

AUTOMATION SOFTWARE

COMPETENCE OVERVIEW



CONTENTS

MÜHLBAUER GROUP AT A GLANCE.....	4
SOFTWARE SOLUTIONS	6
AUTOMATION SOFTWARE SOLUTIONS	8
PRODUCTION & PROCESS MANAGEMENT	
MB PALAMAX®	10
MB INCAPE.....	14
PERSONALIZATION MANAGEMENT	
MB MCES	16
MB MCES Software Development Kit.....	18
MB CHIP CODING Applications for ID Documents	20
MB CHIP CODING Applications for Telecom, Access Control, Transport & Ticketing	22
MB IMAGE ENHANCEMENT.....	24
EMV SOFTWARE SOLUTION	
MB XENO FLEX	26
MB CARD-INK.....	28
MB EMV PERSONALIZATION.....	30
MB EMV INITIALIZATION	32
MB CPT3000V3 / ICPT.....	34
MB XENO-LINK	36
MB XENO-FAST.....	38
MB CMKS.....	40
SOFTWARE MAINTENANCE CONTRACT	42



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 Solutions & Equipment for Security Systems, and innovative Technologies for Electromobility and Flexible Solar Solutions. With around 4,000 employees, technology centers in Germany, Malaysia, Slovakia, the U.S. and Serbia, and 35 sales and service locations worldwide, Mühlbauer created a strong competence network around the globe.

Our global corporation continuously invests in the most modern innovations and creative ideas in order to enhance our competences and to provide you with optimized solutions. We aim to protect the environment with our advanced technologies and make life easier for countless people.

Our in-house precision part production **MPS** – Muehlbauer Parts & Systems – guarantees unlimited flexibility and highest customer satisfaction.

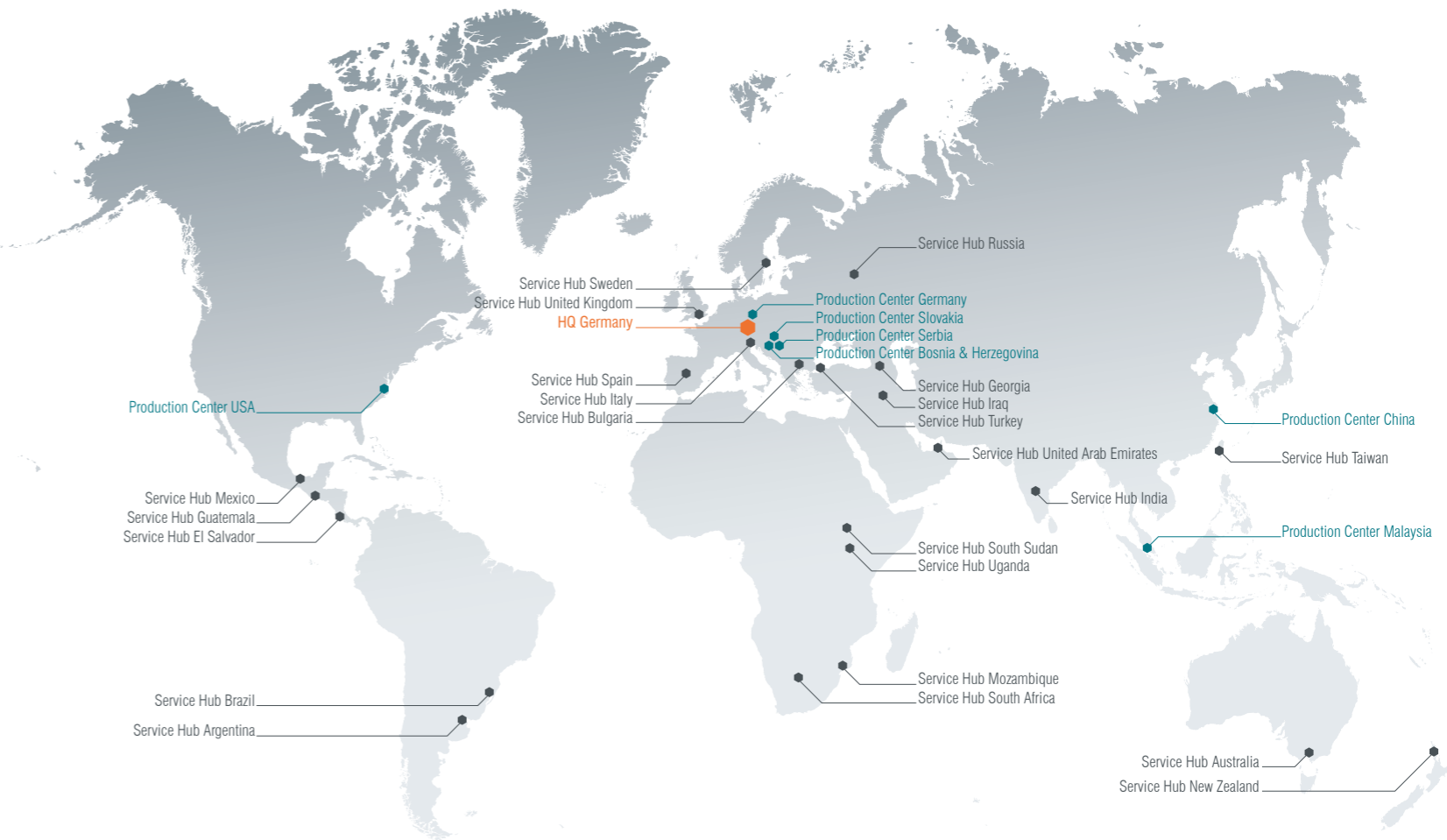
Our business unit **AUTOMATION** does not only develop and assemble individually customized production systems, but also offers intelligent software solutions for production automation

(Industry 4.0). Vision inspection technologies as well as semi-conductor and RFID applications complete our comprehensive portfolio.

Our youngest and currently most dynamic division **ATECH** – **Advanced Energy Technologies** – brings unique machinery requirements to series production. For the eMobility industry, we have been offering highly efficient production lines for the manufacture of pouch- and prismatic cells for lithium-ion batteries, as well as MEA's & stacks for fuel cells since 2022. Another promising area in this business field is our expertise in precise reel to reel material handling, which enables us to provide innovative production concepts for flexible solar cells and panels.

Our business unit **SECURITY**® 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.

There is no "can't do" at Muehlbauer. We tailor your solution!



Mühlbauer
Bosnia & Herzegovina



Mühlbauer
China



Mühlbauer
Germany



Mühlbauer
Malaysia



Mühlbauer
Serbia



Mühlbauer
Slovakia



Mühlbauer
USA



MPS
Precision Parts & Surface Engineering



AUTOMATION
Production Equipment & Systems



MB ATECH
Battery & Fuel Cell Technologies



WORLD OF SECURITY®
Government & Technology Solutions



SOFTWARE SOLUTIONS

MB MCES PERSONALIZATION MANAGEMENT SYSTEM

MB MCES is a personalization management software, which integrates incoming data with product definitions and controls the associated physical and electrical personalization processes. MB MCES handles personalization data from a variety of different input methods and formats.

MB INCAPE PRODUCTION MANAGEMENT SOFTWARE

MB INCAPE is Mühlbauer's Production Management Software for the production and personalization of electronic cards and documents (e.g. ID cards, ePassports, Driver's Licenses, EMV or GSM cards). Combining data management, production control and material management, the system allows for highly automated processes. It processes customer- and application-specific production, personalization, quality control and document delivery scenarios with highest solution flexibility.

MB PALAMAX® TOTAL PROCESS TRANSPARENCY

MB PALAMAX®, Mühlbauer's Smart Factory solution, supports various applications from ID and document production over personalization to semiconductor backend and eMobility shop floors. It helps to monitor production data and makes it available for later processing, visualization and statistical analysis. This helps to uncover and realize efficiency boosts in your production system.

MB TOOL LEADER CONNECTOR BETWEEN SYSTEMS

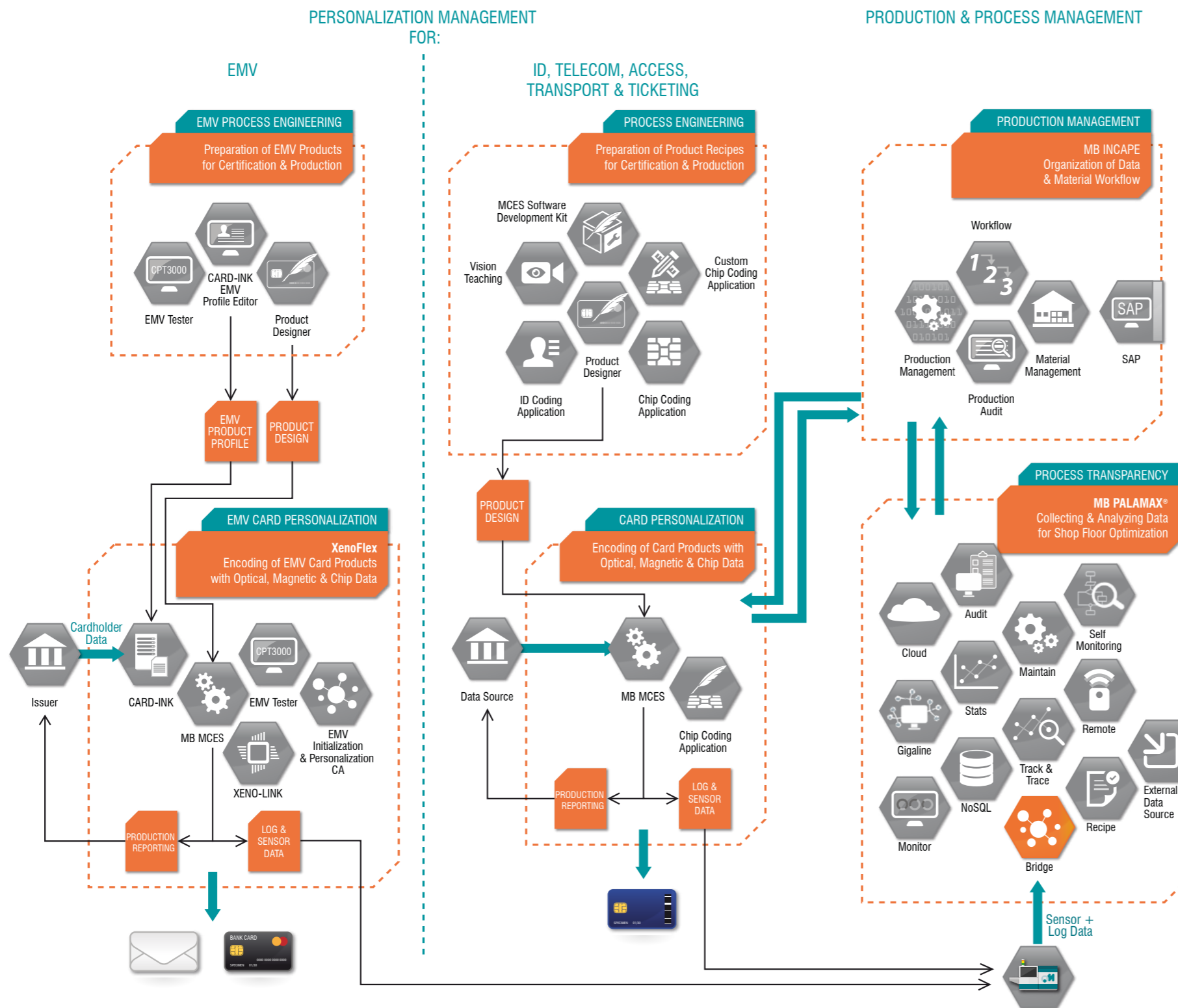
MB TOOL LEADER is a software package which consists of several applications and serves as a reliable link between the individual systems involved in the production process. By means of MB TOOL LEADER, the entire process chain – from the incoming order to the final precision part – can easily be monitored and controlled. This real-time machine monitoring guarantees an automated production process. Production errors can be detected and solved at an early stage. Thus, MB TOOL LEADER reduces the machine downtimes, which in turn leads to an increase of the machine's productivity by up to 20 percent.

FEATURES & ADVANTAGES

-  Configurable workflow steps regarding personalization, quality assurance & issuance
-  Fully-automated processing & production management
-  Scalability regarding different documents, machines & personalization locations
-  Flawless integration of Mühlbauer's material management system (MB INCAPE WAREHOUSE)
-  Connection to card / document management systems via web service, database, file-based interface
-  Standard interface to personalization machines with integration of third-party machines possible
-  Integration of MB USER MANAGEMENT
-  Full coverage of production control requirements (security industry & EMV standards)
-  Seamless connection to MB PALAMAX® & MB DATA PREPARATION
-  Simplified administration due to web-based operator clients
-  Monitoring of real-time performance of the production
-  Seamless tracking of documents from point of production to issuance
-  Statistical tool analyze collected data & deliver customized statistics on OEE
-  Tool which enables the remote operation of machines on the shop floor from a control centre
-  Tool which increases effectiveness & efficiency so that production becomes more profitable
-  Enables production engineering to prepare & test a repeatable factory set-up. Factories can switch between products within minutes.



AUTOMATION SOFTWARE SOLUTIONS



OVERVIEW AUTOMATION SOFTWARE SOLUTIONS

Mühlbauer has developed a broad range of government and industry-specific software solutions. Whether it is government ID management and personalization, vehicle licensing, parking management and control or complete EMV solutions for the banking sector. In addition, we support our customers in the GSM SIM and other special card personalization solution markets.

We have extensive experience in the use of cryptographic systems to implement user/customer authentication solutions and keep data secure in sensitive environments.

Mühlbauer has spent considerable effort in making the user experience of our software solutions intuitive and enjoyable. Our data preparation solutions are highly flexible and employ modern graphic user interface technology. In this context, we developed one of the best operator interfaces for our machines available in the market.

The accompanying map shows our software products in the areas of:

- Process Engineering
- Data Preparation & Processing
- Card Product Design
- MB CHIP CODING APPLICATIONS
- Personalization
- Validation Testing
- Collection & Processing of Shop Floor Data
- Production Planning

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

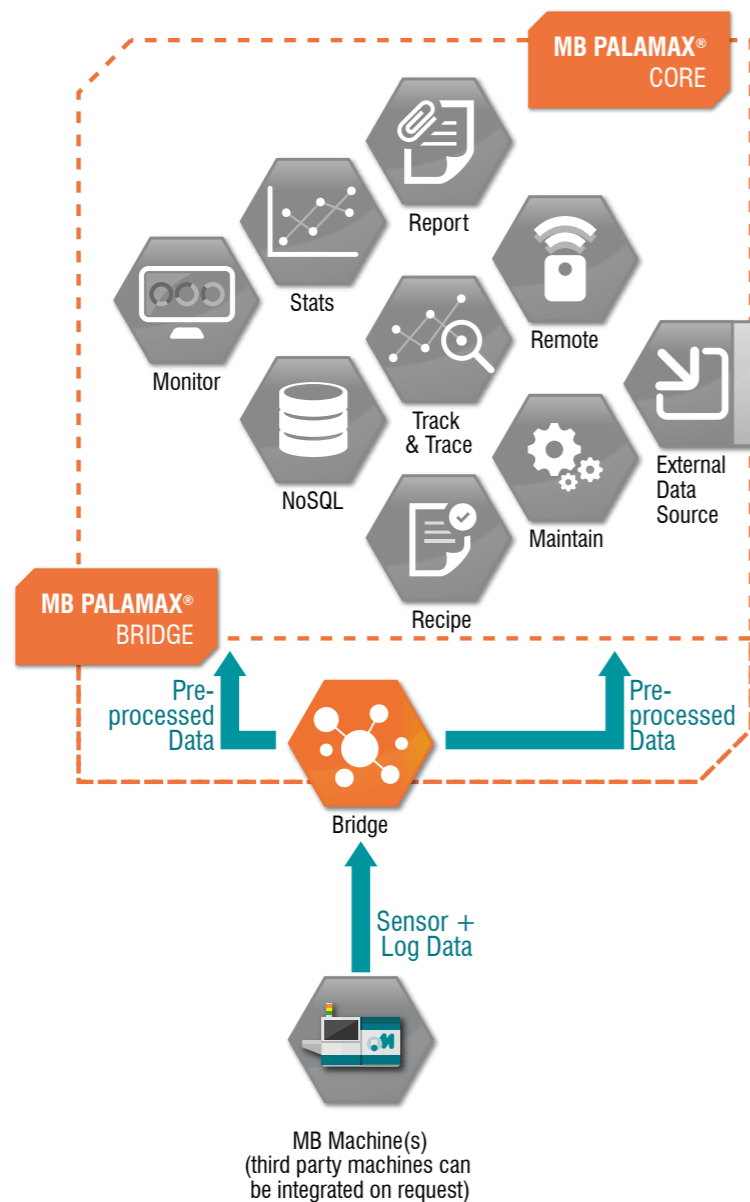
PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



MB PALAMAX®, Mühlbauer's Smart Factory solution, supports various applications from ID and document production over personalization to semiconductor backend and eMobility shop floors. Utilizing a NOSQL database, it is designed

to collect, process and analyze process data. This helps to monitor and improve your production. The collected process data is stored in batches for later processing, visualization and statistical analysis.



FEATURES & ADVANTAGES

INSTANT VISIBILITY

- Real-time KPIs at a glance: Overall Equipment Effectiveness (OEE), yield, performance, availability
- Visualization of all valuable machine data in real-time with interactive charts, graphs & more from any web-enabled device or PC
- Generation of informative reports
- Gives managers the insight they need to improve operations

RETURN ON INVESTMENT

- Spot trends & identify opportunities for improvement due to real-time monitoring
- Immediate intervention before major defects occur
- Production with optimally employed staff

SECURITY & COMPLIANCE

- Full control of data
- Your data is safe in your local IT infrastructure or in the cloud
- Compliance with ISO & PCI standards

ACCESSIBILITY

- Responsive web design
- No expensive installation of application software on the individual devices needed
- Accessible from any web-enabled device

KEY FEATURES

- Real-time production monitoring
- Generation of real production statistics with preferred KPIs
- Improved transparency
- Reception of better data to investigate, understand & portray process flows & relationships
- Production with optimally employed staff
- Intuitive & easy-to-use web interface
- Responsive user interface design for optimal presentation on any chosen device
- Data collection from the shop floor (Mühlbauer or third-party equipment)
- State-of-the-art big data software architecture for future reliability

MB PALAMAX® BRIDGE

- Universal data collector, handler and transformer
- Unlocks access to your machines
- Natively integrates with MB machines
- Integration of 3rd party machines on demand
- Integration with 3rd party MES on demand

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



MB PALAMAX® CORE MODULES



PALAMAX.MONITOR

Monitors the real-time performance of the production



PALAMAX.STATS

Statistical tool which analyzes collected data & delivers customized statistics on OEE



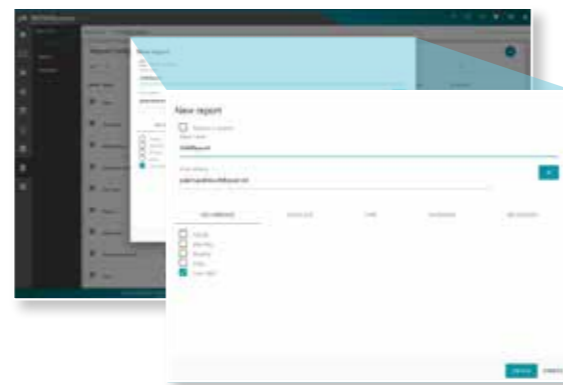
PALAMAX.FACTORY-OVERVIEW

Production overview displays general status of machines. The text fields within the tile show the most important metrics and meta-data of the machine.



PALAMAX.REPORT

Track and document productivity with the MB PALAMAX® reporting module. The automated data collection delivers unbiased and accurate reports without the need for any manual data entry.



OPTIONAL MODULES

MB PALAMAX® can be extended according to your needs



PALAMAX.REMOTE

Enables the remote operation of machines on the shop floor from a control centre

- Centralized, direct access to all machines
- Enables time & manpower savings
- Improved staff efficiency & security



PALAMAX.TRACK&TRACE

Allows for the auditing of single manufacturing runs

- Allows the comparison of different manufacturing runs
- Detection & definition of reasons for production faults
- Better & more useable information about the production process



PALAMAX.MAINTAIN

Enables the implementation of preventive maintenance

- Enables planning of production down times in a deterministic manner
- Supports more efficient maintenance planning
- Saves maintenance costs due to the precise determination of the actual need



PALAMAX.COST

Increases effectiveness & efficiency so that production becomes more profitable

- Easier comparison of different production routes for the same product
- Tighter cost control enables profit



PALAMAX.RECIPE

Enables production engineering to prepare & test a repeatable factory set-up.

Factories can switch between products within minutes.

- Reduces setup times of products on the shop floor
- Ensures the repeatability of produced with qualified qualities
- Enables more comprehensive & specific production

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

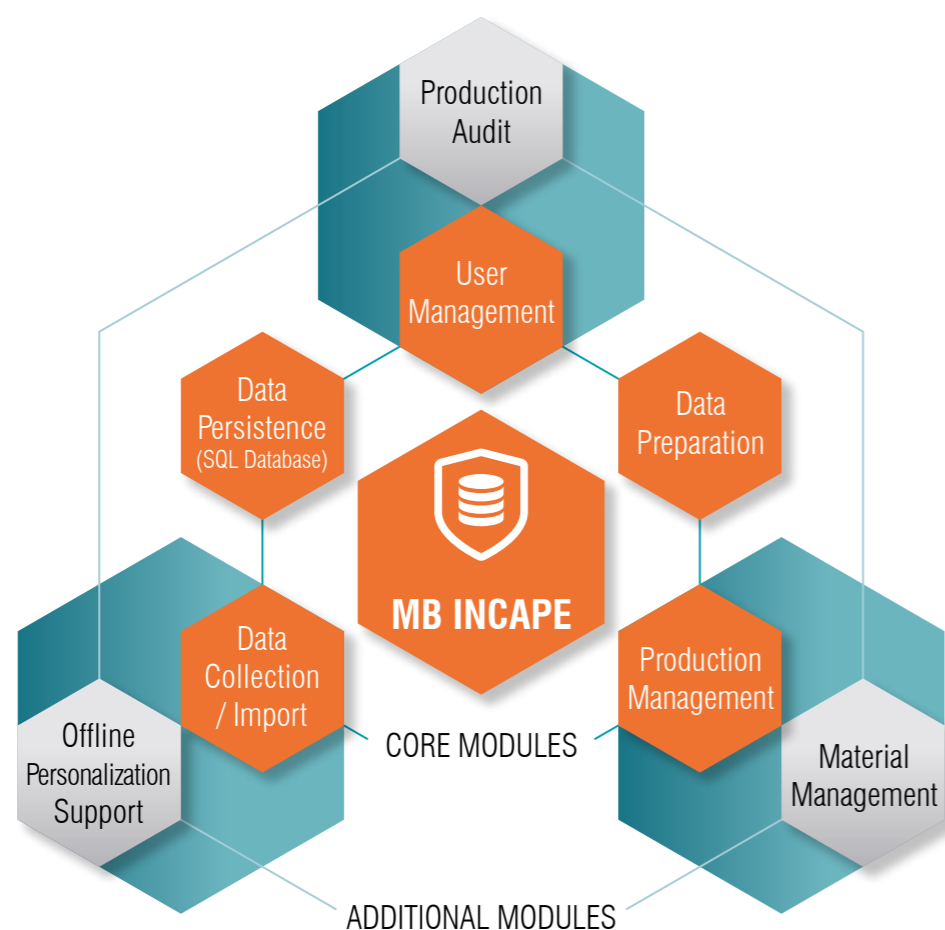
PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS




MB INCAPE is Mühlbauer's Production Management Software for the production and personalization of electronic cards and documents (e.g. ID cards, ePassports, Driver's Licenses, EMV or GSM cards). Combining data management, production control and material management, the system allows for highly automated processes. MB INCAPE's architecture consists of a modular concept to fulfil the needed scalability in all kinds of

document body production steps, as well as in all types of personalization characteristics, for example centralized and decentralized processes, various types of personalization machines or application-specific data preparation scenarios. It allows to process customer- and application-specific production, personalization, quality control and document delivery scenarios with highest solution flexibility.



FEATURES & ADVANTAGES

-  Configurable workflow steps regarding personalization, quality assurance & issuance
-  Fully-automated processing & production management
-  Simplified administration due to web-based operator clients
-  Customizable UI regarding localization, internationalization & branding
-  Scalability regarding different documents, machines & personalization locations
-  Seamless tracking of documents from point of production to issuance
-  Flawless integration of Mühlbauer material management (MB WAREHOUSE)
-  Connection to card / document management systems via web service, database, file-based interface
-  Standard interface to personalization machines with integration of third-party machines possible
-  Integration of MB USER MANAGEMENT
-  Full coverage of production control requirements (security industry & EMV standards)
-  Seamless connection to MB PALAMAX® & MB DATA PREPARATION

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS





MB MCES




PERSONALIZATION MANAGEMENT SYSTEM

MB MCES is a personalization management software, which integrates incoming data with product definitions and controls the associated physical and electrical personalization processes. MB MCES handles personalization data from a variety of different input methods and formats and applies them to the cards,

regardless whether magnetic stripe, chip encoding, or one of the various optical personalization processes such as thermo-transfer printing, laser engraving, embossing or indent printing. MB MCES manages all personalization processes within only one software system.



FEATURES & ADVANTAGES

-  Product Designer: different layout & product design for individual products
-  In-line card data testing, data pre-test, sample post-test & full test
-  Flexible reporting
-  Vendor-independent position through powerful SDK
-  System simulator
-  Multiple data input formats
-  Chip OS-specific coding applications
-  Configurable payment application scripts
-  High-secure document & data processing
-  User configuration
-  Messenger page displays all production data & incidents

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



The MB MCES Software Development Kit gives you the independence to add new hardware or software components to MB MCES. It provides all necessary libraries and wizards for a smooth start of your development. Microsoft®'s Visual Studio is a feature-rich IDE (Integrated Development Environment) and

helps you to flawlessly develop your customized MB MCES components. The MB MCES Software Development Kit seamlessly integrates with the MB MCES System Simulator to provide you a reliable and easy-to-use debugging and testing environment.



KEY FEATURES

- Rapid in-house development: Development of own software components for MB MCES platform
- Quick & cost-effective response to new market demands & opportunities
- Test & pre-production setup for flawless production
- Microsoft® Visual Studio as reliable development IDE
- Simple & fast development of new key components, such as MB CHIP CODING APPLICATIONS, data exchange libraries, data matching libraries, personalization report generation & input data adapters

FEATURES & ADVANTAGES

MB MCES SOFTWARE DEVELOPMENT KIT (SDK)

The MB MCES Software Development Kit is a software package which provides a complete suite of tools and libraries to independently develop MB MCES software components for the MB MCES personalization systems.

The MB MCES SDK suite allows you to develop, enhance and test your own applications Dynamic Link Libraries (DLLs) for monitoring, reporting, data exchange as well as data matching and chip coding.

- Independent development of:
 - » Processing applications
 - » Interface extensions
 - » Monitoring libraries
 - » Data exchange libraries
 - » Data matching libraries
 - » Reporting libraries
 - » MB CHIP CODING APPLICATIONS
- Immediate reaction to changes of requirements or personalization system
- Reliable development & test tool in conjunction with the MB MCES Development Workstation & System Simulator
- Based on Microsoft Products:
 - » Microsoft® Visual Studio
 - » Microsoft® SQL Server
- Easy debugging & testing

MB MCES DEVELOPMENT WORKSTATION & MB MCES SYSTEM SIMULATOR

The MB MCES Development Workstation is a fully-fledged MB MCES System Simulator based on a normal MCES installation. The processing units or workstations are substituted by simulating processing units, except for the chip coding processing unit, which connects to a Mühlbauer card reader.

It is an essential tool for the process engineering in personalization centers, as it allows the testing of coding applications & payment application scripts on a real Mühlbauer card reader with a genuine target smart card.

This allows the preparing of work packages for actual Mühlbauer personalization systems on the personalization center's shop floor, without having to stop production for testing.

- Preparation of job setups
- Creating of layout files
- Adaptable to all purposes
- Offline test procedures (no effect on production)
- Simulation of interfaces to production management software
- Validation of updates & upgrades
- Installation according to existing or future personalization systems
- Integration of new personalization systems possible

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



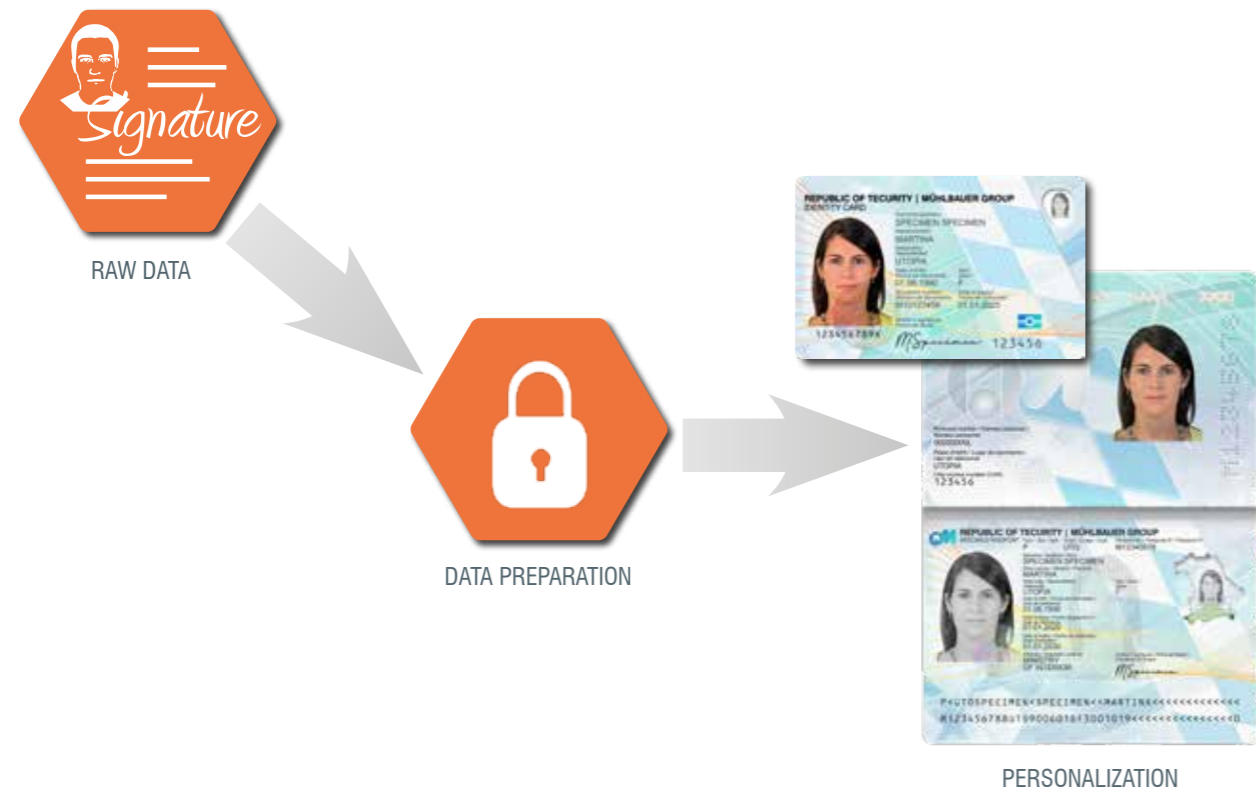


MB ID CHIP CODING

APPLICATION FOR ID DOCUMENTS

Mühlbauer's customized MB CHIP CODING APPLICATION guarantees the successful personalization of ICAO (International Civil Aviation Organization) compliant ID chip applications with BAC and SAC functionality or EAC functionality. Based on our broad experience and background in ID projects, we develop ID per-

sonalization applications according to your requirements with state-of-the-art technologies. Furthermore, we support you with our professional services during every step of the development process: specification, design, implementation and testing.



- Personalization of Basic Access Control (BAC) & Supplemental Access Control (SAC) or Extended Access Control (EAC) passports & ID cards
- Increased security: Uses PACE v2 (Password Authenticated Connection Establishment) & asymmetrical encryption
- SAC & EAC secure the chip access control mechanism & allow the usage of the Card Access Number (CAN)
- Mandatory for electronic passports issued in Europe from 2014 on
- Recommended by ICAO for all new issued passports worldwide
- Fully compliant to BSI (Federal Office of Information Security) & international standards
- Seamless transition: compatible to BAC
- Easy-to-use MB CHIP CODING APPLICATIONs, customizable to individual requirements
- No modification of personalization hardware necessary

FEATURES & ADVANTAGES



ICAO-compliant, electronic ID documents provide highest security for the identification and authentication of the cardholder. Electronic ID cards and passports have a security chip embedded, which stores personal and biometric cardholder data. Several security mechanisms protect the cardholder data against unauthorized access, in order to ensure the authenticity of the ID document and protect it against forgery.



BASIC ACCESS CONTROL (BAC) / SUPPLEMENTAL ACCESS CONTROL (SAC)

Basic Access Control (BAC) protects the chip against skimming (reading content from a distance) and ensures the information exchanged with the reading device is encrypted. BAC and PACE (Password Authenticated Connection Establishment), i.e. Supplemental Access Control (SAC), additionally strengthen the chip access control mechanism.



EXTENDED ACCESS CONTROL (EAC)

Extended Access Control (EAC) provides the full BAC functionality, but also includes several advanced security protocols like chip authentication (detection of cloned chips) and terminal authentication and provides additional security.

An ID chip personalization application takes the personalization information of the document holder and encodes it to the integrated chip in the security document, e.g. ePassport or ID card. The application securely encodes the chip's files and datagroups according to the individual project requirements. This results in a fully personalized and valid ICAO document.

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



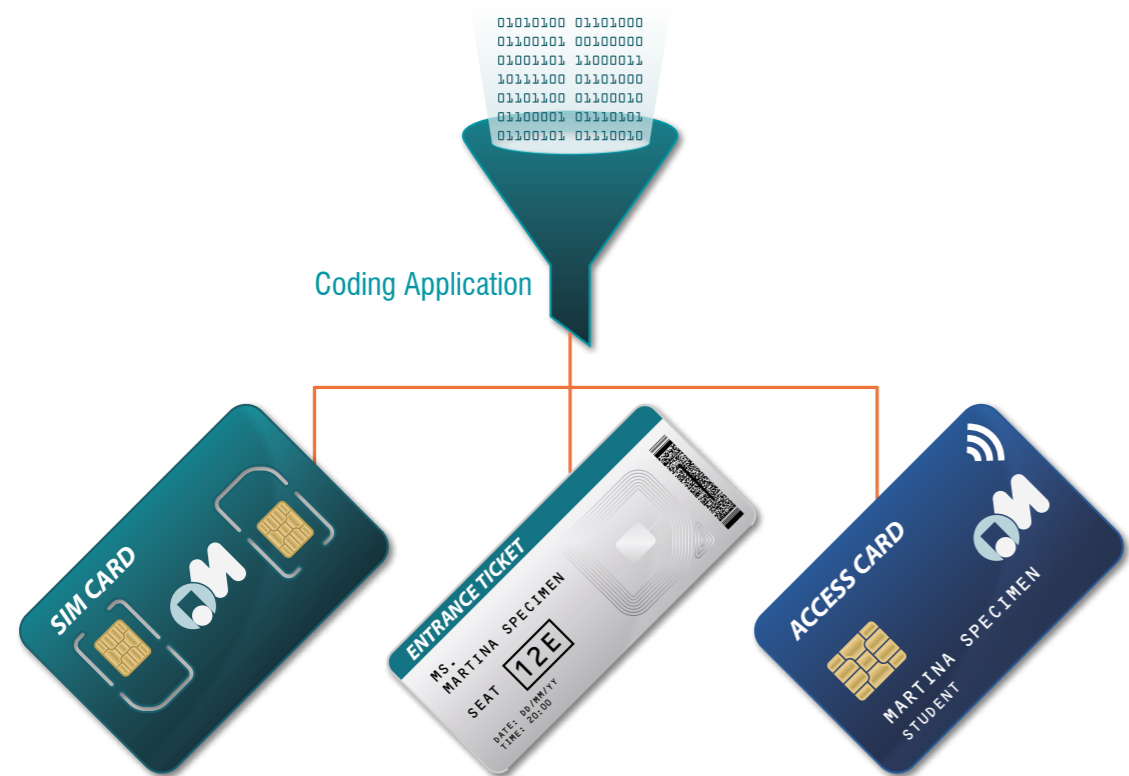


MB ID CHIP CODING

APPLICATION FOR TELECOM, ACCESS CONTROL, TRANSPORT & TICKETING

The MB ID CHIP CODING APPLICATION provides a tool for the chip initialization (pre-personalization with generic basic keys and applets) and the actual personalization (MB CHIP CODING APPLICATION) of a document-holder's specific set of application data. These coding applications are re-usable for different products within the same industry, like telecom or transportation. This simplifies the personalization set up of applications running in a specific chip operating system. The MB ID CHIP CODING APPLICATION tremendously speeds up product devel-

opment, because there is no need to involve a software developer or an external company. The same coding application may be reused for different products within the same industry. Mühlbauer does not charge any additional fees for this reuse, thus providing not only a high implementation speed but also flexibility to pursue smaller business opportunities and grow them. Mühlbauer has implemented a whole host of MB CHIP CODING APPLICATIONS: Multos, Java and a host of native Chip OS.



- MB ID CHIP CODING APPLICATION converts an incoming data set into the command stream of a chip
- Highest flexibility: MB ID CHIP CODING APPLICATION is a chip operating system adapter for chip application data
- Rapid product deployment: Encoding of all chips of one chip operating system type with the same coding application
- Easy change of chip supplier: No additional software license fees

FEATURES & ADVANTAGES



TELECOMMUNICATION

The Mühlbauer Telco Coding Application is a scripted download tool that can communicate with a range of different SIM silicon. The codes required for the download are supplied in form of a script file. The coding application uses this script file to upload a specified Application Data File, which is a binary image of the data to be written into the chip. This MB CHIP CODING APPLICATION is highly re-usable and easily adjustable to individual requirements at no additional cost.



TRANSPORT TICKETING

There are a number of well entrenched public transport ticketing chips available such as MiFare, CIPURSE, Calypso, or FeliCa. Mühlbauer has implemented custom personalization coding applications for many systems using these types of chips. Mühlbauer has already provided an SDK, or has implemented custom coding applications for such applications. In some cases, such fare apps can be easily added to other card applications, (e.g. Calypso in Java Cards) to create multi-application cards.



RETAIL CARDS

Retail cards are used to improve customer binding to a retail outlet by offering extra points for every purchase, to be redeemed later. Thus, retail cards are very similar in function to a standard foreign currency savings account and require a fair amount of administration from the issuing organization. Banks are set up for such business in their card management system. Therefore, such schemes can easily be administered in such systems and provide added value to banks and their retailers. Mühlbauer has already implemented coding applications or has provided SDKs for the development of coding applications for such schemes.



SPECIAL APPLICATION CARDS

Specialty card applications, company staff cards or university campus cards often support premium features by using a simple signed ID string which identifies an unique card. This authentication allows the provisioning of a wide variety of value added services like access control devices to open doors, to pay incidentals or sign out books at the library. Mühlbauer has already successfully implemented a number of such schemes or has provided the SDK tool set for it. This allows third-party solutions to cost-efficiently, easily and speedily integrate with a Mühlbauer personalization system.

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

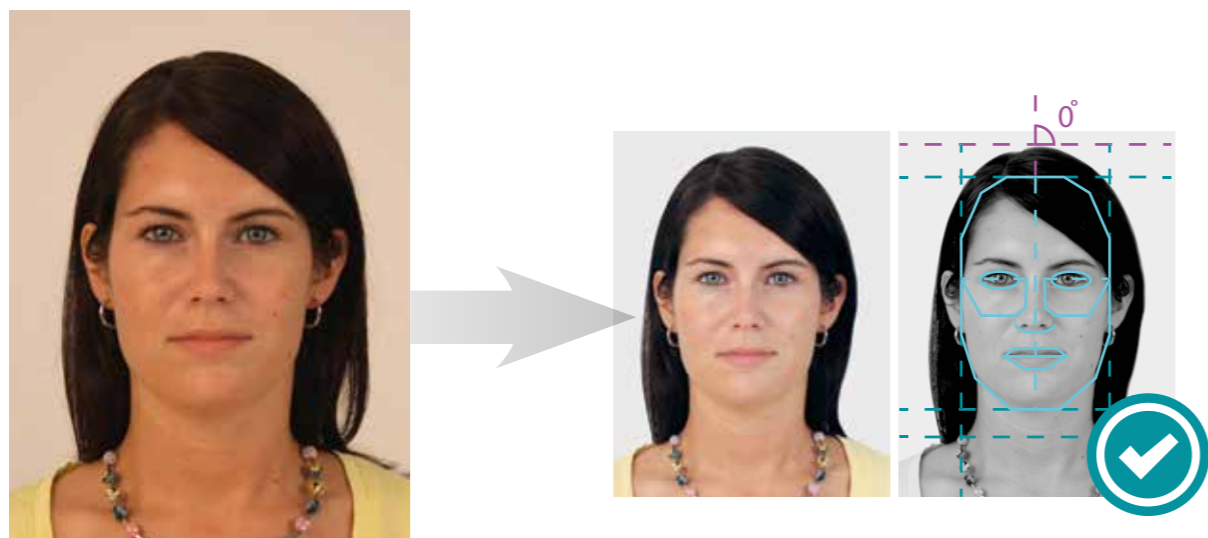
PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



MB IMAGE ENHANCEMENT is the most advanced feature in the market which – according to international standards – allows the fully-automated and/or manual enhancement and correction of

digitally captured images. This is necessary to ensure compliance with international standards such as ICAO.



FEATURES & ADVANTAGES

The MB IMAGE ENHANCEMENT software provides all the necessary features for the automated and/or manual processing of live-captured or scanned portraits:

-  Face recognition & extraction
-  Image cropping according to defined settings
-  Position correction (horizontally & vertically)
-  Color correction: adjusting color palette & white balance
-  Optimizing image appearance with lighting & shadow correction
-  Extracting the face from the background & inserting a new background
-  Checking & evaluating image quality according to ICAO recommendations
-  Easy-to-integrate into any software solution



Typically, a biometric facial image and the document's printed information are to be stored on a contactless, high-security microchip inside an identity document. The compliance with the ICAO Doc. 9303 standard ensures that facial portraits can be used for biometric face identification and verification.

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

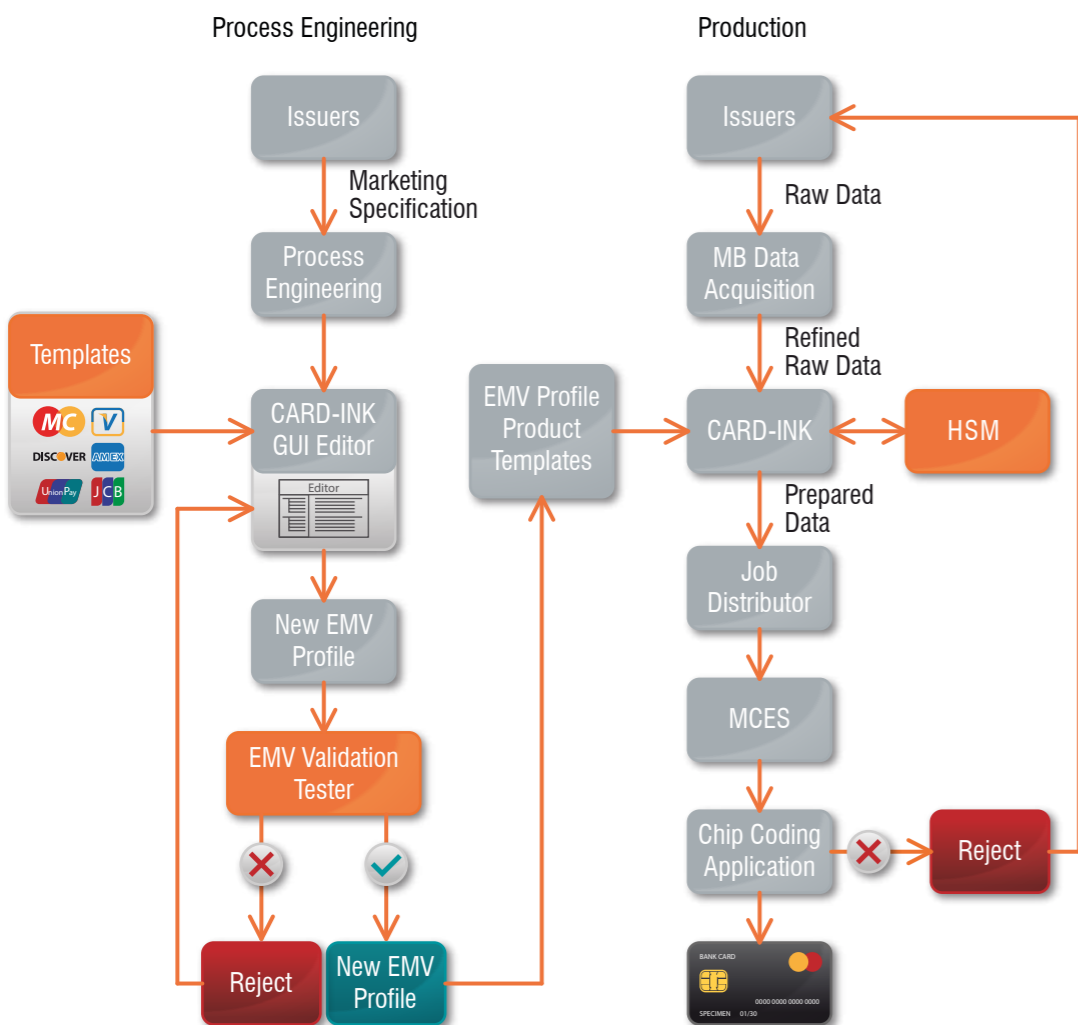
PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



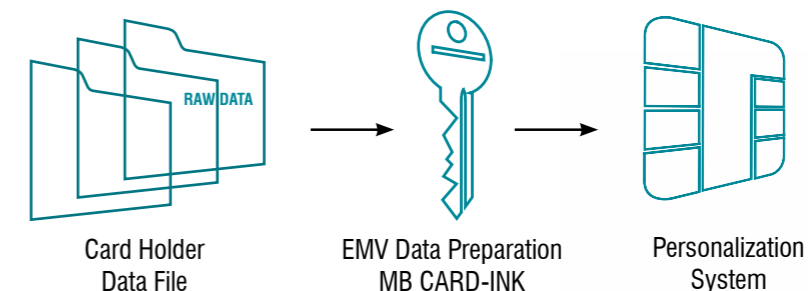
Mühlbauer's EMV solution provides an easy and cost-efficient way to produce EMV products. A key feature is the Chip Operating System (COS) of the chip personalization application. By means of different applets which use the same personalization

application, it allows for the personalization of chips. Mühlbauer has implemented a large number of such applications for various different chip operating systems on the MULTOS and Java card platforms, as well as Native OS from many different vendors.



FEATURES & ADVANTAGES

- Centralized data preparation
- Industrial grade personalization equipment
- Support for
 - » Contact, contactless & dual interface cards
 - » Credit, debit & prepaid cards
 - » Non-EMV banking cards
 - » Magnetic stripe cards
- Hybrid operation
 - » Centralized
 - » Decentralized
 - » Instant
- Open solution
 - » Open interfaces
 - » Excellent documentation available
 - » Open APIs (Software Development Kit)
- Technology transfer
 - » Installation support
 - » Training
 - » Consulting



COMPONENTS

- Data acquisition: Intuitive production setup of personalization equipment. The application accepts & transforms raw cardholder data
- MB CARD-INK data preparation: Processes raw cardholder data for personalization – for a fast and easy way to prepare all the personalization data
- EMV MB CHIP CODING APPLICATION: converts EMV personalization data into the correct APDUs for the chip operating system
- EMV framework in combination with FIPS 140-2 Level 3 Hardware Security Modules (HSM) for secure usage & storage of cryptographic keys & secure re-encryption of secret data

MAIN FUNCTIONS

- Built-in support of XML, P3, DC & text-formatted input files
- Quick reaction & rapid product development: GUI tool for quick, easy & free creation of new card profiles
- Rapid product deployment:
 - » one coding application per Chip OS
 - » encoding of all chips of one Chip OS type
- Independence: no need for source code modifications for new EMV profiles
- Cost efficiency:
 - » No extra costs or limitation of number of issuers & EMV profiles
 - » No costs for additional machines, card products, chips or additional sites
 - » No annual or usage-based costs

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

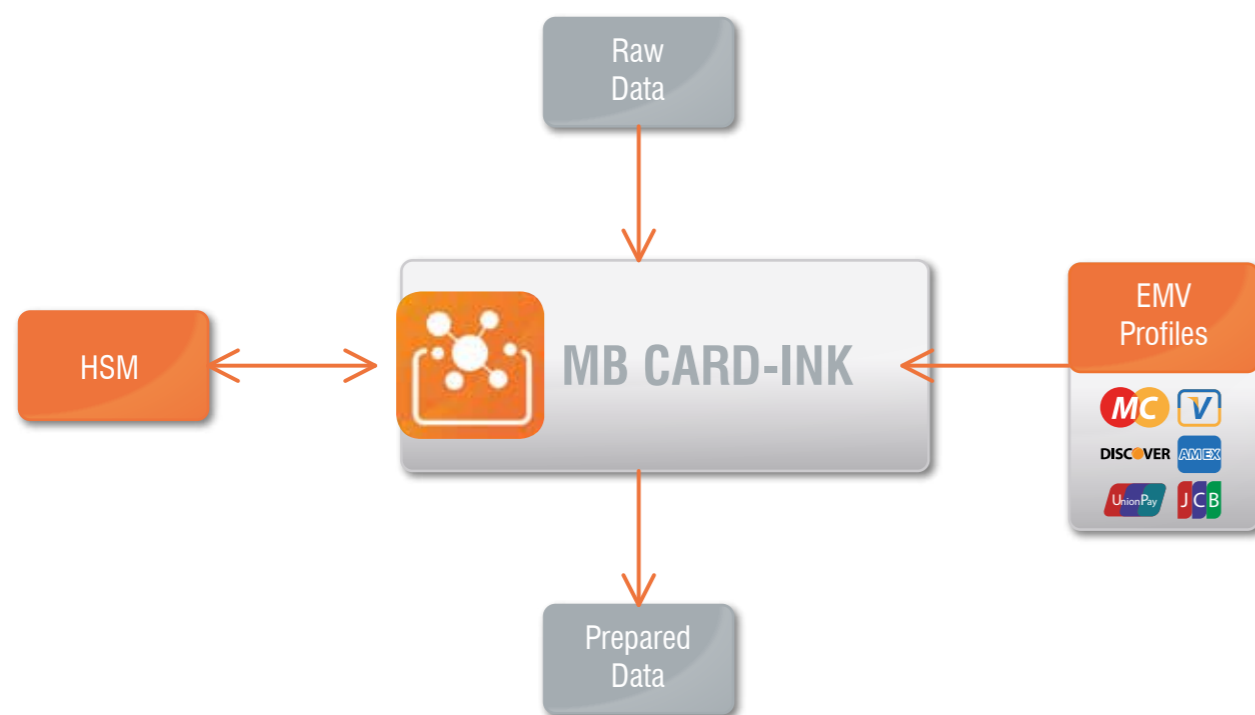
PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



MB CARD-INK is one of the key elements in the MB XENO-FLEX EMV personalization tool chain. It takes raw card data to generate prepared data which is ready to be written to a document or card. It can prepare data for all types of personalization processes, i.e. embosser, magnetic stripe or chip. New EMV profiles or product templates can be prepared without involving a programmer to modify the source code or waiting for a company to perform this work.

The combination of MB CARD-INK and Mühlbauer's EMV Validation Tester is a complete product development process which allows the creation, test and improvement of your individual description. This process is not only fast and reliable, but it can also be done in a easy-to-use Graphic User Interface Profile Editor. MB CARD-INK is implemented in about 100 highly successful personalization centers around the world.



MB CARD-INK is an EMV data preparation system, which offers best-of-breed centralized data formatting and key management while maintaining flexibility to meet any card issuing environment (e.g. mag stripe, chip, single- and multi-applications, instant issuance, NFC). MB CARD-INK is used by bureaus, data processors and card issuers alike.

MB CARD-INK comes with a user-friendly graphical application editor. With this, an operator can configure the TLV structure of the data for individual applications based on built-in application

templates. This feature makes it possible to design customized applications within the frameworks of the supported international standards.

Parameterization of single- and multi-application smart cards is easily done through the concept of card profiling. It is possible to graphically design the data structure of a multi-application smart card by determining which applications and default operational parameters to use.

FEATURES & ADVANTAGES

- Quickest data preparation solution: MB CARD-INK is extremely scalable, perfect for high-volume production and also suitable for small-scaled production environments
- MB CARD-INK is the most comprehensive EMV data preparation solution in the market
- MB CARD-INK is used by more than 100 customers across the globe
- HSM vendor and card platform independent: MB CARD-INK is the only major system which supports:
 - » Global Platform
 - » Multos
 - » Native, proprietary Chip Operating System (COS)
- Highly versatile through product templates
 - » Easy to modify EMV product templates via Graphic Profile Editor
 - » No limitation in the amount of data preparation products
- Multi-issuer and multi-card scheme support

TECHNICAL SPECIFICATION

Applications supported:

- MasterCard M/Chip, CAP, PayPass, Advance
- Visa VSDC, VSDC SDA & DDA (VIS), qVSDC
- AmEx AEIPS, Mag stripe & PIN, Expresspay
- EMV Common Payment Application
- BMS Monéo
- Discover D-PAS
- Diners
- Interac
- SAMA SPAN2
- SIA Bancomat
- China UnionPay

Platforms

- EMV
- GlobalPlatform
- MULTOS / MULTOS step one
- Native cards

Formats supported:

- Tag-Length-Value (TLV)
- Common Personalization (CPS)

Security architecture

- AES protected network communication
- Access control via smart cards
- Secure audit log

MAIN FUNCTIONS

Flexibility for:

- Card issuer – MB CARD-INK is suitable for in-house card production. The system offers security, stability, and low maintenance, and suits any card strategy.
- Card bureau – MB CARD-INK is the most versatile data preparation solution available imposing no limitation on the number of cards issued or issuers supported, hence guaranteeing a high return of investment. The system is easy to set up, so that bureaus can instantly issue cards across a number of different issuers and payment brands.
- Management of cryptographic keys related to data preparation. All keys are handled in HSMs and MB CARD-INK providing secure import / export facilities. This applies to 3DES and RSA keys and includes end-to-end certificate management. MB CARD-INK supports certificate requests for application provider certificate authorities.

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS

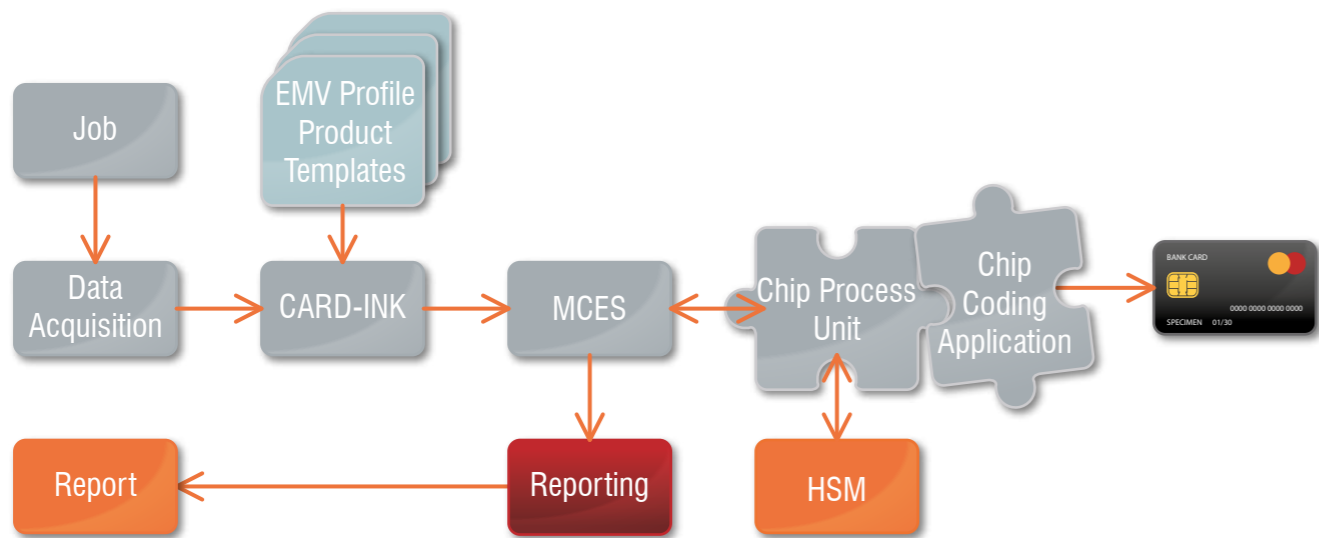


MB EMV PERSONALIZATION

SOFTWARE FOR EMV CHIP PERSONALIZATION

The MB EMV PERSONALIZATION Package provides a number of re-usable chip coding tools for chip personalization (MB CHIP CODING APPLICATION) of a card-holder specific set of application data for a specific purpose. These coding applications are re-usable for different products. This simplifies the personalization set up of EMV chips for specific Chip Operating Systems. This philosophy does not only protect, but it also tremendously speeds up product develop-

ment, as there is no need to involve a software developer or an external company. Different EMV products can re-use the same coding application without additional charges, giving you not only implementation speed, but also flexibility to pursue smaller business opportunities and grow them. Mühlbauer offers a whole host of MB CHIP CODING APPLICATIONs: Multos, Java and many of native Chip OS.



COMPONENTS

- EMV crypto framework
- Hardware Security Module (HSM)
- MB EMV PERSONALIZATION application

FEATURES & ADVANTAGES

- Highest flexibility: EMV coding application as converter of abstract data tree into Chip OS specific commands of a chip
- Easy & cost-efficient EMV chip personalization
- Rapid product deployment: Encoding of all chips of one Chip OS type with the same coding application
- Easy change of chip supplier: No additional software license fees

MB EMV PERSONALIZATIONPACKAGE:

The Mühlbauer EMV PERSONALIZATION Package is the ready-to-go set of components to enable equipment to personalize the chips of EMV cards or modules. The particular EMV package consists of the EMV crypto framework, an EMV MB CHIP CODING APPLICATION and a report logger.

CURRENTLY SUPPORTED CHIP TYPES FOR EMV PERSONALIZATION:

MULTOS

- MULTOS Step One
- MULTOS Full

JAVACARD / CPS (SUPPORT OF ANY JAVACARD OR CPS; PLEASE FIND A SELECTION BELOW)

- Gemalto Clarista (GemXpress)
- Optelio
- Infineon SecoraPay
- Idemia Cosmo
- Kona I Kona
- NXP JCOP 2, JCOP 3, JCOP 4
- Redsys Advantis J Pay, Advantis Private
- ST Micro STPay, STPay-BlueAmber, STPay-Tiger
- UbiVelox Ucard

NATIVE

- AustriaCard (ACOS)
- Gemalto Clarista (eGalleon)
- Redsys Advantis, Advantis Crypto Advantis JPay

CODING TIMES

Depending on the Chip OS and the amount of data, the personalization time is approximately between 5-15 seconds per application.

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS

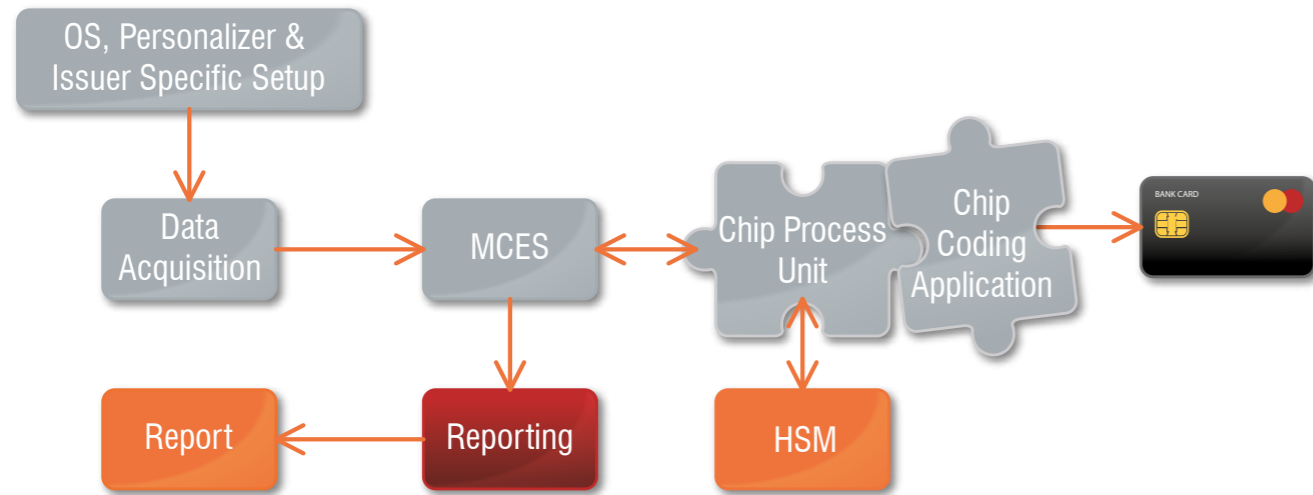


MB EMV INITIALIZATION

SOFTWARE FOR EMV CHIP INITIALIZATION

The MB EMV Initialization Package provides a number of re-usable chip coding tools for chip initialization (pre-personalization with generic basic keys and applets) of a cardholder – specific set of applications for a specific purpose. These coding applications are re-usable for different products within the same industry. This simplifies the personalization setup of EMV chips for specific chip operating systems. The advantage is that this philosophy protects your investment.

It tremendously speeds up product deployment, because there is no need to involve a software developer or an external company. The same coding application can be re-used for different products without additional charges – a fact which provides not only implementation speed, but also flexibility to pursue smaller business opportunities and grow them. Mühlbauer has implemented a whole host of chip coding applications: Multos, Java and many native Chip OS.



COMPONENTS

- EMV crypto framework
- Hardware Security Module (HSM)
- EMV initialization application

FEATURES & ADVANTAGES

- Key rotation from factory key to personalizer & issuer-specific key
- Change of card state of chip operating system initialized
- Update of Card Production Life Cycle Data (CPLC) with initialization information
- Re-usable for all applications of one chip operating system
- Capable of loading additional applets into JavaCard operating system (.CAP file)

EMV INITIALIZATION PACKAGE:

The Mühlbauer EMV Initialization Package is the ready-to-go set of components to enable equipment to initialize the chips of EMV cards or modules. The particular EMV package consists of an EMV crypto framework, an EMV MB CHIP CODING APPLICATION and a report logger.

CURRENTLY SUPPORTED CHIP TYPES FOR EMV INITIALIZATION:

JAVACARD / CPS (ANY JAVACARD OR CPS IS SUPPORTED; PLEASE FIND A SELECTION BELOW)

- Gemalto Clarista (GemXpress)Optelio
- Infineon SecoraPay
- Idemia Cosmo
- Kona I Kona
- NXP JCOP P71
- ST Micro STPay, STPay-BlueAmber, STPay-Tiger
- UbiVelox Ucard

NATIVE

- AustriaCard (ACOS)
- Gemalto Clarista (eGalleon)
- NXP JCOP P60
- Redsys Advantis, Advantis Crypto Advantis JPay, Advantis Private

CODING TIMES

Depending on the Chip OS and the amount of initialization data, the initialization time is approximately between 1-5 seconds per chip.

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS





MB CPT 3000V3 / ICPT

EMV VALIDATION TEST

Mühlbauer offers the complete toolchain for the verification of EMV payment cards. The customer gets the best available test tools starting with the Resonance Frequency Tester for contactless cards which provides 100% measurement of resonance frequency, Q-factor and band width. The offline and online version of CPT3000v3 verifies EMV compliance of payment cards to banking clients, while banks

or card personalizers can rest assured not to ship any dead or faulty cards. The resulting personalization report contains the test result showing the type of EMV profile personalized and the validation result (pass/fail) for every tested card. This is a major step for the implementation of traceability and transparent quality control systems.



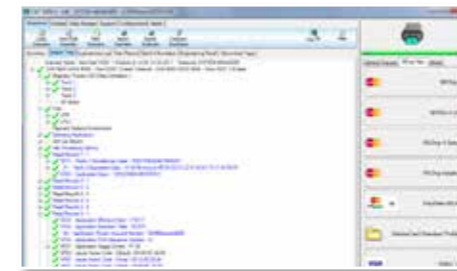
- Quick & accurate tests of personalization data in single or multiple applications on the EMV chip & magnetic stripe to ensure the data is correct and valid
- Test results include pass / fail data displays and detailed test result logs with hyperlinks to the EMV & payment scheme specifications
- Supports all EMV payment applications (contact / contactless)
- Developed in collaboration with Visa, MasterCard, Amex & other payment schemes
- Used by Visa, MasterCard, American Express, JCB, major banks & card bureaus globally

FEATURES & ADVANTAGES

To achieve payment scheme certification, card issuers must ensure that their cards comply with their chosen payment scheme's personalization requirements. To prevent the costly production of invalid EMV cards and delays in the formal card personalization process required by the payment

schemes, Mühlbauer's EMV Card Testing Solutions enables issuers and card personalization bureaus to validate and certify their cards against the latest payment scheme requirements and their own business requirements.

CPT 3000V3 – OFFLINE TESTER



Mühlbauer's EMV offline validation tester CPT 3000v3 is essential for all EMV chip card issuance, personalization, implementation and support operations. Chip and magnetic stripe data can be quickly verified for conformity to the complex and strict rules laid down by the payment system operators as well as to the issuer's own business requirements.

- Magnetic stripe / chip personalization data correlation validation
- Verification of mandatory data objects
- Test scenarios set up with centralized scenario management facilities
- Multi-application test & multi-interface scenario capability
- Report with test summary & individual fail / observations with explanatory annotations & hyperlink reference to applicable payment scheme specifications

ICPT – INLINE TESTER

The Inline EMV Card Test application allows the examination and testing of personalized cards. The testing process is executed inside a personalization system and operated in silent mode, without any user interaction. A hardware upgrade of the personalization machine is not necessary.

- Inline testing of personalized EMV banking cards for data integrity, plausibility & EMV standard compliance in less than 5 seconds
- Integration of validation station into the Mühlbauer personalization solution: No manual sample testing, no re-sorting of test samples into the card batch
- Almost no performance interference between chip personalization & card testing
- Zero-fault-delivery policy: Comprehensive performance testing conducted on all personalized cards
- Guaranteed delivery of validated cards – no shipping of any defective or faulty cards
- Personalization report contains the test result showing the type of EMV profile personalized & the validation result (pass / fail) for each tested card
- Labor saving & security improving product: Improves delivery quality due to reduction of human-error factor

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

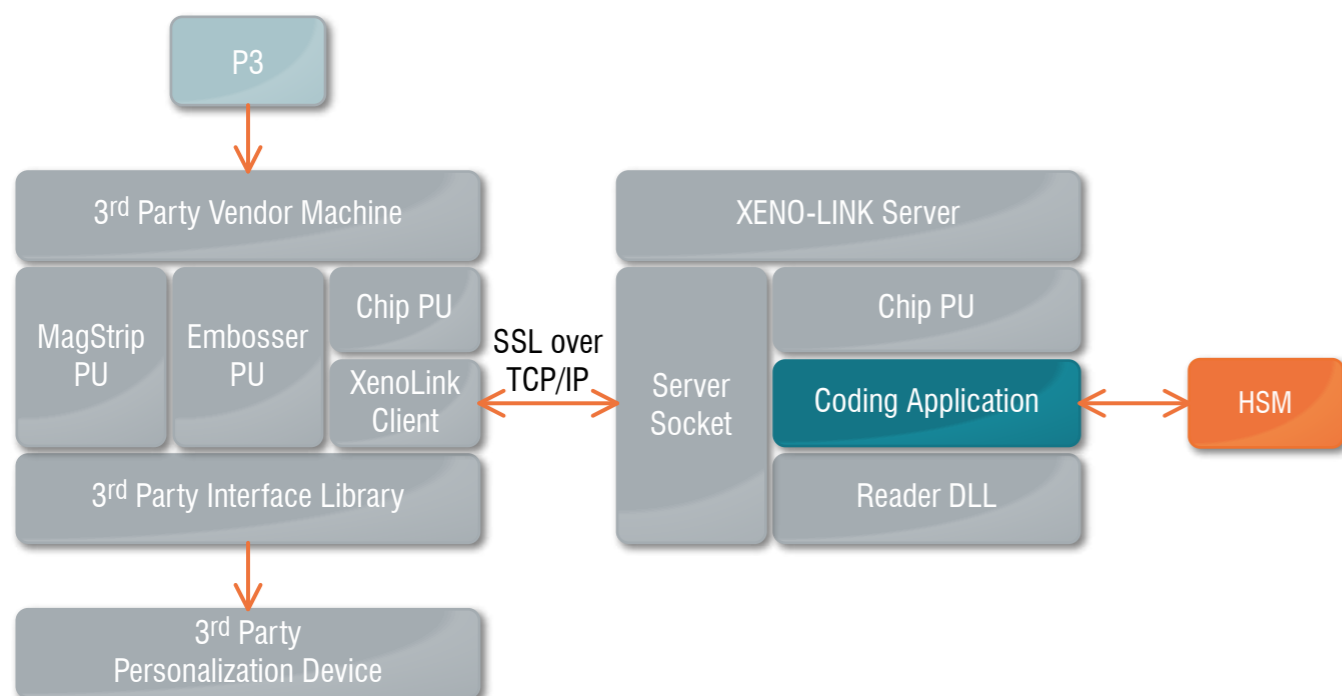
PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



MB XENO-LINK is a platform which offers an integrative and distributed approach to chip personalization. The distributed nature of MB XENO-LINK enhances the scalability and maintainability of chip personalization solutions for bigger personalization centers and for a set of small personalization offices

spread around a large geographical region. In both cases MB XENO-LINK helps covering the cost of maintaining MCES Coding Applications – independent of the number of affected personalization units.



- MB XENO-LINK job manager user interface (GUI) to generate & distribute personalization jobs
- Connectivity for MB XENO-LINK clients on personalization equipment
- Unified coding application code base throughout personalization center
- Execution of Mühlbauer coding applications
- Provision of connectivity to Key Management System & HSM
- Administration of clients & licenses
- Centralized MB CHIP CODING APPLICATION
- Centralized Hardware Security Module (HSM)

FEATURES & ADVANTAGES



MB XENOLINK SERVER

MB XENO-LINK is the chip coding server that uses Mühlbauer Coding Applications and runs them on any hardware that is integrated to support the MB XENO-LINK server. The MB XENO-LINK client implements the connection from the MB XENO-LINK server to the chip coding hardware. It encapsulates the communication from and to the card reader and communicates it to the MB XENO-LINK server. This allows the remote personalization of cards through the coding application from the MB XENO-LINK Server.



MÜHLBAUER CODING APPLICATIONS

MB XENO-LINK utilizes the concept of Mühlbauer coding applications in order to reuse coding logic already developed within existing coding applications. It adds a separation layer between the generation and the execution of the APDUs.

This layering concept enables the reuse of Mühlbauer coding applications on third-party personalization platforms. It supplies native coding applications which implement the XenoProtocol and execute all commands received from MB XenoServer on a target platform using the native smart card communication framework.

MB XENO-LINK CLIENT – 3RD PARTY MACHINE INTEGRATION

MB XENO-LINK enables personalizers to run the same code base on Mühlbauer personalization equipment as on third-party personalization machines.

Moreover, it provides the opportunity of setting up a unified operation of chip coding processes for the MCES personalization platform in heterogeneous personalization centers.

The MB XENO-LINK client is installed as a coding application on the personalization system and can be run in parallel to normal coding applications on the target platform.



OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

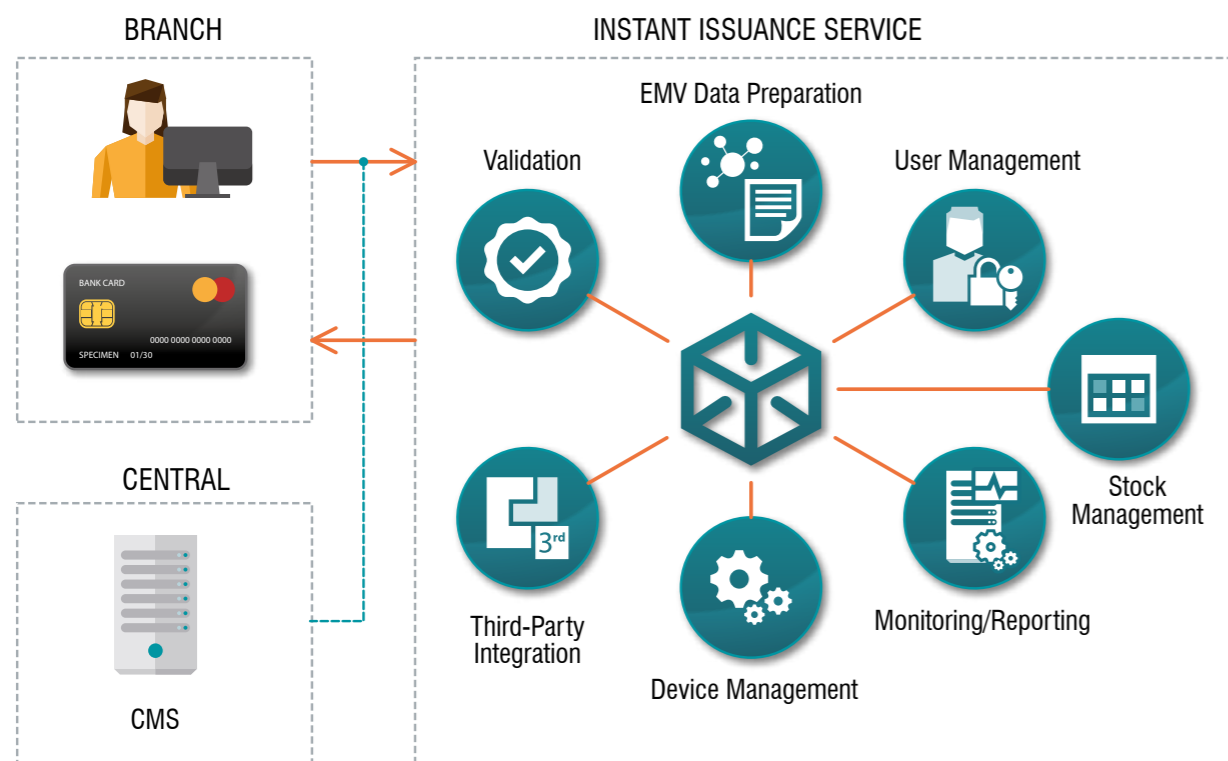
PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



MB XENO-FAST is a platform which offers an integrative and distributed approach to chip personalization. The distributed nature of MB XENO-FAST enhances the scalability and maintainability of chip personalization solutions for bigger personalization centers and for a set of small personalization offices

spread around a large geographical region. In both cases MB XENO-FAST helps covering the cost of maintaining MCES coding applications – independent of the number of affected personalization units.



- Strong user authentication & administration
- Inventory management
- Production reporting
- Auditing & tracking mechanism
- Cardholder PIN selection
- Centralized Hardware Security Module (HSM)
- Network diagnostic service
- Automatic update management
- Support of EMV cards: Chips of all leading chip providers
- Platform independence: Integration of any personalization device possible
- Interface to the bank core / card management system

FEATURES & ADVANTAGES



INSTANT ISSUANCE

Traditionally, bank cards, whether magnetic stripe or EMV, are personalized in batches, in a highly secure environment and usually at a centralized facility. Although this is an efficient and secure way, there are certain situations that require a different approach, for example instant issuance. With Mühlbauer's instant issuance system, cards are immediately produced and issued to the customer. This results in an improved cardholder experience and a higher degree of customer satisfaction, it allows emergency card replacement, reduces card delivery costs and allows banks to differentiate from their competitors.



Instant card issuance enhances customer satisfaction as customers receive their new or reissued card immediately. They can leave a bank branch with their new, fully functional card in a few minutes without having to wait several days.

Moreover, this way of card issuance allows customers to choose their own PIN and therefore eliminates the waiting time for a PIN mailer and the need to change the PIN later on. As a consequence, this way of card personalization can reduce the distribution costs and ensures that it is secure and reliable. As the new card is physically handed over to the cardholder, cards and PIN mailer do not have to be sent to the customers, for example by mail.



MÜHLBAUER'S INSTANT ISSUANCE SYSTEM ENABLES YOU TO:

- Improve the document owner experience by delivering differentiated card lifestyle products
- Increase the profitability & revenue of the cards issued: increased activation & utilization within seconds
- Enhance security with handover of fully tested & verified cards
- Prevent complex or costly delivery of cards
- Issue cards in new & different ways with support of major brands of personalization equipment
- Stay flexible & future proof with an open & modular system that can be extended at any time

The solution requires a minimum setup time, offers flexible customization capabilities and ensures low setup and running costs. The all-in-one solution combines magnetic stripe and EMV card data preparation, card personalization and issuance procedures.

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

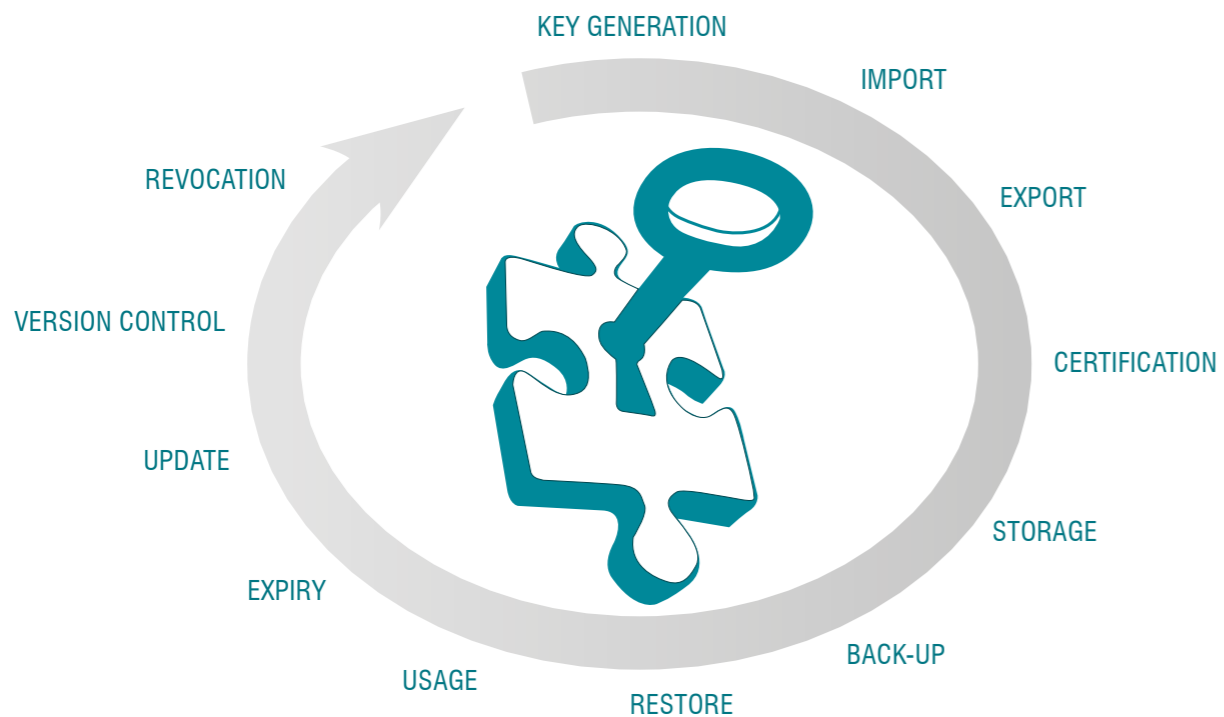
PERSONALIZATION
MANAGEMENT

EMV SOFTWARE
SOLUTIONS



MB CKMS (Central Key Management System) uses a client-server based architecture with shared HSMs to provide a centralized key management solution. The system is accessed by operators using desktop computers equipped with secure PIN pads for key component entry. An extremely flexible 'key-push' protocol allows the MB CKMS server to securely connect with practically any secure host system that supports exchange of cryptographic keys. Each key is assigned its current state and specific set of

attributes, including its history and general life-cycle management. MB CKMS facilitates efficient operation as it automates and optimizes the working processes according to the strictest set of security standards. Full compliance with all relevant industry and government regulations and best business practice is maintained throughout, with the added benefit of automated key management across multiple subsystems and a central view of all cryptographic keys within the business as a whole.



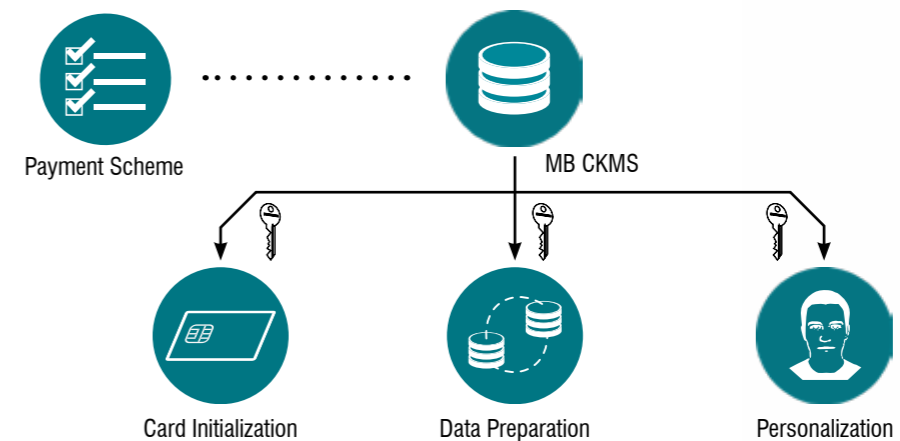
- Centralized life-cycle management of cryptographic keys & their related properties: Key generating, import, export, renewing, etc.
- Secure management of keys across multiple parties / key-zones
- Automated key distribution & updating of decentral key targets
- User-friendliness: Flexible at your desk key ceremonies & elimination of paperwork
- Secure: Automated & tamper-evident audit logs are maintained for all keys, allowing complete accountability and the restoration of keys to a given state at any time
- Strong user authentication: Sophisticated user management system and user authentication via smart cards
- Time-saving: No more inefficient & time-consuming paper-based procedures & multi-party key ceremonies
- Various key targets: Data-preparation, card personalization systems, support of internal or network HSMs, etc.
- Fully compliant with all relevant industry & government regulations

FEATURES & ADVANTAGES

Across all industries, the requirements for managing cryptographic keys are become increasingly complex. Ensuring that the right key is in the right place at the right time is mandated by many organizations, i.e. major card payment scheme providers. This is a complicated requirement as most businesses need to manage an ever-increasing number of keys, while at the same time reducing the risk of internal and external fraud, as well as keeping costs at a minimum.

MB CKMS streamlines administration and reduces costs associated with traditional key management. Through its flexible and automated protocols, MB CKMS gives users the flexibility to manage a very large number of keys – throughout their entire life-cycle – without drowning in work. Using MB CKMS, administrators can uniformly and centrally manage the life-cycle of all cryptographic keys across a range of encryption platforms.

Keys can securely be generated and pushed to any key distribution target when required. Key custodians can use asynchronous log-ons to projects for adding components securely – a procedure which reduces the need for manual key ceremonies, while at the same time vastly improving workflows.



MAIN FUNCTIONS:

- Consolidated management: Security officers set up templates to manage logical sets of keys, exchange them with relevant parties (issuers, payment scheme etc.) and securely push them to their intended target when required.
- Reduced dependency: Asynchronous log-on allows for key custodians to add components securely as they are available.
- Demonstration of compliance: Tamper-evident audit logs are maintained for all keys, allowing for complete accountability and restoration of keys to a given state at any time.

OVERVIEW
AUTOMATION
SOFTWARE SOLUTIONS

PRODUCTION &
PROCESS
MANAGEMENT

PERSONALIZATION
MANAGEMENT

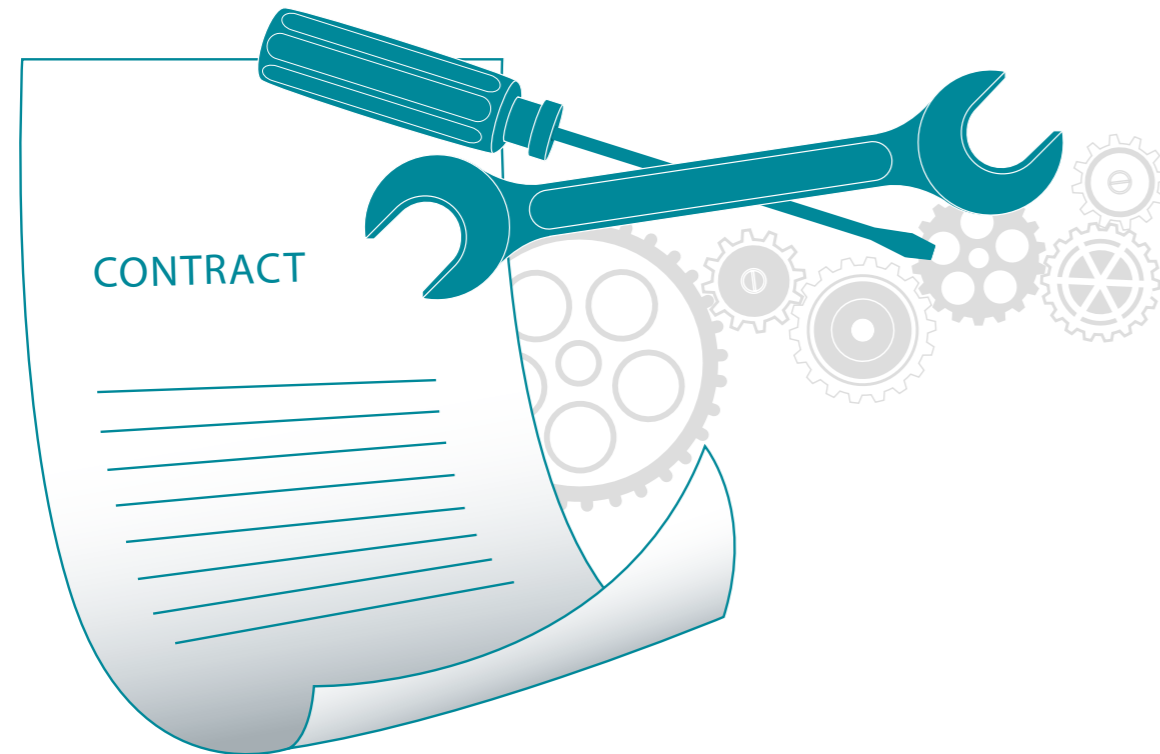
EMV SOFTWARE
SOLUTIONS



SOFTWARE MAINTENANCE CONTRACT

Software as well as the underlying hardware changes need refreshing from time to time. Furthermore, a living software product sees continuous improvements that the customer can only make use of when the software is refreshed through a new release. Especially for the market participants in the production and personalization environments of the Payment Card Industry

(PCI) it is mandatory to have the latest software versions installed and to keep the system always up to date and secure. Mühlbauer's software maintenance contract provides customers with increased system security, better productivity and long-term maintenance.



- Regular software updates (including documentation to maintain the ability to update the existing system)
- Stringent version & configuration control allows the application of any required release version
- Ensures the upgradeability of the software solution & also the full compatibility & integration of existing software components
- Additions in the software life-cycle at ISO/IEC 12207
- Free access to the Software Service Portal
- Provision of security patches on a regular basis
- Support of new operating system environments
- Fast deployment of new technology from development to customer
- Support for customer system maintenance resulting in reasonable & predictable IT costs

TECHNICAL FEATURES:

Software and its functionalities are subject to a fast and innovative change. To ensure that a Mühlbauer installation is up-to-date at any time, we recommend a Software Maintenance Contract as a guarantee for actuality, progress and support.

The Software Maintenance Contract guarantees that the provided software is always maintained.

- Corrective: Correction of bugs & errors
- Adaptive: Software adaptations to changed environments
- Perfective: Improving of performance & maintainability
- Preventative: Prevention of problems before they occur

BENEFITS:

SOFTWARE MAINTENANCE - BASIC

- Software update
 - » Provision of the latest bug fixes, in the context of regular software development, including new software-technologies or adaption of the software to operating system upgrades
 - » Preservation of functionality & operability of the system (excluding new or customized functions)
- Software Service Portal
 - » Access to ticket-based Mühlbauer Service Desk
 - » Access to Customer Maintenance Portal
 - » Monthly information about security patches
- Support for new operating systems
- Recommendation of anti-virus software & description on how to use and make regular definition updates
- Backup & reconstruction
 - » Software backup (partition / images before delivering machine) (incl. system software on MCES PCs & machine PCs)
 - » Software (no data) is backed up within a regular software maintenance intervention
 - » Secure storage of customer backups (no data) at Mühlbauer premises
- Data archiving
 - » Archiving of temporary & no longer required files
 - » Archiving of the MB MCES database
- Software upgrade consulting
 - » Presentation of improvements on software products
 - » Presentation of innovations of the program modules used by the customer
 - » Propose an intervention date for the software upgrade implementation

SOFTWARE MAINTENANCE – TELEPHONE SUPPORT / ERROR DIAGNOSIS

- Registration & analysis of software issues or user based scenarios of Mühlbauer machines
- Diagnosis of error messages on the production machine or the MCES system
- Recovery from erroneous activities on the production machine



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