

SOLUTIONS

FACTORY
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MHP-Leitstand[®]
Version 6.9

Product-Description

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1 The AHP-Leitstand® – Extended Transparency and Efficiency for Manufacturing Planning and Control

*The AHP-Leitstand®:
The system for
production control*

The AHP-Leitstand® is a practical, graphics orientated data management instrument to support planning and control of manufacturing.

It can be introduced either as a stand-alone system or well integrated into a CIM concept (e.g. data exchange with ERP or order data communication). The modular structure allows every solution best adapted to the customer's requirements.

*AHP-Leitstand®:
The first graphical
planning system*

The AHP-Leitstand® has been introduced 1986. The success story began with the awareness that a connector is necessary between the more and more powerful ERP systems and the shop floor data collection systems..

*AHP-Leitstand®:
A well-known term
inside the planning
world*

Spirit of innovation and the knowledge about resource planning have been leading to the AHP-Leitstand®, today well known as a kind of category term.

Today the AHP-Leitstand® is running in different languages over 680 times worldwide. Enterprises from most different sectors are using it to plan their resources in a way of working that can be considered as practical as exact. High demands for transparency and flexibility are fulfilled and the personnel's competence and experience are underlined and optimised with this instrument.

AHP-Leitstand® is supporting even most modern organisational structures and thus ensuring their potential.

*The AHP-Leitstand®
supports modern
operating systems*

The system is available as stand-alone or as network version for the Windows operation systems 2000, 2003, XP and Vista. In the network version, the system offers all possibilities to the illustration of forward-looking, decentralized organization structures of the production planning and control.

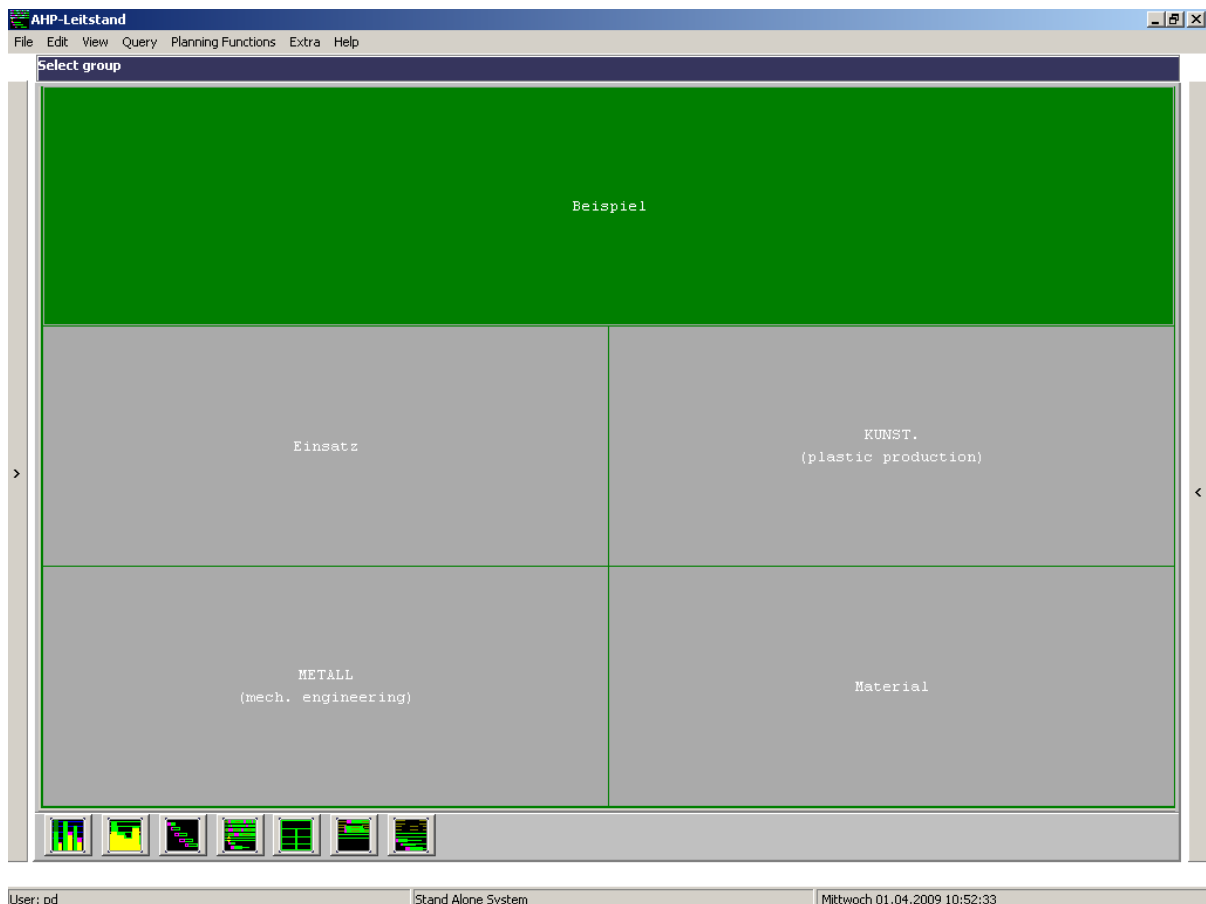
The AHP-Leitstand® can be adapted to customer's requirements

The present product summary gives an abstract about basic functions and additional modules for the AHP-Leitstand® Release 6.9. The described functions and appearances are reflecting a standard system that can be adapted to the customer's particular requirements.

2 Basic Modules to the AHP-Leitstand®

2.1 Graphical Planning Functions

On the planning board all manufacturing resources (machines, manual work places, tools and devices) are represented and ready to be planned. Functional groups (similar resources) or organisational groups (different resources for one product) can be build following organisational requirements. The entrance into groups is possible by clicking onto the respected fields by mouse click. A group can have an unlimited number of subgroups. Up to eight levels of subgroups are possible.



Picture 1: The Group Selection

*Basic Function:
Planning Board*

The Planning Board is the central planning instrument. On the planning board all these resources are combined into a resource group which are declared to be able to execute identical or similar operations. Alternatively, all resources required for a certain product can be combined. The Planning Board is served mainly with the mouse. However, many functions can be activated also with the freely verifiable function keys in addition

*Current informations on
a view*

The planning board resource window shows the recent planning status of a group is, while the planning stock window shows all operations ready to be planned. Scale of the time axis is selectable. It is possible to navigate into future or past.

Simple controls

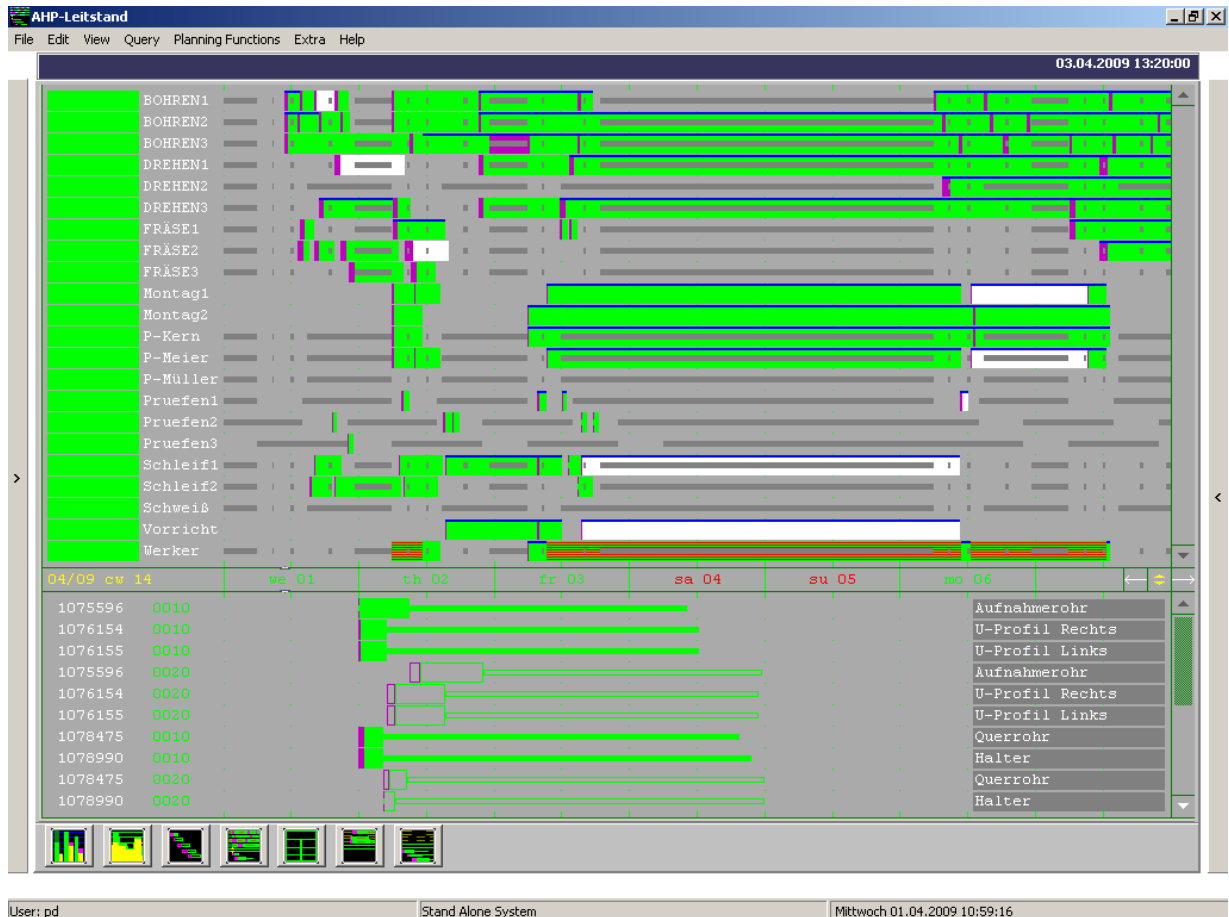
The assignment for every single resource is supported by several planning tools. Predecessor-Successor relationships are automatically considered. Existent assignments for other orders are also automatically considered.

A machine allocation plan is the result of the Gantt Chart planning under consideration of different planning tools.

Several messages give information for user guidance. Further selection of functions and different views are possible by clicking onto the respected buttons on the planning screen.

The following scheduling methods are available:

- Mouse click or drag-and-drop into the group or resource planning boards
- All operations in an order (forward and backward, controlled by configuration)
- All operations in a resource group
- All unscheduled operations with user defined (PRIOS)
- All unscheduled operations of a resource group with a cost optimizer (optional)
- Selected operations with a project-specific optimization programme.



Picture 2: The Planning Screen

The planning of operations

Operations are planned by targeting a time on a resource (= manual planning). Operations (and optionally the successor) which are planned on the same time and resource will be automatically shifted under internal restrictions. If no time is specified the AHP-Leitstand® looks for a resource which processed the operation as soon as possible (=half-automatic planning).

Planning simply with the mouse

It is possible to plan all operations for a planning group automatically by one mouse click. (=automatic planning). Priorities and deadlines are respected.

*Forward-, Backward- or
Centerplanning*

Normally when an operation is scheduled, its predecessor operation is automatically scheduled so that material availability will be assured. This function can be selectively switched off for the scheduling of bottleneck resources. Automatic scheduling of the successor (Centerplanning) can be configured.

If the last operation in an order is scheduled, the order will be automatically scheduled backward. In the same way forward scheduling will be carried out with the scheduling of the first operation in an order.

*Restrictions are
interactively checked*

Restrictions (machine availability, efficiency level, current machine loading) are interactively checked by the AHP-Leitstand®. If a due date cannot be met during scheduling, this is instantly indicated by a change of colour on the operation bar.

Furthermore, by special display devices the Planner can oversee at a glance the status of production (active operations, condition of machines, time delays, extent of utilization) and take appropriate counter-measures.

Technical restrictions are examined in the scheduling by considering Technology Groups and Setup families for each operation. This means that in the scheduling of an operation technical feasibilities (for example, the maximum stress exerted by a press, diametric capacity) are examined. In cases of error, a pertinent message is displayed and the scheduling rejected.

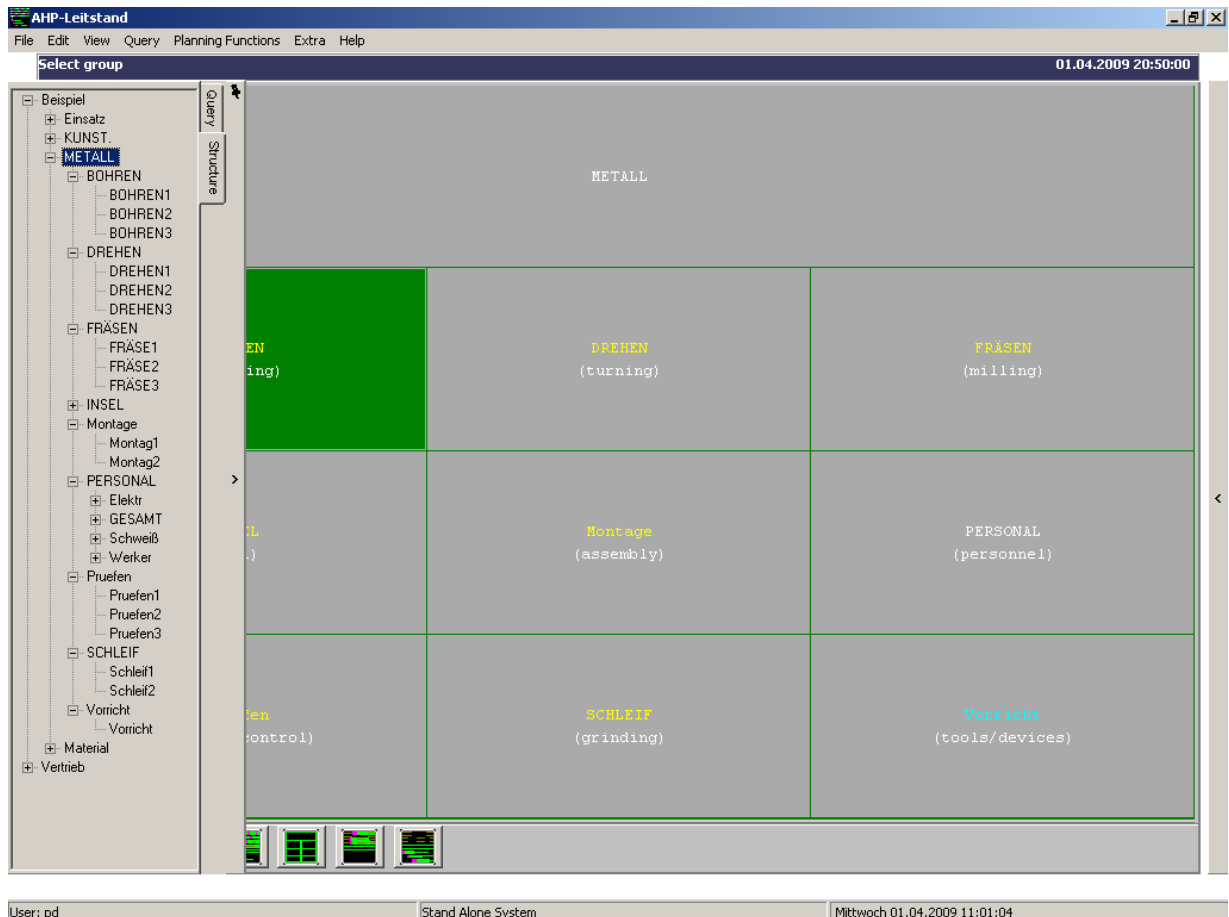
Comfortable navigation

There are many functions to navigate within the orders. So it is possible always keeps the overview also over extensive orders.

The search of individual orders works out practically and can be stored.

Queries, structures or other important planning functions are stored on the menu bars. They are on the left and right side of the screen.

The menu bars are opened by the user with the mouse dynamically and can be fixed.

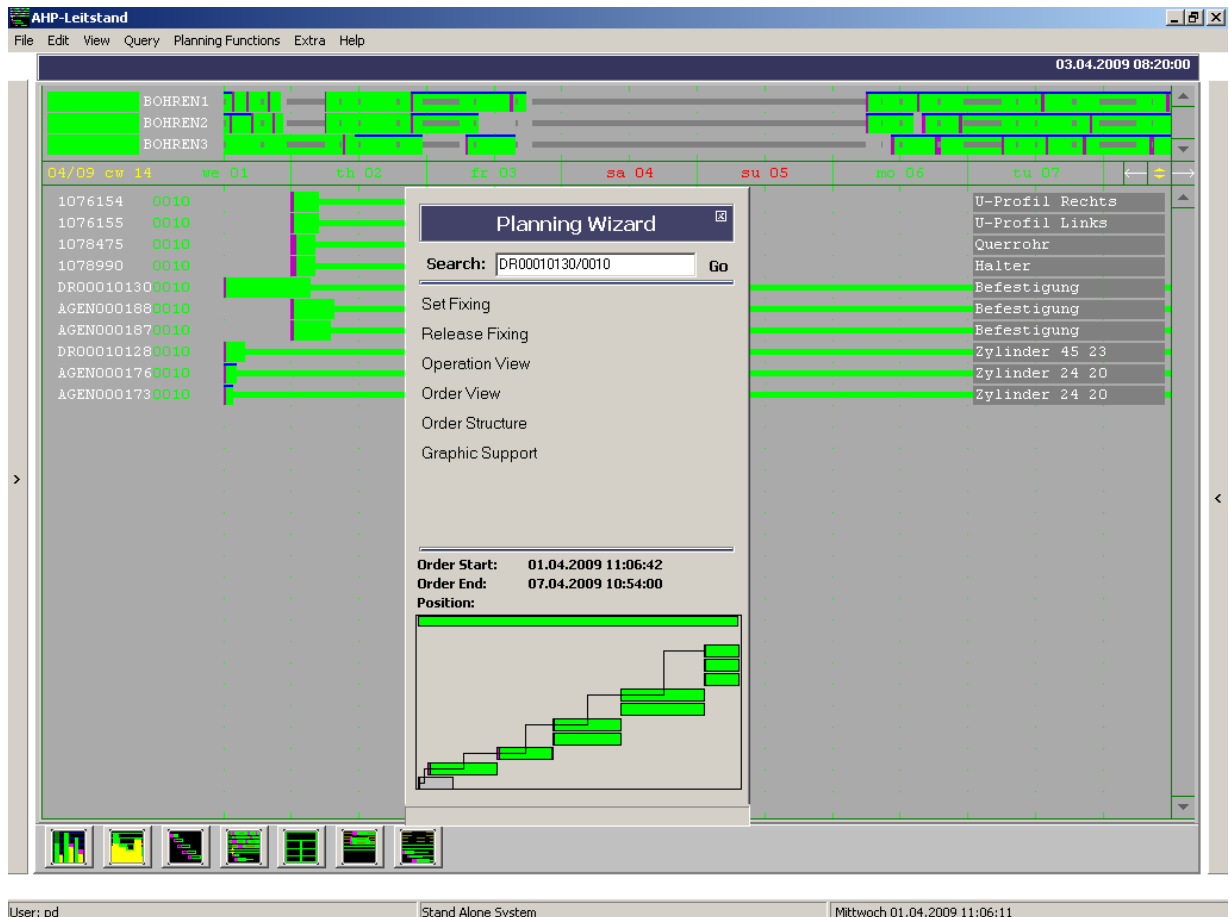


Picture 3: The Left Menu Bar

Planning Wizard: for a better overview

By clicking the right mouse button on a selected operation the Planning Wizard opens.

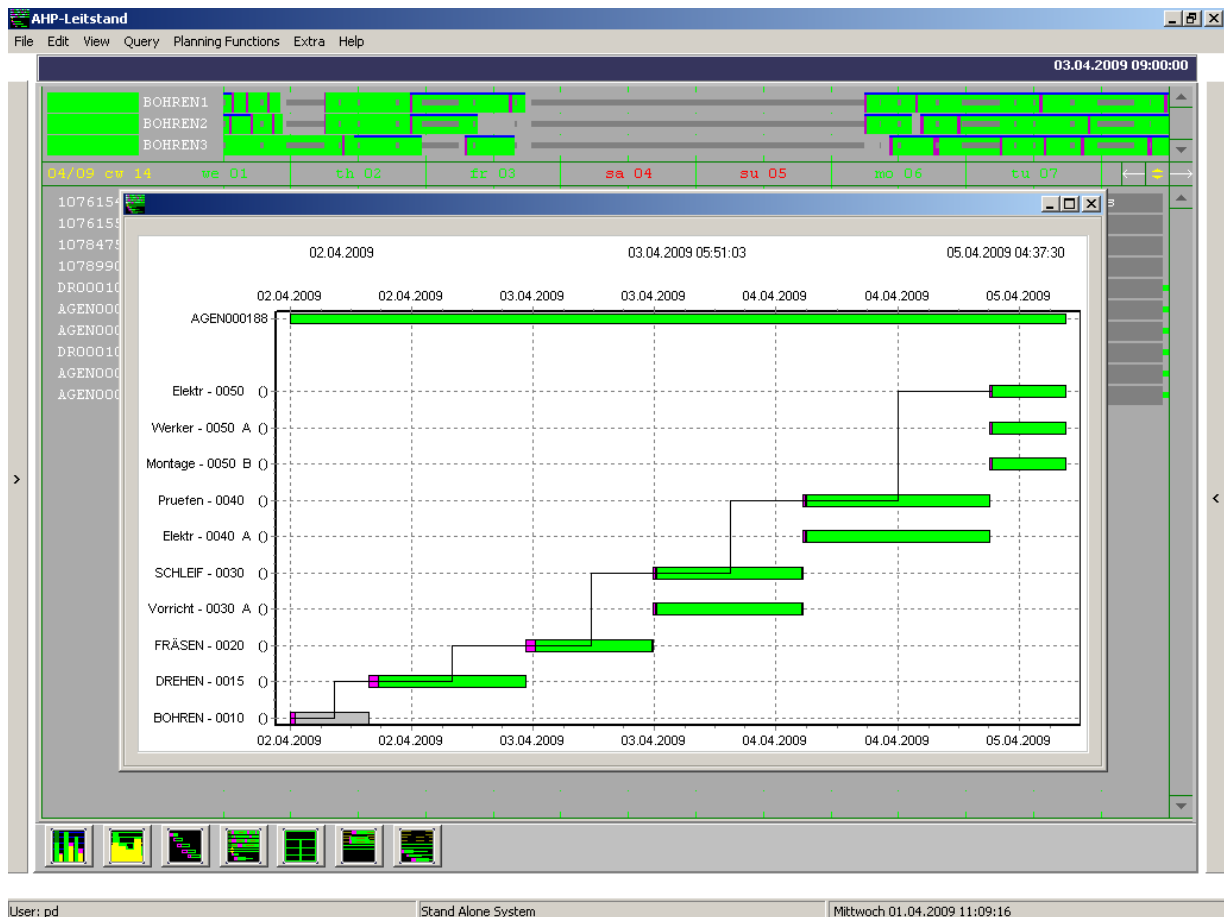
There are some useful functions available on the Planning Wizard. Some of them can also be called from the Information Screen. But these functions can be used much faster by the Planning Wizard.



Picture 4: The Planning Wizard

The sequence display

All operations of a work order are graphically displayed in sequence display. For each operation the current status (planned, setup, started, partially completed, completed) is displayed on a time axis, and the current machine occupancy likewise displayed.



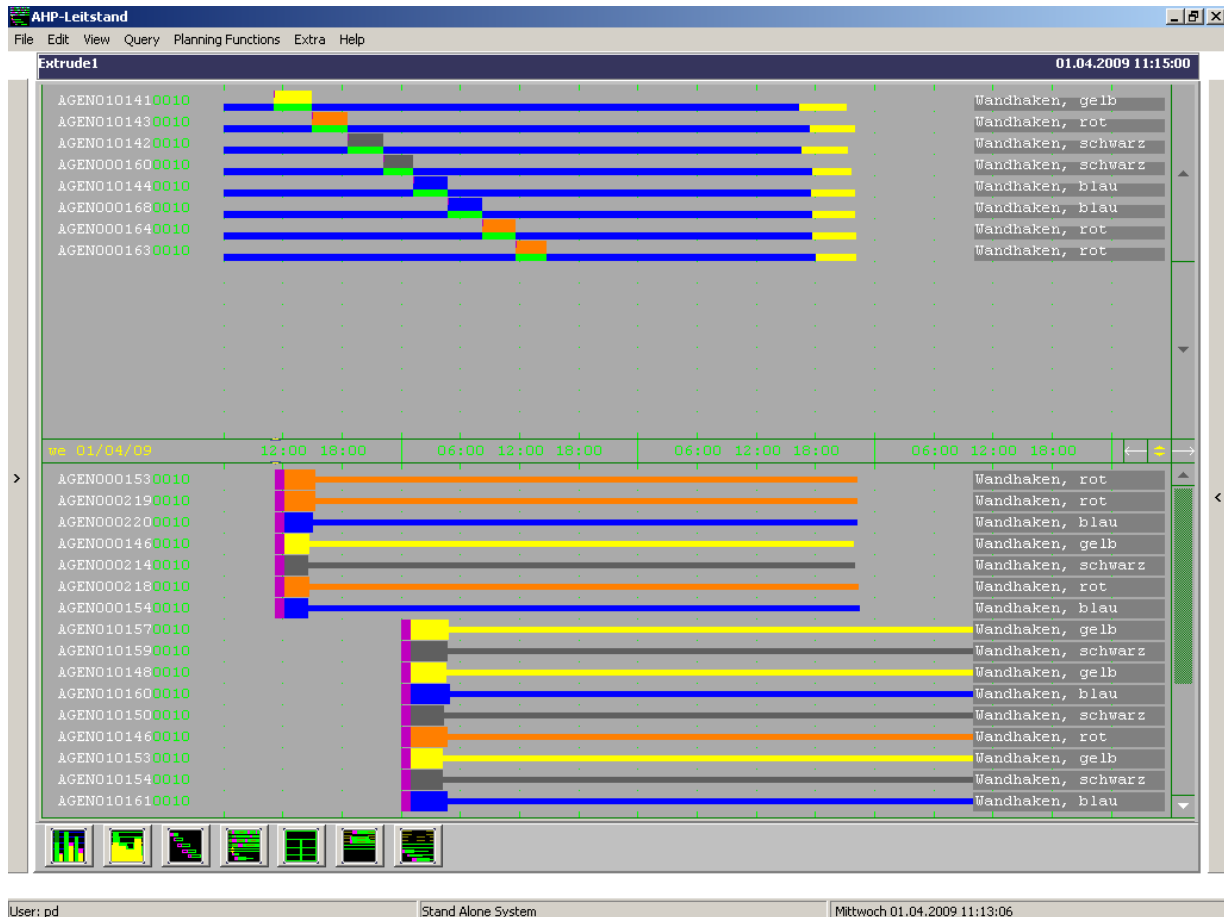
Picture 5: The Operation View

Fast preparation of the desired information

Short-term information of any work order is granted directly.

Planning board for a single resource

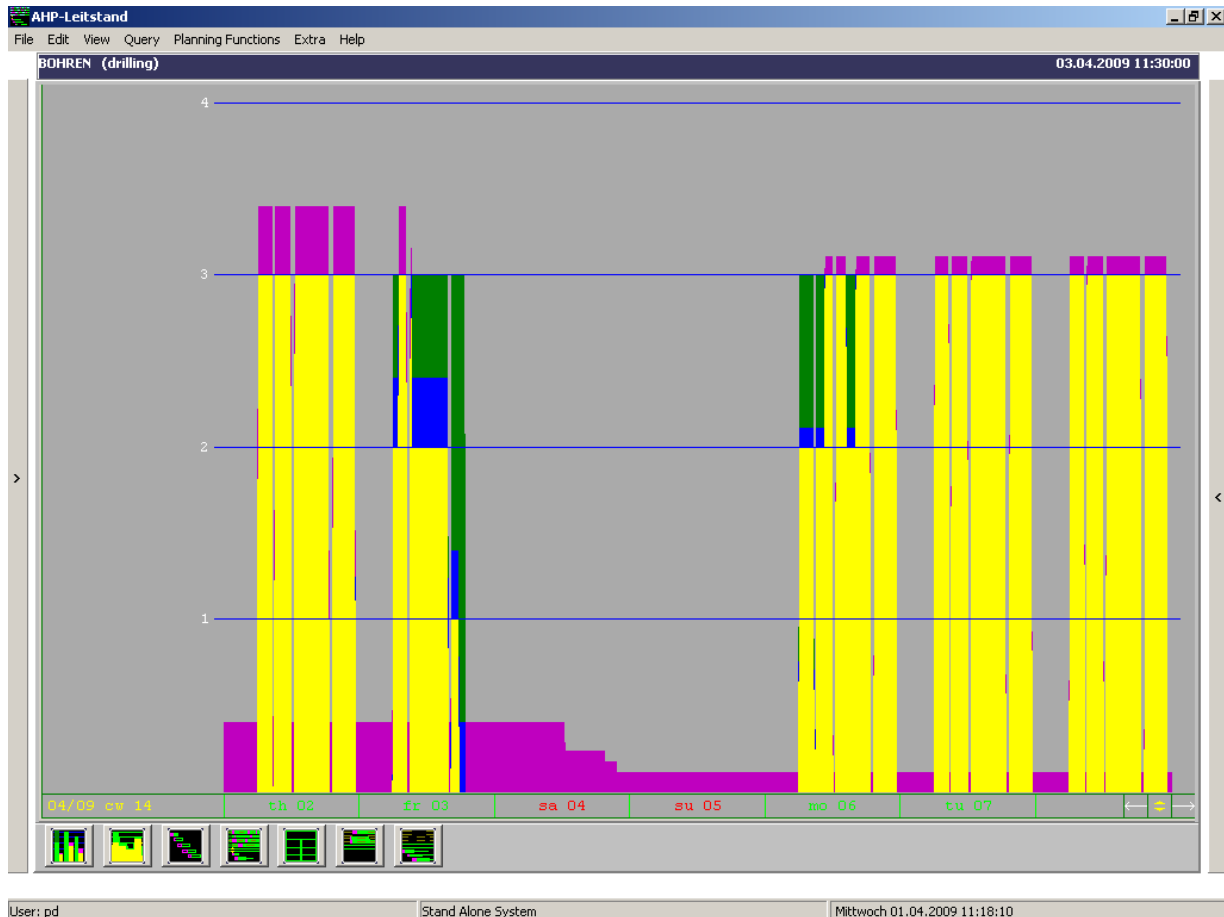
The Planning Board is applied to all resources in a group while the Planning Board for a single resource relates only to a chosen resource. The planned operations are shown with it on a time axis horizontally. Every operation proves an individual line. Different colours and further representation forms shows additional information like earliest start date, latest start date, latest end date and perhaps delays.



Picture 6: The Planning Board for a Single Resource

Capacity Graph

Representation of capacity of a resource group shows the extent of utilization of the resource group within a specified time-period. For a selected time period the planned capacity, the available capacity, the required capacity, and under- or overloading will be displayed.



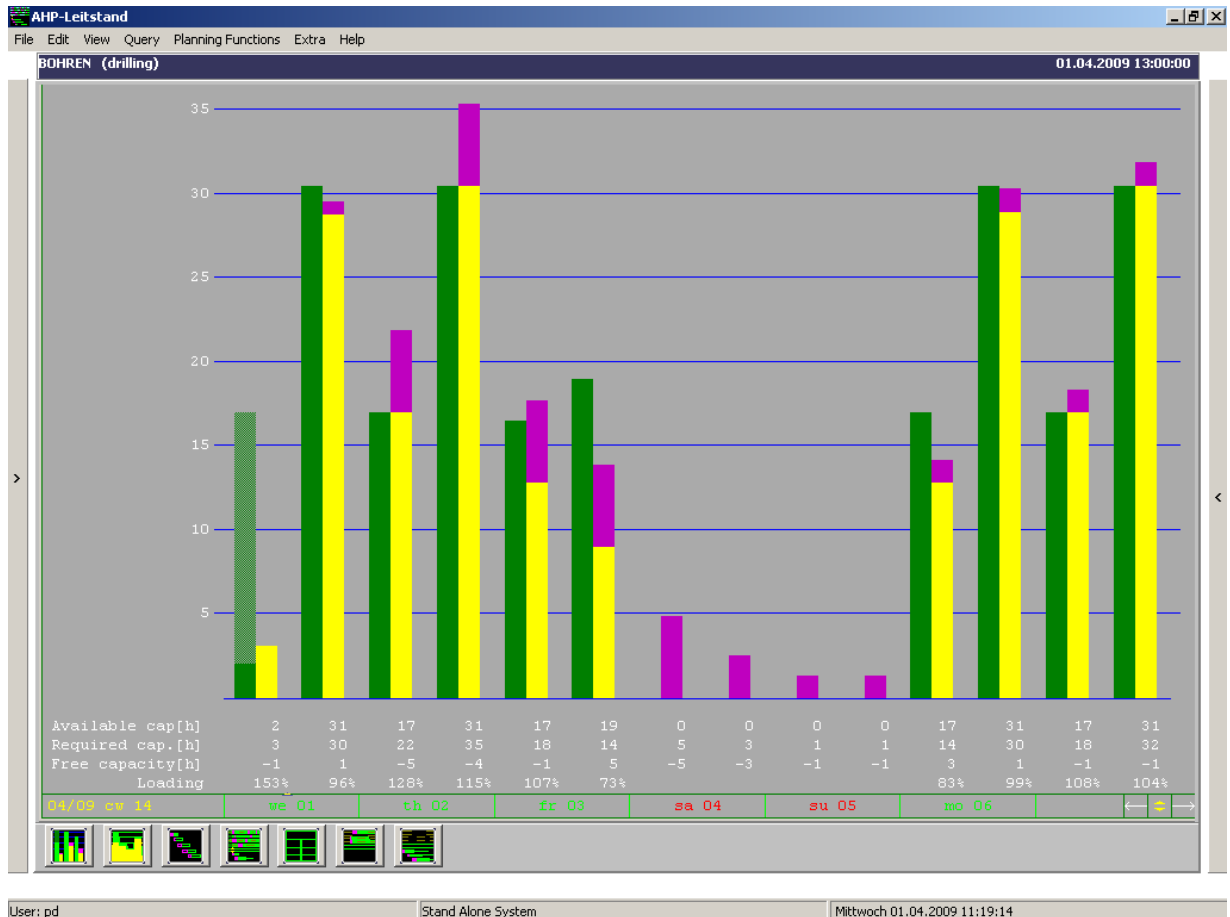
Picture 7: The Capacity Graph

Utilization of capacity is shown

By such presentation a speedy statement with regard to future resource requirements is supported. The representations can be displayed for resource Groups and/or for individual resources.

Different capacity graphs are possible

Another capacity display is the bar chart. For a selected time period the available capacity, the planned capacity, the required capacity will be displayed.



Picture 8: The Bar Chart

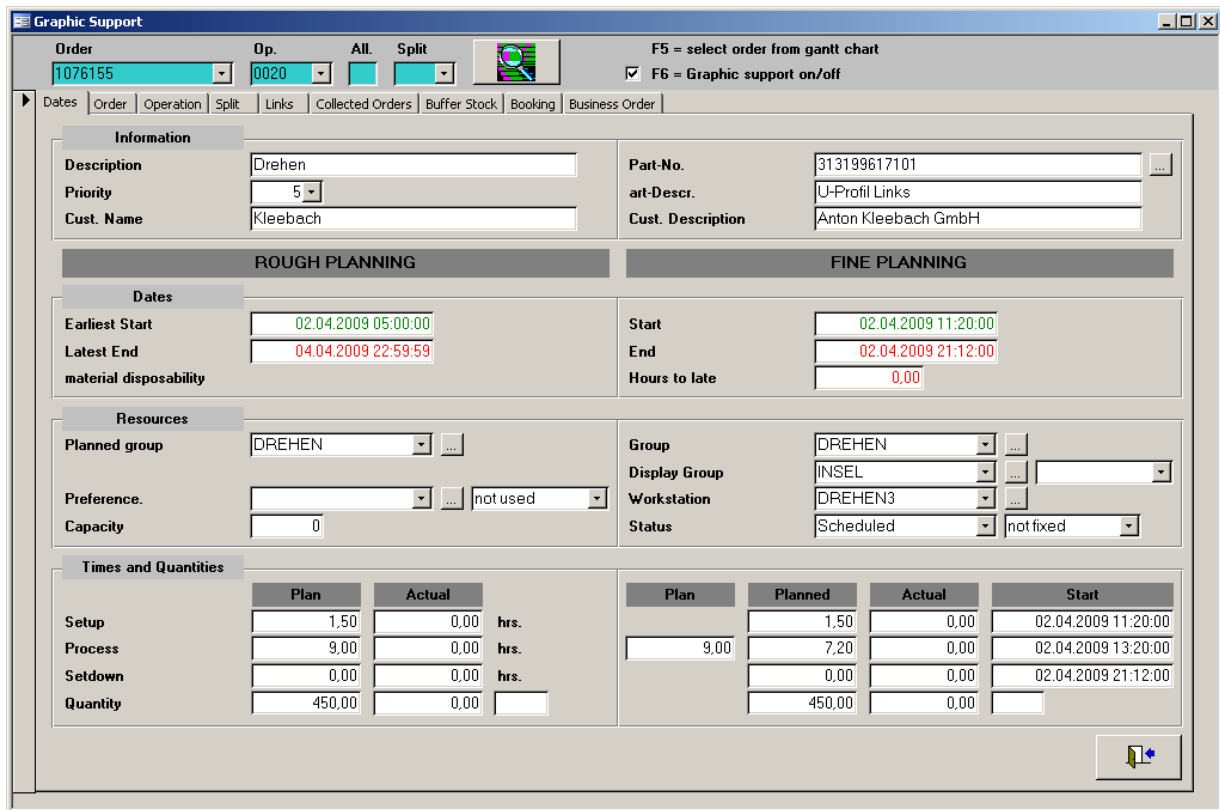
2.2 The Information Screen



Picture 9: The Main Menu

User friendly masks

The information screen has been realised as a Windows application, regarding to requirements for customizing. The MS Access environment grants user-specific appearances and additional functions for the customer's information requirements. All records are stored either in the integrated Database or in a standard database such as e.g. Oracle. With SQL instructions it is possible to create own overviews and reports.



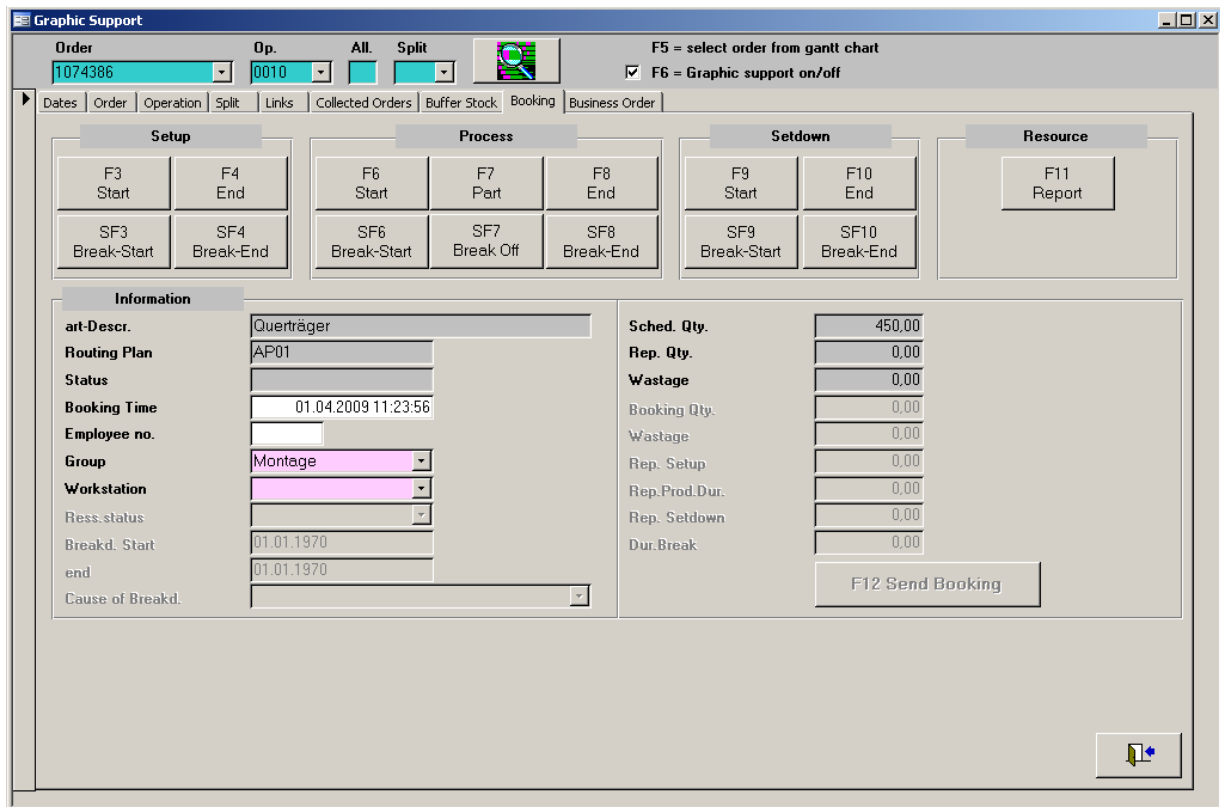
Picture 10: The Graphic Support

The graphic support

In the graphics support, detailed informations to an operation or to a resource chosen at the planning screen are shown. The synchronization takes place automatically so that no mouse click is necessary. Consequently, all necessary informations are always visible for the user.

Synchronization between the planning screen and the information screen

The synchronization is sure-placed not only in direction Planning Screen ⇔ Information Screen but also is valid inverted. If a search becomes on the information screen so the planning screen shows the found operation in the planning board.



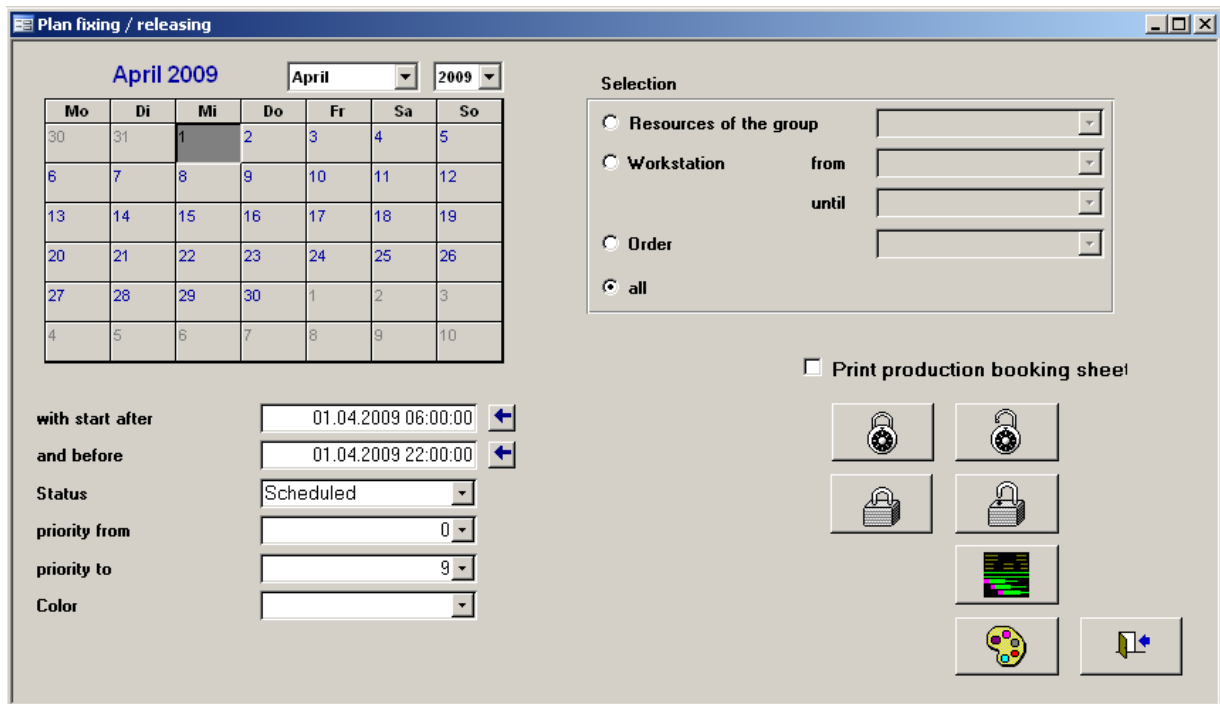
Picture 11: Booking Mask

Bookings can be received directly from an external MES-system (communication software for standard software products is available), or entered manually at the AHP-Leitstand®.

Bookings are instantly reflected

Bookings are processed continuously as they are received at the AHP-Leitstand® so that the current status of each operation is instantly reflected on the graphical planning board.

Most requirements for processing bookings by the AHP-Leitstand® can be configured so that customization is seldom necessary.

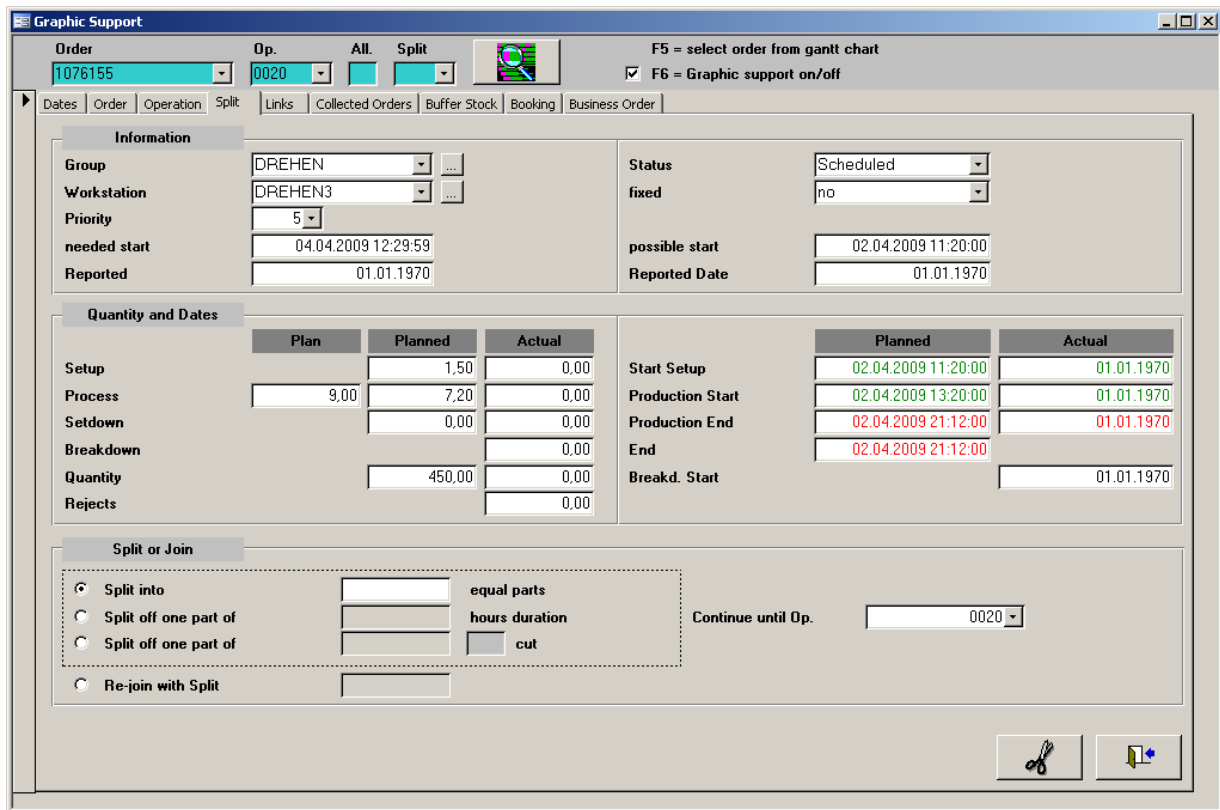


Picture 12: The “PLAN-OK” dialog

Freeze and unfreeze operations

Scheduled operations within a defined period can be frozen (or unfrozen) using the Plan-OK dialogue. Frozen (fixed) operations cannot be rescheduled. Upon freezing a message is usually transmitted to external systems (ERP-System, MES, DNC, Inventory Management, Material Disposition, ...) using standard AHP-Leitstand[®] communication modules. This data transfer can be turned off by parameter.

Alternatively a production booking sheet can be printed out with this function. The expression of barcodes is supported standard.



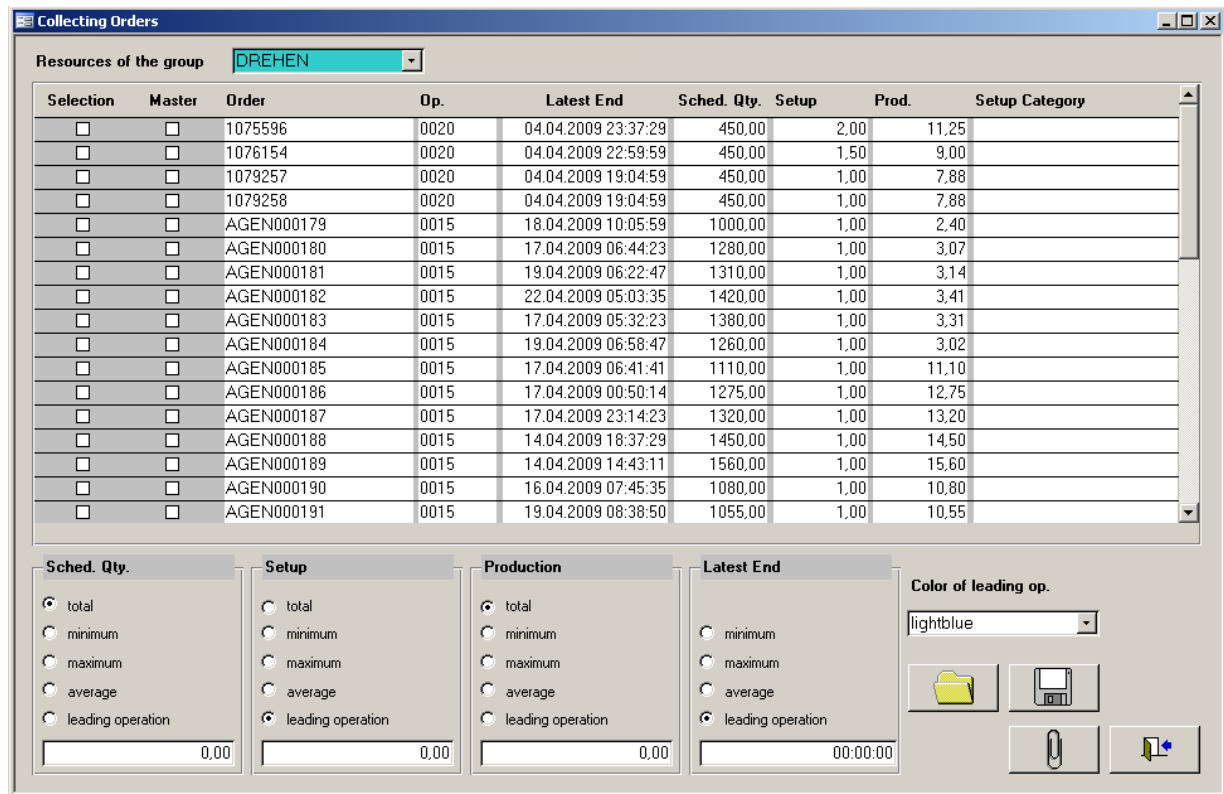
Picture 13: Split and Join

Generate splits

To reduce throughput time, operations can be split and scheduled on multiple resources.

An operation can be split by quantity or duration. Alternatively, a given number of equal splits can be created.

The inverse function (join splits) is also available.



Picture 14: Collect Orders

Collect orders

With the function collect orders operations within a resource group can be summarized to one operation.

Collected operations can indicated and are dissolved also again with demand.

2.3 Lists and Reports of AHP-Leitstand®

The AHP-Leitstand® offers a multiplicity of evaluations, that as well as in list form also as in graph to the disposal stands. The here described evaluations represent only a small departure

Order	Op.	All.	Split	Part-No.	art-Descr.	Sched. Qty.	Setup	Start	Workstation
Description				Cust. Order Id.	Cust. Description	Booked	Prod.	End	Status
▶ AGEN000175	0010			X240020	Zylinder 24 20	1600,00	0,50	01.04.11:30	BOHREN1
Bohren						0,00	1,60	01.04.14:06	Scheduled
AGEN000172	0010			X240020	Zylinder 24 20	1200,00	0,50	01.04.14:06	BOHREN1
Bohren						0,00	1,20	01.04.15:48	Scheduled
1078990	0010			313199631101	Halter	450,00	1,00	02.04.06:00	BOHREN1
Bohren				BA-588677	Anton Kleeback Gmbh	0,00	3,38	02.04.10:42	Scheduled
1078475	0010			313199604101	Querrohr	450,00	1,00	02.04.10:42	BOHREN1
Bohren				BA-588677	Anton Kleeback Gmbh	0,00	3,38	02.04.15:35	Scheduled
1076154	0010			313199617102	U-Profil Rechts	450,00	0,50	02.04.15:35	BOHREN1
Bohren				BA-588677	Anton Kleeback Gmbh	0,00	4,50	02.04.21:15	Scheduled
1076155	0010			313199617101	U-Profil Links	450,00	0,50	02.04.21:15	BOHREN1
Bohren				BA-588677	Anton Kleeback Gmbh	0,00	4,50	03.04.09:25	Scheduled
1079257	0010			313172606002	Seitenteil Rechts	450,00	0,25	03.04.09:25	BOHREN1
Bohren				BA-588677	Anton Kleeback Gmbh	0,00	13,50	06.04.11:10	Scheduled

AGEN000175 0010 Reprint production booking sheet

Datensatz: 1 von 7

Picture 15: The Work Distribution List

Show on screen or print
it out

The result of scheduling is shown on the work distribution list. All planned operations are shown within a freely selectable time period and freely selectable resource or resource group. These results can be shown on screen as well as printed out.

Order	Op.	Split	Group	Earliest Start	Start Setup	Delay
				Latest End	Production End	
1079257	0010		BOHREN	02.04.2009	02.04.2009 21:40:00	44,00
				04.04.2009 10:12:29	06.04.2009 06:15:00	
AGEN000175	0020		FRÄSEN	01.04.2009 02:06:00	03.04.2009 10:00:00	1,00
				03.04.2009 11:53:59	03.04.2009 12:36:00	
DR00010129	0040		Pruefen	04.04.2009 19:54:00	10.04.2009 08:30:00	0,00
				16.04.2009 10:11:59	16.04.2009 10:33:00	
AGEN010158	0020		Stanzen	02.04.2009 04:45:00	06.04.2009 06:00:00	32,00
				04.04.2009 22:07:29	06.04.2009 06:52:30	
AGEN010149	0020		Stanzen	02.04.2009 04:24:00	06.04.2009 06:52:12	33,00
				04.04.2009 22:17:59	06.04.2009 07:42:36	
AGEN010147	0020		Stanzen	02.04.2009 04:42:00	06.04.2009 06:00:00	32,00
				04.04.2009 22:08:59	06.04.2009 06:52:12	
AGEN000217	0040		Verpack	01.04.2009 04:01:48	06.04.2009 06:00:00	55,00
				03.04.2009 23:59:59	06.04.2009 06:51:45	
AGEN000215	0040		Verpack	01.04.2009 04:08:24	06.04.2009 06:00:00	55,00
				03.04.2009 23:59:59	06.04.2009 06:54:00	

Datensatz: 1 von 8

Picture 16: The Delay List

Which orders are in delay?

After scheduling the operations whose completion date is behind the latest end are marked red in the planning board. Additionally these operations can be shown in the delay list. In this list, only the first operation of an order which are in delay are shown. Besides the delay duration, also the data of the rough planning and fine planning are compared.

How big are the delays?

The evaluation shows the resource groups they with the number of the operations in delay and with the delay hours. The coloured fields show the degree of the delays.



Picture 17: Delays

Evaluation

With the evaluation module, the results of the planning are clearly represented in list form.

Investigation of costs about the current planning

They are calculated the number of the operations must be prepared, the number of the operations the production costs, that cause number of the operations the warehouse expenses and cause the number of the operations the delay costs, causes. The respective hours and the corresponding costs are calculated additional to the number.

2.4 Work Orders Management

Bill of Material (Parts Lists)

Parts lists, that were handed over to the AHP-Leitstand[®], can be shown in the tree-structured architecture and in list opinion. Consequently, the planner has not only the overview over the production orders of the individual articles but also over the business order to the manufacture of the final product.

Order bill of material

Business Order: BA-588677
 Article (BOM): 313199600002 Querträger
 No. of draft:
 ERP planned: Start 02.04.2009, End 11.04.2009
 LS planned:
 F5 = select order from gantt chart

Pos.	Level	Ref.	Article No.	Article Descr.	Order	F/E	L/A	A	S	B	Quantity	Unit
0	1	0	313199600002	Querträger	1074386	F	A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		450,00	St
1	2	0	313199602001	Schweißteil	1076500	F	A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		450,00	St
2	3	1	313199604101	Querrohr	1078475	F	A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		450,00	St
3	4	2	22299	Vierkanrohr 70 x 40 x!		E	L	<input type="checkbox"/>	<input type="checkbox"/>		9,00	m
4	3	1	313199621001	Aufnahmerohr	1075596	F	A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		450,00	St
5	4	4	6216	Rundstahl 65 - 116,5 nr		E	L	<input type="checkbox"/>	<input type="checkbox"/>		450,00	St
6	4	4	303078623102	Lagerring		E	L	<input type="checkbox"/>	<input type="checkbox"/>		450,00	St
7	3	1	313199631101	Halter	1078990	F	A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		450,00	St
8	4	7	18001	Blech 3 x 1250 x 2500		E	L	<input type="checkbox"/>	<input type="checkbox"/>		6,44	m2
9	3	1	313199617101	U-Profil Links	1076154	F	A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		450,00	St
10	4	9	19035	Grobblech 5 x 1250 x 2		E	L	<input type="checkbox"/>	<input type="checkbox"/>		46,18	m2
11	3	1	313199617102	U-Profil Rechts	1076155	F	A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		450,00	St
12	4	11	19035	Grobblech 5 x 1250 x 2		E	L	<input type="checkbox"/>	<input type="checkbox"/>		46,18	m2
13	3	1	313172606001	Seitenteil Links	1079257	F	A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		450,00	St
14	4	13	19035	Grobblech 5 x 1250 x 2		E	L	<input type="checkbox"/>	<input type="checkbox"/>		29,57	m2
15	3	1	313172606002	Seitenteil Rechts	1079258	F	A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		450,00	St
16	4	15	19035	Grobblech 5 x 1250 x 2		E	L	<input type="checkbox"/>	<input type="checkbox"/>		29,57	m2
17	2	0	313199600110	Hinweisschild		E	A	<input type="checkbox"/>	<input type="checkbox"/>		450,00	St
18	2	0	313199608101	Steckdosenhalter		E	L	<input type="checkbox"/>	<input type="checkbox"/>		450,00	St
19	2	0	508292	O-Ring 26 x 3		E	L	<input type="checkbox"/>	<input type="checkbox"/>		450,00	St

Picture 18: Bill of Material (Parts List)

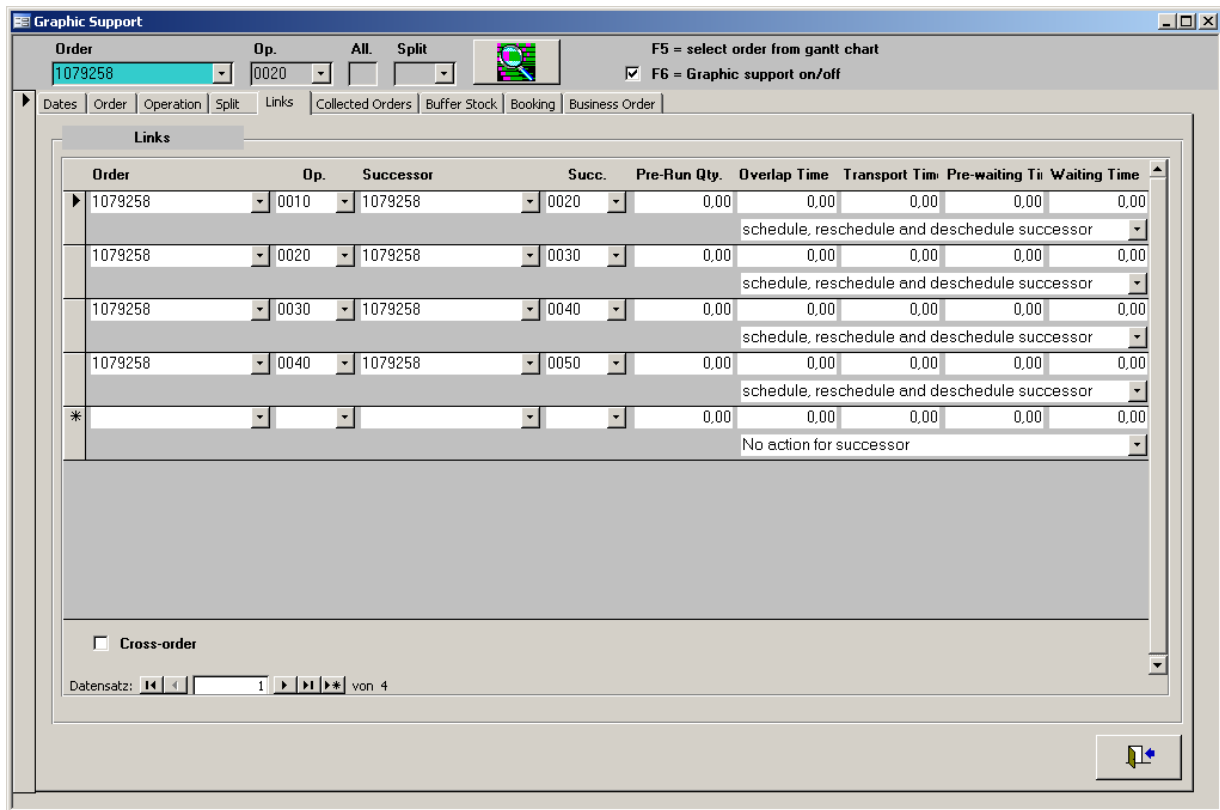
Work orders Work orders are maintained in a relational structure in form of order headings and associated operations.

All masks and functions necessary for management of order data are available. Order data can either be entered manually, generated at the AHP-Leitstand[®] from routing plans or downloaded from an external system. Changing and deleting of orders is likewise possible, manually or via updates from an external system. With an integrated HOST connection data can also be read. Respective decisions about interface strategy have to be discussed regarding the customer's work flow organization.

Operations The relationship between operations in an order (the routing plan) is defined by operation link records. These records can be created and maintained by any of the methods described above.

Operation links Operations can be overlapped to reduce throughput time. This is only realistic where the production and consumption rates of two adjacent operations would facilitate such a schedule. The following transfer times are supported:

- Overlap time of two operations
- Transport time
- Pre-determined waiting time at the predecessor resource
- Pre-determined waiting time at the successor resource



Picture 19: The Predecessors / Successor Relationship

Parallel resources

In order to carry out an operation several resources are frequently required, a CNC machine, a preparatory procedure and an operator, for example. At the AHP-Leitstand[®], up to this point, only one resource has been scheduled. It is left to the planner which one this is. Now it is possible to schedule several resources for the one operation. As these resources are required simultaneously, that is in parallel, we call them „Parallel Resources.“ At the AHP-Leitstand[®] each available resource is entered as a separate work station, each required resource as a separate operation bar:

There are two principal operational areas for parallel Resources

- Scheduling one or several simultaneous bottleneck Resources.
- Informative function for required capacity without planning restrictions.

Material Buffer Stock

The material buffer stock is intermediary storage into which several production orders can deliver material where it remains in a central pool until it is withdrawn by one or more production orders. Unlike the usual operation linkage, the quantities in the buffer store are not related to those of a calling operation.

“Buffer Stock Management” facilitates the definition of prerequisite materials necessary for each operation to start production; scheduling is only possible when all materials are available in sufficient quantities.

Management of buffer stock takes place at the AHP-Leitstand[®], whereby expected delivery through internal production (an operation produces materials) can be depicted.

Compute Throughput Schedule

With this module the buffer times per operation are computed for a selected order.

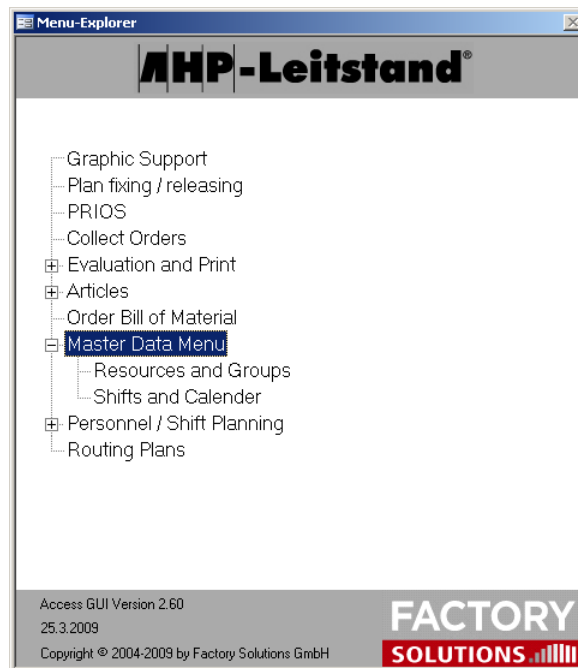
The throughput scheduling is computed in two phases: the first phase works back from the due date, taking account of the shift times, to calculate the latest completion of each operation. In the same way the second phase uses the earliest start of the first operation to calculate the earliest possible start for all the following operations

The difference yields the buffer for the entire order.

Delete orders

Order deletion is necessary for AHP-Leitstand[®] solutions which are not integrated. Completed, old or cancelled orders can be removed. Integrated systems more often rely on other methods of deleting redundant orders such as „super delete” commands from a host system.

2.5 The Master Data Management



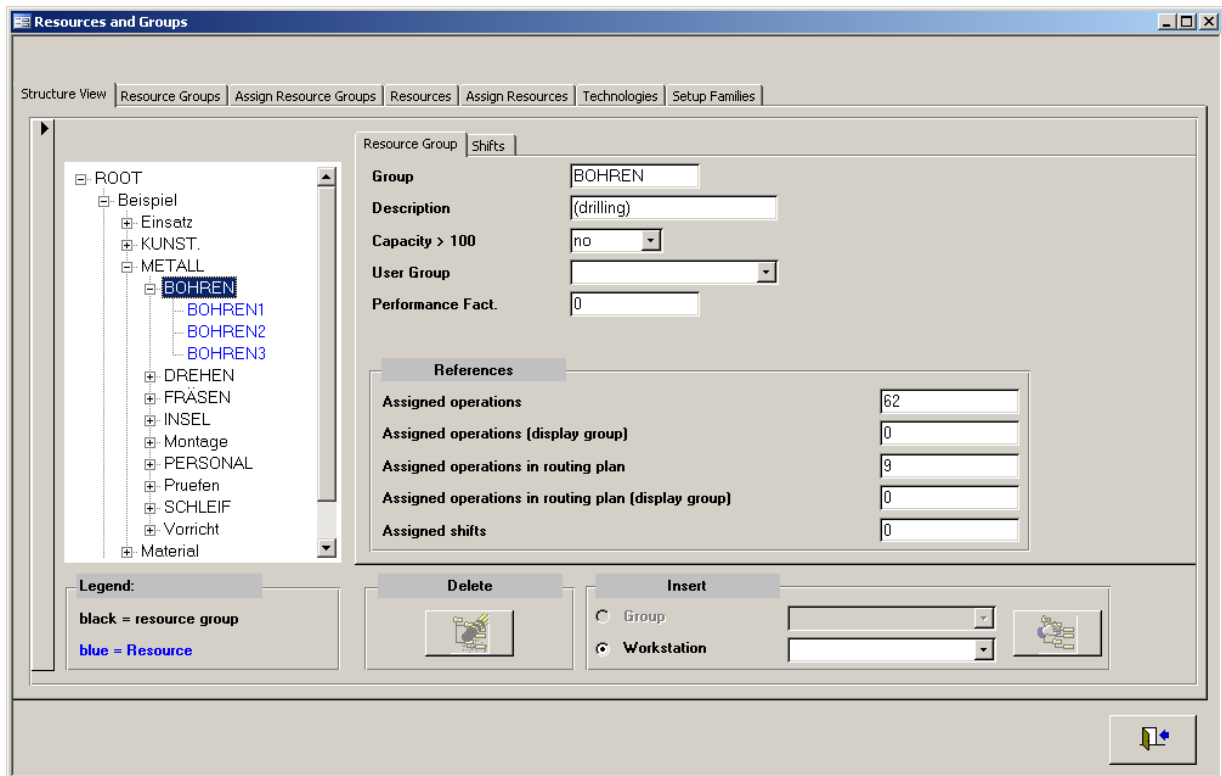
Picture 20: The Master Data Management

This menu and its sub-menus provide all functions for the management of master data.

Resource groups and resources

The AHP-Leitstand[®] resource structure consists of over groups, resource groups and resources. This structure can be expanded to a maximum of eight levels from the highest over group down to a single resource.

An over group can contain one or more over groups and/or one or more resource groups. A resource group consists of one or more resources. An over group can only contain groups and a resource group may only contain resources, mixing is not possible.



Picture 21: The Administration of Resources and Resource Groups

A resource can be allocated to one or more resource groups and a resource group can be allocated to one or more over groups.

Shifts

As many shifts as required may be defined. A shift describes the availability of a resource or of a resource group in elapsed time. Cyclical work patterns are supported by the AHP-Leitstand[®]; this means that after a specified number of days the shift starts over again from the beginning. Within a shift several work periods may be defined each of which can have differing production factors and capacities.

Shifts can be assigned to resources and groups

There is no limit to the number of shifts which can be assigned to a resource or resource group. However, at any point in time only one shift can be active. The active shift determines the availability of the resource.

Non-working-days

Non-working days (plant vacations, holidays) which apply to all resources can likewise be defined.

2.6 Dynamic Setup-Time Calculation

Purpose If dynamic setup-time calculation is active while scheduling an operation, its setup time is computed subject to the current setup status.

Reduce the setup-time In serial production, small-quantity production and often in single part production identical or similar parts from various orders are produced one after the other on one machine. In this way setup-time can be eliminated or at least reduced.

This module reveals resources which can be utilized to eliminate unnecessary setup-times and thus greatly increase the throughput for a resource group.

2.7 The Menu Routing Plan Maintenance

Picture 22: Routing Plan

*The AHP-Leitstand®
without ERP-System*

For the stand-alone release of the AHP-Leitstand® and some special applications in an integrated environment use routing plans to generate work orders.

Routing Plans

The routing plans maintained in this dialogue form the basis and reflect the structures of work orders to be generated (heading, operations, operation links, and if present, parallel resources).

Generation of work orders

With this dialogue a work order can be generated, simply select the desired routing plan.

The work order number is allocated automatically by the system but can be overwritten. Suggested start and due dates are calculated, these can also be changed. The order quantity is entered and the work order is inserted in the database for further processing.

2.8 Variant Management

Store and back-load several planning conditions

Using the module "Variant Management" up to three scheduling variants can be stored. Each of these variants may be reinstated at a later time.

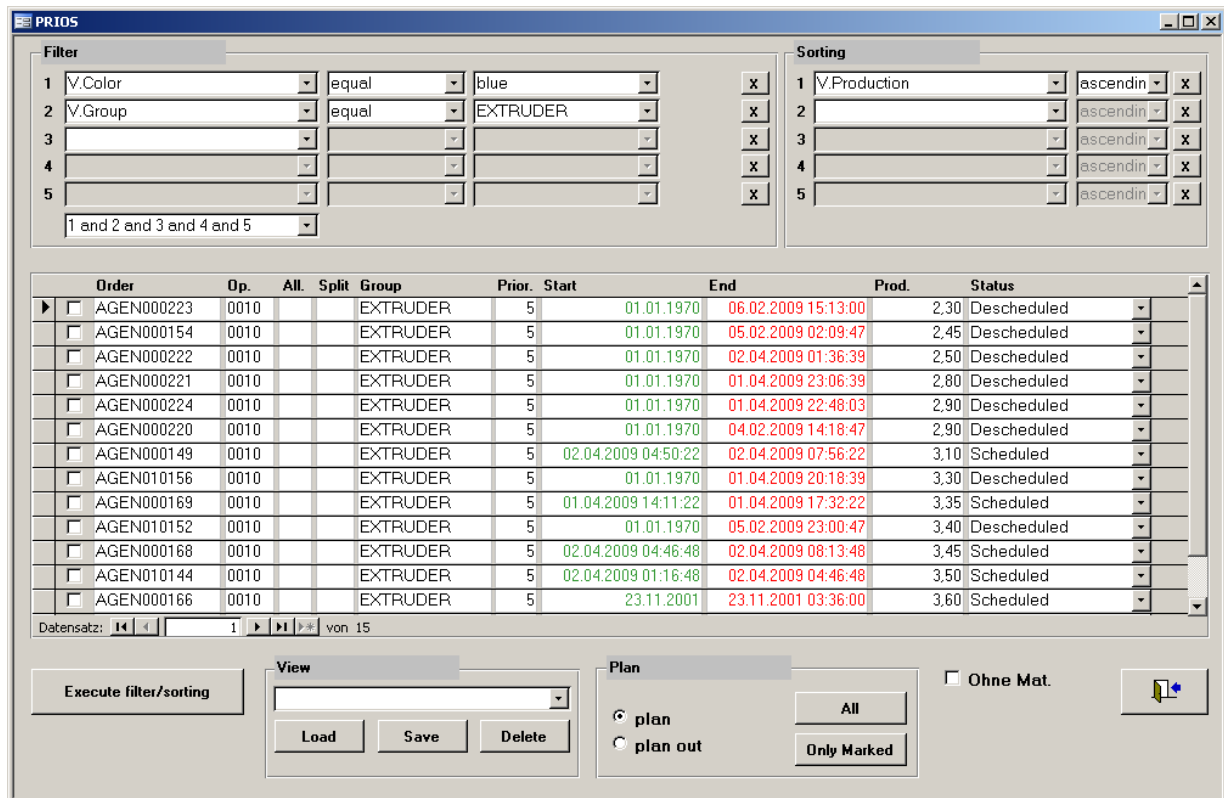
In so doing, operations in the past at the time the variant is reinstated, will be scheduled in accordance with the current AHP-Leitstand[®] rules. The scheduling sequence will correspond as far as possible to that which obtained when the variant was stored.

2.9 Scheduling with PRIOS

By the automatic planning the operations are planned strictly after priority and necessary start date. With the module PRIOS, it is possible to define own rules for scheduling.

Scheduling with own priority rules

The operations can become filtered and sorted according to own criterions. These priority rules can be stored and can be loaded again with demand.



Picture 23: The Module PRIOS

2.10 Personnel / Shift Planning

The module „Personnel / Shift Planning” allows the user to assign a team of co-workers or also individual co-workers to the resources. Through the prior definition of qualifications and this with it connected skill factors, the AHP-Leitstand[®] calculates the performance factor for the resource on the basis of the personnel use. Consequently, it is possible to determine the performance factor, if for example instead of 3 co-workers only 2 co-workers could work on a resource.

3 Optimizer

Planning of the operation sequences of a production process is the foundation of manufacturing control. The starting point until now was setup times, which were themselves coupled exclusively with the respective operations. The approximation to actual scheduling time was scarcely imperilled by the limited participation of setting-up time on total duration of production time, and hence setup time as a production factor was of minor interest. On the one hand, increasing complexity of setup procedures and attendant time expenditure, and concurrent smaller production lots with more frequent setup changes on the other hand, allowed setup times to become an essential planning (and thus cost-) factor.

Rigidly defined setup times seldom correspond to manufacturing realities. In the usual case the duration of a setup operation depends on what common product was previously produced by the machine. Similar characteristics such as material required, common tools used, etc. allow setup time to be shortened, differing characteristics to prolong it. Setup times are also dependent on the operating sequence of the production procedure(s) performed by or on the machine.

The AHP-Leitstand[®] planning takes all of above into consideration. To do this, rules are defined how long a setup takes if one of the manufacturing characteristics alters the operation of the machine and process. In calculating the sequence-dependent setup time, the characteristics of the previous operation are compared with those of the subsequent operation. When characteristics differ, precisely-defined setup times are established for this transition.

For planning and optimization calculations setup time is not the significant factor, but the additional expenditures associated with setup operations. Among these are, for example, increased personnel expenditures or the cleaning materials used. Setup expenses must not then be strictly proportional to setup time; under some conditions a short setup operation can be more expensive than a longer one. For this reason the same logic used in determining setup time must be applied in determining the extra setup costs. So then rules for determining setup time and rules for determining additional setup expenses can be defined. Should a „time” rule be specified, then total setup expenses would be calculated as a product of setup time at the hourly rate of the firm's facilities added to the additional setup costs.