Mühlbauer
High Tech International

Die Sorting

product overview

speed. independence. reliability.

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DIE SORTING

MUEHLBAUER GROUP **AT A GLANCE**

The Muehlbauer Group is a German high-tech company that is known worldwide for its innovative solutions in the field of automated production. With over 40 years of experience, Muehlbauer develops customized technologies for the future of industry and everyday life. The company is the secret driving force behind many developments that make our modern lives safe and efficient.

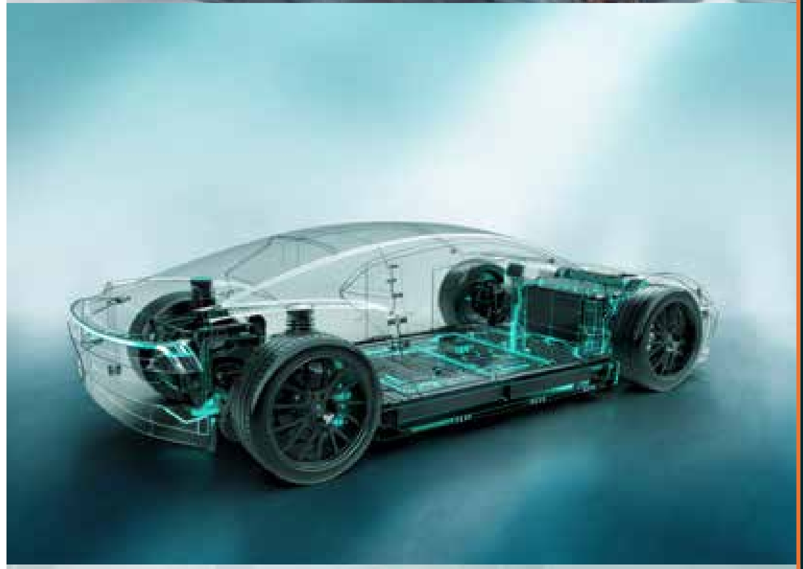
Around 4,000 employees at over 30 locations worldwide ensure that Muehlbauer's visions become reality around the globe. Sustainability, quality and unwavering trust in partnerships are the pillars on which our company has built its success story. Muehlbauer is not just a service provider, but a creative problem solver that shapes the future every day with innovative ideas and technological excellence.

>160 m
ID-Documents produced & delivered

~4.000
Employees worldwide

>90.000
Machines in the field

40
Service Hubs & Sites around the globe



BUSINESS UNITS

MPS
PRECISION PARTS & SURFACE ENGINEERING

Since its foundation in 1981 in Roding, Bavaria, Muehlbauer has stood for maximum precision. The Muehlbauer Parts & Systems business unit consists of the company's own precision parts production with a state-of-the-art electroplating facility. All components for machines and other products are manufactured here in-house – individually and, if necessary, overnight! Our MPS makes us extremely agile and independent.

AUTOMATION
PRODUCTION EQUIPMENT & SYSTEMS

Our AUTOMATION division goes far beyond the assembly of customized production systems! We provide intelligent software solutions for the automation of different production steps and drive Industry 4.0 forward. We are passionate about serving 90 % of the global RFID market with our high-speed bonders, and have achieved market leadership in the semiconductor industry with our unique die sorting technology.

MB ATECH
BATTERY & FUEL CELL TECHNOLOGIES

Our newest and currently most dynamic division ATECH – Advanced Energy Technologies – brings unique machine requirements to series production. In the field of eMobility, we offer highly efficient production lines for the manufacture of pouch cells and prismatic cells for lithium-ion batteries, as well as MEAs & stacks for fuel cells. Our newly built ATECH Giga Center with dry room provides optimal conditions for gigascale manufacturing.

TECURITY®
GOVERNMENT & TECHNOLOGY SOLUTIONS

Our TECURITY® division is the leading specialist when it comes to implementing innovative security systems for identifying and verifying documents and people. For example, we manufacture systems for the production of chip cards, IDs and passports or supply electronic gates and self-registration kiosks, along with the associated software, for airports and border crossings. With more than 30 years of experience and over 300 successfully implemented ID projects worldwide, we provide our customers with unmatched expertise and trust.

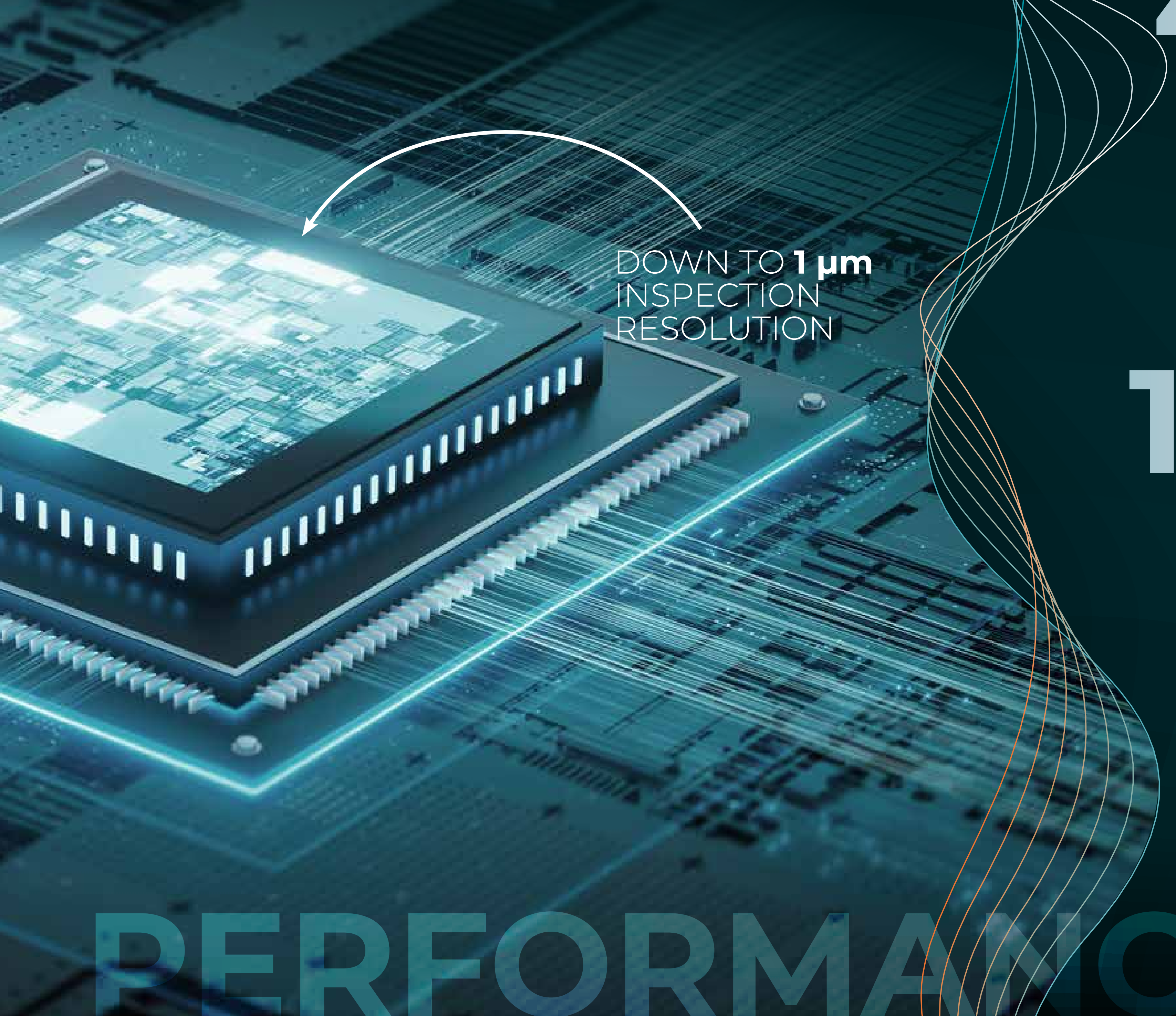
MUEHLBAUER
PRODUCTION, TECHNOLOGY & SERVICE LOCATIONS

Muehlbauer operates a global network of production, technology and service locations, ensuring close customer proximity, fast response times and consistent support across all regions.

WORLDWIDE PRESENCE

DRIVING THE FUTURE OF DIE SORTING.

ENGINEERED FOR PRECISION.
BUILT FOR AUTONOMY.
DESIGNED FOR YIELD.



DOWN TO **1 µm**
INSPECTION
RESOLUTION

where we
are today ...

AI+ **ARTIFICIAL INTELLIGENCE**

LEVEL 3 – self-optimizing
inspection systems

» Advancing toward
100% self-optimized yield and
quality – LEVEL 4

40+ **YEARS OF EXPERIENCE**

proven expertise in
semiconductor backend

» Building the foundation
for the next generations

1m **DIES PER DAY**

ultra high-volume
production

» Scaling production
to millions of dies per day

1µm **INSPECTION RESOLUTION**

highest precision
in defect detection

» Driving quality in
advanced applications

7+ **BILLION SMARTPHONES WORLDWIDE**

Dies sorted on
Muehlbauer Technology

» Always one step ahead

... and where
we'll go

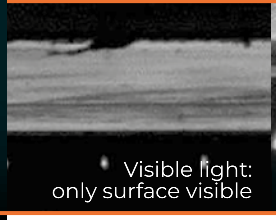
PERFORMANCE

DS MERLIN 60000

THE WORLD'S BENCHMARK IN DIE SORTING: ULTRA-HIGH-SPEED AI-DRIVEN 6-SIDE AOI-LEVEL INSPECTION

BENEFITS

- **Maximum High-Volume Performance**
  » Up to 1 million dies / day output with lowest cost per die through high-throughput T&R processing.
- **Multi-Spectrum Vision Technology**
  » Combines Visible, NIR, and SWIR imaging for deeper inspection and higher detection accuracy.
- **AI-Driven Yield Optimization**
  » Improves yield up to 50 %, reduces false rejects, and increases good-die output per day.
- **Efficient & Simplified Operation**
  » Auto self-alignment reduces setup time, operator dependency and cost by ~25 % and improves uptime.


Visible light:
only surface visible


Infrared light:
inner defects visible


Carrier Tape


Surf Tape


Punched Tape


Paper Tape

55,000 UPH

SYSTEM CAPABILITIES

INPUT

- Standard: Wafer
- Non-Flip option: Tape & Reel (De-taping)

OUTPUT

- Standard: Tape & Reel
- 8, 12 or 16 mm carrier tape cassettes

WAFER

- Wafer mapping software incl. barcode scanner
- MAP-host PC for data conversion into SCES / GEM format
- Size: up to 6", 8", 12"

SPECIAL FEATURE

- Automatic self-alignment system for fully automatic product and machine setup (operator-independent)
- Small Die Handling
- Latest 5 Megapixel Shortwave IR Technology

DIE HANDLING

- 100 % Flip-Chip
- 100 % Non-Flip
- Two pick-and-place wheels (no turret system) in a Flip-Chip configuration or one pick-and-place wheel in Non-Flip configuration

QUALITY REQUIREMENTS

- Placement accuracy: ± 30 µm and ± 0.3° tolerance
- Optional: 1 µm resolution
- Standard: 5 µm, 9 µm, up to 25 µm

AVAILABLE OPTIONS

- IR inspection, die back-side at die on tool, post place, after sealing, laser groove
- Automatic reel changer
- MB PALAMAX® integration possible
- AI supported yield improvement

REJECTS BY VISION

- Defective dies are directly rejected
  » higher machine uptime

DIE SIZES

- Minimum: 0.2 x 0.4 mm
- Maximum:
  » Standard: 7.0 x 7.0 mm
  » Optional:
  Flip: 9.0 x 9.0 mm
  or 12.0 x 12.0 (18.0 x 18.0)
  Non-Flip 12.0 x 12.0 mm
  (other die sizes upon request)

FACILITIES

- Power: 400 V, 16 A, 50 / 60 Hz
- Air: 6 bar, oil-/water-free
- Vacuum (absolute): 0,2 bar

ENVIRONMENTAL CONDITIONS

- Room temperature: 23 °C ± 3 °C
- Humidity: 50 % ± 10 %
- Clean room class: ISO 7

THROUGHPUT

- Flip: up to 55,000 dies/hour
- Non-Flip: up to 25,000 dies/hour

MACHINE DIMENSIONS

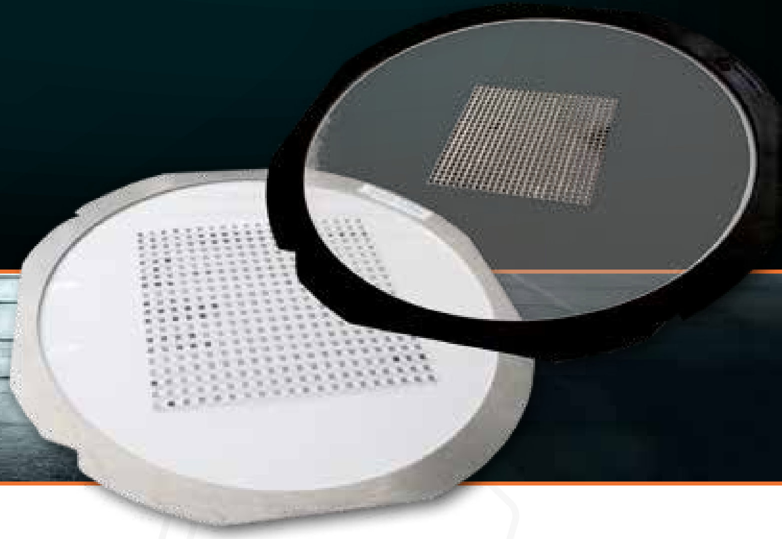
- Height: ~1990 mm
- Length: ~2500 mm
- Depth: ~1775 mm
- Weight: ~1800 kg

DS MERLIN WAFER-TO-WAFER WAFER-TO-PANEL

PRECISION FOR ADVANCED PACKAGING APPLICATIONS

BENEFITS

- **Flexible output media support: Wafer, panel or tray**
  » Sorting on demand with high UPH across formats
- **Reconstructed die sorting: Fan-In / Fan-Out**
  » High yield with precise die placement accuracy
- **Direct die bonding on Printed Circuit Board (PCB) without carrier tape**
  » No consumables and lower running cost
- **Inline and offline process control on demand**
  » Flexible integration into backend and SMD lines



30,000 UPH

SYSTEM CAPABILITIES

INPUT

- Standard: Wafer (up to 12")
- Optional: Hoop ring

OUTPUT

- Standard: panel size 12”
- Optional: 600 mm panel
- JEDEC tray / Waffle Pack

WAFER

- Size: up to 6”, 8”, 12”
- Wafer mapping software incl. barcode scanner
- MAP-host PC for data conversion into SCES / GEM format

SPECIAL FEATURE

- Automatic self-alignment system for fully automatic product and machine setup (operator-independent)
- Latest 5 Megapixel Shortwave IR Technology
- Standalone (Magazine) or Inline integration (SMEMA connection)

DIE HANDLING

- Option A: 100 % Flip-Chip
- Option B: 100 % Non-Flip Chip

QUALITY REQUIREMENTS

- Placement accuracy: ± 25 µm ± 15 µm with high accuracy mode
- Rotation: ± 1° rotation tolerance

AVAILABLE OPTIONS

- Global alignment
- NEW: Laser groove IR
- MB PALAMAX® integration possible
- Output map generation
- Output trace file
- Panel handling at SMEMA Standard

REJECTS BY VISION

- Defective dies with front or backside defects are rejected directly and not placed into output medium
  » higher machine uptime

DIE SIZES

- Minimum: 0.2 x 0.4 mm
- Maximum:
  » Standard: 7.0 x 7.0 mm
  » Optional: Up 9.0 x 9.0 mm
  (other sizes available)

FACILITIES

- Power: 400 V, 16 A, 50 / 60 Hz
- Air: 6 bar, oil-/water-free
- Vacuum (absolute): 0,2 bar

ENVIRONMENTAL CONDITIONS

- Room temperature: 23 °C ± 3 °C
- Humidity: 50 % ± 10 %
- Clean room class: ISO 7

THROUGHPUT

- Flip: up to 30,000 dies/hour with flip and sidewall (depending on configuration)
- Non-Flip: up to 30,000 dies/hour with sidewall (depending on configuration)

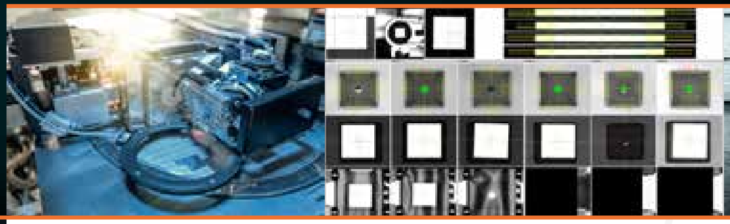
MACHINE DIMENSIONS

- Height: ~1990 mm
- Length: ~2500 mm
- Depth: ~1775 mm
- Weight: ~1800 kg

MB ALBATROSS
LIGHTS-OUT PRODUCTION WITH MAXIMUM UPTIME, YIELD AND OPERATIONAL EFFICIENCY

BENEFITS

- **Higher Real Output**
  - » Dual handling eliminates idle time → higher net throughput per shift.
- **Fast Lights-Out Changeover**
  - » Fully automated changeover in <30 min enables true lights-out production.
- **Accurate Coplanarity Control**
  - » Warpage control improves placement accuracy and yield.
- **Scalable Factory Automation**
  - » GEM300-ready design enables fully autonomous, future-proof fabs.



SYSTEM CAPABILITIES

INPUT
- Wafer (up to 12") / Hoop ring
- JEDEC Tray

OUTPUT
- 6 x Tape & Reel
- 2 x JEDEC Tray
- 12 x Waffle Pack
- Reconstructed Wafer 12“

WAFER
- Wafer mapping software incl. barcode scanner
- MAP-host PC for data conversion into SCES / GEM format
- Size: up to 12"

ALTERNATIVE CONTACTLESS DIE RELEASE TECHNOLOGY
- No die ejector needles
- Thin thermal release wafer foil
- Applicable for standard & thin dies below 30 µm
- FOUP handling included (robotic transport to the wafer expander)
- No frame required

SPECIAL FEATURE
- Ready for factory automation (SECS / GEM, GEM300)
- Lights-out factory qualified

DIE HANDLING
- 100 % Flip or Non-Flip process
- Dual-bonding head
- AOI wheel

QUALITY REQUIREMENTS
- Placement accuracy: ± 30 µm

AVAILABLE OPTIONS
- MB PALAMAX® integration possible
- Automatic tool changer
- Load port compliant + OHT / AGV

DIE SIZES
- Minimum: 0.7 x 0.7 mm
- Maximum:
  - » Standard: 15 x 15 mm
  - » Big die size range: 45 x 45 mm

FACILITIES
- Power: 400 V, 16 A, 50 / 60 Hz
- Air: 6 bar, oil-/water-free
- Vacuum (absolute): 0,2 bar

ENVIRONMENTAL CONDITIONS
- Room temperature: 23 °C ± 3 °C
- Humidity: 50 % ± 10 %
- Clean room class: ISO 7

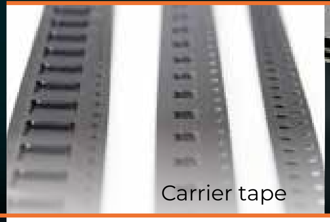
THROUGHPUT
- Flip: Up to 8,000 dies/hour

MACHINE DIMENSIONS
- Length: ~4340 mm
- Width: ~4990 mm
- Height: ~2550 mm
- Weight: ~6740 kg

DS VARIATION PRO
FLEXIBLE HIGH-PERFORMANCE DIE SORTING WITH ADVANCED INSPECTION

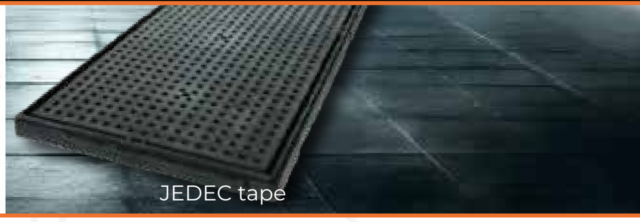
BENEFITS

- **Ultra-High Precision Placement**
  » Up to ±10 µm placement accuracy for advanced packaging applications.
- **Integrated 1 µm Inspection**
  » Built-in AOI-level inspection detects even the smallest defects in-line.
- **Maximum Application Flexibility**
  » Processes 0.2–50 mm dies (other sizes on demand) in a single platform.
- **High-Uptime Lights-Out Operation**
  » Fully automated changeover in <30 min enables 24/7 production with minimal downtime.


Carrier tape


Waffle Pack / Gel-Pak


Reconstructed wafer


JEDEC tape

SYSTEM CAPABILITIES

INPUT
- Standard: Wafer
- Optional: Tape & Reel / De-taping, Waffle Pack, JEDEC Tray / Custom Tray, Hoop ring

OUTPUT
- Reconstructed Wafer 12", optional 600 mm
- Tape & Reel x 6 Indexers / De-taping
- Waffle Pack / Gel-Pak
- JEDEC Tray / Custom Tray

WAFER
- Mapping: wafer mapping software incl. barcode scanner
- Size: up to 12"

ALTERNATIVE CONTACTLESS DIE RELEASE TECHNOLOGY
- No die ejector needles
- Thin thermal release wafer foil
- Applicable for standard & thin dies below 30 µm

SPECIAL FEATURE
- 8/12/16/24/optional 32 mm Carrier Tape cassettes
- Input tray adapter
- Input Carrier Tape feeder » De-taping
- High resolution AOI with 4 or 127 mega-pixel or higher resolution on demand
- Lights-out factory ready
- Cleanroom compatibility (ISO Class 5/6)
- Small footprint
- FOUP handling included (robotic transport to the wafer expander)
- TBC support (Temporar Bonding Carrier)
- No frame required

DIE HANDLING
- Flip-Chip
- Direct pick & place (Non-Flip)
- Dual-place head
- Multi-pick head

QUALITY REQUIREMENTS
- Placement accuracy of +/-30 µm and in HQ Mode ± 10 µm
- Rotation: ± 1.5° rotation tolerance

AVAILABLE OPTIONS
- IR inspection, NIR or SWIR technology
- MB PALAMAX® integration possible
- Multi-bin sorting

AUTOMATION
- Gem 200
- Gem 300
  » Loadport
  » AGV / OHT
  » Light's-out factory ready
- Ready for Advanced Packaging

DIE SIZES
- Minimum: 0.2 x 0.2 mm
- Maximum: 50 x 50 mm

FACILITIES
- Power: 400 V, 16 A, 50 / 60 Hz
- Air: 6 bar, oil-/water-free
- Vacuum (absolute): 0,2 bar

ENVIRONMENTAL CONDITIONS
- Room temperature: 23 °C ± 3 °C
- Humidity: 50 % ± 10 %
- Clean room class: ISO 6

THROUGHPUT
- Flip / Non-Flip Dual-bond head: Up to 6,000 dies/hour
- Flip / Non-Flip Dual-bond head + Multi-pick head: Up to 10,000 dies/hour

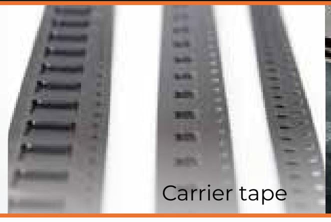
MACHINE DIMENSIONS
- Height: ~2200 mm
- Length: ~2750 mm
- Depth: ~3080 mm
- Weight: ~3500 kg

DS VARIATION ECO-LINE
COST-OPTIMIZED DIE SORTING PLATFORM WITH MAXIMIZED FLEXIBILITY

BENEFITS

- **Lowest Entry Costs**
  » Minimized CAPEX risk → ideal starting point for die sorting adoption.
- **Fast ROI**
  » Designed for high-mix environments → faster return on investment.
- **Right-Sized Precision**
  » ±30 µm (±20 µm optional) → pay only for the precision you need.
- **Multi-Format Capability**
  » Supports wafer, waffle pack, T&R, and de-taping in one system.


Combined solution


Carrier tape


Waffle Pack / Gel-Pak


Reconstructed wafer


JEDEC tape

SYSTEM CAPABILITIES

INPUT
- Standard: Wafer
- Optional: Tape & Reel / De-taping, Waffle Pack, JEDEC Tray / Custom Tray, Hoop ring

OUTPUT
- Tape & Reel / De-taping (also with Flip)
- Waffle Pack / Gel-Pak
- JEDEC Tray / Custom Tray
- Wafer (reconstructed wafer 12”) + Hoop ring
- Combination of 2 outputs in 1 machine

WAFER
- Mapping: wafer mapping software incl. barcode scanner MAP-host PC for data conversion into SCES / GEM format
- Size: up to 12”
- Multi Project Wafer capability (optional)

SPECIAL FEATURE
- 8/12/16/24/optional 32 mm carrier tape cassettes
- Input tray adapter
- Input Carrier Tape feeder » De-taping
- High resolution AOI with 4, 9, 12 or 25 megapixel camera
- Active force control

DIE HANDLING
- Flip-Chip
- Direct pick & place
- Single bond head

QUALITY REQUIREMENTS
- Placement accuracy: ± 20 µm / ± 30 µm
- Rotation: ± 1.5° rotation tolerance

AVAILABLE OPTIONS
- IR inspection
- MB PALAMAX® integration possible
- Multi-bin sorting

DIE SIZES
- Minimum: 0.25 x 0.25 mm
- Maximum:
  - » Flip
    Standard: 15.0 x 15.0 mm
    Optional: 25.0 x 25.0 mm
  - » Non-Flip
    Standard: 25.0 x 25.0 mm
    Optional: 35.0 x 35.0 mm

FACILITIES
- Power: 400 V, 16 A, 50 / 60 Hz
- Air: 6 bar, oil-/water-free
- Vacuum (absolute): 0,2 bar

ENVIRONMENTAL CONDITIONS
- Room temperature: 23 °C ± 3 °C
- Humidity: 50 % ± 10 %
- Clean room class: ISO 7

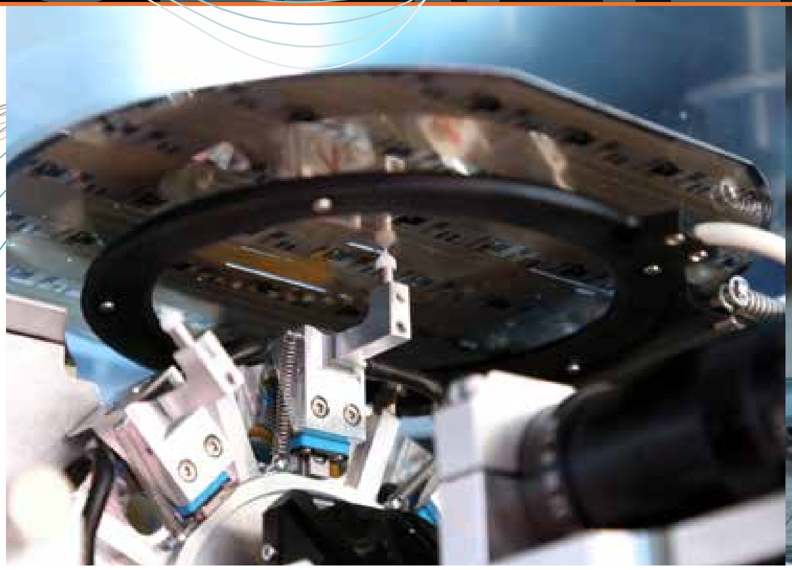
THROUGHPUT
- Flip: Up to 6,000 dies/hour
- Non-Flip: Up to 5,000 dies/hour
- De-taping: 2,500 dies/hour

MACHINE DIMENSIONS
- Height: ~2000 mm
- Length: ~2550 mm
- Depth: ~2000 mm
- Weight: ~2300 kg

SYNERGIES WITH **CARRIER TAPE AND COVER TAPE**

**Die sorting and carrier tape solutions are closely linked in semiconductor backend production.
Sorted dies are directly placed into carrier tape for safe transport, storage and further processing.**

SEAMLESS FLOW



DIE SORTING

Mühlbauer die sorting solutions stand for precise handling, reliable inspection and maximum process stability. But this is only the beginning – Muehlbauer goes far beyond die sorting, delivering fully integrated solutions that seamlessly extend into downstream handling and packaging processes.

CARRIER TAPE

Sorted dies are directly placed into carrier tape, ensuring safe transport, secure storage and reliable processing in automated production environments.
Muehlbauer develops customized carrier tape solutions tailored to specific product requirements, enabling maximum protection and process efficiency.

COVER TAPE

The carrier tape is sealed with cover tape to ensure secure fixation and protection of sensitive components throughout transport and handling. With perfectly matched cover tape solutions, Muehlbauer guarantees a reliable final packaging process and a smooth transition to shipment and customer integration.

MB PALAMAX®

TOTAL PROCESS TRANSPARENCY

MB PALAMAX® is Muehlbauer's Smart Factory solution for semiconductor backend shop floors. Consisting of a NOSQL database, it is designed to collect and analyze process data in order to monitor and improve production efficiency.
This data is stored in large sets for later processing, visualization and statistical analysis.

BENEFITS

- Monitor your production in real-time & generate real production statistics with your preferred KPIs (for specific chip types only)
- Increase your transparency
- Gain better data to investigate, understand & portray process flows & relationships
- Run your production with improved security & optimally trained staff
- Intuitive & easy-to-use web interface
- Responsive user interface design allows an ideal presentation on any chosen device

FEATURES & ADVANTAGES

PALAMAX.MONITOR
Monitors the real-time performance of the production

PALAMAX.STATS
Statistical tool which analyzes collected data and delivers customized statistics on OEE

PALAMAX.REMOTE
Enables the remote operation of machines on the shop floor from a control center

PALAMAX.TRACE
Allows for the auditing of single manufacturing runs

PALAMAX.MAINTAIN
Enables the implementation of maintenance on demand

PALAMAX.COST
Increases effectiveness and efficiency so that production becomes more profitable

PALAMAX.RECIPE
Enables production engineering to prepare and test a repeatable factory set-up. Factories can switch between products within minutes.

Mühlbauer
High Tech International

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