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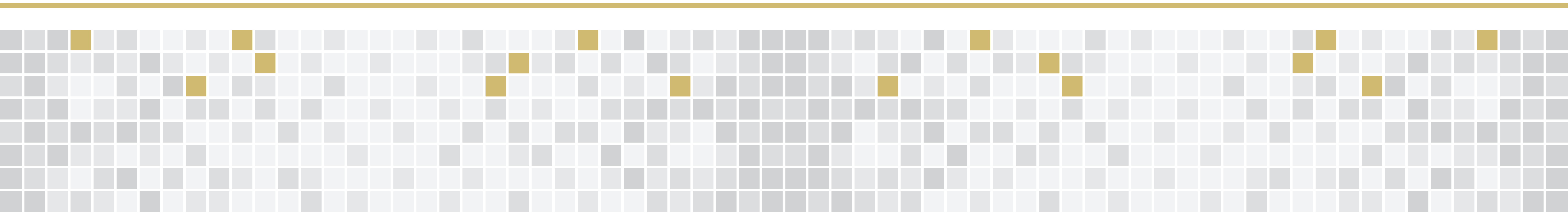
MC-6454A 08/19

FUZION SC™

semiconductor performance

at surface mount speeds



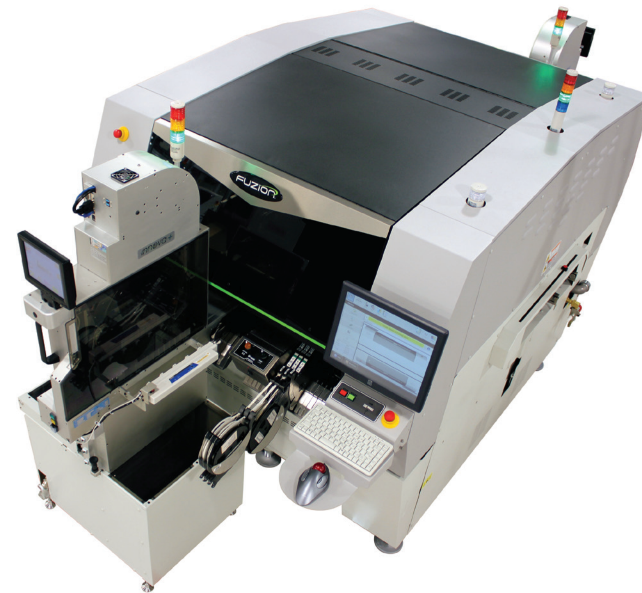
Building Better

System-level solutions for next-generation challenges

Bringing high productivity to advanced packaging assembly

Traditional advanced assembly methods can no longer keep pace with today's higher-volume, higher-complexity production demands. Universal's FuzionSC™ Platform offers a complete solution to today's most challenging semiconductor packaging applications by combining extreme accuracy with surface mount performance. FuzionSC is the ideal solution for Flip Chip, System-in-Package (SiP), 2.5D, Package-on-Package (PoP), Wafer and Panel-level Fan-out, Embedded, and Conformal Shielding applications.

With the largest component range of any advanced packaging pick-and-place solution, FuzionSC has the inherent capability to assemble a complete module on a single machine, placing both die and passives precisely and seamlessly. This enables you to move quickly and cost-effectively to your next product while getting to market faster, minimizing operating costs and enjoying long-term asset protection.

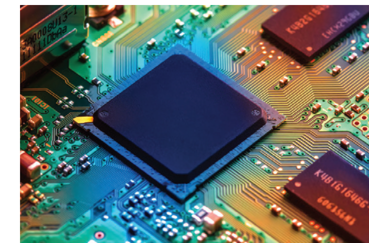


FUZION™

Build better. Build more. Spend less.

Empowered by know-how

Universal Instruments' solutions include not only best-in-class equipment, but also proven in-depth process knowledge, application expertise and integration experience to ensure your equipment delivers your product at the highest possible yield and reliability, and at the lowest possible cost.



Achieve best accuracy at highest speed over largest area

- ±10μm accuracy, < 3μm placement repeatability
- High throughput up to 10K cph Advanced Packaging Assembly Solutions (APAS), 30K cph standard applications
- Populate the largest panels to process higher die counts

All-in-one platform for any assembly challenge

- Place broad range of die and components on one platform
- Placement capability from ANY feeding option
- Place on ANY substrate

Leverage process expertise and years of experience

- Advanced Process Lab focused on realizing rapid product introduction, maximizing yield and optimizing reliability
- APAS applications since 1990; thousands of platforms, all markets

New Benchmark

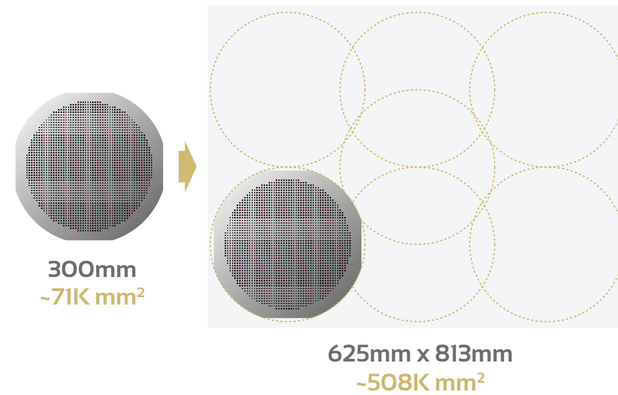
Achieve best accuracy at highest speed over largest area

±10µm accuracy, < 3µm placement repeatability

- High-stiffness frame, within 1µm from corner to corner
- Proprietary VRM linear motor: thermally stable, dual-drive, 1µm resolution
- Optimized motion control for sub-micron repeatability
- Environmental thermal management
- High-resolution optics, mapping and calibration routines
- Two-step precise global fiducial find
- Look before pick
- Top Alignment Process (TAP)
- Accuracy Management System (AMS) validates accuracy while in production
- AOI feedback and placement adjustment

High throughput up to 10K cph APAS, 30K cph standard applications

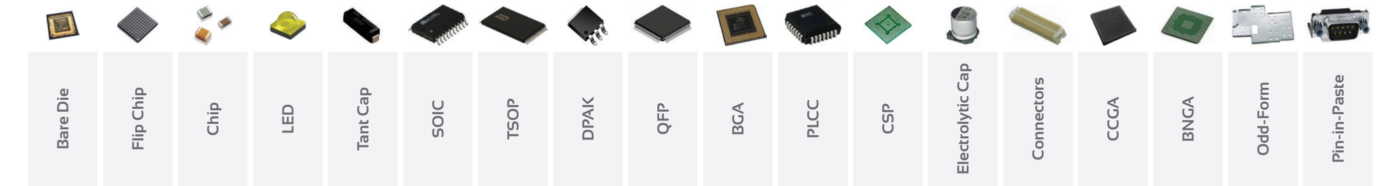
- Dual-drive VRM linear motor with fast motion response and settling times
- Available dual-beam configurations with multiple heads
- Multiple heads/spindles reduces number of cycles from pick to place
- Gang pick and gang dip maximizes cycle time efficiency
- On-the-fly vision with large field of view



Populate the largest panels to process higher die counts

- Traditional platforms follows wafer form factor, limiting assembly size
- Populate panels without sacrificing speed or accuracy
- *Achieve a 7X processing increase!*

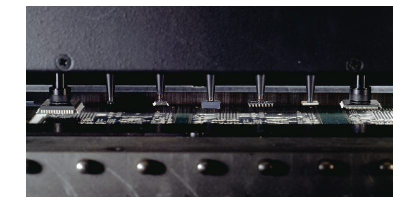
All-Around Performer



All-in-one platform for any assembly challenge

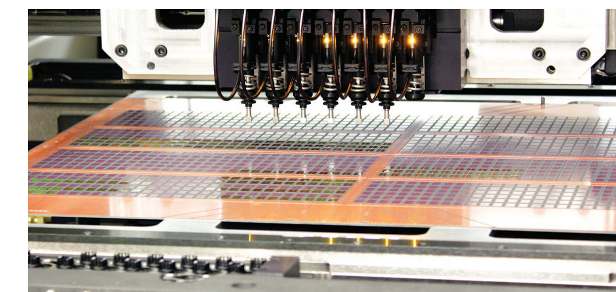
Place broad range of die and components on one platform

- High-accuracy flip chip, bare die, surface mount, and odd-form
- Full range of die: 0.5–40mm, 0.05–4mm thick
- Advanced vision algorithms, programmable lighting, bump recognition down to 20µm
- SMT: 01005–55mm square and up to 25mm tall
- Supports solder/flux dipping and pin transfer
- 150–5000g placement force (lower-force options available), dynamic force control



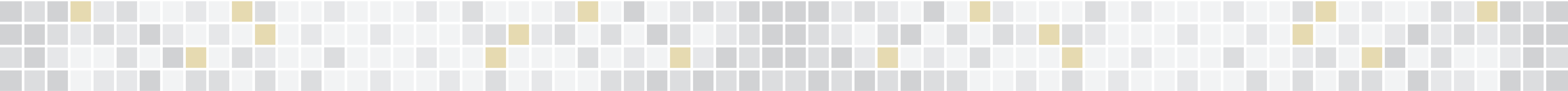
Placement capability from ANY feeding option

- Wafer, tray, tape, tube, and bulk
- Supports wafers up to 300mm and multiple die part numbers
- Tape: 4 x 1mm (01005) up to 56mm
- Matrix tray: supports stationary and automated stackable feeders (2x2, 4x4, JEDEC)



Place on ANY substrate

- Thin, thick, narrow, and large assembly area
- Substrates, wafers, lead frames, ceramics, glass, flex, and laminates
- Reel-to-reel systems



Differentiation Through Knowledge

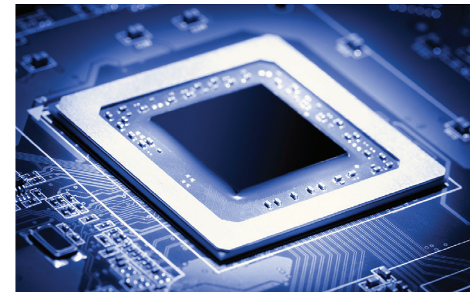
Leverage process expertise and years of experience

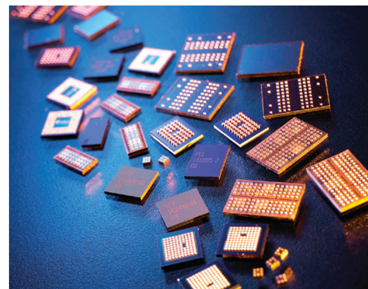
Advanced Process Lab focused on realizing rapid product introduction, maximizing yield and optimizing reliability

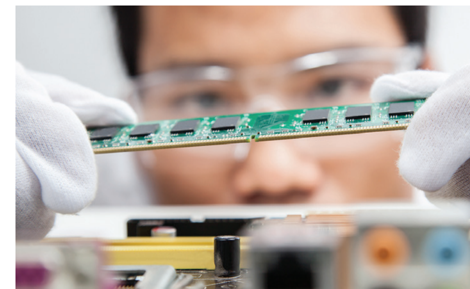
- Leading-edge, fully equipped laboratory
- Optimized assembly solutions (design, materials, process, pioneering equipment technology) for new and existing products
- Prototyping and development, first article build, NPI, volume production
- Design for Manufacture (DfM), Design for Reliability (DfR)
- Research partnerships: industry-leading Consortium, multiple University collaborations

APAS applications since 1990; thousands of platforms, all markets

- Flip Chip in Package
- System-in-Package
- Wafer-Level Packaging
- Embedded
- High-Accuracy Place
- High-Speed Passive



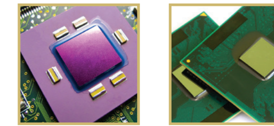




All Markets

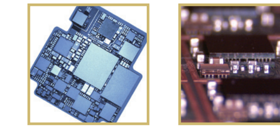
One solution for all advanced packaging application challenges

The precision performance and versatile capabilities of the FuzionSC deliver maximum throughput per floor space for virtually any application. With an unbeatable combination of speed, accuracy and flexibility, FuzionSC will have you well-positioned for your next product.



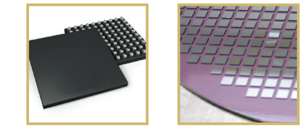
Flip Chip in Package

- Substrate and carrier handling with precision lifter and vacuum tooling
- Flux dip capability with Linear Thin Film Applicator (LTFA)
- Supports up to 4 Innova direct die feeders for multi-die applications
- High-speed passive/SMT device placement
- Vision algorithms/lighting support all substrate materials & packages
- Look-before-pick ensures highest pick accuracy



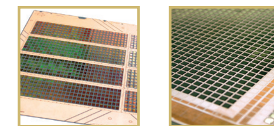
System-in-Package

- Thin and narrow substrate handling
- Bad circuit detection, electronic pass-down
- Gang flux dip for maximum cph
- Supports up to 4 Innova direct die feeders for multi-die applications
- High-density passive placement, 01005 and smaller, 4x1 feeding
- Small fiducial & fiducial teach-by-show pattern find
- Highest speed flip chip placement



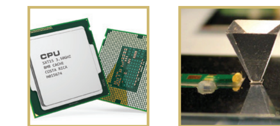
Wafer-Level Packaging

- Best accuracy (±10μm) at highest speed over largest area
- Supports panels up to 610mm x 813mm
- AOI accuracy feedback for post-process compensation
- Software supports high die count assemblies
- Precision material handling and thermal stage options
- Die-level traceability SECS–GEM



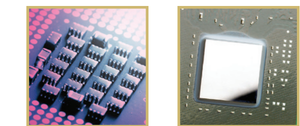
Embedded

- Best accuracy (±10μm) at highest speed over largest area
- Panels up to 610mm x 813mm
- Supports high device count, both passives and actives
- AOI accuracy feedback for post-process compensation
- Precision material handling and thermal stage options
- Die-level traceability SECS–GEM
- Top-side alignment (TAP) process



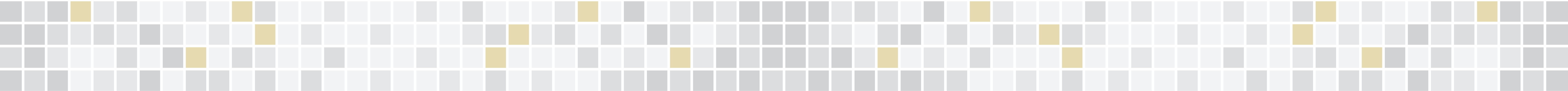
High-Accuracy Place

- High speed, high accuracy
- 01005–55mm sq & up to 25mm tall
- Top-side alignment (TAP) process for LED headlamps, CPV
- Advanced vision algorithms, programmable 3-axis lighting
- Wafer, tray, tape, tube, and bulk feeding formats
- Custom applications tooling: nozzles, grippers, substrate support
- Up to 5000g force, 30 seconds dwell

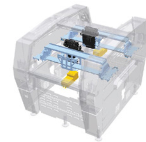


High-Speed Passive

- Available dual-beam configurations with multiple heads
- Up to 14 spindles with gang pick
- Up to 30,750 cph
- 4 x 1mm tape feeders
- High-speed & high-accuracy modes
- Bad circuit detection, electronic pass-down
- Custom applications tooling: nozzles, substrate support
- Motion profiles for sensitive device handling



FuzionSC Portfolio & Solutions



FuzionSC2-14

For higher throughput requirements

FuzionSC1-11

Lower cost with additional flexibility

FuzionSC2-14	FuzionSC1-11
Dual-beam, dual-drive overhead gantry system	Single-beam, dual-drive overhead gantry system
2 FZ7 (7-spindle) placement heads	1 FZ7 (7-spindle) + 1 optional FZ4 (4-spindle) placement head
450ms tact time (w/ flux dipping), 360ms (w/out)	750ms tact time (w/ flux dipping), 600ms (w/out)

	FuzionSC2-14 Specifications	FuzionSC1-11 Specifications
Throughput (cph)	30,750 (Max) / 14,200 (4-Bd IPC Chips)	16,500 (Max) / 8,400 (4-Bd IPC Chips)
Accuracy (µm@>1.00 Cpk)	±10 (Array Devices/Flip Chip) / ±38 (Passives/Chips)	±10 (Array Devices/Flip Chip) / ±38 (Passives/Chips)
Max Board Size	508 x 813mm (20 x 32"), larger board specials available	508 x 813mm (20 x 32"), larger board specials available
Max Feeder Inputs (8mm)	120 (2 ULC)	120 (2 ULC)
Feeder Inputs Types	Wafer (up to 300mm), tray, tape, tube, and bulk	Wafer (up to 300mm), tray, tape, tube, and bulk
Component Range (mm)	(0201) .25 x .5 x .15 (Min) to 150 square (MFoV), up to 25 tall	(0201) .25 x .5 x .15 (Min) to 150 square (MFoV), up to 25 tall
Min Bump Size & Pitch (µm)	Bump Size: 20, Bump Pitch: 40	Bump Size: 20, Bump Pitch: 40

Scalable solutions for cost-efficient productivity

Stand-alone machine solution – *All-in-one efficiency*

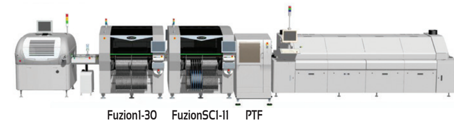
Single-beam for high flexibility, dual-beam for higher throughput; Wafer, tray, tape, tube, bulk feeding – ***Fan-Out WLP, Die Attach, Lid Attach, High-Accuracy Place, Embedded***

Mass reflow – *Full-process, high-mix/NPI*

Complete process solution supporting multiple feeding formats and flux or solder paste dipping – ***Package-on-Package, System-in-Package, 2.5D, Flip Chip, SMT, Odd-Form***

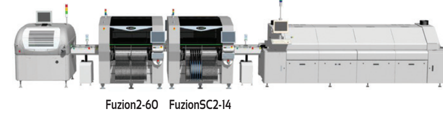
Mass Reflow – *Scaled assembly, Medium-mix, medium-volume*

Complete process solution with dedicated chip placer and flexible high-accuracy placer supporting HVHM tray packaging – ***High-Speed Passive, High-Accuracy Flip Chip***



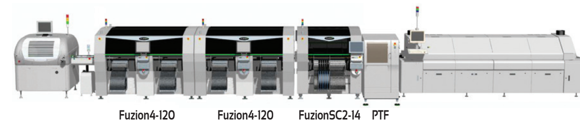
Mass Reflow – *Medium to high-volume*

Complete process solution with chip placer and high-accuracy placer; higher volume, same footprint – ***System-in-Package, High-Speed Passive, High-Accuracy Flip Chip***



Mass Reflow – *Versatile high-volume*

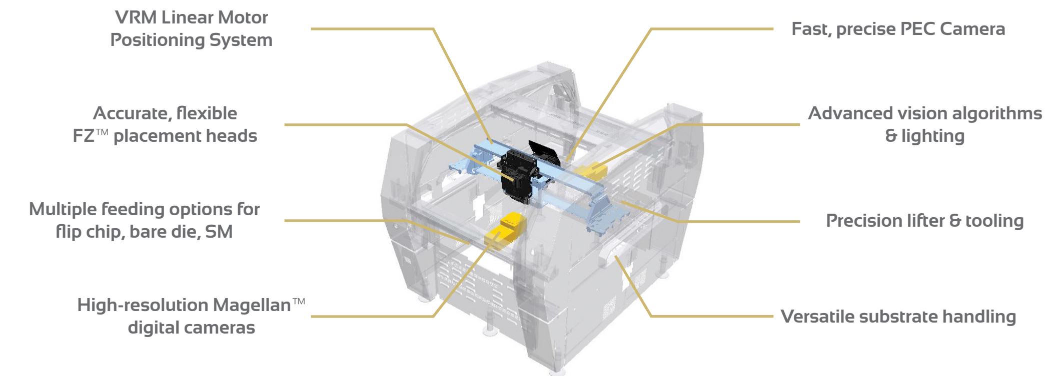
High-throughput full process solution with large feeder capacity for streamlined change-overs – ***System-in-Package, High-Speed Passive, High-Accuracy Flip Chips, WLP***



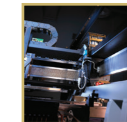
Capability Designed In

Advanced technologies for advanced applications

FuzionSC features specialized technologies to address leading-edge component packaging challenges.



VRM Linear Motor Positioning System



- High-accuracy (1µm resolution), closed-loop positioning control supports converging & emerging technologies
- High acceleration (up to 2.5G), thermally stable
- Self-correcting, dual-drive control reduces settle times

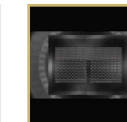
Fast, precise PEC Camera

- High-resolution (.27MPP)
- Programmable lighting, wavelength illumination, cross polarization
- Standard/taught fiducial and pad site recognition

Accurate, flexible FZ™ placement heads

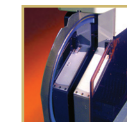
- Precision accuracy (27µm @ Cpk>1)
- 0201 – 150mm square (MFoV), up to 25mm tall
- High-speed IC and chip, gang pick up to 7 components
- Standard Package-on-Package (PoP) functionality

Advanced vision algorithms & lighting



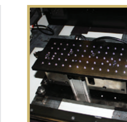
- Front, side, and on-axis combination lighting
- Lighting calibration performed on the machine, eliminating machine-to-machine intensity variation
- Lighting intensity is consistent across viewable area

Multiple feeding options for flip chip, bare die, SM



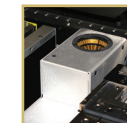
- Wafer, tray, tape, tube, and bulk
- Up to 4 direct die feeders, wafers up to 300mm
- Stationary and stackable matrix trays
- Standard and dual-lane tape for small passives

Precision lifter & tooling



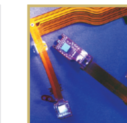
- Handles strips/lead frame, auer boats, carriers/pallets, boards/panels from 0.10mm – 12.0mm thick
- Integral vacuum generator
- Precise registration of the substrate in x, y and z axis

High-resolution Magellan digital cameras



- Supports all flip chip and SM devices
- High resolution of 1024 x 1024 enables small part feature recognition
- 2.3, 0.94, 0.5, 0.2MPP (supports 20µm bumps/pillars)

Versatile substrate handling



- Thin, thick, narrow, and large assembly area
- Substrates, wafers, lead frames, ceramics, glass, flex, and laminates
- Large substrates up to 625mm x 813mm

Complete Solutions

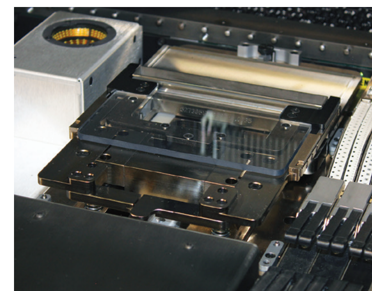
Complementary Technologies

Linear Thin Film Applicator (LTFA)

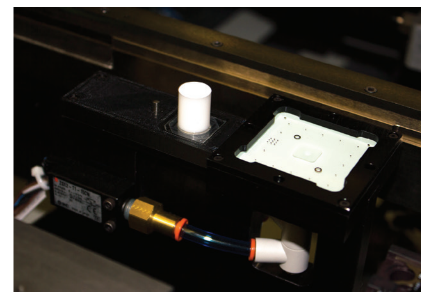
On-board dipping for maximum efficiency

The Linear Thin Film Applicator (LTFA) creates a thin film of flux, solder paste, or adhesive. Flip chips, stacked CSPs and other area array packages are individually or gang dipped, thereby applying the necessary amount of material to the appropriate area.

- Linear actuation for thickness uniformity and repeatability
- Gang dipping, up to seven spindles
- Up to two LTFAs per FuzionSC Platform
- Quick-change plates for depth control (no adjustments)
- Typical viscosity 10K – 28.5K centipoise
- Programmable milling cycles
- Programmable dipping dwell time
- Programmable Maintenance Monitor
- Quick-release tooling for easy cleaning
- Large reservoir (up to eight hours run time)
- Dip verification based on spindle impact sensing



Accuracy Management System (AMS)



Maintaining the performance you demand

The Accuracy Management System (AMS) combines a hardware station with supporting software to manage FuzionSC accuracy performance over time.

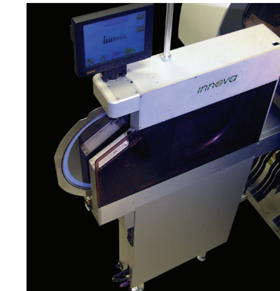
- Uses patterned glass plate and glass device to measure and automatically optimize placement accuracy
- Aligns each individual spindle in x, y and theta
- Ensures sub-micron process repeatability
- User interface displays X, Y offset history
- Activated by time/board number intervals or temperature limits

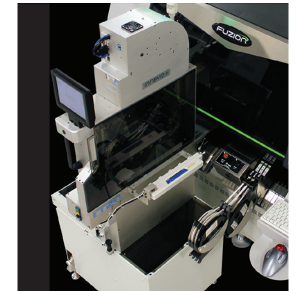
Innova Direct Die Feeder

Delivering high-speed bare die to the mainstream

Embrace the convergence era of electronics assembly with the Innova™ and Innova +™ Direct Die Feeders. Innova enables the presentation of wafer-level devices to Universal's FuzionSC Platform without incurring costly packaging charges.

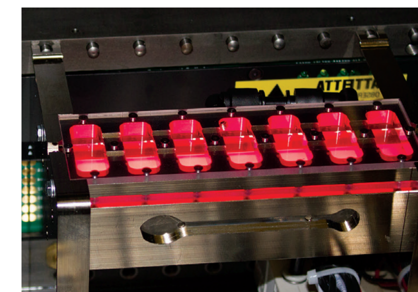
- Presents flip chips and bare die in wafer format for pick and place
- Enables flip chip, bare die and SMT on a single platform
- Single-wafer feed (Innova), 13-slot cassette wafer-feed (Innova +)
- Eliminates upstream wafer sorting
- Ideal for SiP applications
- Up to four feeders per FuzionSC Platform
- Processes wafers up to 300mm
- Ink and ink-less wafer map support
- Wafer expansion: programmable (Innova +), fixed with grip rings (Innova)
- Flip and non-flip die presentation support
- Traceability support
- Ideal for NPI or high-volume





	Innova Direct Die Feeder Specifications
Max Throughput (uph)	Flip Chip: 4,700 for 1mm die Direct Chip: 4,000 for 1mm die
Presentation Accuracy (Cpk ~1)	X,Y = ± 0.15mm @ 3s / ±27.0° (verified against 1.0mm die size)
Wafer Specification	Maximum Size: 300mm (12") Minimum Size: 100mm (4") Expansion Depth: 6.35mm, 6.0mm, 0.0mm (unexpanded)
Vision Recognition Methods	Thresholding, Pattern Matching, Corner Detection, Solder Bump Detection, Wafer Mapping
Die Specification	Minimum Size (L x W): 0.7mm x 0.7mm (0.027" x 0.027") Maximum Size: (L x W) 11.0mm x 11.0mm (0.43" x 0.43") Minimum Thickness: 75 μm (0.003") Maximum Thickness: 4.0mm (0.163" nominal) Die Material: Silicon, Gallium Arsenide, Ceramic, Glass Ball Types: Ball bumps, Stud bumps

Precisor Top Feature Inspection Station



Ensuring highest accuracy without compromise

The Precisor™ Top Feature Inspection Station optimizes placement accuracy by providing a platform for precise device inspection.

- Provides accurate top-side feature alignment through body-to-feature inspection
- Leverages gang pick and place for speed
- Holds up to 7 components with vacuum
- Field-retrofittable option