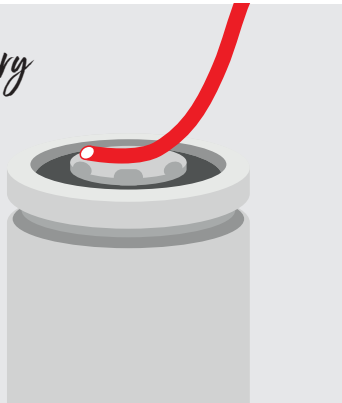
For electric cars, they allow electrical energy to be converted into the required voltage and frequency via power electronics for electric drive motors. And, wherever an electrical current flows, safety and quality are essential. Modern laser systems can be relied upon to deliver both.



Product solutions

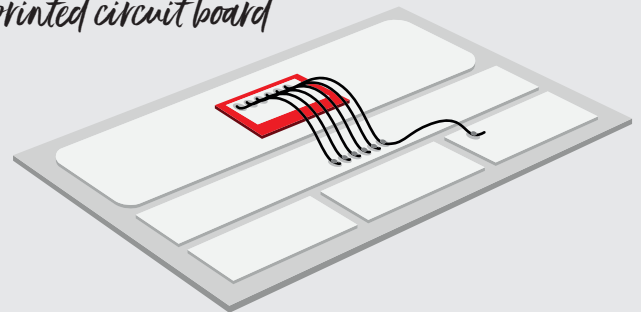
RAYLASE offers machine manufacturers and manufacturers of power electronics the laser beam deflection units they need, with a wide range of configuration options for connecting, welding and soldering electrical components.

Bonding in a battery cell connection



When connecting battery terminals or bonding power electronics, conventional connection technology reaches its physical limits due to ever-increasing current strengths and wire diameters. Laser bonding technology enables the creation of secure connections without large clamping forces – even for large wire diameters. The laser beam is often “wobbled” in this case, meaning that a defined weld line width is created using Lissajous figures. This guarantees that the contacts are connected securely and reliably.

Welding the contact points on a printed circuit board



DYNAMIC RESPONSES, SPEED AND PRECISION ARE VITAL

Speed, dynamic responses and precision are essential features of the laser deflection units and corresponding optics used during these process steps in the manufacturing of power electronics, and all these features are offered by the SUPERSCAN IV from RAYLASE, with stiff and extremely light mirrors made from silicon carbide.

STRONG ELECTRICAL CURRENTS NEED STRONG CONNECTIONS

In the past, ultrasonic welding was often used to bond copper and aluminium. For very fine, thin materials, this

remains the method of choice. However, it is outmatched by laser technology in the area of micro-welding with thicker ribbons, also known as ribbon bonding. The benefit of a laser scanner in this context is its lower surface pressure, which prevents damage to the contact material below. This is also the conclusion reached by a publicly funded research project by the Fraunhofer Institute for Laser Technology (ILT) in Aachen, comparing the various effects, benefits and limitations of the different technologies.

HIGH-PRECISION LASER SOLDERING WITH MINIMAL HEAT DEVELOPMENT

Laser soldering is also commonly used in the manufacturing of power electronics, in particular chips on printed circuit boards for mobile phones and antennae. Conventional techniques often present the disadvantage of heating the entire component excessively, to the point that other ma-

terials may also be affected. In this context, lasers offer the benefit of enabling very precise wire connection of contact points, while simultaneously minimising the heat-affected zone. Of particular importance to the end result is the precision and repeat accuracy of the scanning system, which ensure that laser energy is only applied to the required positions on products during series production.

WHICH LASER BEAM DEFLECTION UNIT IS SUITED TO WHICH TASK?

The individual requirements for the manufacture of power electronics, as well as the materials and material strengths used and the specifics of the task will determine which particular system configuration of a deflection unit is suited to which job. To ensure the highest quality standards, another important consideration is the size of the processing field that is to be processed with the deflection unit.

RAYLASE solution

High-power-welding-unit – ideal for battery production

Laser welding of battery cell covers is a typical application for the HIGH-POWER-WELDING-MODULE. Another is the welding of cell contact surfaces made of aluminium or copper plates in order to electrically connect the individual cells to a battery block. The module is also a perfect solution for welding steel plates using the "remote welding" method, mounted on axis gantries or robot arms. In addition to the deflection unit with a 30 mm aperture, deflection units with a 20 mm aperture are available for laser welding of plastics.

Special Features

- 3 deflection unit types available: "Economical," "High speed" and "Full digital – high precision"
- Fibre collimator for all standard fibres and beam parameter products
- On-axis camera and/or sensors for monitoring weld seam parameters and protective glass monitoring
- Wide range of mirror substrates and coatings for diverse applications
- Laser power up to 6 kW (8 kW, 75% duty cycle)



RAYLASE solution

RAYLASE SUPERSCAN IV – laser-bonding has never been this easy

The SUPERSCAN IV is an ultra-high-speed scanner that offers the highest wobble frequency – making it ideally suited to the **laser bonding** of battery cells. Its extremely dynamic responses and final speed really come into play when used in marking-and-processing-on-the-fly (MOTF) applications in conjunction with one of our linear translator modules. The robust, water-cooled master block design, combined with optional air flushing, enables applications at up to 6 kW laser power.

Special Features

- Control via SL2-100 protocol 20 bit or XY2-100 protocol 16 bit
- Greatly reduced power loss and minimal heat development thanks to a digital PWM output stage
- Highly dynamic responses and high speeds for maximum productivity, in particular for MOTF applications
- Wide range of mirror substrates and coatings for diverse applications
- Available apertures (mm): 10, 15, 20, 30



RAYLASE solution

RAYLASE AXIALSCAN 30 FIBER – a premium product for welding processes

One of the star products from RAYLASE is the AXIALSCAN 30 FIBER – a premium product for **welding processes** in the areas of electromobility and additive manufacturing. The deflection system can be easily integrated into any laser system by means of various mechanical interfaces from above or below, or with a robot flange or to the side. The integrated fibre collimator allows light to be focused into the laser fibre without beam path alignment. A second external protective window can be quickly and easily replaced, with optional monitoring

available. Camera and welding monitoring systems can be adapted to the process light output without aberrations. All optical elements are dust-proof and are therefore ideal for use in a harsh industrial environment.

Special Features

- "High Power" version for welding in the e-mobility market or "High Dynamic" version for the powder-bed process (SLM) in additive manufacturing
- "Quadruple design" boosts productivity four times with 100% overlapping of the processing field
- Dust-proof and designed to meet the requirements of industrial powder bed machines
- Easy system integration with a direct laser fibre connection and a range of attachment options
- "On-axis" quality control with an integrated process monitoring interface
- Integrated fibre collimator
- IP64 with a second additional protective window
- Integrated sensor and camera monitoring
- Processing field sizes: 200 mm x 200 mm² to 800 mm x 800 mm²
- Very large Z range for 2.5-D and 3-D applications
- Up to 4 kW laser power (single- and multi-mode)
- Optional air and water cooling



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