THE RFID FACTORY

PRODUCT OVERVIEW

Mühlbauer
High Tech International

CONTENTS

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.

Service Hub Russia
HQ Germany
Production Center Germany
Production Center Slovakia
Production Center Bosnia & Herzegovina
Production Center Serbia
Service Hub Spain
Service Hub Georgia
Service Hub South Korea
Service Hub Japan
Service Hub Turkey
Service Hub Iraq
Production Center USA
Production Center China
Service Hub United Arab Emirates
Service Hub Taiwan
Service Hub India
Service Hub Mexico
Production Center Malaysia
Service Hub El Salvador
Service Hub Uganda
Service Hub Brazil
Service Hub South Africa
Service Hub Australia

Mühlbauer
Bosnia & Herzegovina

Mühlbauer
China

Mühlbauer
Germany

Mühlbauer
Malaysia

Mühlbauer
Serbia

Mühlbauer
Slovakia

Mühlbauer
USA

MPS
Precision Parts & Surface Engineering

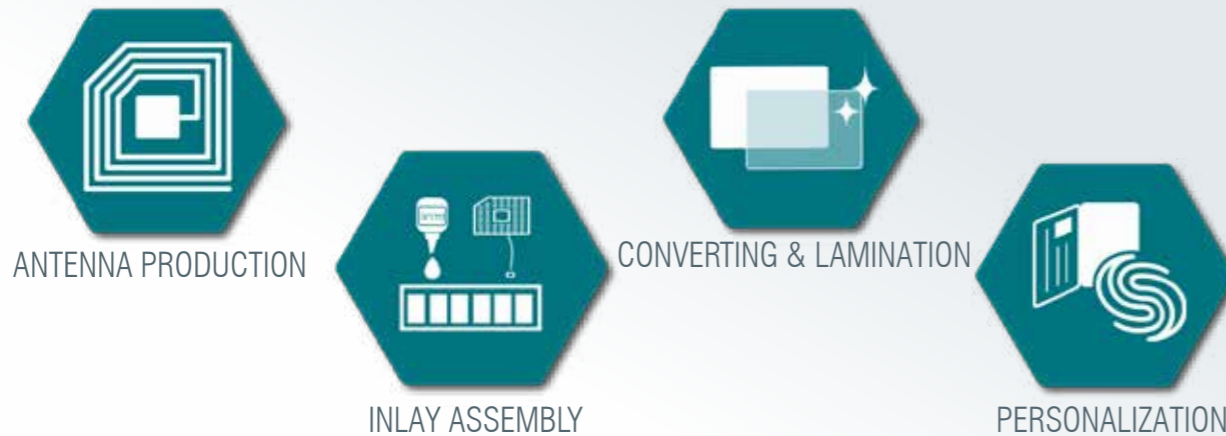**AUTOMATION**
Production Equipment & Systems

WORLD OF TECURITY®
Government & Technology Solutions

REALIZING RFIDeas WORLDWIDE

ANTENNA PRODUCTION

INLAY ASSEMBLY

CONVERTING & LAMINATION

PERSONALIZATION

Newport News,VA
USA

Roding
GERMANY

Dresden
GERMANY

Melaka
MALAYSIA

Wuxi
CHINA

COMPETENCE IN RFID

|	ANTENNA PRODUCTION	CHIP HANDLING	CONVERTING	PERSONALIZATION	
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
2010			■		First Converting solution
2014	■				The lastest innovations "Antenna Production Systems ACS" was realized
		■			The revolutionary "Direct Die Attach System DDA 20000" Roadmap for 100.000 UPH entered the marked
				■	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
2019	■	■	■	■	Mühlbauer release "Concept 2023" + MB PALAMAX®
2020		■			The world record machine DDA 80000 WF was launched as the "front runner" of our flexible DDA WF Family
			■		CL 90000 a revolution in high speed converting
2021	■				APS & ACS - newest market solution available
				■	PL Light - Personalization solutions approach to medical applications

CONCEPT 2023

THE FUTURE OF 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.
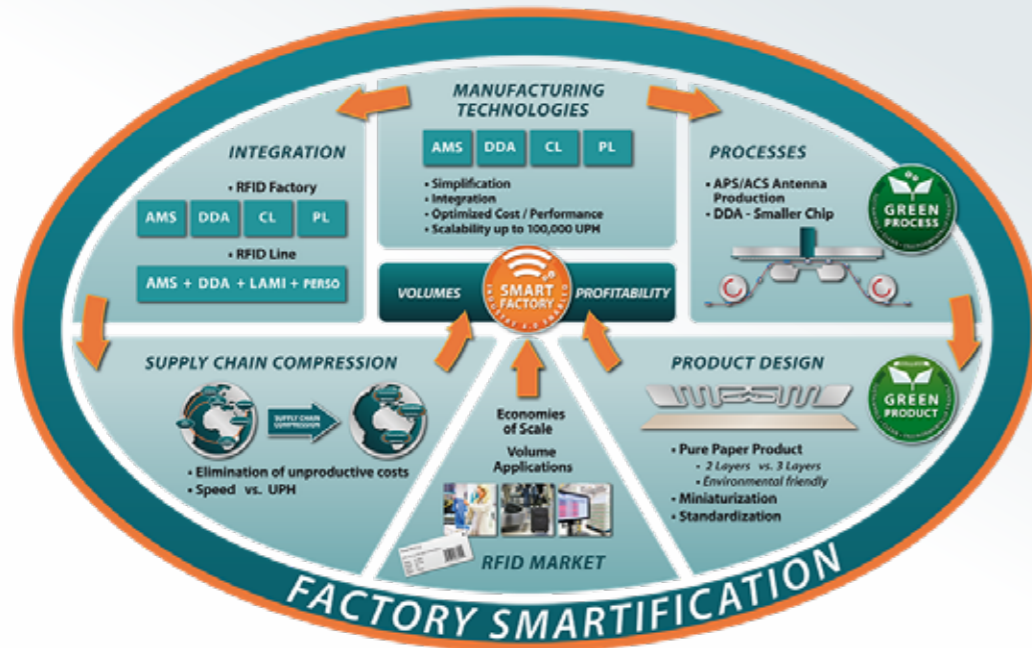
The integration of various manufacturing processes leads to stable and productive manufacturing lines, which guarantee high volume production with consistently high yield and uptimes. Furthermore there will be up to 30% less floor space required. With our Concept 2023 we combine the revolutionary advancements with our unmatched expertise to a state-of-the-art technology controlled, monitored by our own-developed software solution. 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 of the RFID market will lead us to. Mühlbauer is 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 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 factory 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. 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.
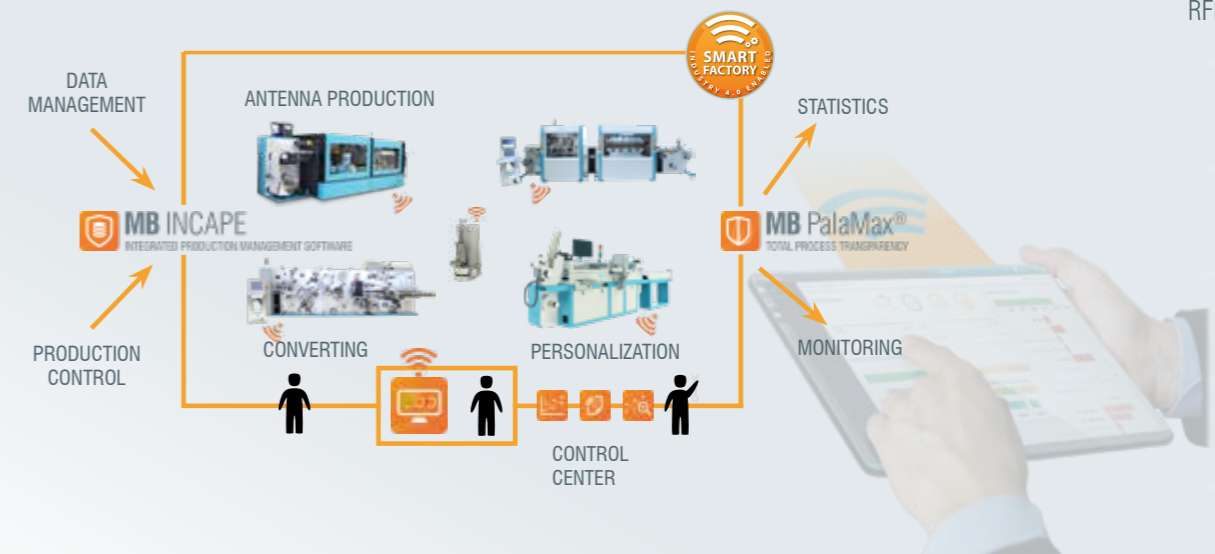
- Optimized material flow by automated vehicles for material transport
- Optimized machine utilization
- Preventive maintenance
- Support engineering in precise detection
- Fully automated data collection in real time
- Increased OEE and very fast ROI within months
- Significant reduction of manpower and floor space
- Full production transparency

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 PALA-MAX® is the backbone of our Smart Factory solution, by collecting all relevant data and handling the process & material flow.

SMART FACTORY
INDUSTRY 4.0 ENABLED

FEATURES & ADVANTAGES

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

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

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

MB PALAMAX.TRACE
Allows for the auditing of single manufacturing runs

MB PALAMAX.MAINTAIN
Enables the implementation of maintenance on demand

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

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

SMART PRODUCTION MANAGEMENT

SMART MATERIAL MANAGEMENT

TRANSPARENCY OF YOUR PRODUCTION
- Real-time monitoring during production
- Tracking & tracing of each individual product
- Minimized maintenance

- Productivity +50%
- Efficiency & Speed +30%
- Cost Reduction +20%

- Securing Future Competitiveness
- New Business Models
- New Services

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, well-trained 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 Mühlbauer's equipment
- State-of-the-art big data software architecture ensures future reliablility

- 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

ANTENNA PRODUCTION

TECHNOLOGY OVERVIEW

Driven by the need of environmental friendly production processes, 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 chemicals. The Mühlbauer antenna production technology marks a milestone in supply chain compression, antenne on demand production, full and full control over your design.

	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	Yes
Troughput	25m/min	8m/min Roadmap 20m/min
MATERIAL	PET, Aluminium	Paper, Copper ink
YIELD	>99,7%	>99,7%

CUTTING TECHNOLOGY

MAGNETIC CYLINDER
● with exchangeable cliché for individual and flexible antenna designs

PRINTING TECHNOLOGY

ROTATION SCREEN PRINTING
● fully compostable thanks to natural materials

ACS 350

ANTENNA CUTTING SYSTEM

Mühlbauer's Antenna Cutting Systems ACS 350 produces reliable UHF aluminum antennas on PET. The reel-to-reel system 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.

GREEN PROCESS
SUSTAINABLE · CLEAN · ENVIRONMENT FRIENDLY

PROVEN PRODUCT
SUSTAINABLE · CLEAN · ENVIRONMENT FRIENDLY

EFFICIENT GREEN WAY OF ANTENNA PRODUCTION

BENEFITS

- Up to 50% process cost reduction „compared to alu etching"
- 75% Time saving „antenna on demand – in 1 hour"
- Environmentally friendly „sell your alu flakes"
- Less inventory / work in process

M/MIN
5   10   15   20   25   60

FEATURES & ADVANTAGES

ADVANTAGES

- Supply chain compression
  ship your new RFID labels 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
- Green process
  collection of waste, dry process, no chemicals involved
- Independent from suppliers
  with fast reaction to the market

WORKSTATIONS

Input spooler	Tester and bad unit marker
Cutting tool	Output spooler
Cleaning station (with suction unit)	

PRODUCT REQUIREMENTS

- Material: up to 350 mm PET/Alu
- Antenna lenght: 3 - 105mm
   width: up to 320mm
- Pitch: 8mm ≤ x-distance ≤ 100mm depends on chichec

THROUGHPUT

- Up to 25m/min
- Up to 160 000 UPH (20 mm pitch, 4 row)
- Up to 2 billion / year

ACS 350 DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
7220	3440	2900	4560

SMART FACTORY
INDUSTRY 4.0 ENABLED

APS 350

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 available on the market. With APS 350, copper ink antennas can be produced undergo- ing 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.

GREEN DESIGN
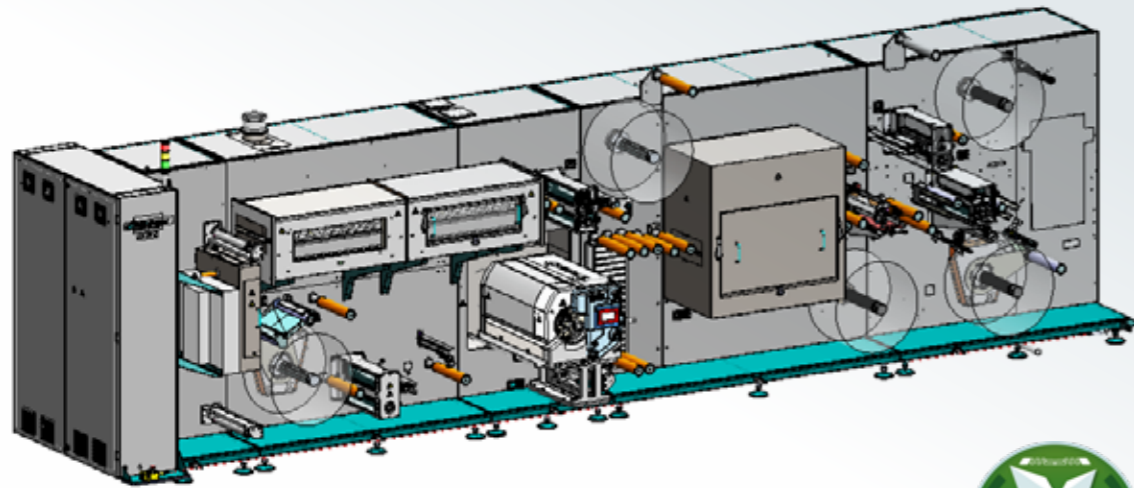
GREEN PROCESS

ANTENNA ON DEMAND ON PAPER SUBSTATE

BENEFITS

- Fully decomposable copper antennas on paper
- Copper ink printing process without any waste chemicals (green process)
- Enables two layer products (green design)
- Cost reduction up to 70% compared to silver printing
- In house antenna supply – just in time
- Flexible for HF/NFC and UHF production

ROADMAP

M/MIN						
	2	4	6	8	10	20

FEATURES & ADVANTAGES

ADVANTAGES
- Supply chain compression (no shipping from sub-supplier)
- Print-on-Demand flexibility (with existing design production within 8 hours)
- Know-how remains in your company
- Tag disposal < 30 days in standard composter

WORKSTATIONS

- Input spooler
- Printing system
- Drying system
- Drive module
- Sintering system
- Visual tester
- Output spooler

THROUGHPUT
- up to 8m/min, roadmap for 20m/min with rotative screen print
- up to 80 000 UPH (20 mm pitch, 4 row)
- up to 600 Mio. per year

APS 350 DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
6000	2100	2300	2000

SMART FACTORY · INDUSTRY 4.0 ENABLED

INLAY ASSEMBLY

TECHNOLOGY OVERVIEW

Thanks to continuous development efforts, our chip attach machines are the most proven solution for inlay production. Besides the well-known Mühlbauer quality & technology standards, our DDA 80000 WF demonstrates leading edge performance with a world record and unique UPH up to 80.000. With our green DDA 40000-P your paper inlay will improve your operations to environmental friendly and flexible inlay production.

|		TAL 15000	DDA 20000 WF	DDA 40000 WF	DDA 80000 WF	DDA 40000	DDA 40000 - P
WEB WIDTH							
35 - 160 mm						Narrow Web	Narrow Web
100 - 350 mm		Wide Web	Wide Web	Wide Web	Wide Web		
TECHNOLOGY		Pick & Place (Dual Head)	Direct Die Attach (Single Head)	Direct Die Attach (Dual Head)	Direct Die Attach (Quadruple Head)	Direct Die Attach (Single Head)	Direct Die Attach (Single Head)
Max. UPH		13 000	20 000	40 000	80 000	40 000	40 000
Yield				>99.7%			
Highlight			Upgradeable	Upgradeable			
DIES							
Size	min.	0.3 x 0.3 mm			0.2 x 0.2 mm		
	max.				1.5 x 1.5 mm		
	optional	3.0 x 3.0 mm or 5.0 x 5.0 mm					
ANTENNA							
Material		Copper, aluminum, silver on PET or paper	Copper, aluminum, silver on PET or paper	Copper, aluminum, silver on PET or paper	Copper, aluminum, silver on PET or paper	Copper, aluminum, silver on PET	Copper, aluminum, silver on paper or PET
OUTPUT							
Single Row		■				■	■
Multi Row		■	■	■	■		
ACCURACY							
Machine				± 15 μm			
Die Attach				± 30 μm			
Post Cure				± 50 μm			

DDA TECHNOLOGY

## THE REVOLUTION IN FLIP CHIP DIE ATTACH - PROCESS FLOW
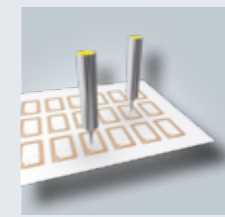
ADHESIVE APPLY
- Latest generation of adhesive jetting technology available
- Glue savings approx. 25 % compared to dispensing system
- Highest flexibility for all antenna formats
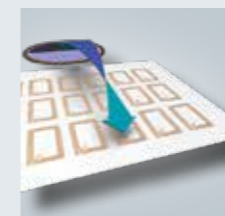
PRE-BONDING
- Machine accuracy ± 15 μm, die attach accuracy ± 30 μm
- Die handling from 0.2 x 0.2 mm up to 5.0 x 5.0 mm
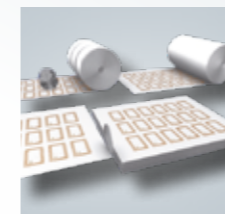- Full throughput with 100 % vision control for highest yield
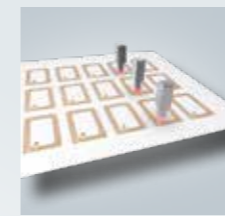
FINAL BONDING
- Smallest & most efficient thermode generation 0.5 N to 5 N ± 10 %
- Best thermode coplanarity ± 5 μm/mm
- Highest process accuracy ± 50 μm (after final bonding)
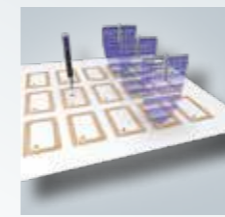
TESTING & BAD UNIT MARKING
- 100% tested output quality
- In-house customized reader antenna design

UPWINDING OR SLITTING
- Single or multirow reels for label / ticket conversion

SUITABLE FOR EVERY APPLICATION

UHF

HF/NFC
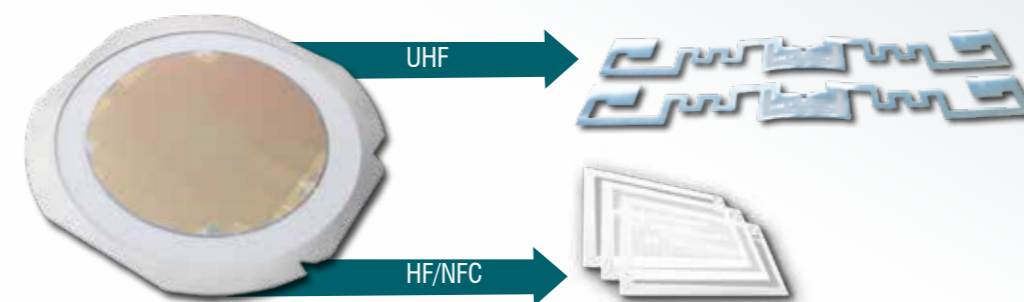
TAL 15000

FLIP CHIP ASSEMBLY LINE FOR WIDE WEB

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, NFC 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

- 5th generation of TAL machines
- Cost reduction with fast return of investment
- High efficiency with yield ≥99,7%
- Easy change over different antenna formats
- Ideal for regular & irregular web layouts

UPH

| 1000 | 3000 | 6000 | 9000 | 13000 | 15000 | 18000 |

FEATURES & ADVANTAGES

ADVANTAGES

- Proven process know-how
- Fast changeover for almost all web layouts
- Highest accuracy and quality

WORKSTATIONS

- Input spooler
- Adhesive dispenser
- Chip placement
- Buffer
- Final bonder
- Tester and bad unit marker
- Output spooler

CONFIGURATION FLEXIBILITY

- Slitting unit
- Sheet-cutting unit
- Interleave paper handling
- Handling of small dies down to 0.3 x 0.3 mm
- Handling of big dies up to 5.0 x 5.0 mm
- Web width up to 350 mm
- Glob top module

TAL 15000 DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
8660	1600	2070	5450

SMART FACTORY
INDUSTRY 4.0 ENABLED

DDA WF FAMILY

FLEXIBLE TECHNOLOGY FOR EACH & EVERY VOLUME

The DDA WF family represents the most proven and established Mühlbauer chip attach solutions for the latest market potentials. The flexible technology ready for each and every volume is based on our well-known direct die attach concept and beats up to 80 000 UPH with only one system and lowest footprint. With our state-of-the-art technology, you can enter at any production volume and be flexible with upgrading your inlay production machine to the next stage. The production from 2 to 12 antenna rows is possible with tape width from 100mm – 385mm and 100% high-quality output control to reach highest yield.

UPGRADEABLE

MOST PROVEN CHIP ATTACH SOLUTION FOR THE LATEST MARKET POTENTIALS

BENEFITS

- Highest flexibility, in fied upgrade possible at any time
- Inlay production from 2 to 12 rows possible
- Tape width from 100 - 385 mm

STANDARD	UPGRADEABLE	UPGRADEABLE	UPGRADEABLE
UPH ▼	▼	▼	▼
20000	40000	60000	80000

FEATURES & ADVANTAGES

ADVANTAGES
- Highest flexibility for wide web chip attach production
- Future proven technology
- Upgradeable concept growing with the market - also later on field

WORKSTATIONS

Input spooler	Finalbonder
Prebonder	Tester and bad unit marker
Buffer	Output spooler

MILESTONES
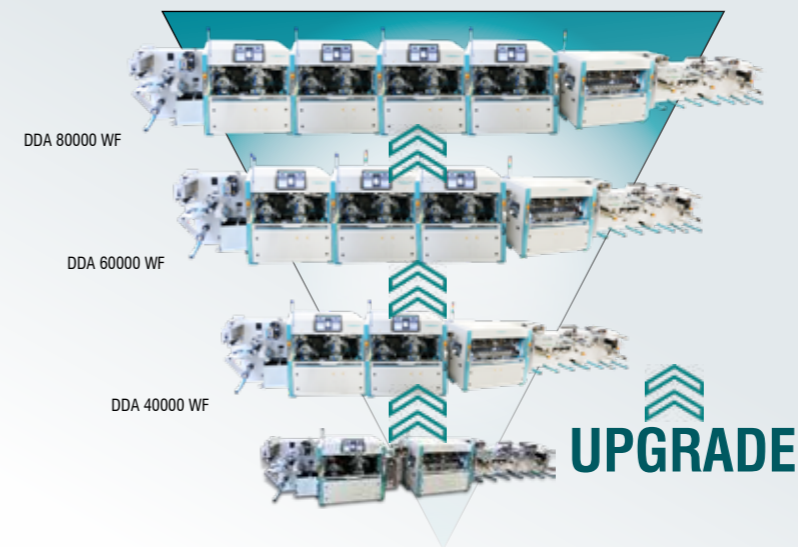
DDA 80000 WF

DDA 60000 WF

DDA 40000 WF

UPGRADE

20000 WF DIMENSIONS E.G.

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
11605	2022	2480	8150

SMART FACTORY
INDUSTRY 4.0 ENABLED

DDA 40000

ENTER A NEW DIMENSION FOR CHIP ATTACH

10 years ago, the Direct Die Attach concept was developed 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 results in 80% less die attach costs, an outstanding quality and highest reliability. This system redefines the high-volume production and provides considerable potential for further cost and performance optimization.

SIMPLICITY IS THE ULTIMATE SOPHISTICATION

BENEFITS

- Production proven > 80 systems
- Cost reduction up to 80%
- Very high productivity, more than 10 billion products produced
- Fully compatible with standard curing process

UPH

| 10000 | 20000 | 30000 | 40000 |

FEATURES & ADVANTAGES

ADVANTAGES

- Consistently high uptime
- Small footprint
- High accuracy & quality standards

WORKSTATIONS

Input spooler		Finalbonder	
Prebonder		Tester and bad unit marker	
Buffer		Output spooler	

DDA - PROCESS

- DDA - Strap - Info on request

DDA 40000 DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
5760	1625	2000	3130

SMART FACTORY
INDUSTRY 4.0 ENABLED
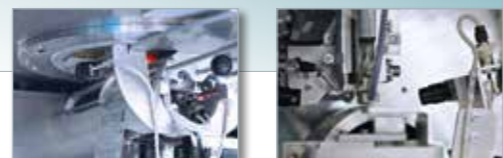
DDA 40000 - P

SUSTAINABLE PRODUCTION SOLUTION FOR PAPER ANTENNAS

Our sustainable Direct Chip Attach DDA 40000-P was developed as a production solution for paper antennas. The equipment is based on our well-known Direct Die Attach technology and further allows you a green inlay production with the same flexibility and speed at your inlay production. The handling of transparent and non-transparent materials guarantees you unlimited flexibility and prepares you for future material requirements. With 100% high-quality output control, the machine can attach up to 280 Mio. chips per year onto antennas on paper substrate.

FEATURES & ADVANTAGES

ADVANTAGES
- More pitch independend
- Cleaning paper from dust before processing in the machine (optional)
- High accuracy & quality standards
- Handling of green and enviromental friendly products

WORKSTATIONS

Input spooler		Final bonder	
Prebonder		Tester and bad unit marker	
Buffer		Output spooler	

GREEN PRODUCT
SUSTAINABLE · CLEAN · ENVIRONMENTALLY FRIENDLY

GREEN PRODUCTION MEETS HIGH SPEED CHIP ATTACH

BENEFITS
- Well-prepared for future material requerements
- Handling of transparent & non-transparent materials (e.g. paper)
- Fully compatible with standard curing process

UPH

10000	20000	30000	40000

DDA 40000-P DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
6695	1757	1990	3950

SMART FACTORY
INDUSTRY 4.0 ENABLED

DDA + CL

MÜHLBAUER'S VISION FOR LINKED RFID PRODUCTION

Working accordingly to our Concept 2023 for full factory automation, the DDA+CL is the next step towards your Industry 4.0 production plant. With a footprint reduction, 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.

INCREASED EFFICIENCY WITH REDUCED HANDLING

BENEFITS

- Overall cost reduction (floor space, idle time, reduced human resources)
- High productivity (increased OEE)
- Improved material flow
- Smooth process flow combining two process steps

UPH

| 10000 | 20000 | 30000 | 40000 | 50000 | 60000 |

FEATURES & ADVANTAGES

ADVANTAGES
- Footprint reduction
- Better manpower utilization
- No stockkeeping inbetween processes
- Higher transparency (less material in progress)

WORKSTATIONS

Input spooler	Adhesive components	Tester and bad unit marker
Prebonder	Material Handling	Output spooler
Buffer	Lamination	
Final bonder	Cutting	

ROADMAP
- Inline antenna printing
- Inline personalization
- Variable data printing

CUTTING PRODUCTION COSTS TO < 1/10
5 MIN / 5M

DDA + CL DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
10030	2510	2500	5900

SMART FACTORY
INDUSTRY 4.0 ENABLED
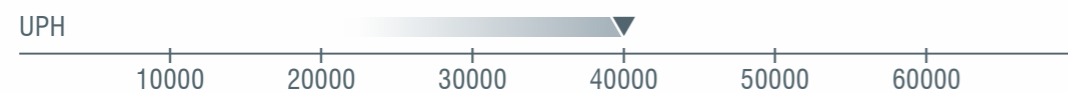
CONVERTING

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 30000	CL 60000	CL 90000
Max. Speed	60 m/min	30 m/min	60 m/min	90 m/min
Max. Reel Diameter	600mm	400 mm	600 mm	600 mm
Web Width	30 - 250mm	30 - 150 mm	30 - 250 mm	30 - 250 mm
GLUE PROCESSING				
Transfer Glue		■	■	■
Hotmelt		■	■	■
INPUT MATERIALS				
Face Liner	■	■	■	■
Dry Inlay		■	■	■
Wet Inlay	■	■	■	■
Compensation Layer			■	■
Bottom Liner	■	■	■	■
DIE CUTTING				
Cutter		■	■	■
Accuracy		± 0.5 mm	± 0.5 mm	± 0.5 mm
Technique		Semi-rotative (optional), rotative	rotative	Rotative
OUTPUT				
Single Ticket			■	■
On Reel	■	■	■	■

FOR LABELS, TICKETS & TAGS

PROCESS FLOW
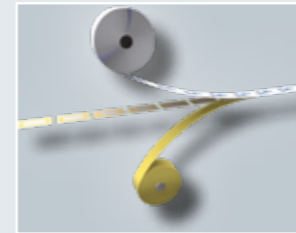
ADHESIVE COMPONENTS
- Transfer adhesive hotmelt station
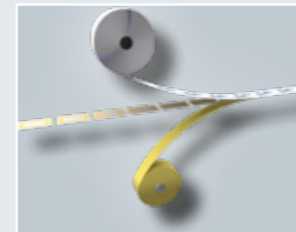
LAMINATION
- Cold lamination
- Register controlled

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
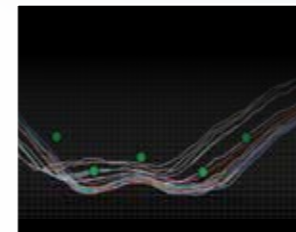
INLINE READ RANGE VERIFICATION/PERFORMANCE
- Inline performance test of UHF-inlays, -labels, -tickets etc. with Voyantic Tagsurance system
- Frequency test range (e.g. 860... 960 MHz) instead of one fixed frequency in standard test procedures
- Characteristical performance curve over the test range for judgement of quality & tolerances
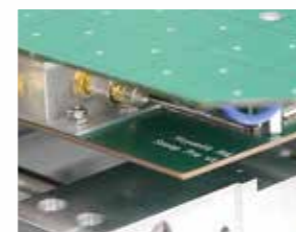
IL 15000

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 converted 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") with minimal invest and very fast production integration, it is your door opener into the RFID world.

FEATURES & ADVANTAGES

ADVANTAGES
- Easy process solution with very small footprint
- High production speed
- Known process de-lam/re-lam
- Effortless expansion of your portfolio

WORKSTATIONS

Input spooler for self adhesive labels	Tester and bad unit marker
Feeding and despense system of wet inlay	Output spooler
Lamination	

APPLICATION POSSIBILITIES
- Self-adhesive HF & UHF labels
- Multilayer labels (sandwich labels)
- Can also be used as an applicator

FULLY AUTOMATED INSERTION OF RFID INLAYS

BENEFITS
- Low investment cost and fast return of investment
- Upgrade for baggage tags possible
- Easy in operation
- Highest placement accuracy

M/MIN

10	20	30	40	50	60

IL 15000 DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
2700	1220	2190	1500

SMART FACTORY
INDUSTRY 4.0 ENABLED

CL 30000

CONVERTING LINE FOR MID-VOLUME PRODUCTION

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 rotative 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 (optional) / Rotative Die Cut
- Fast return of investment
- Reduced production time and costs
- Dry Inlay with hotmelt possible
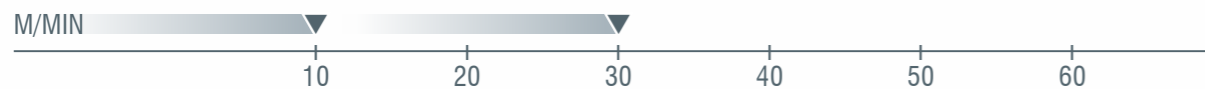
FEATURES & ADVANTAGES

ADVANTAGES
- Fast, easy & cost-minimized product change over
- Easy in operation
- High precision inlay placement
- Small footprint

WORKSTATIONS

- Input spooler
- Input tester and bad unit marker
- Adhesive components
- Material handling
- Lamination
- Cutting
- Output tester and bad unit marker
- Output spooler

CONFIGURATION FLEXIBILITY
- Dry inlay off-pitch placement
- Dual hotmelt station
- One step production from inlay to Smart Label

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

M/MIN

| | 10 | 20 | 30 | 40 | 50 | 60 |

CL 30000 DIMENSIONS

| Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
4910	1200	2000	2110

SMART FACTORY
INDUSTRY 4.0 ENABLED

CL 60000

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.
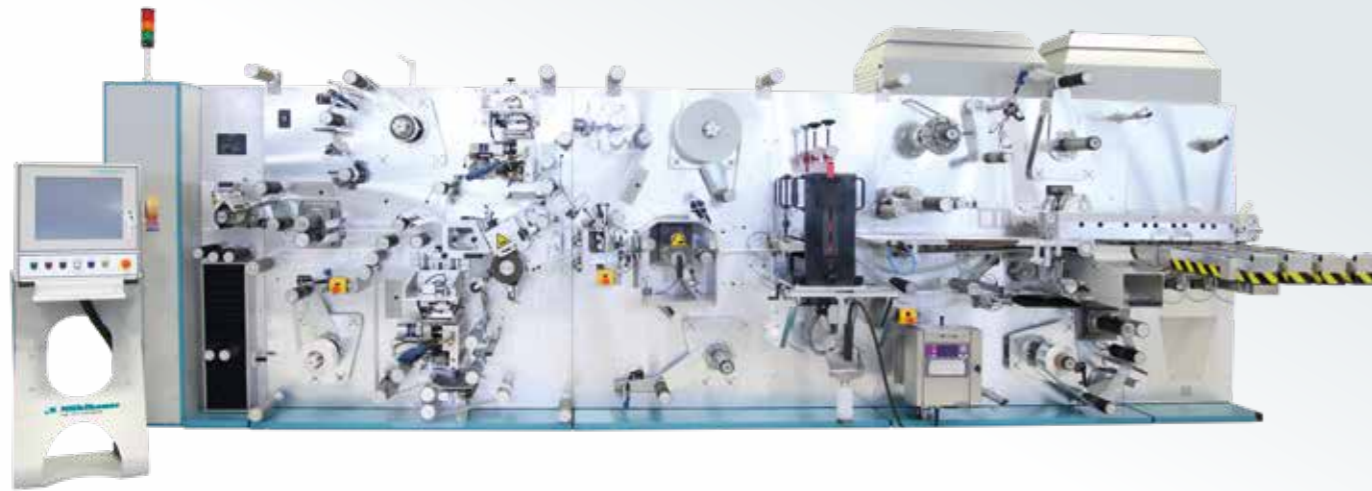
MOST FLEXIBLE MODULAR CONVERTING SOLUTION

BENEFITS

- Price / Performance leader
- Highest level of customization
- Lowest cost of ownership
- Flexible for labels, tickets and hangtags
- Dual-row solution

M/MIN

| | 10 | 20 | 30 | 40 | 50 | 60 |

FEATURES & ADVANTAGES

ADVANTAGES

- High application flexibility
- Flexible for dry and wet inlays
- Upgrade possibilities also in field
- Hotmelt and/or transfer glue process

WORKSTATIONS

- Input spooler
- Input tester and bad unit marker
- Adhesive components
- Material handling
- Lamination
- Cutting
- Output tester and bad unit marker
- Output spooler

CONFIGURATION FLEXIBILITY

- Transfer adhesive and hotmelt
- Second die cutter
- Single ticket output
- 4-Layer handling
- Performance testing inline
- Vision system
- Delam/Relam process

YOUR APPLICATIONS

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

SPECIAL APPLICATIONS

- CL wide web

CL 60000 DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
8000	3600	2500	5610

SMART FACTORY
INDUSTRY 4.0 ENABLED

CL 90000

GAIN HIGHEST COMPETITIVENESS WITH HIGHEST FLEXIBILITY

Thanks to the modular platform of our converting line family, the CL 90000 system is characterized by a successful combination of cost-efficient production and highest flexibility. Smart labels, smart tickets, baggage tags, hangtags and wet inlays can be processed from reel-to-reel or reel-to-ticket. Paired with the highest speed and perfect product quality. Due to 100% output control the converting system is perfectly suitable for mid- and high volume production. To gain limitless production flexibility the machine can operate in single row as well as in multi row application.

FULL CONVERTING PORTFOLIO SOLUTION

BENEFITS

- Highest level of customization
- Flexible for labels, tickets, hangtags and baggage tags
- Multi-row solution

M/MIN

| 40 | 50 | 60 | 70 | 80 | 90 |

FEATURES & ADVANTAGES

ADVANTAGES

- High application flexibility
- Flexible for dry and wet inlays
- Hotmelt and/or transfer glue process

WORKSTATIONS

Input spooler	Lamination
Input tester and bad unit marker	Cutting
Adhesive components	Output tester and bad unit marker
Material handling	Output spooler

CONFIGURATION FLEXIBILITY

- Transfer adhesive or/and hotmelt
- Second die cutter
- Single ticket output
- 4-Layer handling
- Performance testing inline
- Vision system
- Delam/Relam process

YOUR APPLICATIONS

- Self-adhesive label
- Ticket on reel
- Single Ticket / Hang tag
- Baggage Tag

CL 90000 DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
9700	1400	2500	6210

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

CONVERTING

PERSONALIZAITON

SMART FACTORY
INDUSTRY 4.0 ENABLED

PERSONALIZATION

TECHNOLOGY OVERVIEW

The personalization brings each label/ticket to life and with our wide range of solutions they represent the ideal machine for chip encoding, printing and verification. The efficient and fast set-up allows for a rapid change over. With transport speeds up to 60m/ min the systems reaches peak-performance values with regard to UPH. To guarantee 100% flawless output quality, 100% of the labels/tickets are tested for functionality and print. The license free encoding gain you highest flexibility for all encoding formats.

|	PL LIGHT SCAN & ENCODE	PL LIGHT	PL 30000
SCOPE OF OPERATION			
Barcode reading	■	■	■
Chip encoding	■	■	■
Printing		■	■
Cutting			■
Verification	■	■	■
UPH	up to 50000	up to 50000	up to 30000
FREQUENCIES			
UHF	■	■	■
HF	■*	■*	■
NFC	■	■	■
MATERIALS FORMAT			
Max. product width	150 mm	150 mm	250 mm
Labels on reel	■	■	■
Tickets on reel	■	■	■
Singulated Tickets/Tags	■	■	
Reel to ticket			■
PRINTING			
max. dpi		600	600
Mono color		■	■
Multi color			■
OUTPUT FORMAT			
On reel	■	■	■
On belt	■	■	■
Bad ticket removal	■	■	■

*depending on chip type

CHIP ENCODING & PRINTING

PROCESS FLOW
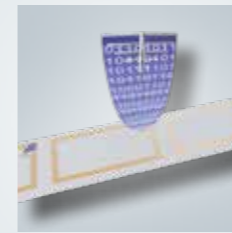
ENCODING
- Encode electronically data to each tag's RFID chip
- Data base containing all pertinent information
- For advanced encoding features such as password lock, perma lock and more
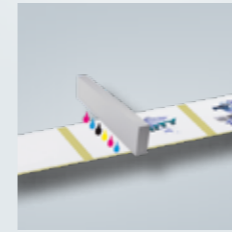
PRINTING
- High-speed digital print system
- Mono chrome or full colour
- Variable Data-Printing (VDP) capability

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

VERIFICATION & TESTING
- Every label will be tested for RF functionality and/or visual defects and/or data match
- Bad labels can either be visually marked or completely removed from the roll

MÜHLBAUER ENCODE FOR MAXIMUM FLEXIBILITY AND INDEPENDENCE (MCES)

Customer Database

MÜHLBAUER ENCODE

Database | Coding DLL:
- RFID Chip Specifics
- Encoding Algorithm

using Visual C#

RFID Reader

Chip

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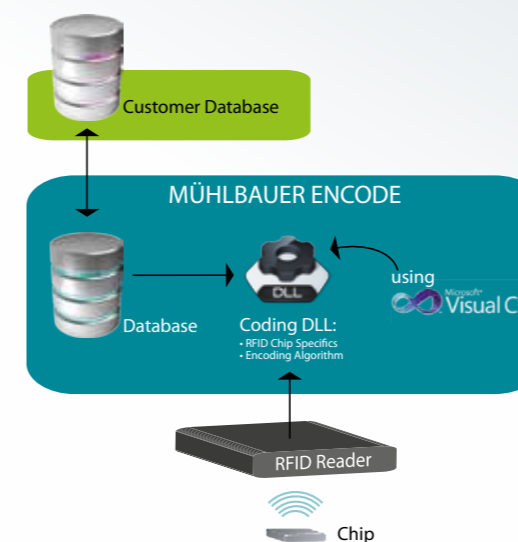
The personalization software MÜHLBAUER ENCODE is based on Microsoft Dynamic Link Library (DLL) and therefore allows the adaption to any RFID Chip and encoding algorithm.

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.

PL LIGHT SCAN & ENCODE

FASTEST & SIMPLEST ENCODING SOLUTION

Mühlbauer´s latest PL light Scan and Encode technology guarantees you a high speed encoding solution at minimal cost. The line represents the ideal machine for encoding and verification of tickets and tags with same high speed and 100% output control functionality test and automatic reproduction of rejected tickets. With the lowest footprint and effort the wide range of formats UHF or HF/NFC can be encoded.

HIGH SPEED ENCODING PAIRED WITH MINIMAL COST

BENEFITS

- Multi-job handling in one batch
- Highly efficient personalization line
- Low investment costs
- Small footprint
- License free encoding

M/MIN

| | 20 | 30 | 40 | 50 | 60 | |

FEATURES & ADVANTAGES

ADVANTAGES
- Wide range of encoding formats for UHF, HF of NFC
- MB ENCODE: Suitable for almost all chip types
- Ready for Industry 4.0 and the MB Palamax Software solution

WORKSTATIONS

Input spooler		Encoding
Trigger sensor		Verification
Barcode reader		Output spooler

CONFIGURATION FLEXIBILITY
- UHF, HF and NFC combined in one machine (dual frequency)

YOUR APPLICATIONS
- Individually personalized Single Tickets / Hangtags
- Individually personalized Labels / Tickets on reel

PL SCAN & ENCODE DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
4800	880	1630	660

SMART FACTORY
INDUSTRY 4.0 ENABLED

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
- Small footprint
- License free encoding

FEATURES & ADVANTAGES

ADVANTAGES
- Wide range of encoding formats for UHF, HF of NFC
- MB ENCODE: Suitable for almost all chip types
- Ready for Industry 4.0 and the MB Palamax Software solution

WORKSTATIONS

- Input spooler
- Trigger sensor
- Barcode reader
- Encoding
- Printing
- Verification
- Output spooler

CONFIGURATION FLEXIBILITY
- UV inkjet (600 dpi)
- UHF, HF and NFC combined in one machine (dual frequency)

YOUR APPLICATIONS
- Individually personalized Single Tickets / Hangtags
- Individually personalized Labels / Tickets on reel

RFID COMPETENCE

CONCEPT 2023

MB PALAMAX®

ANTENNA PRODUCTION

INLAY ASSEMBLY

CONVERTING

PERSONALIZAITON

PL LIGHT DIMENSIONS

M/MIN

20	30	40	50	60

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
5700	100	1780	817

SMART FACTORY
INDUSTRY 4.0 ENABLED

Retail RFIDTag
EPC: E2 123 456 7890123456789012
Style: a_shirt
Price: $23.45
Size: XL
Color: white

PL 30000

Retail RFIDTag
EPC: E2 123 456 7890123456789012
Style: a_shirt
Price: $23.45
Size: XL
Color: white

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
- Highly efficient personalization line
- High flexibility through modular concept

FEATURES & ADVANTAGES

ADVANTAGES
- Automatic reproduction of rejected tags
- Efficient set-up and fast charge over differrent products
- Well proven MB cutting and lamination technology
- Wide range of encoding formats for UHF, HF of NFC
- MB ENCODE: Suitable for almost all chip types
- Ready for Industry 4.0 and the MB Palamax Software solution

WORKSTATIONS

Input spooler	Printing
Trigger sensor	Cutting
Barcode reader	Output spooler
Encoding	

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

YOUR APPLICATIONS
- Reel-to-reel personalization
- Reel-to-ticket personalization
- Individually personalized Single Tickets / Hangtags
- Individually personalized Labels / Tickets on reel

PL 30000 DIMENSIONS

Length (mm)	Depth (mm)	Height (mm)	Weight (kg)
4010	1500	1900	1835

M/MIN

10   20   30

SMART FACTORY
INDUSTRY 4.0 ENABLED

MÜHLBAUER GERMANY

Mühlbauer Group Headquarters
Josef-Mühlbauer-Platz 1, 93426 Roding, Germany
Phone: +49 9461 952 0, Fax: +49 9461 952 1101
info@muehlbauer.de, www.muehlbauer.de

MÜHLBAUER USA

Muhlbauer Inc.
226 Pickett's Line
Newport News, VA 23603-1366, USA
Phone: +1 757 947 2820, Fax: +1 757 947 2930
info@muhlbauer.com, www.muhlbauer.com

MÜHLBAUER MALAYSIA

Muehlbauer Technologies Sdn. Bhd.
No. 3 Jalan TU 62, Taman Tasik Utama,
75450 Melaka, Malaysia
Phone: +60 6 2517 100, Fax: +60 6 2517 101
info@muehlbauer.com.my, www.muehlbauer.com.my

MÜHLBAUER SERBIA

Mühlbauer Technologies d.o.o.
Evropska 17, 22300 Stara Pazova, Serbia
Phone: +381 22 215 5100, Fax: +381 22 215 5130
serbia@muehlbauer.de, www.muhlbauer.com

MÜHLBAUER CHINA

Muehlbauer Technologies (Wuxi) Co., Ltd.
No 23. Huayi Road, Wuxi New District
214135 Wuxi, Jiangsu, China
Phone: +86 510 8190 0100, Fax: +86 510 8190 0101
info@muehlbauer.cn, www.muehlbauer.cn

MÜHLBAUER SLOVAKIA

Muehlbauer Technologies s.r.o.
Novozámocká 233, 94905 Nitra, Slovakia
Phone: +421 37 6946 000, Fax: +421 37 6946 501
info@muhlbauer.sk, www.muhlbauer.com

MÜHLBAUER GMBH & CO.KG

Josef-Mühlbauer-Platz 1 | 93426 Roding | Germany
Tel.: +49 9461 952 0 | Fax: +49 9461 952 1101
Mail: info@muehlbauer.de | Web: www.muehlbauer.de