

THE RFID FACTORY

PRODUCT OVERVIEW



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MÜHLBAUER GROUP AT A GLANCE

MÜHLBAUER'S BUSINESS UNITS AND SITES

Founded in 1981 in the heart of Bavaria, the Mühlbauer Group has ever since grown to a leading global player in the fields of Parts & Systems, Semiconductor Related Products, Document Solution Related Products and TECURITY® Solutions. With around 3,500 employees, technology centers in Germany, Malaysia, Slovakia, the U.S.A. and Serbia and 35 sales and service locations worldwide, Mühlbauer created a strong competence network around the globe.

We continuously invest in the latest technologies and innovative processes to enhance our competences and provide you with optimized solutions. Our in-house precision part production MPS – Mühlbauer Parts & Systems – guarantees unlimited flexibility and highest customer satisfaction.

Our business unit AUTOMATION does not only develop and assemble individually customized production systems, but also provides matching software solutions for the production process of Document and Solution Related Products. Vision inspection technologies as well as semiconductor and RFID applications complete our comprehensive portfolio.

Our business unit TECURITY® is established as a competent partner for the implementation of security systems for identifying and verifying both documents and individuals. Our clients benefit from more than three decades experiential value which we have gained during the realization of over 300 ID projects worldwide.



MPS
Precision Parts & Surface Engineering



AUTOMATION
Production Equipment & Systems

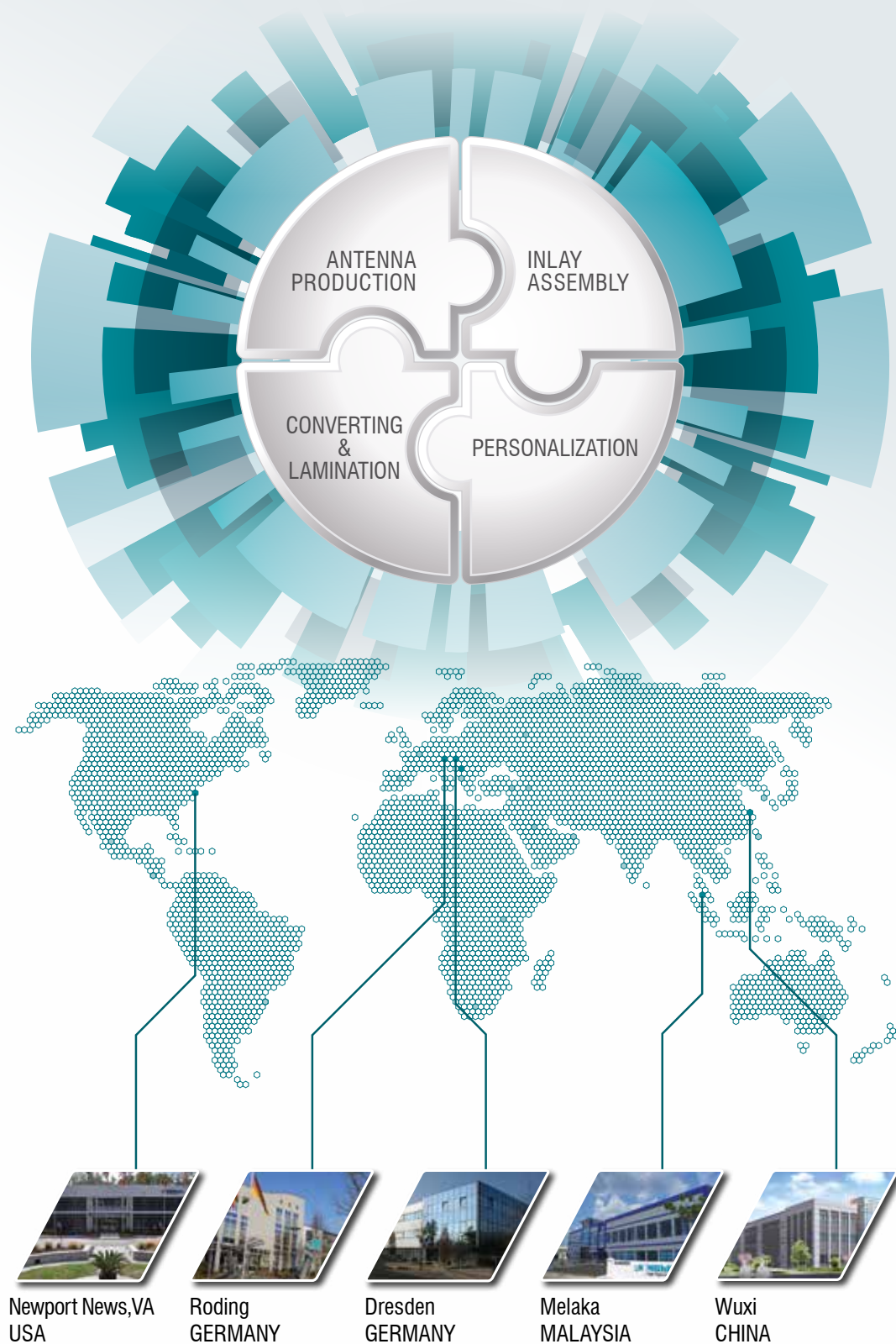


WORLD OF TECURITY®
Government & Technology Solutions



RFID COMPETENCE CENTERS

REALIZING RFIDeas WORLDWIDE



COMPETENCE IN RFID

- 1985 Development of our core competence Chip Handling: Specialization on small chips, high speed and high accuracy for Flip Chip technology.
- 1988 First turnkey production solutions for Smart Cards
- 1995 Development of world first RFID Inlay Production System (TAL 1500). Since then, Mühlbauer has been a major driving force for the RFID production technology.
- 2004 Mühlbauer draws up the strategy to become a turnkey solution provider for the complete RFID Factory. Our target is to provide our customers the most efficient and competitive RFID production and personalization solutions.
- 2014 The RFID Factory is completed: The latest innovations “Antenna Production Systems APS & ACS”, the revolutionary “Direct Die Attach System DDA 20000” and the latest “Personalization Technologies” are presented to the market. The Mühlbauer Group releases its new roadmap “CONCEPT 2020” during the 1st “RFID Innovation Days” event.
- 2018 The DDA 40000 is launched. A roadmap to 100 000 UPH is available for wide web application.
- 2019 MB release “Concept 2023”

EXPERIENCE DRIVES INNOVATION.

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

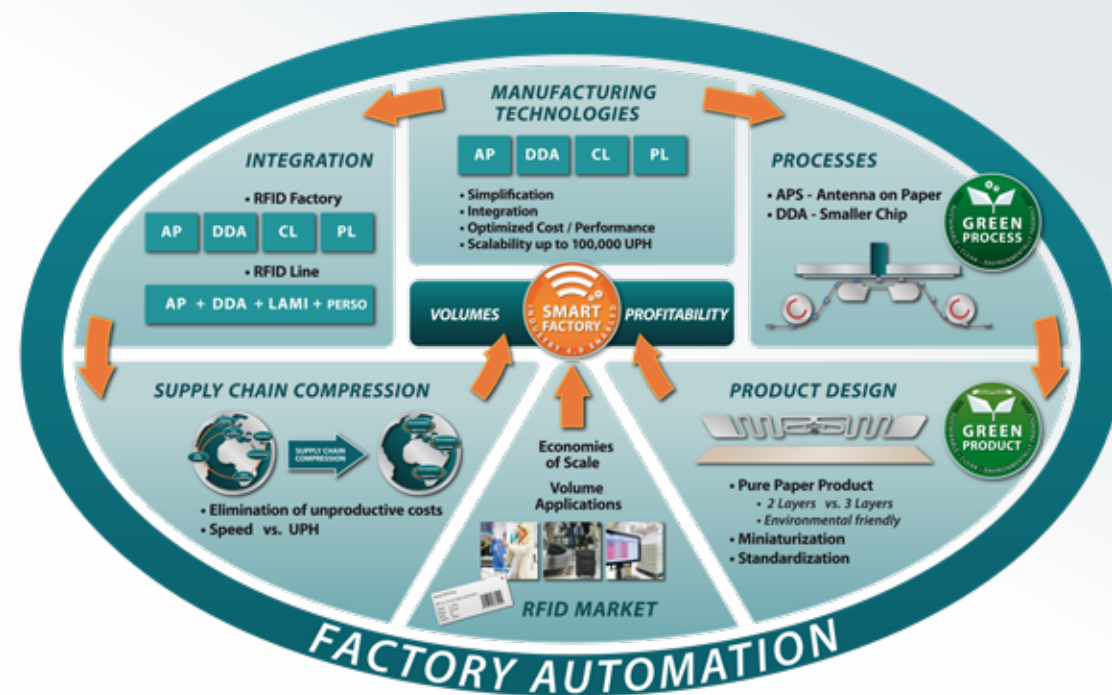
PERSONALIZATION



CONCEPT 2023

RFID MANUFACTURING

Based on the machine innovations from the Concept 2020, we respect the needs of high volume production linked with a sustainable green process and developed the concept 2023.



The concept 2023 is the roadmap for high automated, sustainable production and material flow. Based on the intelligent production planning, the use of automated intelligent vehicles, preventive maintenance and full production transparency, there is only limited manpower required.

The integration of various manufacturing processes leads to stable and productive manufacturing lines,

which guarantees high volume production with consistently high yield and uptimes. Furthermore there will be up to 30% less floor space required.

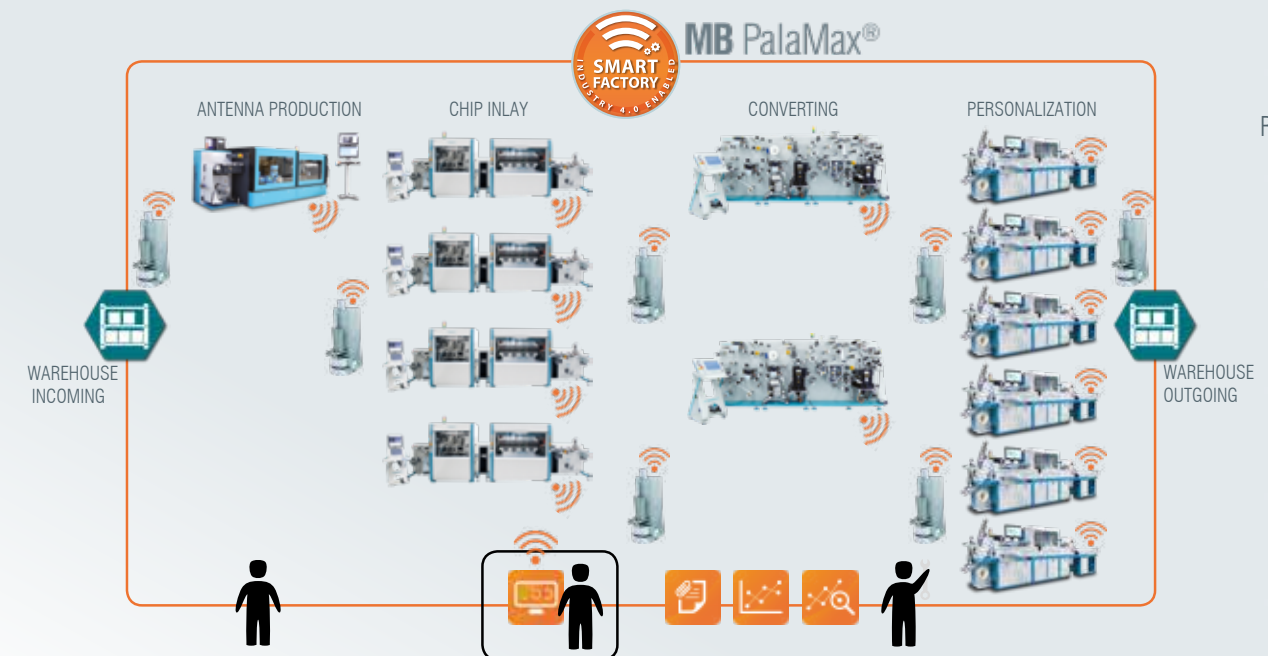
You can trust in us that we will give our very best to develop the future technologies and always provide you the most competitive solutions.

THE RFID FACTORY

YOUR PARTNER FOR THE COMPLETE RFID SMART FACTORY

Nobody knows where the rapid growth in the RFID market will lead us to. Mühlbauer will be able to provide you with the right technology to scope with the demands of tomorrow. Not only supply chain compression, high UPH and yield will be our challenge, in future we need also to work on sustainable green manufacturing technologies and the decrease of process costs. Our new concept 2023 will offer the way to build a smart RFID fac-

tory Industry 4.0, by having automated control of the manufacturing data; material and process flow. This new factory concept will be able to be more productive on less space and will even further reduce the cost significantly. The total process can be handled by just a few people and will guarantee the highest utilization of the installed capacity. Even non Mühlbauer machines will be supported.



- Optimized material flow by automated vehicles for material transport
- Optimized machine utilization
- Preventive maintenance
- Fully automated data collection
- Increased OEE
- Significant reduction of manpower

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION





MB PALAMAX®

TOTAL PROCESS TRANSPARENCY

MB Palamax®, Mühlbauer's Smart Factory solution, is developed for card, tag or booklet productions, personalization factories and semiconductor backend shop floors. Consisting of an NOSQL database, it is designed to set and collect process data to monitor and improve the efficiency of production and person-

alization. The collected process data is stored in big data sets for later processing, visualization and statistical analysis. MB Palamax® is the backbone of our Smart Factory solution, by collection all relevant data and handling the process & material flow.

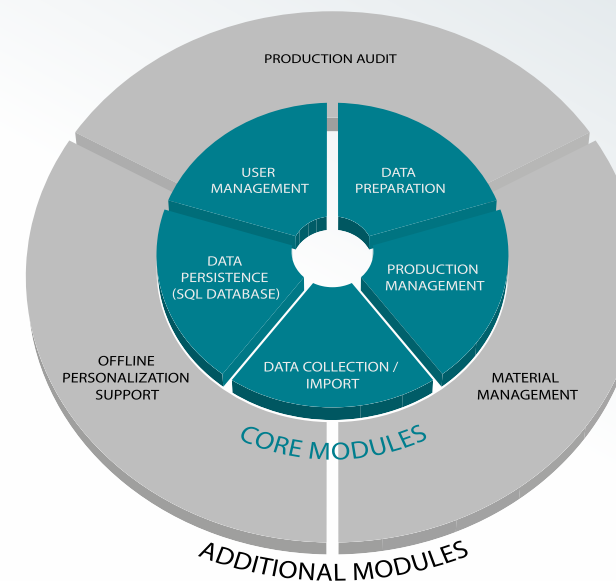


KEY FEATURES

- Monitor your production in real time and generate real production statistics with your preferred KPIs. For specific chip types only
- Improve your transparency
- Gain better data to investigate, understand and portray process flows and relationships.
- Run your production with improved security and optimally employed staff.
- Intuitive and easy to use web interface
- Responsive user interface design allows optimal presentation on any chosen device
- Data collection from the shop floor of Mühlbauer equipment and also third party equipment
- State-of-the-art big data software architecture ensures future reliability

FEATURES & ADVANTAGES

- PALAMAX.MONITOR**
Monitors the real-time performance of the production
- PALAMAX.STATS**
Statistical tool which analyzes collected data & delivers customized statistics on OEE
- PALAMAX.REMOTE**
Enables the remote operation of machines on the shop floor from a control centre
- PALAMAX.TRACE**
Allows for the auditing of single manufacturing runs
- PALAMAX.MAINTAIN**
Enables the implementation of maintenance on demand
- PALAMAX.COST**
Increases effectiveness & efficiency so that production becomes more profitable
- PALAMAX.RECIPE**
Enables production engineering to prepare & test a repeatable factory set-up. Factories can switch between products within minutes.



- The only software solution worldwide to combine personalization data management, complete production control and material management
- Covers the full production control requirements
- Highly automated workflows with little operator interaction
- Streamlined web-based user interfaces with easy localization

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION



ANTENNA PRODUCTION (AP)

TECHNOLOGY OVERVIEW

Driven by the need of environmental friendly production processes, the need for fast and flexible production cycles and high volume production capabilities, Mühlbauer brought the antenna manufacturing to the next level. The Antenna Cutting System (ACS) and the Antenna Printing System (APS) are designed to offer zero waste production without the need of harmful chemi-

cals. The Mühlbauer ACS 350 offers the possibility for produce more than 2 billion UHF antennas per year, with a cost advantage of about 30% to the actual etching process. The APS give a maximum flexibility, even for HF antenna application. By using a special copper ink, this process saves approx. 80% of the consumable cost compared to common silver ink processes.

| | ACS 350 | APS 350 |
|-----------------|-------------------------------|---------------------------------|
| WEB WIDTH | 350 mm | 350 mm |
| Annual capacity | approx. 2 billion unit / year | approx. 600 million unit / year |
| ANTENNA TYPE | | |
| UHF | Yes | Yes |
| HF | | Yes |
| Troughput | 30m/min | 10m/min |
| MATERIAL | PET, Aluminium | Paper, Copper ink |
| YIELD | >99,7% | >99,7% |

TECHNOLOGY

CUTTING TECHNOLOGY



MAGNETIC CYLINDER

- with exchangeable cliché

PRINTING TECHNOLOGY



SCREEN PRINTING

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

IINLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZAITON



ACS 350

ANTENNA CUTTING SYSTEM

Mühlbauer's Antenna Cutting Systems ACS 350 produces reliable UHF aluminum antennas on PET. The reel-to-reelsystem uses a two layer input material with a bottom material of PET and a top layer of aluminum. In the core process of cutting, the milling wheel mechanically removes the unneeded aluminum area from the aluminum layer and only leaves the desired antenna pattern standing, while the PET layer remains untouched. For a flexible production of different antenna patterns, the magnetic cylinder can be easily equipped with a different cliché (pattern).

The integrated cleaning station with fixed brushes and suction system cleans the web and cliché of any loose particles. The next process steps check the quality of the production. A contactless UHF test system verifies the antenna performance by means of an electrical test and loop simulation. In the subsequent vision inspection process the full antenna and the critical antenna gap is checked. Antennas which fail the quality inspection are marked as such.



EFFICIENT GREEN WAY OF ANTENNA PRODUCTION

BENEFITS

- up to 30% Process Cost Reduction „compared to alu etching“
- 75% Time Saving „antenna on demand – in 1 hour“
- Environmentally Friendly „sell also your alu flakes“
- Less Inventory / Work in process



FEATURES & ADVANTAGES

ADVANTAGES

- Supply Chain Compression
ship your new RFID label within 24 hours!
- Just-in-Time Production
for high volumes up to 2 billion / year
- Rapid Prototyping
less than 3 hours from idea to sample
- Small Footprint

WORKSTATIONS

- Unwinder
- Antenna Cutting Unit
- Quality Verification
- Upwinder

PRODUCT REQUIREMENTS

- Material: up to 350 mm PET/Alu

THROUGHPUT

- Up to 30m/min
- up to 250 000 UPH (20 mm pitch, 4 row)
- up to 2 billion / year

ACS 350 DIMENSIONS



RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION



APS 350

IN-HOUSE ANTENNA PRINTING-SYSTEM

The completely new approach of the APS makes it possible for Smart Label suppliers to print their own antennas In-house on demand. The new process is cleaner and faster than all the conventional antenna technologies currently on the market. With APS 350 even 80000 silver or copper ink antennas per hour on

paper can be produced, undergoing an integrated quality assurance system. Especially for Smart Label producers that underlie fast reaction times, the APS is an interesting tool as they can produce antennas within hours instead of weeks.



ANTENNA ON DEMAND ON PAPER SUBSTATE

BENEFITS

- Pure paper & copper product
- Environmentally Friendly (Green Process)
- Enables two layer products (Green Design)
- Cost Reduction up to 40%
- Time Saving



FEATURES & ADVANTAGES

ADVANTAGES

- Supply Chain Compression
- Print on Demand Flexibility
- Rapid Prototyping
- Two layer" RFID Product (pure paper)
- wide web 350 mm

WORKSTATIONS

- Unwinder
- Printer
- Curing System
- Quality Control
- Upwinder

THROUGHPUT

- Up to 8m/min
- up to 80 000 UPH (20 mm pitch, 4 row)
- 600 Mio. (per year)

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

IINLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZAITON

APS 350 DIMENSIONS



INLAY ASSEMBLY

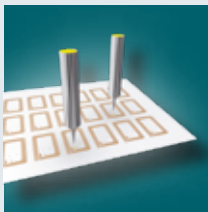
TECHNOLOGY OVERVIEW - INLAY

Thanks to continuous development efforts, our chip attach machines have beaten the 40 000 UPH limit for inlay production: The DDA 40000 for single row as well as the TAL 15000 for wide web are today's benchmark in the area of inlay assembly. Our state-of-the-art machines demonstrate leading edge performance for the entire product range, down to 0.3 x 0.3 mm dies and up to the highest yield of >99.7%. Roadmaps up to 100 000 UPH and antenna-on-paper are available and will be realized soon.

| | | TAL 15000 | DDA 20000 | DDA 40000 |
|---------------------------|----------|----------------------------------|----------------------------------|----------------------------------|
| WEB WIDTH | | | | |
| 35 - 160 mm | | | Narrow Web | Narrow Web |
| 100 - 350 mm | | Wide Web | | |
| Technology | | Pick & Place (Dual Head) | Direct Die Attach (Single Head) | Direct Die Attach (Single Head) |
| Max. UPH | | 13 000 | 20 000 | 40 000 |
| Yield | | >99.7% | >99.7% | >99.7% |
| WAFER | | | | |
| Size 6", 8" or 12" | | ■ | ■ | ■ |
| Frame Metal & Plastic | | ■ | ■ | ■ |
| DIES | | | | |
| Size | min. | 0.3 x 0.3 mm | 0.3 x 0.3 mm | 0.3 x 0.3 mm |
| | max. | 3.0 x 3.0 mm | 1.5 x 1.5 mm | 1.5 x 1.5 mm |
| | optional | up to 5.0 x 5.0 mm | up to 5.0 x 5.0 mm | up to 5.0 x 5.0 mm |
| Thickness 75 µm to 300 µm | | ■ | ■ | ■ |
| ADHESIVE | | | | |
| ACP | | ■ | ■ | ■ |
| NCP | | ■ | ■ | ■ |
| ANTENNA | | | | |
| Material | | Copper, aluminum, silver antenna | Copper, aluminum, silver antenna | Copper, aluminum, silver antenna |
| OUTPUT | | | | |
| Single Row | | ■ | ■ | ■ |
| Multi Row | | ■ | | |
| Sheets | | ■ | | |
| FREQUENCY | | | | |
| UHF | | ■ | ■ | ■ |
| HF | | ■ | ■ | ■ |
| ACCURACY | | | | |
| Machine | | ± 15 µm | ± 15 µm | ± 15 µm |
| Die Attach | | ± 30 µm | ± 30 µm | ± 30 µm |
| Post Cure | | ± 50 µm | ± 50 µm | ± 50 µm |


DDA TECHNOLOGY

PROCESS FLOW




ADHESIVE APPLY

- Latest generation of adhesive jetting technology available
- Glue savings approx. 25 % compared to dispensing system
- Highest flexibility for all antenna formats



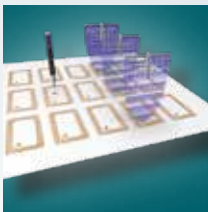
PRE-BONDING

- Machine accuracy ± 15 µm, die attach accuracy ± 30 µm
- Die handling from 0.3 x 0.3 mm up to 5.0 x 5.0 mm
- Full throughput with 100 % vision control for highest yield



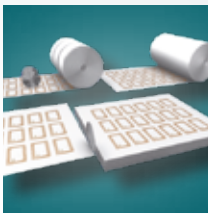
FINAL BONDING

- Smallest & most efficient thermode generation 0.5 N to 5 N ± 10 %
- Best thermode coplanarity ± 5 µm/mm
- Highest process accuracy ± 50 µm (after final bonding)



TESTING & BAD UNIT MARKING

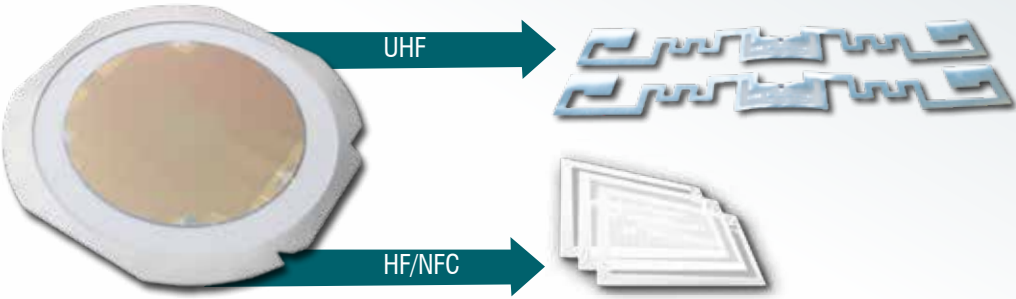
- 100% tested output quality
- In-house customized reader antenna design



UPWINDING OR SLITTING

- Single or multirow reels for label / ticket conversion
- Sheets for contactless plastic card production

SUITABLE FOR EVERY APPLICATION



RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

IINLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZAITON



TAL 15000

FLIP CHIP ASSEMBLY LINE FOR WIDE WEB (WITH OPTIONAL MULTI COMPONENT PLACER FOR ACTIVE SENSOR TAGS)

The TAL 15000 inlay production system is the current benchmark and represents the most proven generation of Flip Chip RFID inlay production with a throughput of up to 13 000 inlays per hour. This wide web system is characterized by its extremely high level of efficiency, flexibility and quality – and is suitable for the complete range of HF and UHF inlays. All processes are

covered in one modular platform: antenna web handling, epoxy jetting, Flip Chip die attach, final curing, testing and bad unit marking as well as slitting into single antenna rows. Furthermore a sheet cutter is available as an option to address the requirements of the contactless card market.



THE WORLD 'S BENCHMARK IN RFID INLAY PRODUCTION SYSTEMS

BENEFITS

- Cost Reduction
- Yield 99,7%
- High Efficiency
- Fast Return of Investment



FEATURES & ADVANTAGES

ADVANTAGES

- Proven Technology
- Fast Changeover
- All Web Layouts
- High Accuracy

WORKSTATIONS

- Unwinder
- Adhesive Jetting
- Pre-bond (Flip Chip) module
- Final bond (curing) module with tester and marker
- Upwinder

CONFIGURATION FLEXIBILITY

- Slitting unit
- Sheet-cutting unit
- Interleave paper handling
- Handling of small dies down to 0.3 x 0.3 mm
- Web width up to 350 mm
- Glob top module

OPTION

- Component Placer for Multi Component Tags like Active Tags, Sensor Tags etc.
- for example: Wearables, medical patches

TAL 15000 DIMENSIONS



RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION



DDA 20000 & DDA 40000

ENTER A NEW DIMENSION FOR CHIP ATTACH

10 years ago, the Direct Die Attach concept was born in Mühlbauer's development department and continuously optimized. The patented technology beats the 40 000 UPH with only one place system and a 30% smaller footprint. The significantly higher

throughput and the reduced complexity result in 80% less die attach costs, an outstanding quality and highest reliability. This system redefines the high-volume production and provides high potential for further cost and performance optimization.



SIMPLICITY IS THE ULTIMATE SOPHISTICATION

BENEFITS

- Cost Reduction up to 50% / 80%
- Very High Productivity
- Yield 99,7%



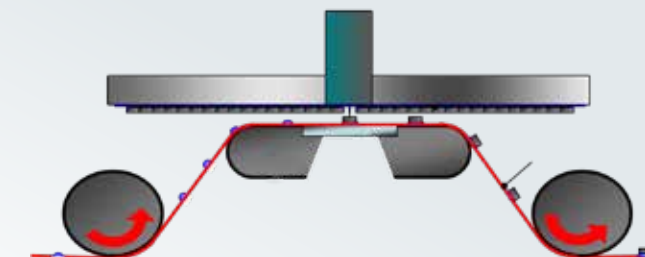
FEATURES & ADVANTAGES

ADVANTAGES

- Performance 20k / 40k
- 100% Vision Control
- Consistently High Uptime
- Small Footprint
- Independent from chip supplier

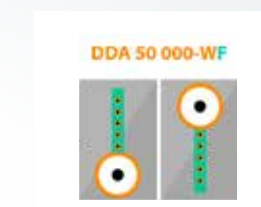
WORKSTATIONS

- Unwinder
- Adhesive Jetting
- Pre-bond (Direct Die Attach) module
- Final bond (curing) module with tester and marker
- Upwinder



DDA - PROCESS

- DDA - Strap - Info on request



ROADMAP / FUTURE OUTLOOK

- DDA Wide Web / Multi row system with 20k/50k/100k
- Handling of chip sizes down to 0.2 x 0.2 mm, independent from chip supplier
- Antenna on paper or preprinted material

DDA 20000 & 40000 DIMENSIONS



RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION



DDA + CL

RFID LINE

Working according to our concept 2023 for full factory automation, the DDA+CL is the next step towards your Industry 4.0 production plant. With the reduction in footprint, better utilization of manpower and improved material flow achieving further cost reduction, higher productivity and more process stability. The

DDA+CL offers a reliable and expandable platform for the RFID Factory of tomorrow. Our roadmap plans go even further to make this line expandable with inline antenna printing, personalization as well as variable data printing, to provide customers with an all in one pass, fully flexible high end RFID production line.



SIMPLICITY IS THE ULTIMATE SOPHISTICATION

BENEFITS

- Cost Reduction
- Higher Productivity
- Higher Transparency
- Yield 99,7%



FEATURES & ADVANTAGES

ADVANTAGES

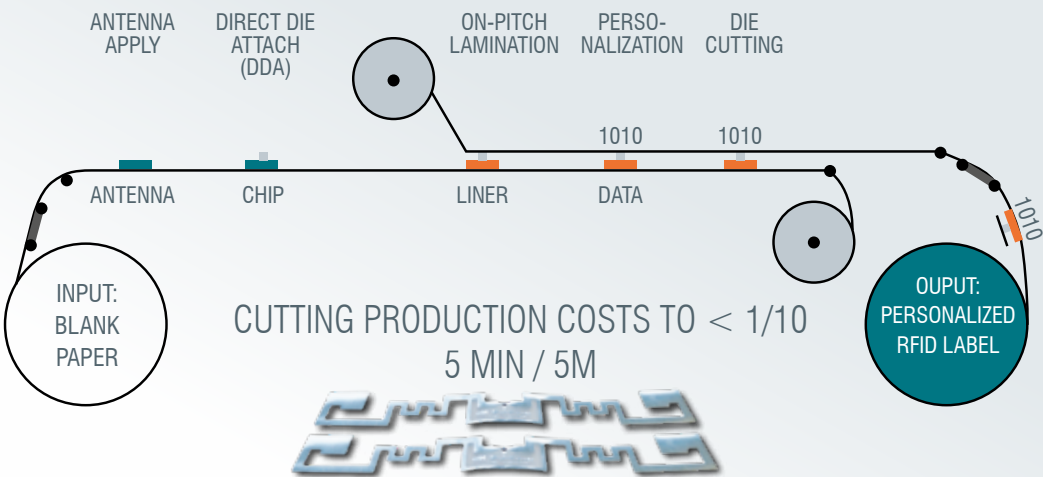
- Smaller machine footprints
- Better Manpower utilization
- No stockkeeping inbetween processes

WORKSTATIONS

- Unwinder
- Adhesive Jetting
- Pre-bond (Direct Die Attach) module
- Final bond module
- Inline hotmelt and / or transfer adhesive process
- Dry inlay cutting unit rotative die cutting
- Upwinder inline testing unit

ROADMAP

- Inline Personalization
- Inline Antenna Printing
- Wide Web – Multirow application



DDA + CL DIMENSIONS



RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION



RFID CONVERTING

TECHNOLOGY OVERVIEW

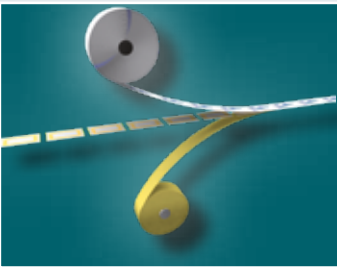
The wide range of Mühlbauer converting lines enables our customers to offer an incredible portfolio depth. From standard RFID labels, to baggage tags, on metal tags, animal ear tags, paper tickets and hangtags, nothing is impossible.

Mühlbauer converting lines can offer you the most efficient production solution for your products, no matter how demanding your product specification might be.

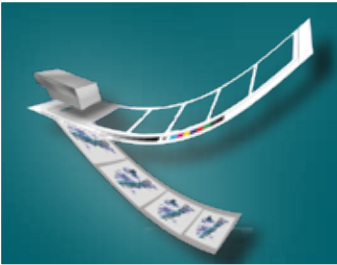
| | IL 15000 | CL light | CL 30000 | CL 60000 |
|------------------------------|----------|---|---|----------|
| Max. Speed | 60 m/min | 10 m/min (semi-rotative) 30 m/min (rotative) | 10 m/min (semi-rotative) 30 m/min (rotative) | 60 m/min |
| Max. Reel Diameter | 500mm | 400 mm, Inlay 300 mm | 400 mm, Inlay 300 mm | 600 mm |
| Web Width | 250mm | 250 mm | 250 mm | 250 mm |
| GLUE PROCESSING | | | | |
| Transfer Glue | | ■ | ■ | ■ |
| Hotmelt | | | □ | □ |
| INPUT MATERIALS | | | | |
| Liner | ■ | ■ | ■ | ■ |
| Face | ■ | ■ | ■ | ■ |
| Compensation Layer (4-Layer) | | | | □ |
| Dry Inlay | | □ | ■ | ■ |
| Wet Inlay | ■ | ■ | | □ |
| BAD INLAY REJECT | | | | |
| Dry Inlay | | | | □ |
| Wet Inlay | | | | □ |
| Inlay Placement Accuracy | ± 0.5 mm | ± 0.5 mm | ± 0.5 mm | ± 0.5 mm |
| DIE CUTTING | | | | |
| Accuracy | | ± 0.5 mm | ± 0.5 mm | ± 0.5 mm |
| Technique | | Semi-rotative, rotative | Semi-rotative, rotative | Rotative |
| Liner-Face-Control | | | | ■ |
| Tension Control | | | □ | □ |
| 2nd Die Cutter | | | | □ |
| TESTING | | | | |
| Testing HF | □ | □ | □ | □ |
| Testing UHF | □ | □ | □ | □ |
| Performance Test | | □ | □ | □ |
| Vision Monitoring System | | | | □ |
| 100% Tested Output Quality | | ■ | ■ | ■ |
| Bad Unit Marking | □ | ■ | ■ | ■ |
| Bad Single Ticket Reject | | | | □ |
| UID & TID Logging | | □ | □ | □ |
| OUTPUT | | | | |
| Single | | | | □ |
| On Reel | ■ | ■ | ■ | ■ |

FOR LABELS, TICKETS, TAGS

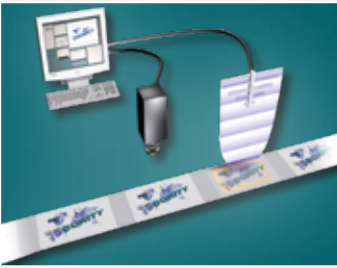
PROCESS FLOW



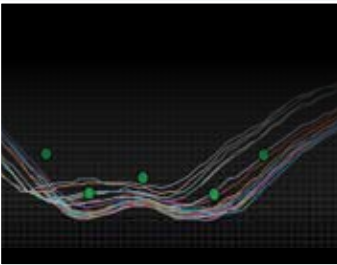
- LAMINATION**
- Transfer adhesive or hotmelt
 - Cold lamination
 - Register controlled



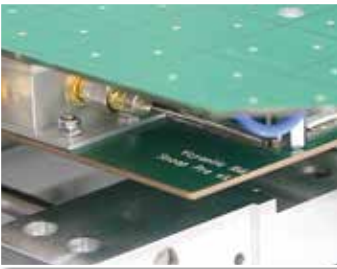
- DIE CUTTING**
- Rotative or semi-rotative die cutting process
 - Fast and accurate
 - Pitch controlled



- TESTING & MARKING**
- 100% tested output quality
 - In-house customized reader antenna design
 - Marking or rejection of bad units



- INLINE READ RANGE VERIFICATION/PERFORMANCE**
- Inline performance test of UHF-inlays, -labels, -tickets etc. with Voyantic Tagsurance system
 - Frequency test range (e.g. 860... 960 MHz) instead of one fixed frequency in standard test procedures
 - Characteristical performance curve over the test range for judgement of quality & tolerances



RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION

IL 15000

RFID INLAY INSERTION LINE

The IL 15000 inlay insertion line is designed for the fully automatic insertion of RFID inlays into conventional self-adhesive labels. Label converters are using their standard label printing presses to produce self-adhesive labels in a very efficient reel-to-reel process. By using the IL 15000, these labels can be easily con-

verted to Smart Labels by inserting "wet RFID inlays" between the adhesive labels and the liner in a stand-alone reel-to-reel-process ("de-lam/re-lam process"): easy and simple with high speed, high precision and high production yields. The IL 15000 can furthermore be upgraded for baggage tag production.



FULLY AUTOMATED INSERTION OF RFID INLAYS

BENEFITS

- High throughput
- Low investment cost
- Upgrade for baggage tags possible
- Fast return of investment
- Less training required
- Superior placement accuracy



FEATURES & ADVANTAGES

ADVANTAGES

- Easy process
- Very small footprint
- High production speed
- Known process de-lam re-lam
- Very attractive price

WORKSTATIONS

- Unwinder for self-adhesive labels
- Unwinder for wet inlays
- Inlay dispense unit
- Inline quality control (output test & marking HF and UHF)
- Upwinder for wet inlay liner material
- Upwinder for self-adhesive Smart Labels

YOUR APPLICATIONS

- Self-adhesive HF & UHF labels
- Multilayer labels (sandwich labels)
- Upgrade for baggage tags possible
- Can also be used as an applicator

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION

IL 15000 DIMENSIONS

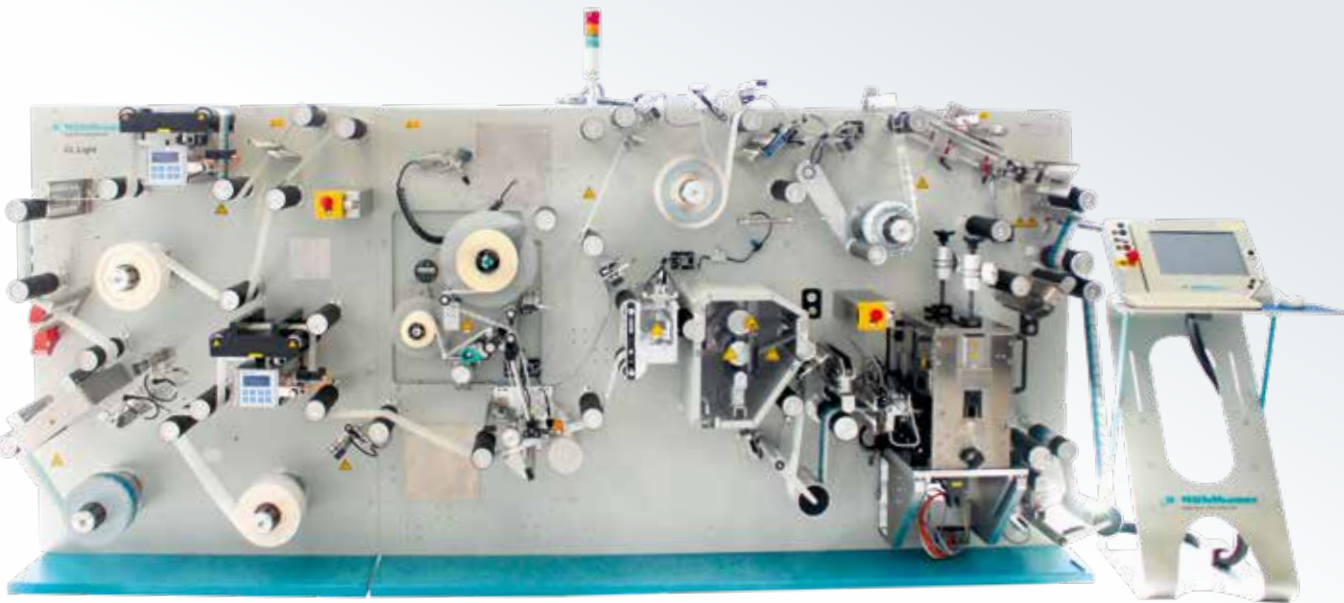


CL LIGHT

ENTRY LEVEL RFID CONVERTING LINE

The CL light is characterized by a successful combination of cost efficient design together with a high flexibility in output configurations. It is possible to convert wet inlays into finished labels or wet inlays from dry inlays in reel-to-reel mode using transfer adhesive. All processes are in one modular system: antenna web handling, label lamination, die cutting as well as output testing. The system has a throughput of up to 10 m/min for semi-rotative cutting respectively 30 m/min for rotative cutting. With an

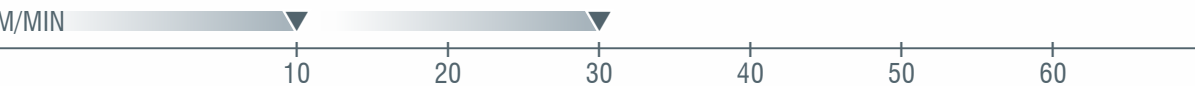
optimized changeover time between different products paired with lowest tooling costs, this converting system is perfectly suited for a production with smaller lot sizes and at the same time fast changing applications. The user-friendly interface, the intuitive handling of this converting machine and the low initial investment makes the CL light especially interesting for start-ups entering the RFID converting market.



BEST PRICE/PERFORMANCE RATIO FOR SMALL & MID-RANGE VOLUME

BENEFITS

- Semi-Rotative / Rotative Die Cut
- Fast Return of Investment
- Reduced Production Time
- Reduced Production Costs



FEATURES & ADVANTAGES

ADVANTAGES

- Low Investment Costs
- Easy to Operate
- High Precision Inlay Placement
- Small Footprint
- Quick Product Change Over

WORKSTATIONS

- Reel-to-reel process (output label rewinder)
- Transfer glue process
- Wet inlay application
- Semi-rotative die cutting unit

CONFIGURATION FLEXIBILITY

- Output test and marking HF and UHF

YOUR APPLICATIONS

- Wet inlay
- Self-adhesive label
- Ticket on reel

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION

CL LIGHT DIMENSIONS



CL 30000

ENTRY LEVEL RFID CONVERTING LINE

The CL 30000 is characterized by a successful combination of cost efficient design together with a high flexibility in output configurations. It is possible to convert wet inlays or finished labels directly from dry inlays in reel-to-reel mode with a wide variety of different adhesive options. All processes are in one modular system: antenna web handling, label lamination, die cutting as well as output testing. The system has a throughput of up to 10 m/min for semi-rotative cutting respectively 30 m/min for rota-

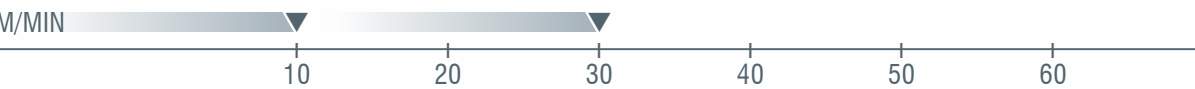
tive cutting. With an optimized change-over time between different products paired with lowest tooling costs, this converting system is perfectly suited for a production with smaller lot sizes and at the same time fast changing applications. The friendly user interface, the intuitive handling of this converting machine and the low initial investment makes the CL 30000 especially interesting for entering the RFID market.



BEST PRICE/PERFORMANCE RATIO FOR SMALL & MID-RANGE VOLUME

BENEFITS

- Semi-Rotative / Rotative Die Cut
- Fast Return of Investment
- Reduced Production Time
- Reduced Production Costs
- Dry Inlay and Hot Melt possible



FEATURES & ADVANTAGES

ADVANTAGES

- Low Investment Costs
- Easy to Operate
- High Precision Inlay Placement
- Small Footprint
- Quick Product Change Over

WORKSTATIONS

- Reel-to-reel process
- Inline hotmelt or transfer adhesive process
- Dry inlay die cutting
- Semi-rotative die cutting unit

CONFIGURATION FLEXIBILITY

- Dry inlay off-pitch placement
- Dual hotmelt station
- Onestep production from inlay to Smart Label

YOUR APPLICATIONS

- Wet inlay
- Self-adhesive label in one pass with dry inlay
- Ticket on reel

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION

CL 30000 DIMENSIONS



CL 60000

RFID CONVERTING LINE FOR HIGH-VOLUME PRODUCTION

Mühlbauer's CL 60000 Converting Line represents a flexible, fast and modular concept for a high range of converting possibilities: Smart Labels and Smart Tickets from reel-to-reel or from reel-to-ticket/fanfold. Various input materials like dry inlay, wet inlay and even compensation layer (4-layer) can be processed. All processes are in one platform: reel-to-reel antenna web handling, label/ticket lamination, die cutting as well as out-

put testing – of course, with leading edge performance, state of the art quality and the best cost/performance ratio available on the market. Mühlbauer's converting machine CL 60000 is perfectly suited for high-volume RFID Label and Ticket production, where the issues of fast change over times and high quality are taken into account.



FAST AND MODULAR CONVERTING SOLUTION

BENEFITS

- Price / Performance Leader
- Yield 99,7%
- Highest Level of Customization
- Lowest Cost of Ownership



FEATURES & ADVANTAGES

ADVANTAGES

- Highest Application Flexibility
- High-Volume System
- Upgrade Possibilities
- Easy Product Change Over

WORKSTATIONS

- Unwinder for dry and / or wet inlay
- Unwinder for top and bottom material
- Flexible inlay separation, bad unit rejection and transfer
- Top and bottom material registration and lamination
- Rotative/semi-rotative die cutting
- Test module for functional test incl. bad unit marking
- Upwinder

CONFIGURATION FLEXIBILITY

- Transfer Adhesive or Hotmelt
- Second Die Cutter
- Single Ticket Output
- 4-Layer Handling
- Performance Testing Inline
- Vision System

YOUR APPLICATIONS

- Wet inlay
- Self-adhesive label
- Ticket on reel
- Single Ticket / Hang tag

SPECIAL APPLICATIONS

- CL wide web up to 350 mm
- CL baggage tag (info on request)

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION

CL 60000 DIMENSIONS



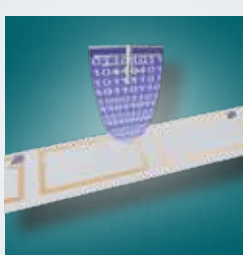
RFID PERSONALIZATION

TECHNOLOGY OVERVIEW

| | PL light | PL 30000 |
|---|--|--|
| SCOPE OF OPERATION | | |
| Barcode Reading | ■ | ■ |
| Chip Encoding | ■ | ■ |
| Variable Data Printing | ■ | ■ |
| UV Curing | ■ | ■ |
| Camera Inspection | ■ | ■ |
| Barcode Verification | ■ | ■ |
| RFID Verification | ■ | ■ |
| Bad Tag Removal | ■ | ■ |
| Auto Remake of Rejects | ■ | ■ |
| FREQUENCIES | | |
| UHF | ■ | ■ |
| HF | ■ | ■ |
| NFC | ■ | ■ |
| CHIP ENCODING METHODE | | |
| from Dataset | ■ | ■ |
| from Barcode | ■ | ■ |
| from Combination of Dataset and Barcode | ■ | ■ |
| Chip Based Serialization | MÜHLBAUER ENCODE or Impinj ItemEncode | MÜHLBAUER ENCODE |
| INPUT MATERIALS | | |
| Max. Product Width | 101.6 mm | 250 mm |
| Labels on Reel | ■ | ■ |
| Tickets on Reel | ■ | ■ |
| Singulated Tickets/Tags | ■ | ■ |
| BARCODE READING | | |
| Linear Barcode | ■ | ■ |
| 2D Barcode | ■ | ■ |
| PRINTING | | |
| DoD UV Inkjet Printer with 360dpi | ■ | ■ |
| DoD Inkjet Printer with 600dpi | ■ | ■ |
| Print width | up to 142 mm | up to 142 mm |
| Data printing | Static and dynamic text, barcodes (1D, 2D) | Static and dynamic text, barcodes (1D, 2D) |
| Single Color (Mono Chrome) | ■ | ■ |
| Multi Color | ■ | ■ |
| QUALITY MONITORING | | |
| Chip Data Verification | ■ | ■ |
| Print Data Verification | ■ | ■ |
| Barcode Grading | ■ | ■ |
| Automated Reproduction | ■ | ■ |
| Multijob Handling | ■ | ■ |
| OUTPUT FORMAT | | |
| Labels on Reel | ■ | ■ |
| Singulated Tickets/Tags | ■ | ■ |
| Z-fold | ■ | ■ |
| UPH | up to 50 000 | up to 30 000 |
| Speed | 30 m/min | 27 m/min (printer limitation) |

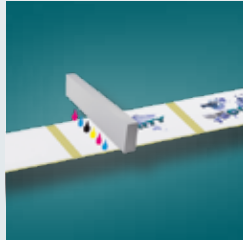
CHIP ENCODING & PRINTING

PROCESS FLOW



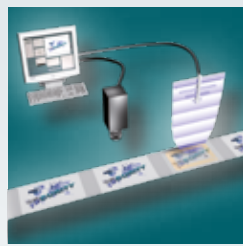
ENCODING

The Mühlbauer chip encoding solutions offer the possibility to electronically encode data to each tag's RFID chip at production speed. The encoded data is linked to a data base containing all pertinent information on the product. Mühlbauer's inherently modular solutions also allow for advanced encoding features such as password lock, perma lock and more.



PRINTING

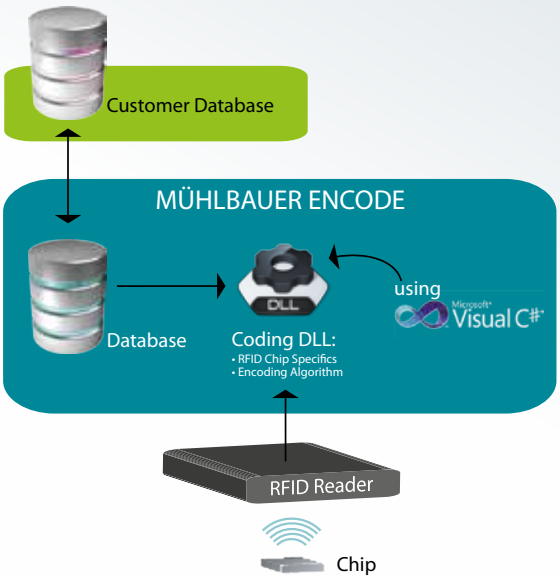
After the RFID chip has been successfully encoded, a high-speed digital print system prints the corresponding information on the face of the label in mono chrome or full colour. It's variable Data-Printing (VDP) capability coupled with our encoding solution guarantees that every label is fully personalized, both visually and electronically.



VERIFICATION & TESTING

Every label will be tested for RF functionality and/or visual defects and/or data match. Depending on the customer's requirements, bad labels can either be visually marked or completely removed from the roll.

MÜHLBAUER ENCODE FOR MAXIMUM FLEXIBILITY AND INDEPENDENCE (MCES)



The personalization software MÜHLBAUER ENCODE is based on Microsoft Dynamic Link Library (DLL) and therefore allows the adaption to any RFID Chip and encoding algorithm.

- Your Advantages:
- Suitable for all chip types with unique ID (TID or UID)
 - For all frequencies (HF/NFC & UHF)
 - Encoding algorithm is freely programmable
- The DLL is based on Microsoft Visual C#. At the Mühlbauer Academy customers receive specialized developer trainings for the coding of the DLL. Our developer workstations are equipped with an offline RFID-Reader kit for HF and UHF frequencies and are available for testing and debugging.

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION

PL LIGHT

SINGLE TICKET / REEL-TO-REEL PERSONALIZATION LINE

Mühlbauer's personalization line PL light represents the ideal machine for the encoding, labeling and verification of tickets and tags for low and medium volumes. The efficient set-up and fast changeover allows for rapid changes of orders, either reel-to-reel or ticket-to-ticket. Also, a multiple handling of jobs is possible. Each ticket is tested and automatically reproduced when

rejected in order to guarantee flawless quality and lot integrity. PL light's small-sized footprint allows it to be placed even in the smallest spaces, e.g. in an office environment. Furthermore, this economically-priced system is available with the license-free Mühlbauer ENCODE software solution, which additionally saves costs during operation.



THE IDEAL SOLUTION FOR YOUR SERVICE BUREAU

BENEFITS

- Multi-job handling in one batch
- highly efficient personalization line
- Low investment costs
- Mühlbauer ENCODE included



FEATURES & ADVANTAGES

ADVANTAGES

- 100% Process Control
- Print on demand flexibility
- 600 dpi print solution
- Fast process
- One machine for all chip types UHF/HF/NFC
- Double checked verification of chip encoding & print layout
- small footprint

WORKSTATIONS

- Unwinder
- Reader for UID and / or Barcode
- Contactless encoding
- DoD Printing
- Verification
- Upwinder / Single output

CONFIGURATION FLEXIBILITY

- Thermal Inkjet (waterbased)
- UV Inkjet
- 600 dpi printing
- Visual verification of print

YOUR APPLICATIONS

- Individually Personalized Single Tickets / Hang tags
- Individually Personalized Labels / Tickets on Reel
- Wide Range of Chip encoding formats: UHF and limited HF / NFC
- Single Ticket / Hang Tag
- Speed up to 50 m/min

PL LIGHT DIMENSIONS



RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION



PL 30000

UNIVERSAL LINE FOR MID & HIGH-VOLUME

Mühlbauer's personalization line PL 30000 represents the ideal machine for encoding, labeling and verification of tickets and tags for medium and high volumes. The efficient set-up and fast changeover allows for rapid changes of orders in a reel-to-reel or reel-to-ticket process. The PL 30000 can handle all common

UHF / HF / NFC frequencies. Each ticket is tested and automatically reproduced when rejected in order to guarantee flawless quality. PL 30000's economically-priced system is available with the license-free Mühlbauer ENCODE, which additionally saves costs during operation.



THE IDEAL SOLUTION FOR YOUR PROFESSIONAL ENCODING

BENEFITS

- Multi-job handling in one batch
- up to 30000 UPH
- Mühlbauer ENCODE included
- License free for all types



FEATURES & ADVANTAGES

ADVANTAGES

- Supply Chain Compression
- Automatic Reproduction of rejected Tags
- Efficient Set-up and fast change over different products
- Small footprint
- TIJ (Thermal Inkjet)

WORKSTATIONS

- Unwinder
- Buffered 5-fold encoding unit (stop and go with flexible encoding times)
- DoD Printing
- Simultaneous verification of print (visual) and chip data
- Upwinder

CONFIGURATION FLEXIBILITY

- DoD monochrome/multi color 600dpi printing
- Thermal Inkjet printing (waterbased)
- Wide range of chip functionality (UHF / HF / NFC)

YOUR APPLICATIONS

- Reel-to-reel personalization
- Reel-to-ticket personalization
- High volume UHF / HF / NFC coding

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

INLAY PRODUCTION

CONVERTING

PERSONALIZATION

PL 30000 DIMENSIONS







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