MRSI-705

ADVANCED PACKAGING WORK CELL

Turnkey Production for:

- 3D Packaging
- Wafer Scale Packaging
- LED Assembly
- Microwave Modules
- Photonics Packaging
- RF Power Amplifiers
- Infrared Sensors
- Pressure Sensors
- MEMS Devices
- Semiconductor Packaging
- Hybrid Circuits
- Multichip Modules
- Pacemakers and Hearing Aids
- Medical Imaging
- Laser Diode Bonding
- Inkjet and Print Head
- Solar Concentrator Packaging
- System on a Chip
- System in a Package

Performs epoxy die attach, eutectic bonding, flip chip and more.

ACCURACY. SPEED. RELIABILITY

SETTING THE NEW STANDARD FOR ADVANCED PACKAGING SOLUTIONS

The MRSI-705 can be configured for multiple component attach and dispense technologies across a wide range of applications:

Assembly Technologies

- Eutectic Bonding
- Epoxy Component Attach
- In-situ UV Bonding
- Flip Chip Assembly
- Thermal Compression Bonding

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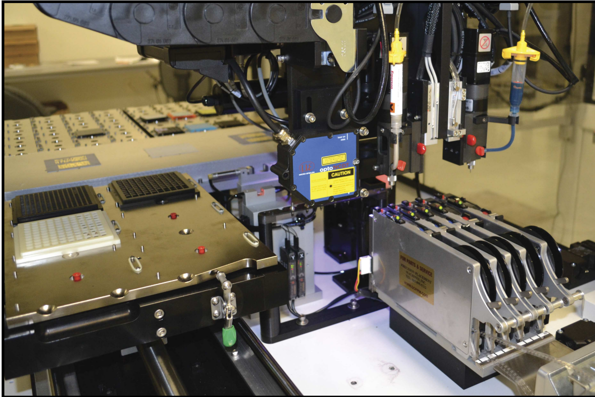
MRSI-705 5μm Die Bonder

The MRSI-705 work cell sets a new standard for ultra-precise, high-speed component assembly. Engineered with many new advanced features and enhanced capabilities, the MRSI-705 is specifically designed and configured for optimum performance in advanced packaging applications, including semiconductor packaging, life & health sciences, aerospace, defense, automotive, lighting, communications, and more.

MRSI Systems builds the MRSI-705 to meet the highest standards for reliable and dependable operation. Its design is based on an award-winning, industry standard platform. The major system X Y axes use zero force, ironless, actively cooled linear motors with high resolution linear encoders. The encoder scales have 0.1 micron resolution for fast, precise, closed-loop positioning. The linear motors deliver faster speeds (acceleration, deceleration and velocity), with better settling times and overall smoother motion. Reliability is enhanced with superior cable management and advanced air bearing technology in the Z axis.

The platform design employs a minimum of moving mechanical parts. A solid granite platform supports the placement head from above, so that no mechanisms are cantilevered. All of this makes the MRSI-705 thermally and mechanically stable with extremely fast settling times and +/- 5 microns or better placement accuracy, a requirement for critical applications.

The MRSI-705 is the Ultimate Die Bonder



The MRSI 705 platform is mechanically and thermally stable with no cantilevered mechanisms.

Large, Configurable Work Area

The overhead gantry design provides a large work envelope. The system picks from any combination of Gel-Paks™, waffle packs, wafers, and tape feeders. When picking from wafer, the system utilizes a motor-driven, controlled force lift mechanism for picking thin die and large aspect ratio die, and includes theta compensation. Ink dot recognition and wafer mapping ensures that only known good die are picked. The 700 in.^{2} work area easily accommodates a wide variety of material inputs and outputs. The MRSI 705 can accommodate up to 90 Waffle Packs when utilizing the system's unique Sector Plate Shuttle. Even the smallest die can be effectively handled.

Force Control for Advanced Assembly

The MRSI-705 features closed-loop force feedback; this enables proper handling of Gallium Arsenide (GaAs) and Indium Phosphide (InP) devices as well as delicate devices such as MEMS. Die are placed with forces as low as 10 grams so fragile microstructures such as air bridges are not damaged. Force is programmed per placement so that each die can be picked and placed with a programmed and controlled force.

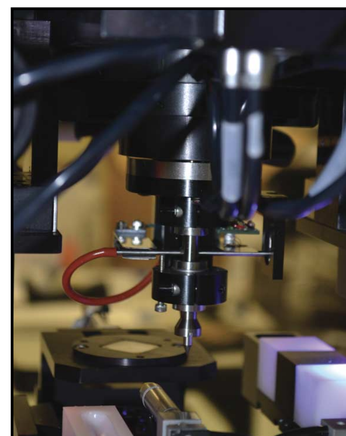
Material Handling

The MRSI-705 is ideally suited for dedicated high volume production requirements, yet flexible enough for small lot production. It can be configured for stand-alone production, cassette-to-cassette material handling, or in-line with other process equipment. The adjustable width, in-line conveyor transports boats, common carriers, or lead frames. Tooling is modular for easy change-over between production runs.

Tool Change – Tool Bank or Turret

The MRSI-705 features a thirteen-position tool bank with fast automatic tool change. Additional tool change banks are added for a wider range of tools. The tool change banks holds both vacuum collets (conical, perimeter, inverted pyramid, custom) and epoxy stamping tools. Custom collets such as perimeter collets and inverted pyramid collets for eutectic bonding provide additional capability for handling devices safely. The MRSI-705 offers heavy part handling capability and excellent co-planarity for large die such as optical or image sensors.

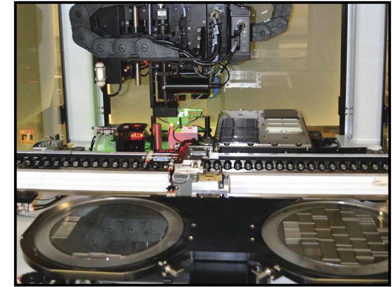
The MRSI-705 is available with an optional six-tool turret. Force is independently controlled for each tool via direct feedback.



The MRSI 705 has controlled programmable pick-up and placement force for placing thin, delicate devices.

Advanced Machine Vision

The advanced vision system enables rapid detection and orientation of die over a full 360° and robust substrate fiducial alignment. This enables the alignment of orientation-critical die such as MMICs and beam lead diodes. The vision system aligns and places die according to substrate fiducials, the die edge, or relative to features of previously-placed die. This ensures repeatability and precise alignment of optical and microwave devices. Boundary trace and/or pattern recognition is used to locate the die center, edges, or application-critical features. Fast orientation enables die such as MMICs and lasers to be used directly from the supplier without any need for pre-orientation. Global and local vision alignments are used for nested substrates and feature alignment. This enables fast, error-free processing of complex assemblies.



Dual magnification cameras are used for substrate and die alignment

The MRSI-705 vision system features multiple magnification and programmable lighting for both upward and downward facing cameras. The MRSI-705 utilizes an upward-facing camera for processing flip chips and other components with bottom features.

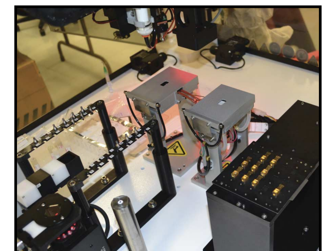
Programmable Multi-color Lighting

Lighting intensity is programmable for both the ring and collimated lights for each camera. Optimal light settings are determined for die and alignments. Multi-colored lighting is used to process a wide range of materials. Red, green and blue programmable lighting provides greater capability for processing challenging alignment surfaces such as gold on alumina. The more robust vision system ensures that production will not be interrupted for missed alignments.

Blue, red and green programmable lighting for vision processing of challenging substrate materials

Eutectic Bonding – Fast Ramping, Pulse-Heating Stage

The MRSI-705 is equipped with eutectic bonding capability. The MRSI-705 supports multiple eutectic processes including Gold Silicon, Gold Tin and Gold Germanium. Unique capabilities include a heated reflow station with fast closed-loop, pulse-heating temperature ramping. The eutectic station is programmable to match the requirements of your eutectic process. The temperature ramp rates are programmable to optimize the heating of parts while preventing thermal shock. The MRSI-705 supports both direct eutectic and reflow eutectic with controlled contact force and programmable scrubbing (variable amplitude, frequency, and direction). Heated cover/forming gas of Hydrogen and Nitrogen is present over the hot plate to eliminate oxidation. The system automatically transfers the substrate or package to and from the reflow stage, which includes provisions for vacuum hold down or mechanical parts clamping.



Dual Fast Ramping, Pulse Heating Eutectic Bonding

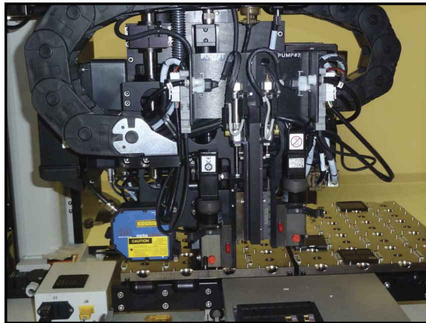
In addition to packaging high power devices such as amplifiers these features enable the mass production of optical assemblies for photonics such as eutectic bonding on submounts, TO headers, and butterfly packages.

An optional Progressive Heated Boat Indexer is available for high volume eutectic applications.

Dispense Capability with Laser Height Sensing

Advanced features include dual positive displacement pumps for conductive and non-conductive epoxy, precision laser height mapping, plus automatic dispense needle locating and cleaning. Cartridge style positive displacement pumps are used with closed-loop servo motors, thereby providing precise control of epoxy volume when dispensing small dots or area fills.

The MRSI-705 achieves unparalleled precision dispensing through highly accurate height sensing. Three-point laser height sensing per alignment determines the tilt of each surface on which material will be dispensed.



Dual dispensing with laser height mapping and rotary positive displacement pumps.

In-situ UV Bonding

The system automatically performs UV epoxy bonding. UV curable epoxy is dispensed, the device is placed and the UV is automatically cured using a programmable UV source and light guides. Light guides can be stationary or actuated.

Epoxy Stamping

Multiple epoxies with multiple stamping tools enable stamping of a large variety of materials and dot sizes. Dots as small as 0.004" (100 microns) are stamped.

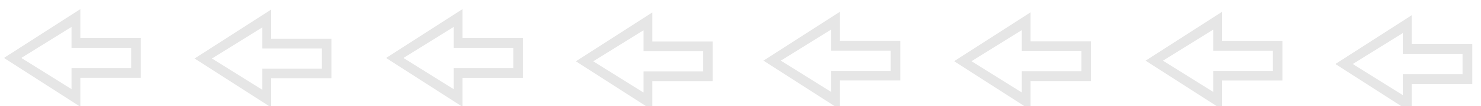
Quality Software, Computer and Motion Control

The MRSI-705's intuitive graphical user interface runs on Windows and simplifies the set-up and production process. The software includes a pre-programmed library of waffle packs and die. Components are easily taught and are available for all substrate programs. The XML-formatted database allows for simple data manipulation and offline programming. New vision tools such as an adjustable region of interest, enhanced gain control, filters, and pattern matching enable vision processing of the most challenging substrate and die materials. CAD download, advanced calibration routines, automatic program selection based on the bar code of an incoming boat, full material traceability and network connectivity mean that very little machine time is devoted to programming, thereby maximizing productivity.

The MRSI-705 control platform provides smoother and more precise control with up to 32 axes of motion, and a common controller for all axes including the conveyors. Computer hardware configuration features front USB ports for ease of use and dual hard drives with ghosting for optimum data security and minimum down time/immediate recovery.

Turnkey Integrated Production Lines

MRSI Systems offers a complete solution for advanced packaging, including our family of high-speed, precision die bonders and epoxy dispensers. SMEMA compatibility allows integration of the MRSI-705 with a wide range of equipment including in-line ovens for a turnkey production solution. MRSI Systems reliable systems combined with our worldwide service and support commitment means that your system will always be available for production.



Specifications

Platform

Platform Construction	Solid granite overhead platform, no cantilevered parts
Placement Accuracy	5 µm, 3 sigma, true radial position (application dependent)
Placement Cycle Rate	1,000 UPH
Placement Repeatability	± 1.5 µm, 3 sigma
X Y Construction	Zero force, ironless, actively cooled linear motors with 0.1 µm linear encoders
X Y Speed	1 m/sec or 40 inches per second
Z Axis Placement	Place to a force or height
Force Control	Programmable per placement with real time feedback control 10 grams to 2,000 grams
Travel	X: 20.0 in, Y: 35.0 in, Z: 1.25, ø: 360° X: 508mm, Y: 890mm, Z: 32mm, ø: 360
Resolution	X: 0.1 µm, Y: 0.1 µm, Z: 0.4 µm, ø 0.004°
Dispensing	Dual epoxy dispensing, laser height mapping

Vision and Lighting

Lighting	Red, green and blue ring or collimated; programmable intensity
Vision System	Edge detection and pattern recognition
Cameras	2 down looking (high and low magnification); 1 up looking
Webcam	Real time webcam for remote process viewing

Tools

Pick up	Vacuum surface pick up tips
Collets	Perimeter collets, 2 & 4 sided inverted pyramid collets, custom designs
Tool Bank	13 position tool tip changing bank; multiple banks possible
Tool Turret	Optional 6 tool turret with each tool with independent force control
Epoxy Stamping	Standard 13 position tool change bank holds stamping tips

Material Inputs and Handling

Waffle Packs	Waffle packs and Gel-Paks on sector plate with slide mechanism
Waffle Pack Covers	ESD safe sector plate covers hold waffle pack lids
Capacity	Up to (90) 2” x 2” waffle or (24) 4” x 4” or combination plates
Tape and Reel	8, 16, or 24 mm with multiple bases possible; supports up to (30) 8 mm feeders
Wafer	Wafer, up to 8 inch with motor driven Z needle mechanism and theta for frame or ring
Die Size	0.008 in sq. minimum; no practical limit maximum
Die Thickness	0.001” thick Die or solder preforms
Typical Die Material	GaAs, InP, Si, solder preforms
Material Handling	Conveyor for boats, tray or carriers with assembly fixturing
Communications Protocol	SMEMA compatibility

MRSI Systems LLC
101 Billerica Ave. Bldg 3
North Billerica, MA 01862-1256
Tel 978- 667-9449
Fax 978- 667-6109
www.mrsisystems.com