

VersaWeld

Production System for Precision Laser Welding



VersaWeld

Combination of Precision, Efficiency and Versatility

VersaWeld combines precision laser welding processes with high robustness and efficiency. The versatile configuration can be easily adopted to changing workpieces and complies with complex welding geometries. Its ease of use and the low operating cost make VersaWeld a sound investment for today and future requirements.

Robust System Structure

The solid structure of the VersaWeld Station consists of a granite or honeycomb plate with numerous mounting holes. It offers a large work area. Depending on the configuration and size of the work area, a portal structure or gantry can be added. Pneumatic vibration isolators decouple the work area from disturbing floor vibrations and ensure high position stability.

The system enclosure with safety switches complies with laser class 1.

Solid-State Laser Sources



The cross section shows the welding penetration of a Kovar lid to a copper baser with a pulsed fiber laser when purging with protective gas.

The intended weld operation and material of the parts determine which weld laser will be selected.

For spot welding, a lamp-pumped Nd:YAG laser with pulses in the millisecond regime offers great flexibility. With several kW peak power, several 10 J of energy per pulse and a spot diameter of 100 µm, a very high power density is achieved. Typical pulse repetition rates are in the order of several 10 Hz.

Modern fiber lasers offer up to 500 W continuous power with a single mode beam profile which can be focused down to spot diameters of approximately 30 µm. This allows for very fine seam welds and high welding speed. Some fiber lasers can switch between cw and pulsed mode. This is an advantage for key hole welding of dissimilar materials – the high peak power helps to penetrate the parts and form a good connection.

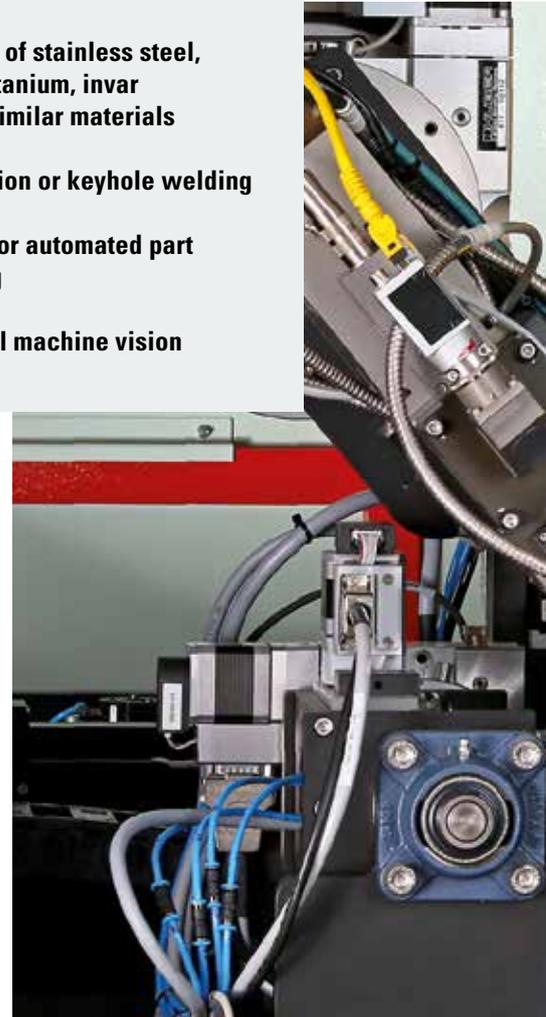
Precision Motion System

A high-performance motion system moves the weld optics and/or the devices. All axes work with encoders for position readout and control of the travel distances. Linear motors or stepper motors drive the axis. These motors are true work horses with excellent reliability and lifetime.

VersaWeld uses up to 6 degrees of freedom with linear and rotary motion axes. As a standard, the 5-axis configuration allows for complex 3-dimensional welding connections.

Advantages of VersaWeld

- Weld seams down to 30 µm width
- Welding of stainless steel, kovar, titanium, invar and dissimilar materials
- Conduction or keyhole welding
- Manual or automated part handling
- Powerful machine vision



Weld Optics and Machine Vision

The standard weld optics use a lens assembly for focusing the laser beam. The spot size and working distance are fixed. Adding a CCD camera to the assembly provides a picture of the weld position and the weld seam.

Device-specific machine vision algorithms reduce the processing time to a minimum. Even under difficult circumstances, the illumination with various wavelengths and strobe light option assures suitable images.

Automated machine vision utilizes these images for motion control purposes, such as seam tracking. With this function, the position of the weld beam follows the calculated path and optimum welding is achieved.

Alternatively, a XY scanner with a f θ lens focuses the laser beam onto the target. The scanner offers extremely rapid movements of the laser beam within an area of approximately 100 mm x 100 mm. This configuration allows for any curvature motion including letters and numbers within shortest time.



Customized configurations of the VersaWeld System replace tedious manual or semi-automated processes. Robots load the piece parts and can hold them in place during laser welding. With automated seam tracking, the position of the weld beam follows the calculated path for optimum welding results.



The NanoRobot precisely handles small parts in the VersaWeld station. Repetitive movements are executed with an error of less than 5 μm . This performance qualifies the robot for direct placement of workpieces under the weld beam as well as for part inspection in machine vision stations for a visual assessment. NanoRobot has 5 N load capacity and a working range of 300 mm.

Spatial Light Modulation

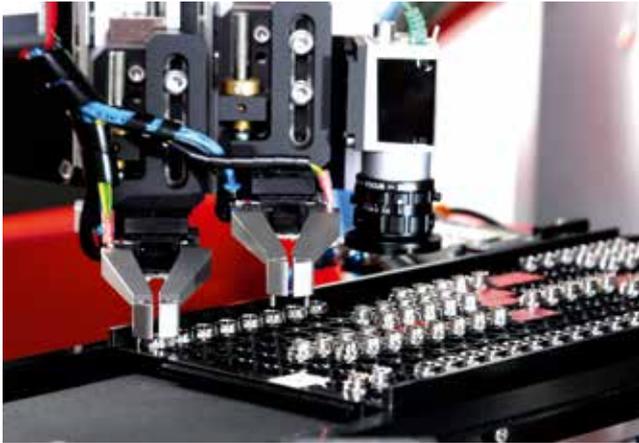
Some applications require the modulation of the spatial profile of the laser beam. This modulation ensures an optimum penetration into the material surfaces to obtain the desired shape and strength of the joint.

Process Gas

The laminar flow jet in the VersaWeld purges the weld area with gases like Nitrogen or Argon. These gases shield the weld spot from ambient air and provide a positive effect on the long-term stability. In addition, the weld process is supported as the heat transfer improves and unwanted spilling is avoided.

Weld Fume Exhaust

The weld process generates toxic gases which have to be extracted. VersaWeld is equipped with internal tubing with a main connection to the outside for further processing.



Automated loading of device trays with feeders: Large volume production of TO diode lasers and lens assemblies with stainless steel housings delivered on trays. The dual gripper design reduces the handling time by a factor of 2.

Modular Process Software

The process software TestMaster controls all process sequences and system functions. Parameter files serve as recipes for different process steps and devices. The process flow programming is easy to understand and the customer has full access to these sequences. Processes for new devices can be set up in short time.

With the import of CAD files (e. g. DWG, DXF or Bitmap) the process programming work is substantially reduced while part quality and throughput will be improved substantially.

Several access levels define user rights and ensure safe operation. An optional database stores relevant data and supports statistical process control.

Manual or Automated Loading

VersaWeld works as a single station or can be integrated into production lines. Trays for single or multiple devices sets, belts and feeders present the parts for processing and allow for the exchange with other work stations in the line. In addition, VersaWeld controls robots for device loading. Quick-release toolings provide maximum flexibility.

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