nanosystec
PRECISION AUTOMATION

NanoPlace

High-Precision Micro Assembly Station

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Precision Assembly

The fully automated assembly station NanoPlace takes components, such as lenses or dies from a loading area and mounts them onto carrier devices. The assembly methods include epoxy gluing with UV or thermal curing as well as laser soldering and eutectic bonding.

The large work area of up to 1000 mm x 1000 mm provides space for the positioning of wafers, device trays and support systems. The parts are presented manually or fully automated. Feeders or stop-motion conveyor belts bring the parts to the working area and collect the finished product.

The NanoPlace processes optoelectronic elements like VCSELs, photo diodes, laser dies and micro optics with highest precision while the passive placement of fiber ribbon cables is another major application.

Multiple device trays and feeders increase the throughput and allow for the automated processing of large quantities. Alternatively, an inline configuration with conveyor belts provides a seamless production flow.

Pick-Up with 360° Capability

The devices to be mounted are picked up from a custom loading jig or directly from a waffle or Gel-Pak. The pickup tool is centered underneath a rotational stage with a large aperture. The machine vision system recognizes the orientation of the device and brings the gripping tool into the correct rotational position for the placement. A preorientation of the components is not necessary.

Gripping with Force Detection

In the standard version, a vacuum gripper is used. Different sizes of the devices to be picked are addressed with various sizes and shapes of the tips. Alternatively, standard pick-up tools for semiconductor applications are chosen. The force measurement allows for applying a repeatable pressure during the bonding procedure.

Repeatable Positioning

Thorough design and continuous optimization of all functional groups lead to superior mechanical stability. Mechanical references with tight tolerances provide a repeatable manufacturing operation from device to device.

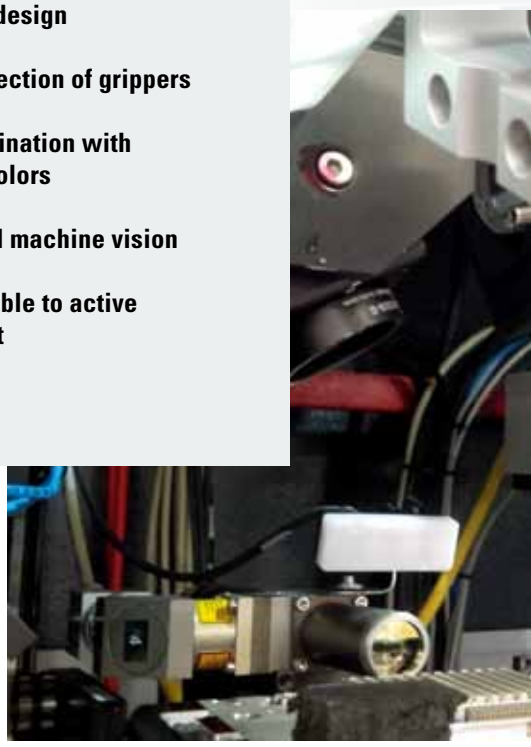
The pick-and-place motion system consists of high-precision motion stages with crossed-roller bearings. They are equipped with linear or brushless DC servo motors with optical position feedback for repeatable high-velocity positioning.

The camera system moves independently from the pick-and-place motion stack and carries the syringe or epoxy stamping tool for the resin or the laser soldering optics. This assembly also holds the UV lamps or the light guides.

The motion stages are mounted onto a vibration-isolated structure. This solid set-up makes NanoPlace insensitive against disturbing external influences and provides a high stability during the assembly procedure.

Benefits of NanoPlace

- **Fast precision placement**
- **Modular design**
- **Large selection of grippers**
- **LED illumination with various colors**
- **Advanced machine vision**
- **Upgradeable to active alignment**



Powerful Machine Vision Capability

The NanoPlace Stations use automated machine vision algorithms. These include pattern recognition, object detection, edge detection and autofocus. The parts and features on the devices are automatically detected which allows for a repeatable gripping position.

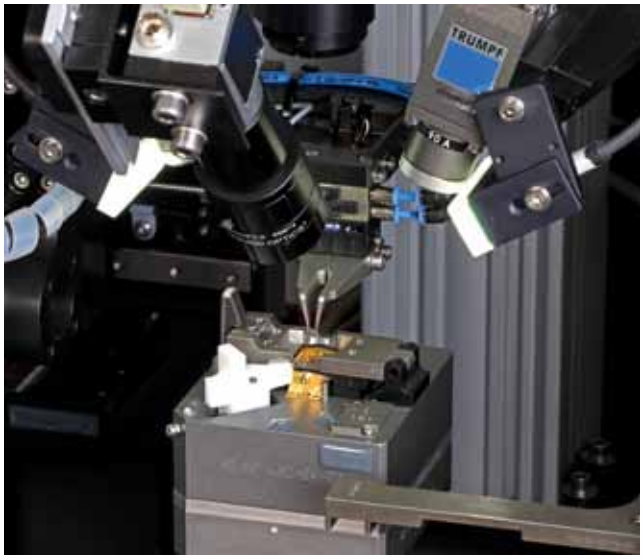
Advanced Camera Systems

Several CCD cameras determine the position and orientation of the parts to be joined. The image acquisition with pulsed LEDs eliminates the disturbing ambient influences. Cameras observing a large working area and parallel cameras with high resolution reduce the image acquisition time substantially.

Adjustable Illumination in various Colors

Various brightness settings of the LED illumination provide ideal imaging conditions. Different colors help to identify even difficult surfaces and features which are hard to see. Standard illumination consists of coaxial lighting through the lens, a ring light from top and side-mounted LEDs with diffusors.

Various assembly techniques can be combined in one station, such as laser welding, laser soldering and epoxy gluing. Exchangeable device trays allow for the versatile micro assembly in various batch processes.



Cameras mounted to the focusing lenses of the laser processing optics support the image data processing during laser soldering and laser welding. In addition, machine vision monitors the dispensing of resin or solder paste.

Assembly Processes

For the final assembly, the NanoPlace station is either equipped with epoxy gluing with subsequent UV/thermal curing, with laser soldering or eutectic bonding capability.

Epoxy Gluing. The epoxy is applied with a dispenser or with a stamping tool. The machine vision system monitors this procedure. After the epoxy is applied and the component is in place, UV guides or UV-LEDs are shuttled into position for the curing procedure.

The syringes of the dispenser or the stamping tool are mounted to the motion system of the camera which moves independently from the pick-and-place stages. They are mounted in a way that the camera monitors the application of the resin.

Laser Soldering. If solder paste or a preform is used, a high power diode laser locally heats the solder to a precise temperature with minimal heat impact to the surrounding area.

As an option, the patented multi-spot beam optics form a geometric pattern of several spots which are treated at the same time. This method avoids tombstone effects and increases the throughput.

A second camera which is mounted to the laser head allows for precise view through the soldering lens assembly in order to automate this process step.

Eutectic bonding complements the joining methods available for NanoPlace. Laser heating guarantees the fast heating of the substrates. A control loop measures the actual temperature and provides a feedback signal to the laser for precise temperature control. Grippers with integrated heating function set the part to be placed on the desired temperature.

Integration into Production Lines

NanoPlace can be easily integrated into production lines. It communicates with other machinery in protocols like SMEMA. The system software allows integration with Material Execution Systems and the mechanical design takes the needs for the smooth transport of the work pieces into account.

Process Software

The automated processes run in the TestMaster process software. This software works with a direct user interface for teaching positions and adapting the process parameters.

The automated process flow is programmed in the YASE sequence editor. The customer has full access rights to this programming and can modify the processes as required.

This structure provides a smooth and secure operation of the systems in high technology production environments.

Process Monitoring

Digital inputs on the general machine control or on the motion controller are permanently monitored and can be displayed. Depending on the process, automated actions follow when an interlock or emergency function change the status. Also a possible power, pressure or vacuum outage can be detected. An automated shut-down can be executed depending on the conditions.

Remote Access

The remote access software works over a secured internet connection. The fast and easy access saves time in case any support or trouble shooting needs to be performed on the system. For safety reasons, nanosystec is only allowed to access the system when the user accepts. For each event, a new session is started.

Active Alignment with Feedback Signal

For high-precision placement in the submicron range and process development, NanoPlace can be equipped with active alignment. In addition to machine vision, a feedback signal from the device is used for the final position optimization. The feedback signals can be current, voltage, beam properties or any other physical value which can be converted into an electrical signal.

Different toolings can be changed during the process without operator intervention.

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