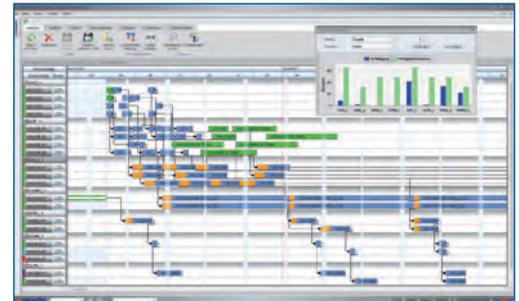
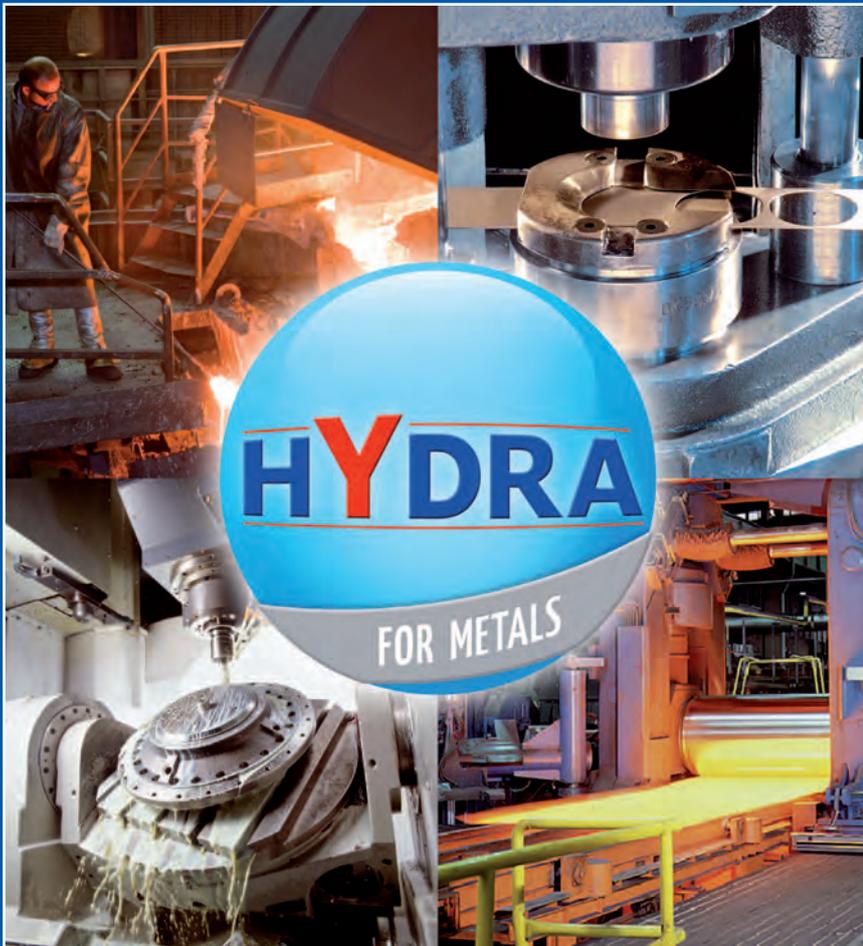


# HYDRA for Metals

... MES Solution for the Metal Processing Industry



# MES Solution for the Metal Processing Industry

## Efficient Metal Processing

Demands placed on the Manufacturing Execution System (MES) by the Metal Processing Industry are similar to other industrial sectors, but with some significant differences. For instance, the new Solution "HYDRA for Metals" is based on the broad standard of the tried and tested MES solution Hydra with some important functions especially tailored to the needs of metal processing industry users added on. In addition, certain elements of the system have been adjusted to meet specific requirements.

The MES solution "HYDRA for Metals" supports the metal processing industry across the entire value chain, covering all manufacturing processes from melting to the finished product. The solution offers comprehensive and individual specialized

functions for separate manufacturing processes. Furthermore, the modular structure allows "HYDRA for Metals" to support individual manufacturing steps. The configuration of modular applications of the MES system makes the system deployable in almost all areas of production.



The MES solution for the entire

## Cost and Benefit Ratio

In general, optimization measures always target cost reduction. Interim results are often varied and process-specific.

The following efficiencies can be achieved when using "HYDRA for Metals":

- An increase in efficiencies of resources (i.e., material, machinery, energy, etc.)
- Reduction of inventory and in-process inventory
- Decrease in maintenance expenses
- Improvements in the area of machinery and equipment utilization
- Reduced processing times
- Reduction in scrap
- Complete documentation of manufacturing processes (traceability)



the metal processing value chain

# MES Solution for the Metal Processing Industry

## MES Industry Solution

“HYDRA for Metals” can either be considered as a solution for the metal processing industry or an extension to an integrated MES solution, depending on the specific needs. Regardless of how it is viewed, the benefits of a tried and tested solution targeting a specific industry are very clear.

Processes and procedures, including operational activities, are displayed specifically in MES and can be controlled and measured within a single integrated system. The possibility of comprehensive traceability boosts the value of the MES solution with regard to the requirements imposed on manufacturers of safety-related products such as those found in the automotive, aerospace and medical industries.

## Optimal Combination

The MES solution “Hydra for Metals” consists of standardized applications from the MES solution HYDRA and specific functions for the metal processing industry. The blue bars on the bottom of the brochure pages indicate standard functions. The pages with the red bars describe functions for specific metal processing industry processes. “HYDRA for Metals” offers the perfect combination of standard and customized functions. The solution includes custom settings for the metal processing industry and therefore merges a modular system into an optimal solution.

### Standard functions of an integrated MES solution defined by VDI 5600:

- Shop Floor Scheduling & Control
- Data Collection
- Resource Management
- Material Management
- Quality Management
- Information Management
- Performance Analysis
- Energy Management
- HR Management



### Specific functions for metal-processing (by processes) in accordance with DIN8580:

- Primary shaping
- Forming metals
- Changing material properties
- Coating
- Cutting and assembling



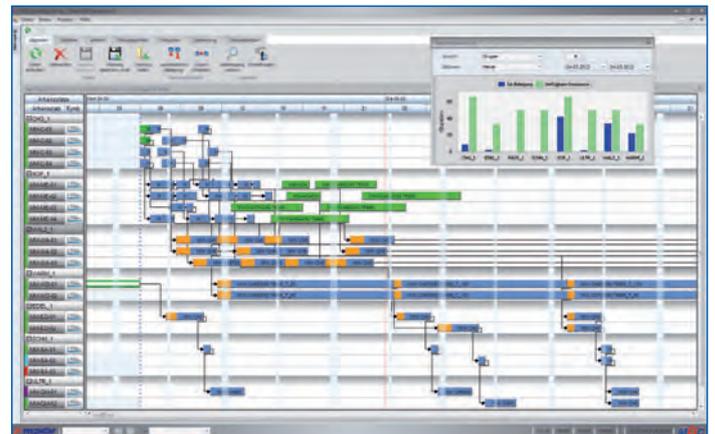
# Shop Floor Scheduling and Control

## Efficient Manufacturing Planning

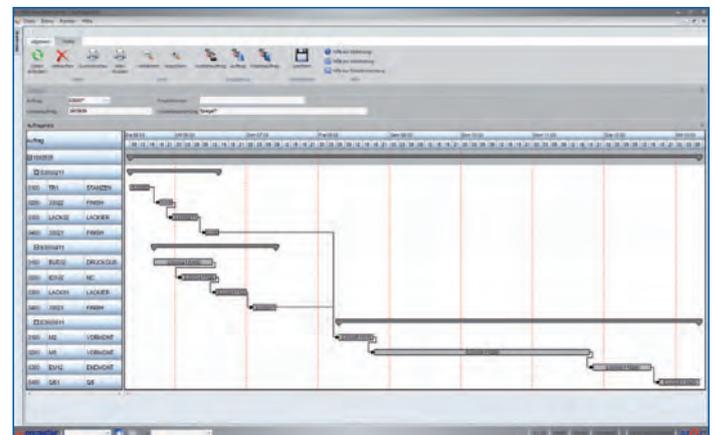
Shop floor scheduling or control is an integral part of the manufacturing process. Most processes in metal processing are time-sensitive and require specific sequence optimization based on similar product characteristics or manufacturing steps (i.e., development of batches or lots).

### Relevant Functions of HYDRA Shop Floor Scheduling:

- Cross-functional process planning covering all manufacturing steps
- Detailed graphical planning and control (Gantt charts)
- Automatic allocation per predefined rules
- Collective ordering processes
- Simulation of planning scenarios, including calculation of key data
- Consideration of shift calendars and performance data
- Matrix for setup changes as the basis for setup optimization
- Crucial information for planning personnel: conflict list, peaks in capacity, utilization profile
- Collective planning of machinery, tools and other equipment
- Batches and campaign building
- Minimum and maximum buffer and process times
- Planning of furnace batches
- Scheduling with regard to machining centers
- Taking into account recycled materials



*HYDRA Shop Floor Scheduling offers comprehensive production planning functionalities taking into account available capacities in real time.*



*Order networks are the basis for detailed planning of multilevel manufacturing processes.*

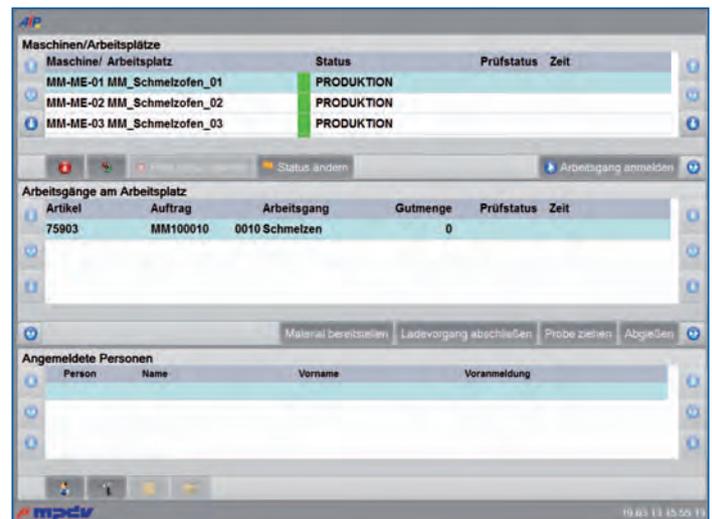
# Data Collection

## Data Collection in Real-time

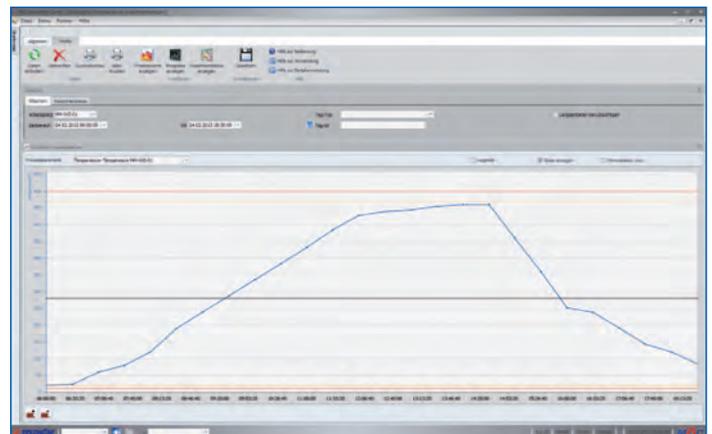
All MES modules, from shop floor scheduling to quality management, benefit from comprehensive real time data collection covering the entire value chain. This includes the collection of information generated by connected machinery, facilities and/or production lines, the counting of units, registering equipment statuses and process data (i.e., temperature, pressure or speed of rotation). In addition, it allows for the manual input of operating and order data (i.e., logging of process data).

### Relevant HYDRA Functions:

- Data collection in real time
- Intermediate buffering in case of network failure
- Automated measuring of quantities
- Monitoring of machine status via operating signal, clock pulse or manual input
- Collection of batch and lot data to ensure complete documentation (traceability)
- Continuous process value collection
- Measuring of energy consumption and performance directly at the machinery
- Ergonomic and flexible customizable dialogues for manual data collection (i.e., order registration)
- Collection of staff-related data (i.e., incentive pay)
- Connectivity to digital instrumentation for quality assurance data
- Easy-to-use navigation for quality control, including plausibility checks of manually entered data
- Logging of tools and manufacturing equipment (manually or via Auto-ID)
- A wide range of existing machinery interfaces (i.e., OPC, UMCM, and many more)



Flexible and easy-to-use input dialogues are the basis for a high level of acceptance by manufacturing staff.



The continuous collection of process parameters ensures a reliable production flow. This feature allows for the implementation of timely countermeasures when unfavorable trends are registered.

# Resource Management

## Monitoring of Machinery and Tools

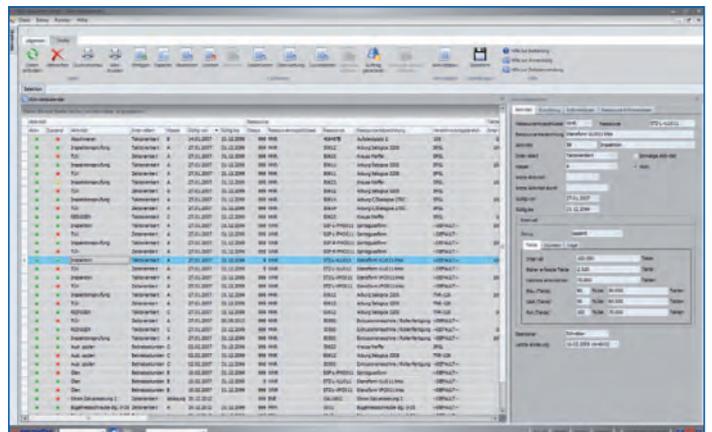
Management and maintenance of machinery, tools and other equipment are of special significance in the metal processing industry because production processes put an immense strain on these resources. The MES system manages preventive maintenance and monitors the timely availability of tools.

### Relevant HYDRA Functions:

- Managing machinery, tools, test equipment, and of all other production resources, including NC programs and documents
- Maintenance of digital resource histories
- Maintenance schedule for preventive maintenance
- Evaluation and comparison of production key data of individual machines and production equipment
- Managing pallets as secondary resources to machining centers
- Taking into account the limited life cycle of certain equipment, such as molds, standard tools, etc.
- Maintenance programs for special machinery categories (i.e., drums)
- Scheduling and management of all types of transport units
- Escalation management (i.e., immediate notification regarding maintenance during downtime of machines)
- Basis for scheduling the availability of resources in the shop floor scheduling



All relevant machinery data can be viewed at a glance at the workplace.



The maintenance schedule supports preventive maintenance by providing a timely overview of upcoming and necessary maintenance measures.

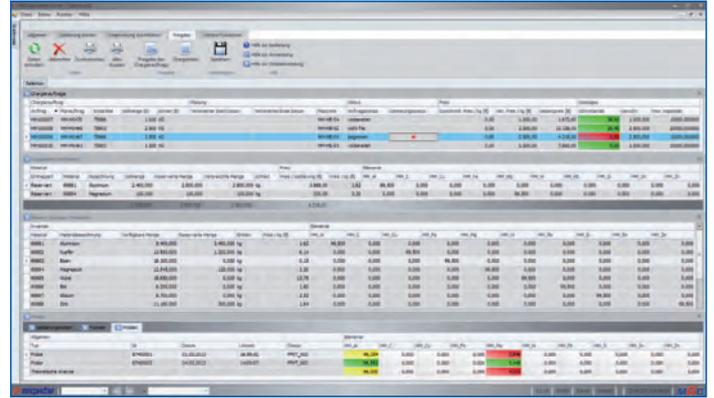
# Material Management

## Material Flow and Traceability

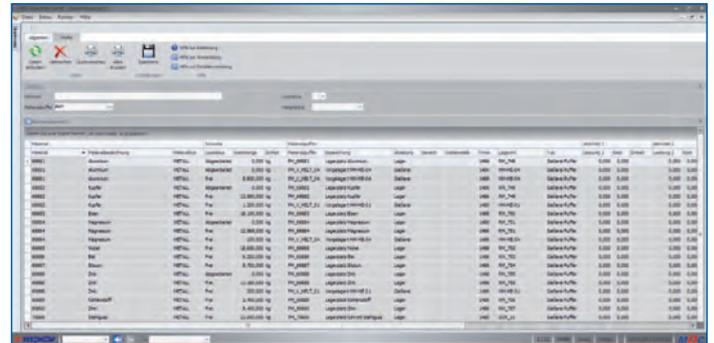
As raw metals are very expensive, the material management feature of “HYDRA for Metals” supports the cost-optimized use of raw materials, scrap, and semi-finished goods. Safety-related sectors, such as the automobile or medical technology industries, depend on the consistent and reliable control of material flow, because the documentation of such manufacturing processes is mandatory.

### Relevant HYDRA Functions:

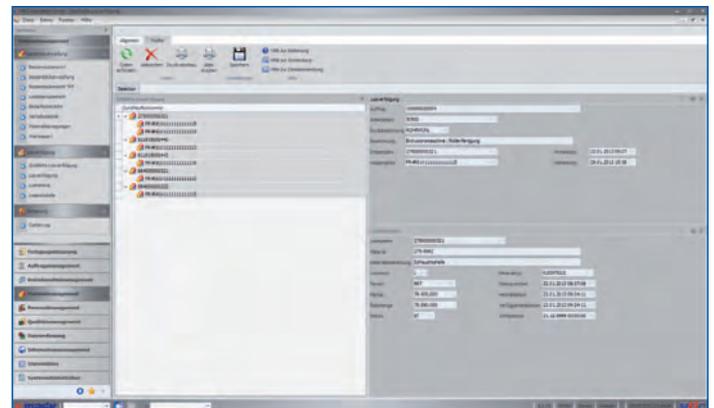
- Management and planning of materials and semi-finished goods in WIP and buffer areas
- Planning of consignments, taking into account authorized transportation units
- Support of eKanban principles
- Monitoring of inventory, inventory range, expiration dates and alerts
- Palleting and assembly, including label printing
- Material availability checks beginning during the planning phase at the terminal
- Composition and management of composition recipes
- Cost-optimized use of material
- Tracking and tracing
- Complete documentation
- Management of batches and lots
- Traceability by means of batch tree structures
- Fulfillment of safety requirements and standards, such as FDA, GMP or TS16949



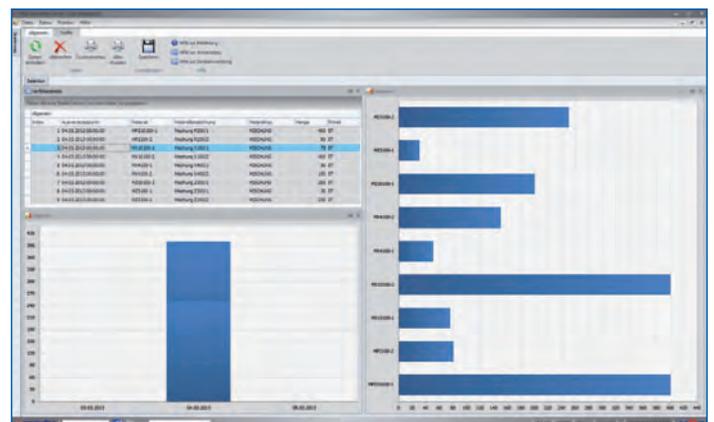
“HYDRA for Metals” supports the complete process from charging to casting.



All available materials and raw materials are displayed clearly in the inventory overview.



Retracing batches (“traceability”) using graphical means is facilitated by the “Batch Tree.”



The expiration statistic displays time-critical materials sorted by their corresponding shelf life.

# Quality Management

## Quality Assurance – Minimizing Efforts

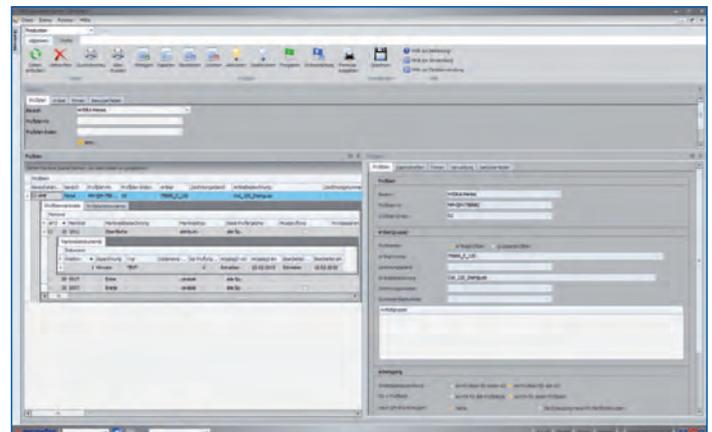
Integrating quality management into production processes can result in significant savings relating to cost, time and effort, especially in the metal processing industry. Several checks can be conducted by operators themselves directly at the machine using the same shop floor terminal as for shop floor notifications. More complex checks are carried out in the quality laboratory.

### Relevant HYDRA Functions:

- Sharing of data collection terminals in the shop floor
- Planned checks based on single production steps
- Test dates are calculated based on general data collection (e.g., entry of quantities, change of machinery status, etc.)
- Connection to digital test equipment (e.g., Steinwald-box) and measuring devices
- Standardized test process from incoming goods to finished products
- Comprehensive evaluation (control charts, analysis of main errors, etc.)
- Comprehensive utilization of test results for supplier evaluation, complaint management and process interlocking
- Issuance of test certificates and complete documentation of process parameters (e.g., TS16949)
- Workflow-based complaint management



Control charts are considered a crucial evaluation tool for quality management.



“HYDRA for Metals” aligns planned inspections with production steps. This feature saves effort and prevents errors.



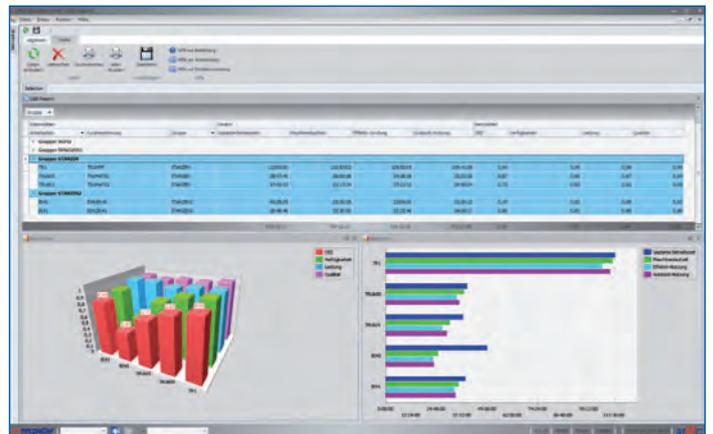
# Performance Analysis

## A Focus on Productivity

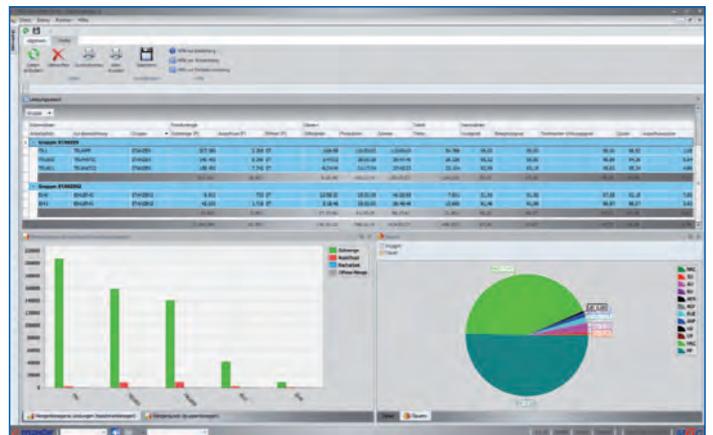
In highly competitive industries like the metal processing industry, meaningful key data and target-performance comparisons play a vital role. This is where standardized (e.g., according to VDM Standard 66412) as well as individually determined or defined key data is crucial. It is important that data is current and reliable because short-term and long-term decisions are based on these indicating figures.

### Relevant HYDRA Functions:

- Processing of data at different consolidation levels (granularity)
- Calculation and evaluation of key data in real time (e.g., OEE, rate of capacity utilization, set-up rates, etc.)
- Flexible presentation and preparation, including pivot tables and customizable diagrams
- Utilization of standardized and individualized reports (e.g., OEE, scrap profile, sick leave, analysis of errors, etc.)
- Target group oriented visualizations
- Custom users can be defined when saving evaluation profiles
- Standardized interfaces and export functions for the use of data in other systems (e.g. Microsoft Excel or SAP BI)



OEE (Overall Equipment Effectiveness) can be calculated for individual machines, different work areas or entire plants.



The "Performance Analysis Report" shows productivity of individual machines and different groups.

# Energy Management

## Optimization of Energy Consumption

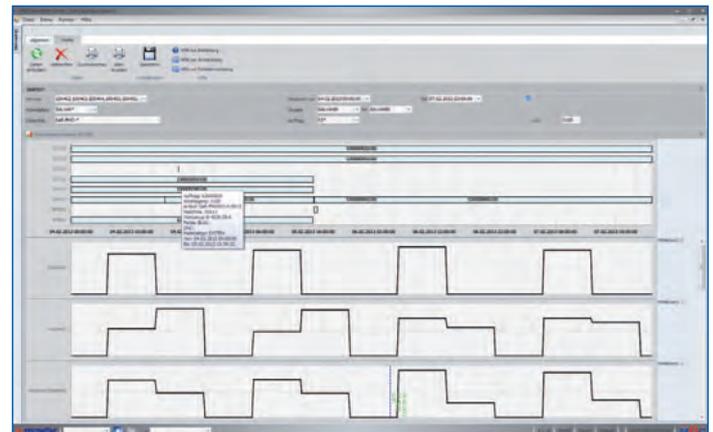
Although energy management is not yet an integral part of standard VDI 5600, "HYDRA for Metals" is already addressing the issue as metal processing manufacturing processes require a large amount of energy. Therefore, energy management is a relevant issue in the metal processing industry.

Ever increasing electricity costs and other fuel surcharges, such as renewable energy surcharges, make compliance with ISO 50001 even more important. HYDRA Energy Management provides a wide range of functions to meet these requirements.

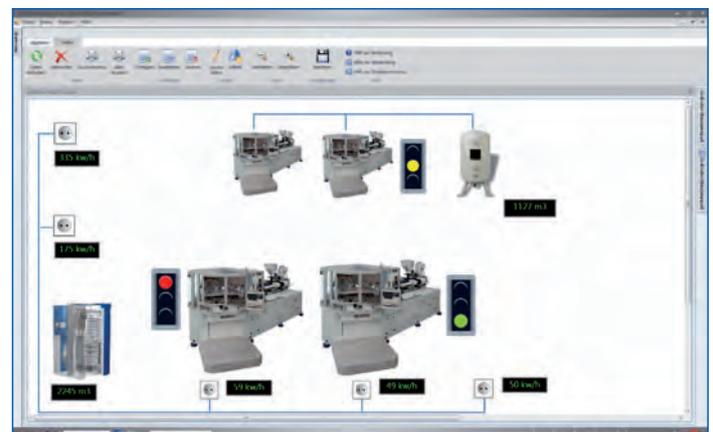
It is increasingly important to comply with ISO 50001 as exhibited by additional charges such as renewable energy re-allocation, and varying energy prices. HYDRA Energy Management supports manufacturers with a broad field of industry-specific functions.

### Relevant HYDRA Functions:

- Logging of energy consumption and performance values via interfaces of existing meters
- Planning and coordination regarding the manual reading of meters
- Monthly balances and statement of consumption
- Consumption analysis for customizable time periods
- Monitoring of energy consumption to compare individual machines, facilities and user-defined groups
- Correlation of energy consumption data with order and machine data
- Collection and evaluation of electricity consumption and other forms of energy (e.g., gas, compressed air, steam or exhaust heat)
- Utilization of energy data for preventive maintenance and other optimization processes
- Foundation for compliance with ISO 50001



A correlation of consumption illustrates clearly how much energy is consumed by individual orders.



Energy consumption and performance values can also be viewed via the machinery illustration.

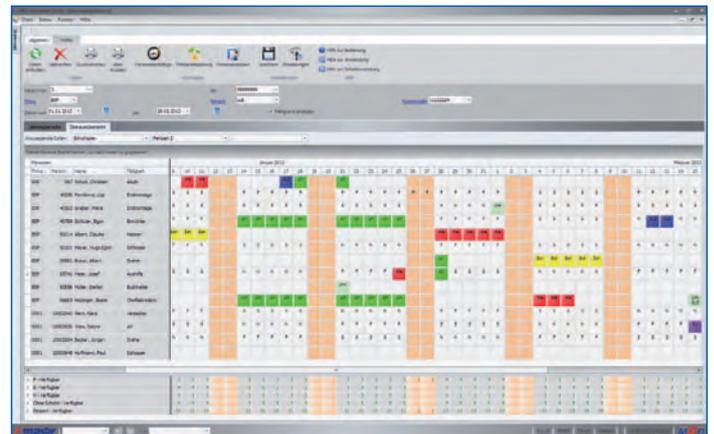
# Human Resource Management

## Optimization of Human Resources

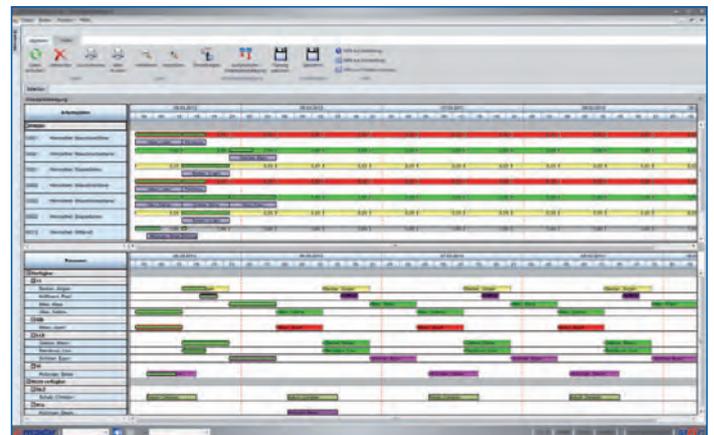
In addition to manufacturing and quality management “HYDRA for Metals” also covers human resource management requirements as defined in VDI 5600. Because personnel is viewed as a valuable yet costly resource, every organization should strive for optimized deployment of staff, based on specific qualifications and skills.

### Relevant HYDRA Functions:

- Employee master data, including shift models
- Digital personnel files
- Staff information system
- Time and attendance, including clock-in /clock-out
- Attendance sheet
- Workflow-based absence planning
- Time account administration
- Personnel and salary statistics
- Wage models and regulations as a basis for payroll accounting
- Formula-based performance and incentive wages based on collected operating and machinery data (e.g. ERA)
- Labor time planning / planning of shifts
- Planning relating to deployment of personnel based on employee qualifications
- Allocation of workplaces via gantt charts
- Comprehensive evaluation and reporting
- Certified standard interfaces for HR systems (e.g., SAP HR)
- Access control for security control center and room zone overview



Personnel scheduling visualizes employee positioning during various shifts and projected absences.



Allocation of workplaces allows for deployment of personnel based on staff qualifications.

# Primary Shaping

## Melting, Casting and Secondary Metallurgy

In contrast to primary metallurgy, which covers the production of raw metals, secondary metallurgy includes methods to reach perfect metallic properties of molten metals. The chemical composition of an alloy can be impacted during the entire melting process. The core element is the composition: it includes the preparation of raw materials and the operating framework. This covers the selection of materials and the tolerance limits applicable to the allowed amounts that can be added to the molten metal ("recipe of composition"). Furthermore, it is essential for the metal processing industry to control costs by optimizing the compounding of existing scrap and raw materials while taking into account scheduled deliveries of material to prevent an unnecessary increase in inventory. "HYDRA for Metals" supports the melting process by reviewing all types of data, such as material costs, tolerance limits and theoretical analyses of molten metals. The actual composition of molten metals is compared to composition recipes by means of drawing samples and checking product characteristics. Additional material is added if necessary to

- Composition, including management of different compositions
- Drawing of samples, target analysis and recharging
- Cost-optimized use of material (calculation of material costs)
- Resource management for ladles, casting dies, molds, and other tools
- Consideration of combustion and oven sump

change the composition and attain optimal conditions. All accomplished steps are documented in the central HYDRA data base.

While other conventional composition solutions are not integrated, a composition feature is completely integrated into "HYDRA for Metals," offering new opportunities. For example, individual orders can now be planned collectively with subsequent processing steps (i.e., hardening, sawing, or polishing). In addition, it offers a traceability feature which can trace a finished product back to the raw material used at the foundry.



## Rolling, Forging and Other Processes

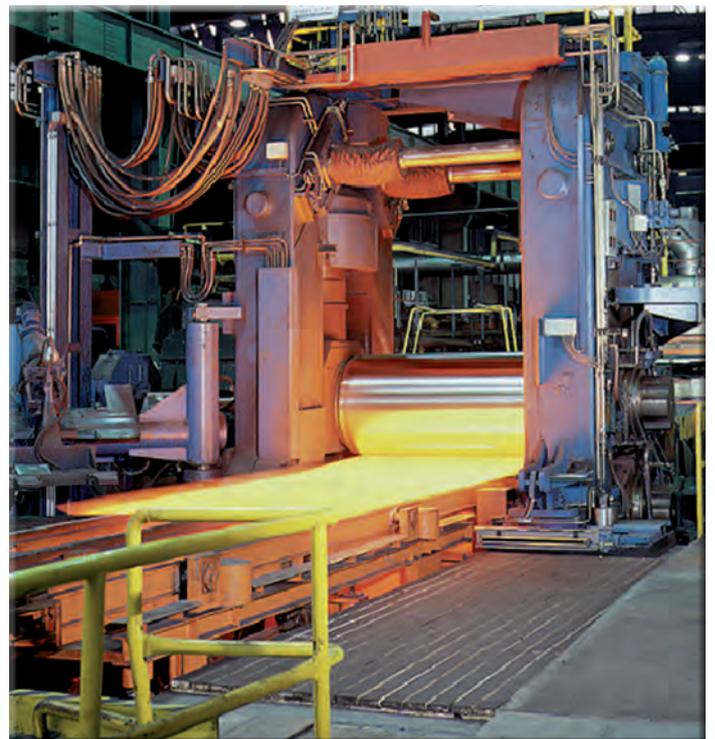
- Efficient planning of rolling mills (“coffin programs”)
- Reallocation of material in the event of cracked coils
- Position detection during production of coils
- Continuous process data collection
- Traceability of transport units
- Preventive maintenance

An important production step after casting is the forming of metals. Depending on the original shape and desired result, different types of processes like rolling or forging are used. While the forging process can be displayed on the MES system fairly easily, rolling is a more complex issue with respect to manufacturing IT. The complexity of rolling mills and their high investment value suggest that a high operational availability of the mill should be ensured by performing regular preventive maintenance. “HYDRA for Metals” can provide a variety of critical parameters (e.g., abrasion of rolls) in real time which improve optimization of maintenance planning.

In addition to maintenance, optimized machine utilization is beneficial to improve wear and tear of rolling mills. With an ideal production sequence calculated by HYDRA Shop Floor Scheduling, the set of rolls can be loaded and worn down evenly. The application also runs programs like “coffin” programs to warm rolling mills evenly and prepare them for utilization.

Differences in hot and warm rolling and in other ways of processing can be displayed in “HYDRA for Metals”. Continuous collection of material speed and other process data creates an important foundation for the traceability of processed lots and batches.

Expensive transport units (i.e., racks) are used in the rolling process which can be managed and traced with the HYDRA module “Tool and Resources Management” feature. This supports traceability of racks and helps streamline internal logistics processes.



# Changing Material Properties

## Heat Treatment

- Planning of process and setup times (heating, cooling)
- Provision for heat treatment codes (batch generation)
- Management of different items in the furnace
- Multi-terminal operation (e.g., at continuous furnaces)
- Process data collection, including escalation management
- NC data and setting parameters

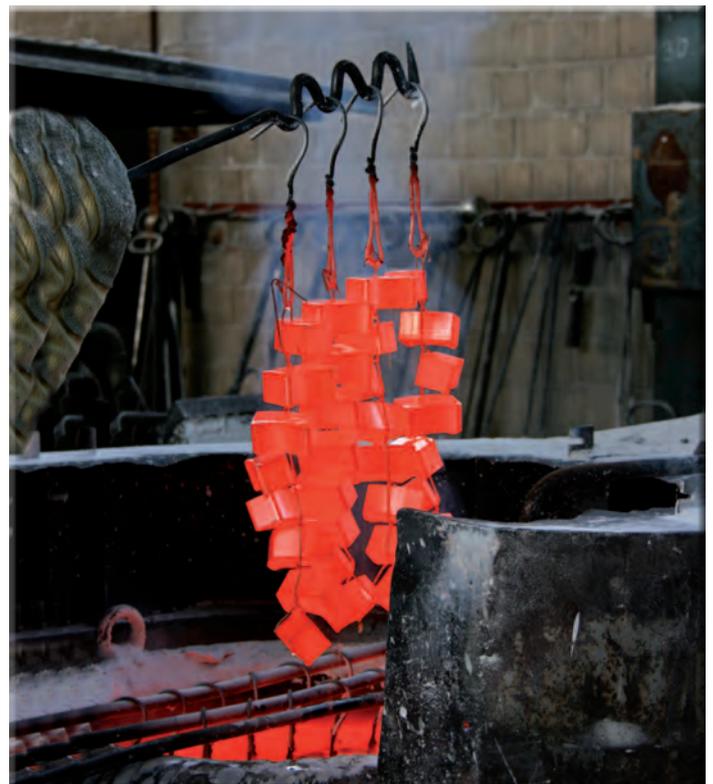
Improved material characteristics and optimized time and cost control are important areas of concern in metals processing. Optimization is achieved by letting items with identical heat treatment codes run through the furnace simultaneously. This has to be taken into account during the planning stage. In addition, heating and cooling phases of the furnace also have to be taken into account. Depending on volumes and quality of the furnace, these heating and cooling periods can be quite time-consuming and therefore need to be defined as setup times. These setup times may require replanning in some instances. A setup matrix allows for the required times to be calculated dynamically in HYDRA Shop Floor Scheduling and utilized as part of the optimization process. Optimized furnace planning helps to save costs, as the preheating process for electrical furnaces is especially energy and time-consuming. "HYDRA for Metals" supports optimized planning processes based on heat treatment codes as well as the registration of multiple operations. Hence, different items may be processed in a single furnace.

For very large furnaces, such as continuous furnaces, it is useful to collect data at several separate terminals. HYDRA supports multi-terminal operations and simplifies data collection for operators of furnaces by providing terminal dialogs specified to individual activities (e.g., loading and unloading).

Continuous collection of process values is of the utmost importance for all temperature-critical processes. "HYDRA for Metals" documents failures when trigger points are exceeded or not reached and forwards them to the responsible persons using the integrated Escalation Management module. This enables short-term responses to limit possible damage.

The more complex the furnaces and machinery, the higher the possibility of human error during operation and configuration. Automatic transfer of setting parameters facilitates simplified production processes and prevents configuration errors.

The HYDRA-DNC module supports the operator during the logon of operations by displaying pre-selected setup data. This pre-selection depends on the currently processed item, machinery, and, if applicable, utilized tools.



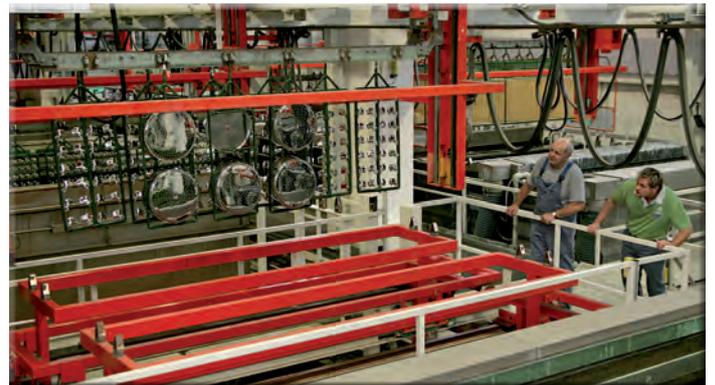
## Surface Finishing

- Management of different items (e.g., in galvanization)
- Planning of processing times
- Batch generation
- Process data collection including escalation management
- Integrated quality management

Like other materials, metal can be coated or its surface can be finished for specific purposes. The different procedures vary depending on the physical state of the material to be applied: gaseous (e.g., vapor deposition), liquid (e.g., varnishing), dissolved (e.g., galvanizing), or solid (e.g., powder-coating). Depending on the complexity of the procedure, it might be beneficial to select several items for one production batch, even if they originate from different orders. In this case, "HYDRA for Metals" supports with the option to generate batches.

Surface irregularities can be pivotal for product quality with regard to visual appearance and corrosion prevention. "HYDRA for Metals" records numerous process parameters (e.g., temperature, flow rate, pressure, etc.) to keep surface finishing processes as stable as possible while reducing the scrap rate. In addition, integrated CAQ functions provide an extensive range of options to monitor the quality of processed semi-finished and finished products and to initiate

counter measures, if required. The earlier production errors are recognized, the lower the costs. Additional efforts among planners and operating personnel can be minimized by utilizing the inspection planning feature that applies to various phases of the production process.



# Separating and Assembling

## Mechanical Processing

- Management and assignment of machining centers, including tool warehouse and pallet station
- DNC for machining centers and other NC machinery
- Position monitoring (rolling mills, plates) during cutting
- Position detection on saw bench
- Planning of tool maintenance and preventive maintenance measures

Although mechanical processing (e.g., turning, milling, drilling, grinding, cutting, riveting and welding) is part of the application of modern MES, the metal processing industry still provides additional challenges. In particular, linking machining centers is often much more complex than anticipated. Pallet stations located in front of machining centers are a special feature in machining centers, where multiple or even different items are stored for further processing. For this reason, multiple orders are logged at machining centers simultaneously. However, times, quantities and machine malfunctions may only be posted to a specific active order. HYDRA supports this process with correct posting of recorded actual data and by providing matching NC programs, including functions for selection and comparison. The MES solution “HYDRA for Metals” currently manages pallet stations with up to 20 storing positions and supports automatic identification of pallets using RFID technology.

Different tools are used (drills, mills, etc.) during order processing. These tools are stored in the tool warehouse via the machining center, but they can also be managed at a higher level by MES. Utilization times as well as wear and tear are documented to project upcoming maintenance or necessary tool replacements.

“HYDRA for Metals” also supports planning processes pertaining to machining centers by means of shop floor scheduling functions. This includes multiple assignments, management of pallets as secondary resources and pallet sequence planning. Setup times can be reduced by optimizing pallet utilization planning. All assignments undergo a plausibility check. This helps ensure availability and prevents scheduling conflicts.

HYDRA supports the entire processing phase of machining centers to ensure transparency for quality inspections (SPC) and complete traceability. Apart from linking machining centers, “HYDRA for Metals” offers a position detection feature for cutting coils on the saw bench to provide for comprehensive documentation. Additionally, the HYDRA DNC module provides NC machines with matching programs and setup data. HYDRA’s portfolio for metal processing is complemented by preventive and tool maintenance features together with a maintenance calendar and detailed planning functions.



# MES – The Link Between ERP and the Shop Floor

## Integration Into Business Environments

In addition to a comprehensive overview on all resources used during manufacturing and supporting the production process, HYDRA offers another important function. In vertical integration, MES connects the technical production level with higher level, commercial ERP, TQM, and HR systems. HYDRA has standardized, configurable interfaces that not only provide for interfacing to existing machinery controls, but also for smooth integration into existing IT environments. Moreover, HYDRA is based on IT standards and uses IT components such as networks, office PCs and PC-based shop floor devices to allow for a modern MES infrastructure.

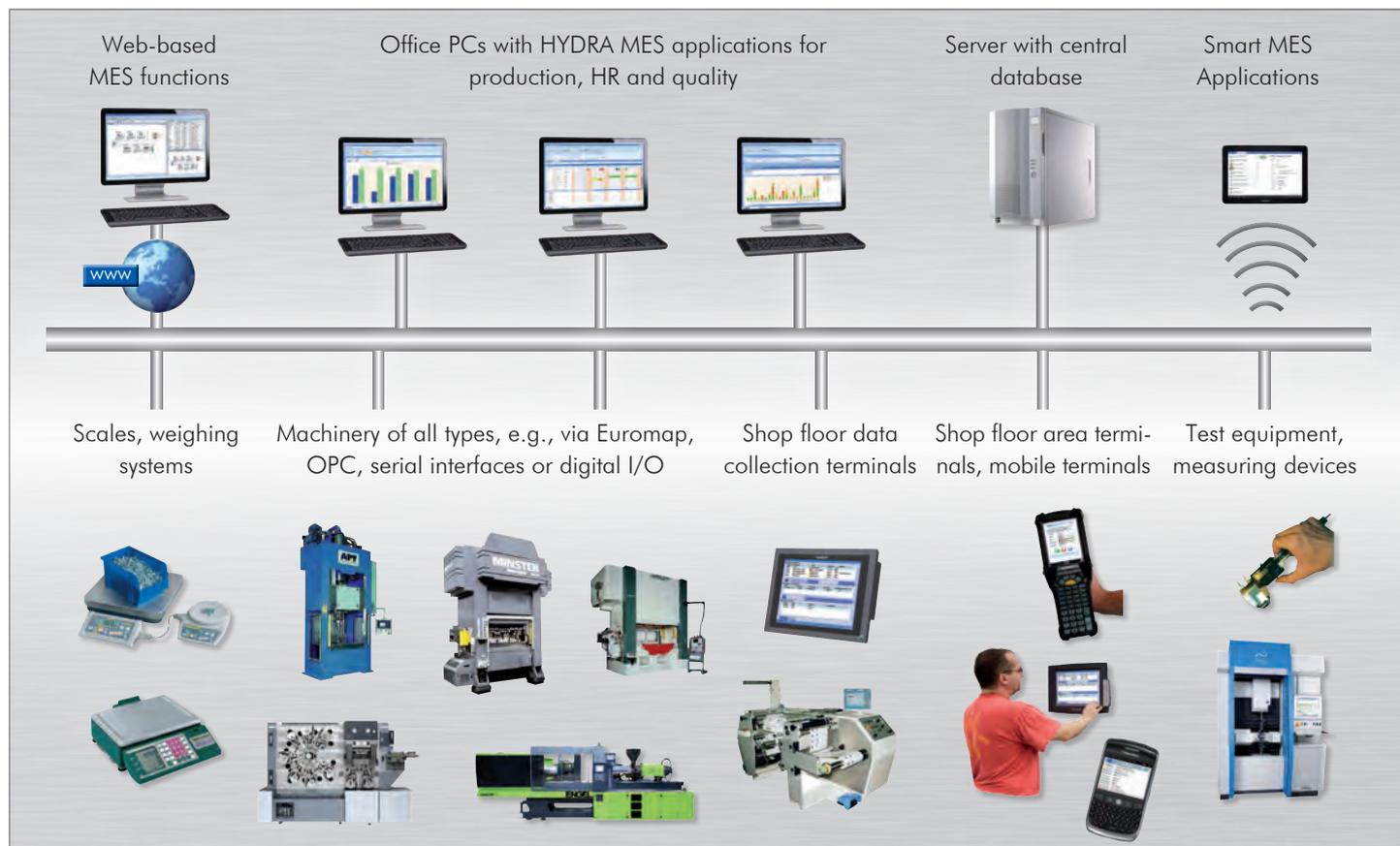
## Seamless Flow of Information

MES facilitates a seamless flow of information. Supplemental information such as bills of material, work plans, inspection requirements or drawings as well as NC data and setting parameters may be forwarded digitally and directly to the shop floor from the ERP system to machinery and equipment. Time and effort for manual data collection can be reduced significantly if data is directly transferred from machinery and equipment controls.

## Machinery Interfaces

HYDRA uses configurable data interfaces to communicate with different types of devices from different manufacturers and is able to exchange data in both directions. The benefits are obvious: machine data and process data are directly collected at machinery and equipment or transferred from the controls before being processed, visualized, and archived in HYDRA in real time. Setting parameters and data records can also be transferred directly to the controls.

HYDRA provides an extensive library of proprietary and/or standardized interfaces and protocol modules. This includes modern OPC interfaces and common industrial bus systems, such as Arcnet, Modbus and Profibus. The new UMCM standard (Universal Machine Connectivity for MES) defined by MPDV allows for user-friendly connections to modern machinery. If older machines without data interfaces are to be integrated into MES, they can be connected to HYDRA by using competitively priced and easy to install peripheral devices, including digital inputs and outputs.



# MPDV: The MES Experts

## HYDRA – A Proven MES Solution

The MES solution “HYDRA for Metals” fulfills all tasks of modern MES systems in accordance with VDI 5600 and, as a result, is synonymous to the vertical integration between the technical shop floor and the commercial ERP or management level. In addition, HYDRA provides departments working closely with production with efficient functions for analysis, planning and the provision of information in the fields’ Shop Floor and Machine Data Collection, Shop Floor Scheduling and Control, Material and Production Logistics, including Tracking & Tracing, Tool and Resource Management, DNC, Energy Management, Quality Assurance/CAQ, Process Data, Time & Attendance, Time Management, Personnel Scheduling, Incentive Wages and Access Control.

MES applications are based on modern Service Oriented Architecture (SOA) and related databases. Our software designers utilize highly efficient development tools. If required, users can utilize these tools to create individual MES applications. Our product managers and software developers consistently meet design specifications, such as ergonomic user interfaces, configurability, modularity and scalability.

MPDV provides customized MES solutions that consistently meet the requirements of predefined tasks. We prefer using standard functions of our proven, modular product lines that may be customized, if necessary.

## MPDV: The MES Experts

MPDV Mikrolab GmbH is one of the leading solution providers in the field of Manufacturing Execution Systems (MES). We have been developing MES solutions for more than 35 years. These solutions are based on innovative software products complemented by services such as consulting, project management, implementation, customizing, software modifications, training, and support.



MPDV has 11 locations worldwide and offices in Germany, France, Switzerland, Singapore, China and the USA. More than 850 production companies from a variety of industry sectors, ranging from small and medium-sized companies to international corporations, use our MES solutions.

MPDV is considered a pioneer in the development of the MES concept and supports organizations such as VDI (The Association of German Engineers), VDMA (German Engineering Federation), MES D.A.CH-Verband and MESA. Many awards vouch for MPDV’s market leadership. Frost & Sullivan has awarded MPDV the Best-Practice-MES-Award and most recently, the Global MES Award. MPDV also belongs to the TOP 100 enterprises and therefore is one of the most innovative medium-sized businesses in Germany.



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### MPDV Locations:

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