



# Detailed Order Scheduling

Version 4

*Manual*



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## 1 Introduction

### 1.1 What is DOS?

DOS Detailed Order Scheduling is a module in FORCAM FORCE™ used for dynamic production scheduling and control. Its fundamental purpose is to determine the machine assignment for the workplaces to be scheduled taking the limited capacity into account. The DOS module is designed for use in the operative shop floor environment and intended to enable the MRP controller to respond quickly to any changes (e.g. machine trouble, urgent orders) in the production environment. Furthermore, another task is to provide optimum timing for an ever increasing number of orders going through production.

### 1.2 How does DOS work?

#### 1.2.1 Technical implementation

The DOS module is a client/server database system. It has been written in JAVA completely. The client/server interface is based on the RMI concept provided by JAVA.

The client is only used for information output and command input/initiation. Logic processing is handled entirely by the server. The DOS module is a completely object-oriented application and features a 3-tier architecture which includes:

- Presentation level      User tier
- Processing level        Business tier
- Database level         Persistence tier

The **database level** provides the mapping of the object model to the relational database. It includes a cache for read operations in which all objects are kept for quick access.

The **processing level** encapsulates the complete application logic required for scheduling and simulation.

The **presentation level** is subdivided into 2 parts by the client/server interface. The client part is dedicated to the display of information which is often transferred at a very abstract level. In addition, the client part is used for inputting commands which are passed on almost unmodified to the server part.

The server part of the presentation level prepares information for display. This involves translating the data of the logic object model into graphically abstract display data and transferring them to the client. The commands received from the client are interpreted on the server, initiating processes at the processing level.

For a detailed description of the technical implementation of the DOS module and its integration with FORCAM FORCE™, refer to chapter 9, Technical Integration with FORCAM FORCE™.

Note:

Running DOS requires a JAVA plugin installed in the Internet Explorer of the client!

### 1.2.2 Objectives and conditions

The objective of DOS is to produce a feasible and realistic resource allocation schedule as quickly as possible. In this process, DOS must never violate the sequence conditions existing between the operations of an order or order network in the simulation. A feasible schedule is required at all times.

Hence:

- A scheduling action always originates from the order or order network. Orders or order networks are simulated either individually, altogether or by groups.
- The allocation of orders, or their existing operations that are not rescheduled, is fixed and not modified by scheduling.
- For these reasons, a resource cannot be scheduled.  
This would violate the sequence conditions of subsequent operations.
- Operations under processing are not scheduled freely but from the fixed current time on the workplace or left in the scheduling status of the previous confirmation message.
- A resource defined as a scheduling capacity cannot overbook the available capacity defined in the job model. Operations are therefore postponed into the future until a suitable slot is found.
- The target start date of an order absolutely determines the earliest possible time of scheduling. The start date relies on the material availability which cannot be violated. An exception is scheduling of order networks.
- The target end date of an order is considered as the (desirable) target criterion of optimized scheduling. This date may be disregarded for reasons of capacity utilization and appropriateness.
- DOS always uses forward scheduling since the focus is on enforcement of released orders in production and backward scheduling would therefore be a meaningless processing step.


The objective of DOS is to compute the pool of orders based on the current situation in production and show the resulting time-related situation. The DOS module may be considered as the MRP controller's hand calculator.

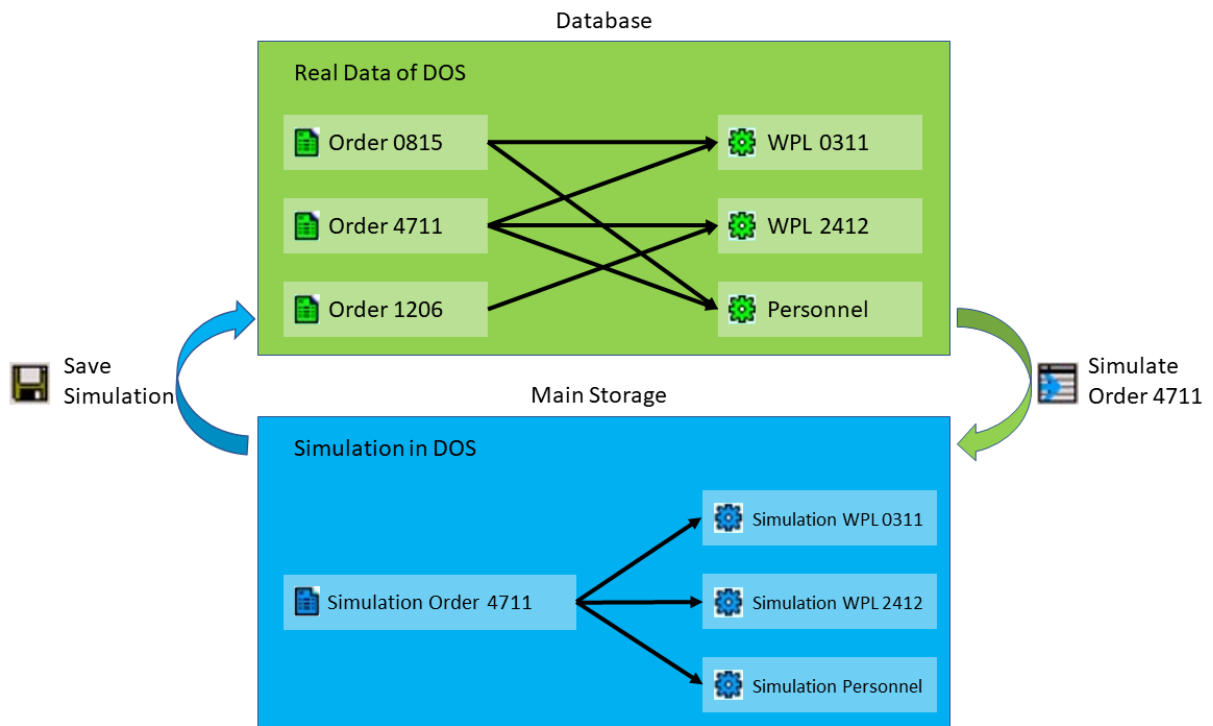
### 1.2.3 Simulations in the DOS module

The DOS module has a simulation core with multi-user capability for implementing the scheduling process. A cache-based simulation concept was chosen to achieve higher simulation speeds. For this purpose, all relevant data are loaded into the main memory for processing when the program is called (server start). All functions are executed with the data (objects) loaded in the main memory.

The data transferred from FORCAM FORCE™ are referred to as real data below. This designation is also useful since all confirmation messages from the MDC/PDA level are incorporated immediately into the real data.

The contrasting group of data are the simulation data. Simulation data are copies of real data used for performing a simulation. The background is the required segregation at simulation time, since a simulation may take longer, e.g. due to manual interaction by the user.

 Real data are saved in the database with each change in the DOS module.



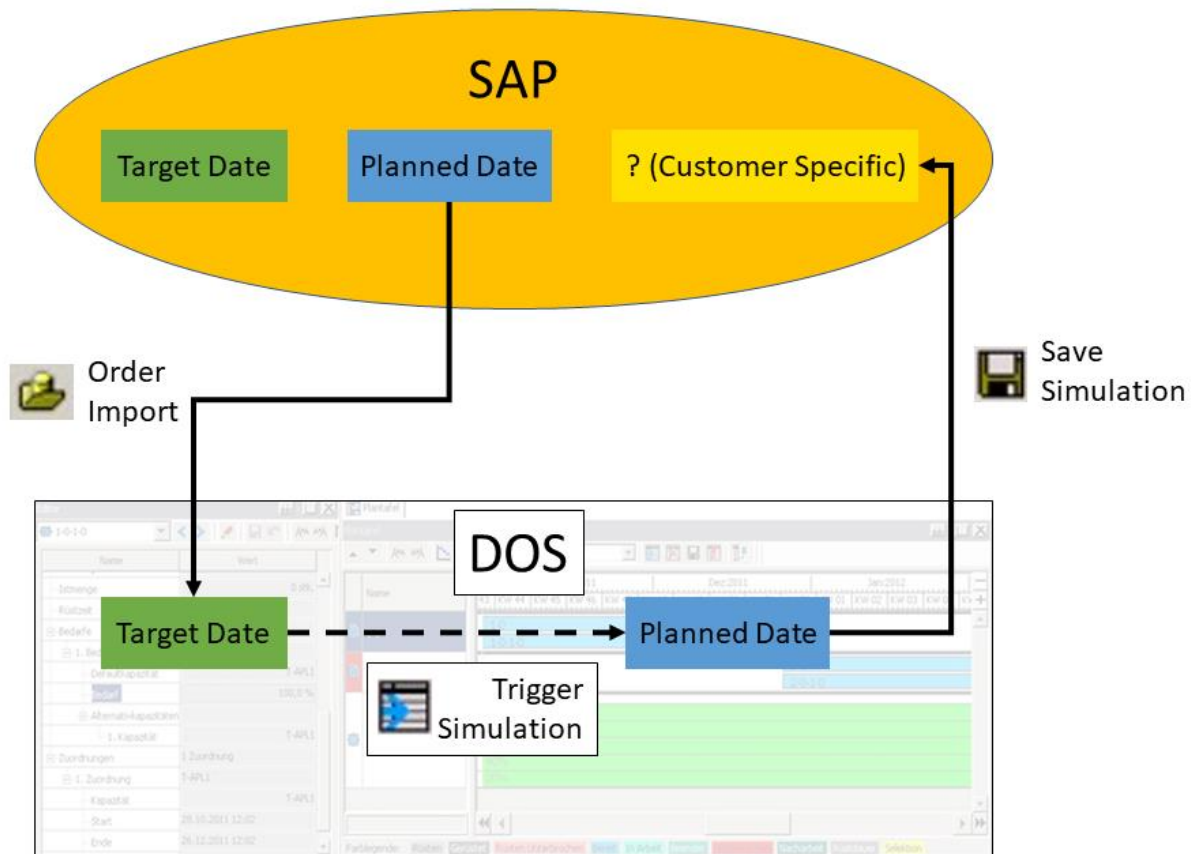
When a simulation is initiated (e.g. for an order), the order header and the related operations are initially copied into the simulation area. Subsequently all resources that are or might be used by the operations of the order are also copied into the simulation area. When copying resources, the complete allocation and available capacity of the resource are included. During simulation, the allocation of the simulation operations is cleared on the simulation workplaces and the operation is rescheduled.

The simulation data are written back to the real data when the data are transferred. Simulation data of those operations the status of which has changed during the simulation are not written back.

**i** Once copied, real data are not updated any more during the simulation!

### 1.2.4 Planned and target dates

In order to avoid confusion regarding the planned and target dates, the following graphic is intended to explain the difference between planned and target dates in SAP and the DOS module.



Within the SAP system, there are SAP target dates and SAP planned dates. Only the SAP planned dates are relevant for processing within the DOS module. They are loaded into the DOS module by order import and represent the DOS target dates there. The DOS target dates are used as a basis for the scheduling simulation.

The simulation turns the DOS target dates into DOS planned dates. If the simulation result is accepted, the DOS planned dates are written to a customer-specific field in the SAP system. The SAP planned dates are not overwritten when a simulation is accepted.

 Unless otherwise specified, DOS planned and target dates are referred to below!

### 1.2.5 Queue principle

A queue-based process is used in the DOS module for sequencing operations with resources. With the ultimate aim to achieve global optimization with respect to the order end date by means of the queue priority rules, the date limits (earliest start/latest end, etc.) are determined at the beginning of each simulation for each operation using a network procedure.

When a simulation is initiated for the complete order volume, all executable operations are determined initially, included into an initial queue and assigned the simulation start date/time. An

## Introduction

executable operation is an operation the predecessor of which is completed or the transfer quantity of which is reached.

The initial queue is sorted according to the priority rules. Now an attempt is made along the sort sequence to schedule the topmost operation with a resource. If an operation has several requirements (machines and personnel), scheduling must be tested with all resources. If all resources are free at this point in time, the operation is scheduled. If one or more resources are already in use at this point in time, the next possible scheduling time is determined. Another queue is opened now for this point in time, assigned the next possible starting date/time, opened and assigned the operation.

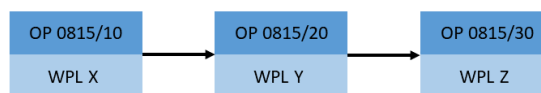
When an operation is scheduled successfully, its successor(s) is (are) determined including the starting date/time resulting from scheduling. Usually this is obtained at operation scheduling end or when the transfer quantity of the scheduled operation is reached. Another queue is opened up then for this point in time and the successor operation is assigned.

When the complete queue has been processed, the next queue in time is determined and re-sorted according to the priority rules configured.

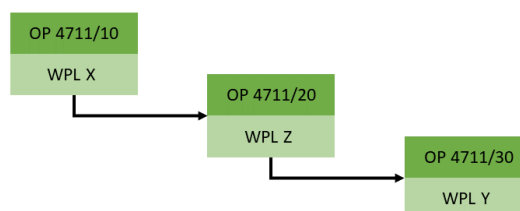
### 1.2.5.1 Example: Order scheduling

The queue principle is illustrated by the following example involving two orders.

Order 0815 has 3 operations linked in a strictly linear arrangement. This means that a successor operation can only be executed when the predecessor operation has been finished.

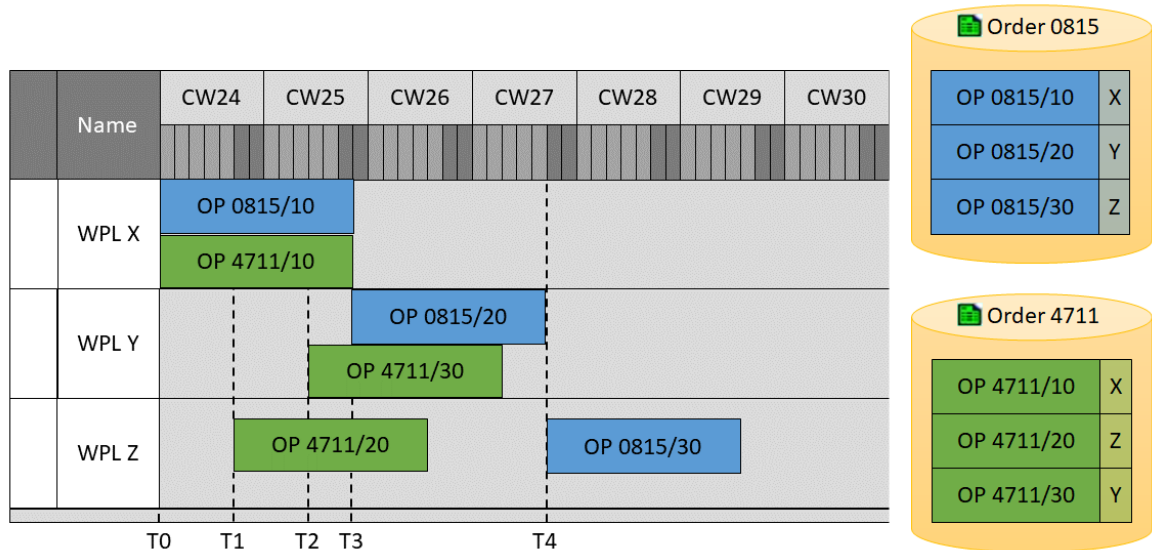


Order 4711 has 3 operations linked in a linear arrangement with overlaps. This means that a successor operation can be started as soon as an operation-specific transfer quantity has been reached in the predecessor operation.



If you now schedule these two orders on the associated machines without considering their capacity limits, the following schedule pattern results. The symbols of the resource and order objects are green since they represent real data.

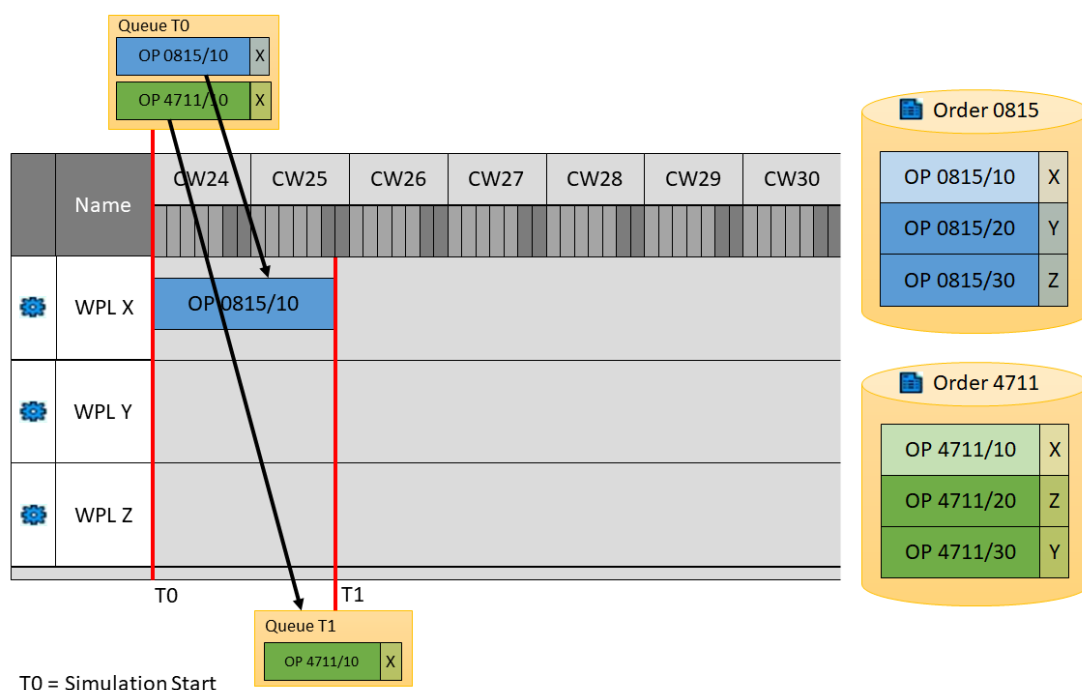
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It is evident that the orders overlap on workplace X and workplace Y. This is not intended and detrimental for timely scheduling. This can be improved by optimizing order scheduling using a queue process simulation.

The symbol colors of the corresponding objects change from green to blue (indicating simulation data), since a simulation was initiated. At the beginning of the simulation, the operations subject to scheduling are determined and incorporated into the first queue for the T0 point in time. The T0 queue is sorted according to the priority rules and the first operation 0815/10 scheduled. The successor operation 0815/20 is incorporated into a new T1 queue. T1 is the end time of operation 0815/10.

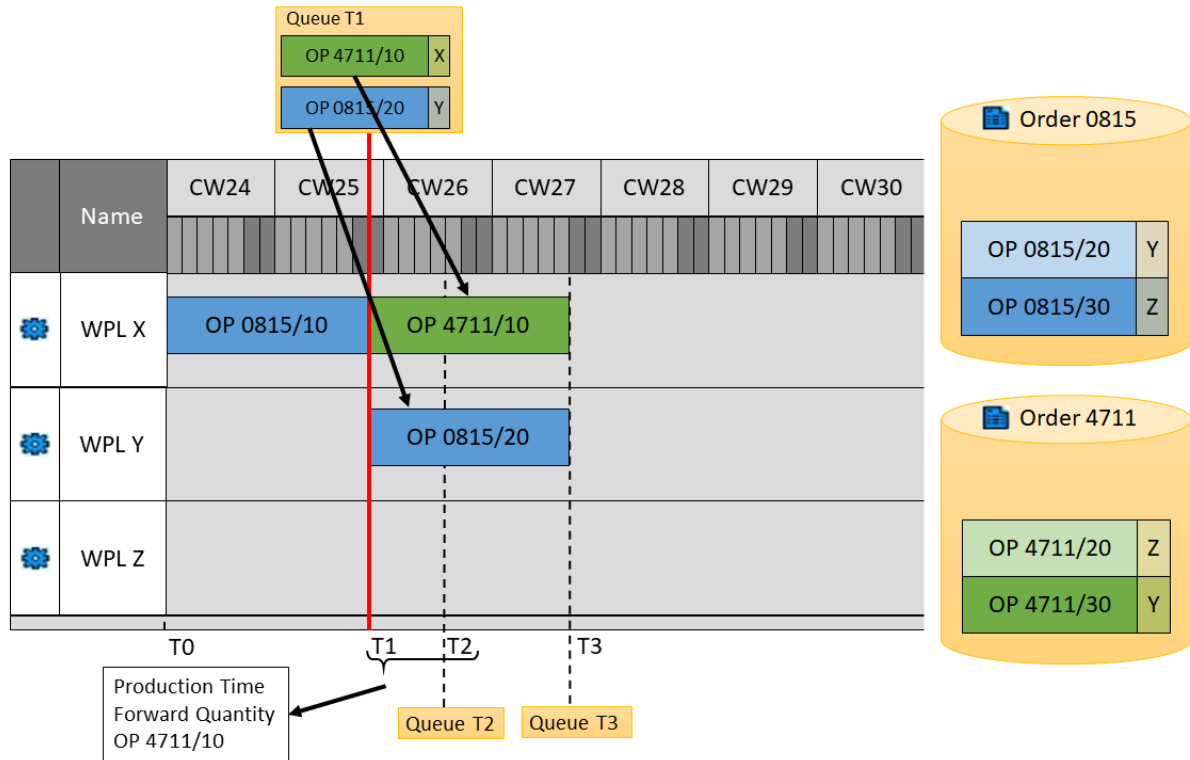
Since scheduling of operation 0815/10 has reserved workplace X for T0, operation 4711/10 is shifted to another queue at point in time T1. T1 is the point in time when free capacity is available again on workplace X. Once queue T0 has been processed, the next queue T1 is processed.



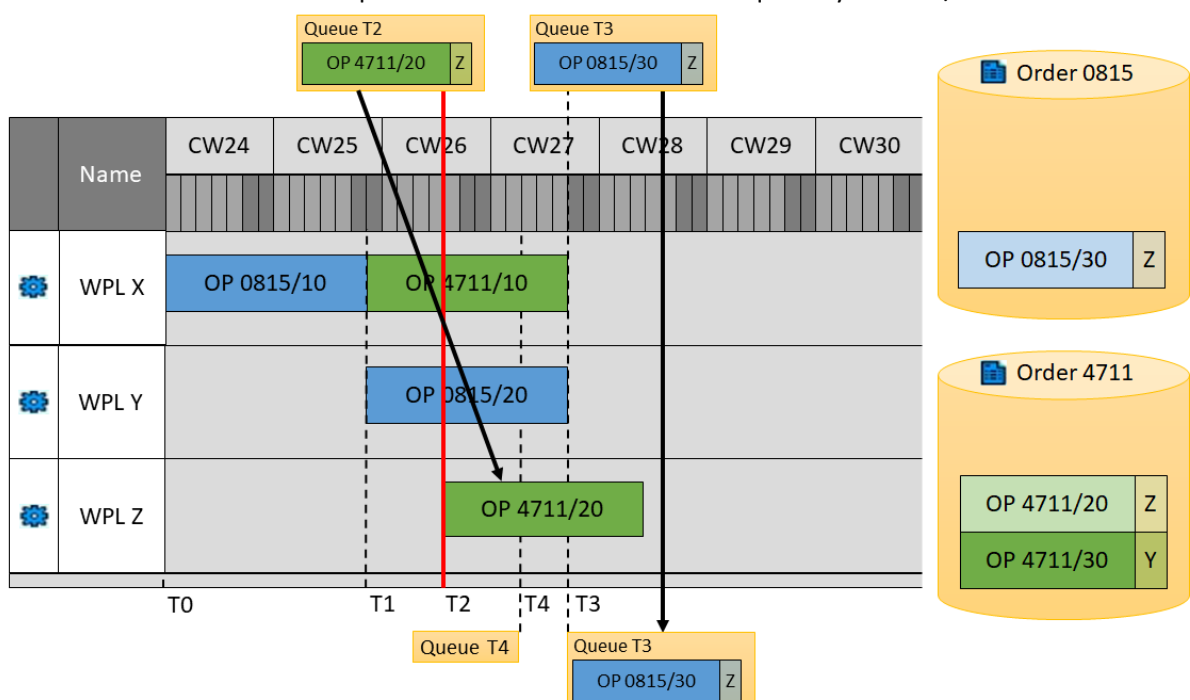
T0 = Simulation Start

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The two operations of queue T1 can be scheduled on workplace X and Y. The successors and their possible start dates are determined and (since  $T2 \neq T3$ ) a separate queue is opened for them. Operation 4711/20 can already be scheduled once the transfer quantity of operation 4711/10 is reached. However, operation 0815/30 cannot be scheduled before operation 0815/20 is finished.

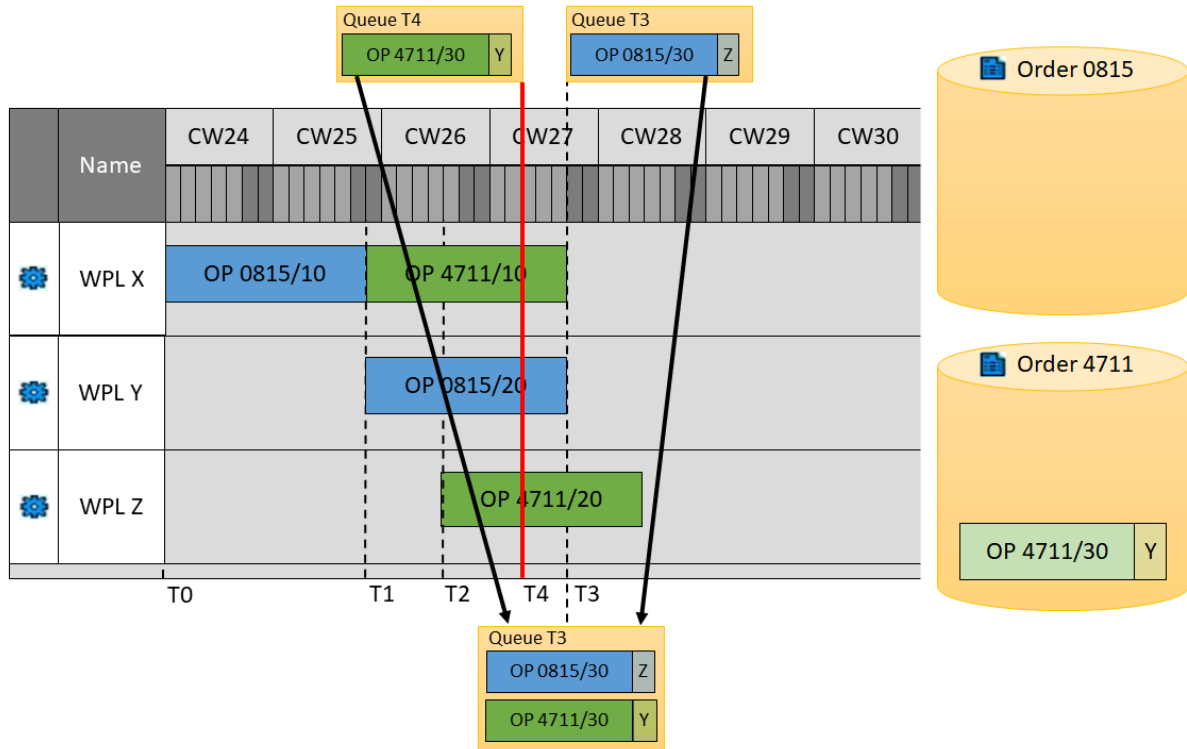


The application tries to process queue T2 first. Since workplace Z has not yet been assigned, operation 4711/20 can be scheduled. For its successor 4711/30, another queue is opened for time T4. T4 in turn results from the production time for the transfer quantity of 4711/20.

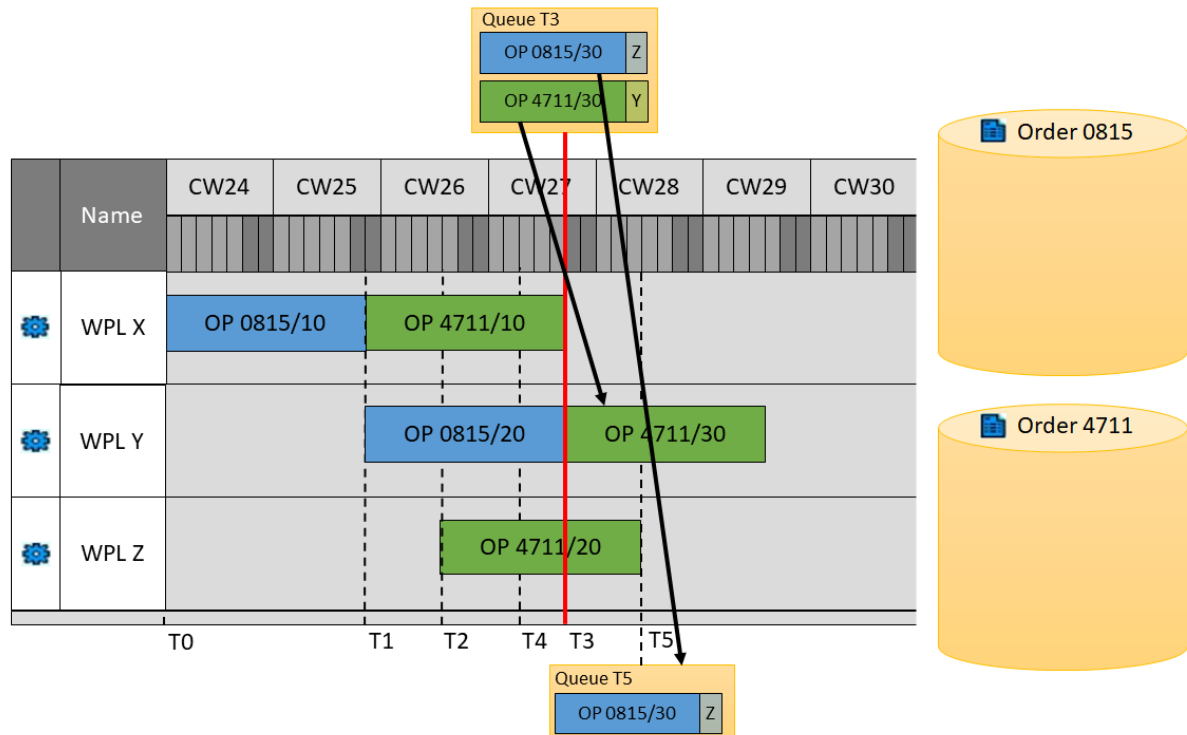


## Introduction

When trying to proceed with scheduling operation 4711/30, it is found that workplace Y is already in use at time T4 and re-scheduling is not possible until time T3. For this reason, 4711/30 is included into the existing queue T3.



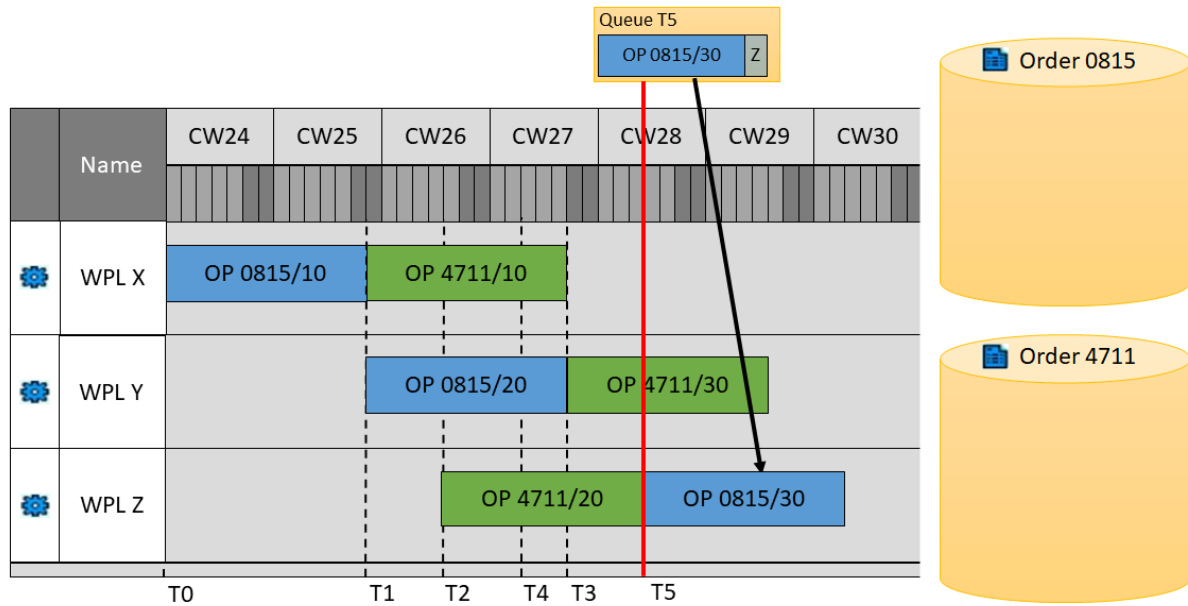
When processing queue T3, operation 4711/30 can be scheduled on workplace Y. Operation 0815/30 must be moved to queue T5 since workplace Z is still busy with operation 4711/20 at time T3.





## Introduction

Finally the operation 0815/30 from queue T5 is scheduled for workplace Z. Then all queues are processed.



## 2 Fundamental preparations

This chapter is about the first steps in DOS. Cross-references are provided to refer you to other chapters explaining the procedures or providing supplemental or background information.


### 2.1 Configuring the DOS module

The first steps and the fundamental preparations relate to system parameters, data import and how to initiate a simulation.



These configuration steps are essential and any changes to the fundamental settings should only be made with due caution after a substantial period of use. Making modifications at a later date may result in incorrect and/or obsolete data since the data are reloaded from the database. Any order or resource related settings already customized would also be lost in this case since a new import will overwrite them.

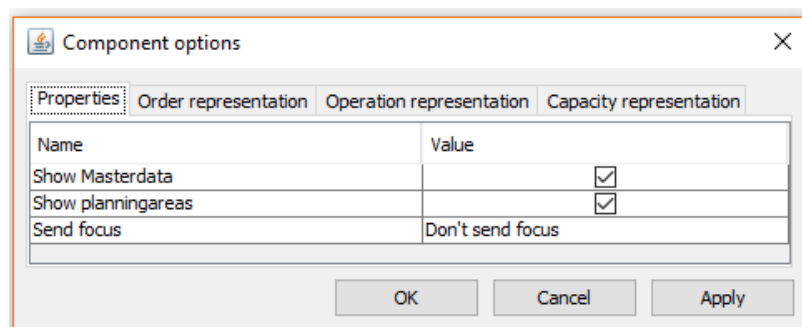
#### 2.1.1 System parameter settings

The system parameters govern the basic settings and the behavior of the DOS module.

Select the “Master data” option in the Navigator. Right-click to open the menu and select the “Show/Edit” option. The master data appear in the editor and can be edited. Click  to save the settings entered.

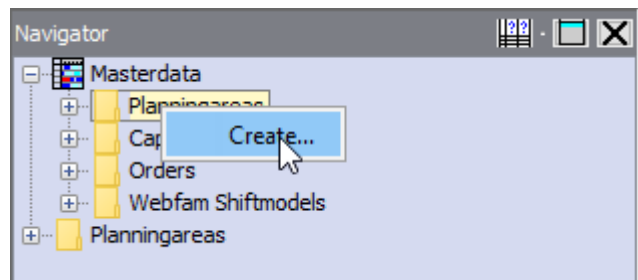
For a description of the various parameters, refer to chapter 6.10.2.1 Master data.

-  If the “Master data” option should not be available, open the component options () of the Navigator and activate the “Show master data” option.

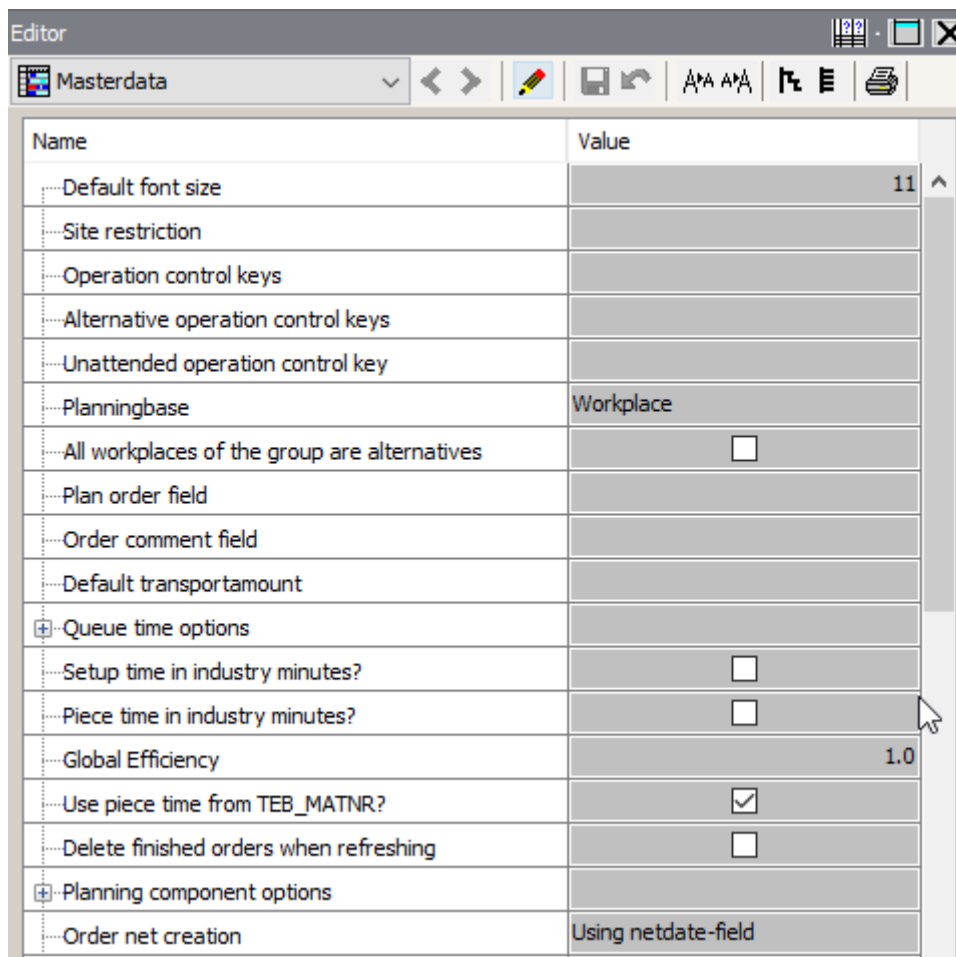


To configure the DOS module, create the planning areas you require in the Navigator in “Master data → Planning areas”. Subsequently it is necessary for you to customize these parameters according to your specific requirements.

## Fundamental preparations




- Customize the “Planning base” parameter to your requirements. It is used for deciding if scheduling is to be done for workgroups or individual workplaces.
- Set the “Site restriction” filters and the various “control keys”. If you do not set a filter, all existing orders are imported into the DOS module.
- Define a “Default transfer quantity”. This makes it possible to overlap predecessor and successor operations.
- If you want to enable order networks, activate the “Order network creation” option. This will activate linking orders to generate order networks.



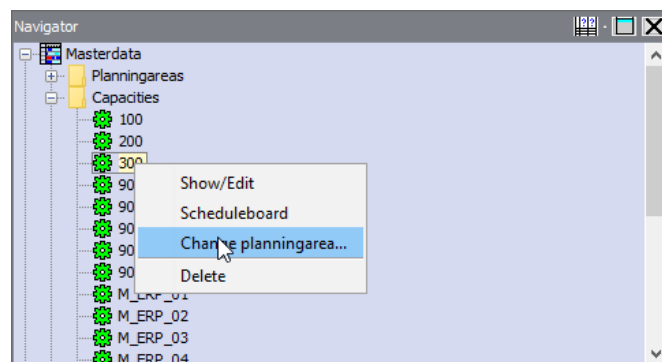
Name	Value
Default font size	11
Site restriction	
Operation control keys	
Alternative operation control keys	
Unattended operation control key	
Planningbase	Workplace
All workplaces of the group are alternatives	<input type="checkbox"/>
Plan order field	
Order comment field	
Default transportamount	
Queue time options	
Setup time in industry minutes?	<input type="checkbox"/>
Piece time in industry minutes?	<input type="checkbox"/>
Global Efficiency	1.0
Use piece time from TEB_MATNR?	<input checked="" type="checkbox"/>
Delete finished orders when refreshing	<input type="checkbox"/>
Planning component options	
Order net creation	Using netdate-field

### 2.1.2 Resource configuration

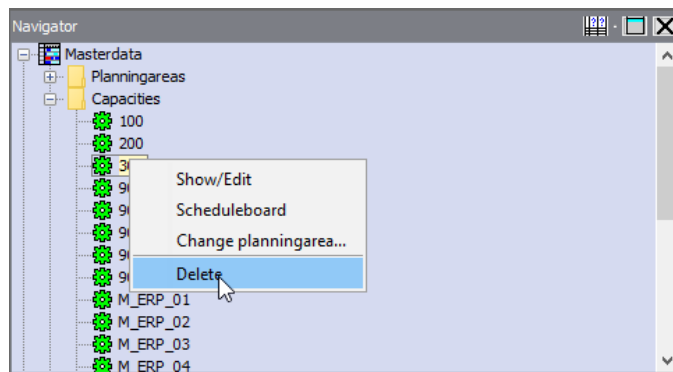
Once you have set the system parameters, use  (Resource import) to import the workplaces and resources into the DOS module (see also chapter 5.1.1.1 Commands). These can be viewed and edited in the System Administration of the Workbench (Workplace option). When the data are read in, a prompt will appear to ask into which planning area you want to import the resources.

- ❗ When importing resources, all existing work time assignments of the re-imported resources are deleted and need to be reassigned!

The resources read in should then be assigned to their corresponding planning area, if necessary. This can be done using the pop-up menu in the Navigator. Select the “Change planning area...” function and a target planning area.



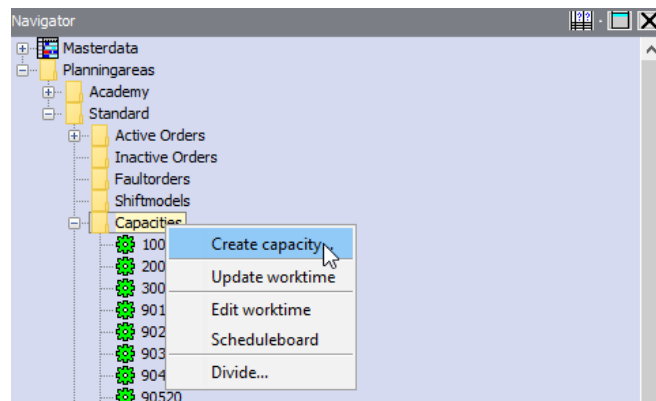
If a resource was imported which had no orders and/or operations scheduled, you can delete these using the pop-up menu in the Navigator.



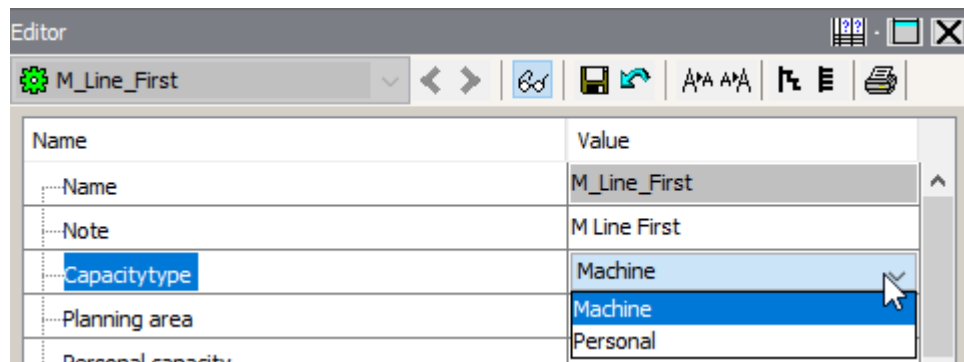
Personnel resources must also be determined, defined and allocated in addition to machine resources.

For this purpose, create the required personnel resource using the “Create resource” command available in the resource tree of each planning area.

## Fundamental preparations



Once created, open the new resource in the editor and change the resource type from “Machine” to “Personnel”.



When all machine and personnel resources have been defined and the machines allocated to their planning area, the personnel resources are assigned to the machines. To do this, open the machine in the editor and select the required personnel resource. These categories are distinguished:

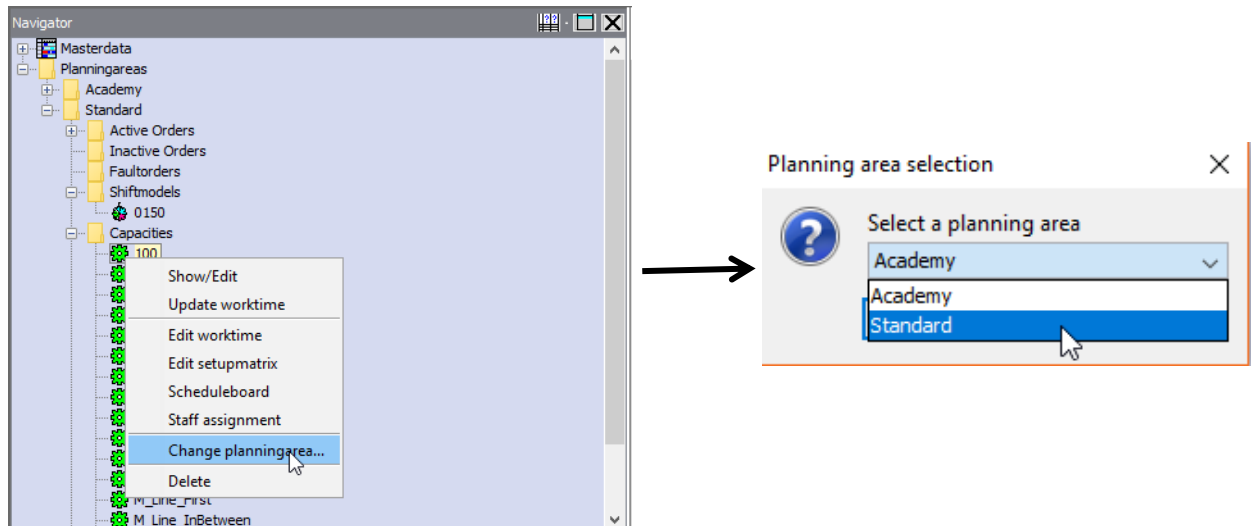
- General personnel
- Setup personnel
- Production personnel
- Setup inspection personnel
- Production inspection personnel

For more detailed information about personnel resources, refer to chapter 4.1 Personnel planning / additional demand planning.

## Fundamental preparations

After having made the assignments among machines, personnel and workplaces, it is necessary to define work times for the resources used.

1. Create a work time hierarchy in the Navigator for this purpose. Workplaces are arranged in the work time hierarchy depending on areas and locations.
2. The personnel resources created manually have to be included into the appropriate hierarchy level via the pop-up menu of the work time hierarchy folder.





For general information about work time hierarchy and how to create it, refer to chapter 4.2.3 Work time hierarchy.

### 2.1.3 Configuring the planning areas


The planning areas contain all configuration data relevant for scheduling.

You can access the parameter area of the planning areas in one of two ways:

1. Click on  "Master data" to open the tree structure and the planning areas.
2. Click on  "Planning areas" to open the tree structure.

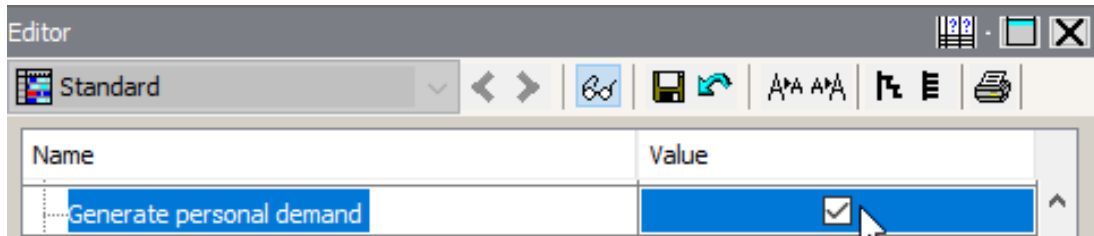
Right-click on the appropriate planning area and select "Show/Edit" to load the selected area into the editor. You can now configure the parameters of the planning area selected.

For a description of the various parameters, refer to chapter 6.10.2.2 Planning area.

-  If the "Planning area" option should not be available, open the component options of the Navigator and activate the "Planning areas" option.

## Fundamental preparations

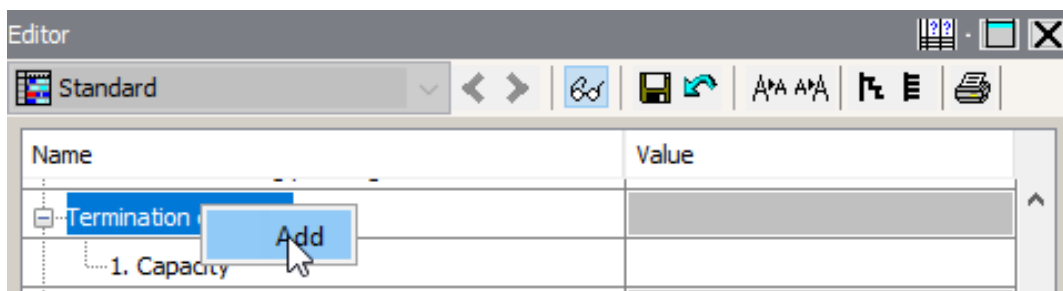
3. Activate “Generate personnel requirements” in editing mode of the editor, if required. This function will determine the personnel requirement automatically if a personnel requirement is defined for the machine to be scheduled.



4. Define the planning type to be used for scheduling the available resources. You can subdivide the resources according to “scheduling resources” and “planning resources”.

By default, all workplaces/workgroups imported are categorized as planning resources. However, you may change this in the properties of the specific planning area by defining “scheduling resource” or “planning resource”.

Change to editing mode and right-click to add a new capacity for the resources to be planned. (See also chapter 4.3 Resource planning types.)



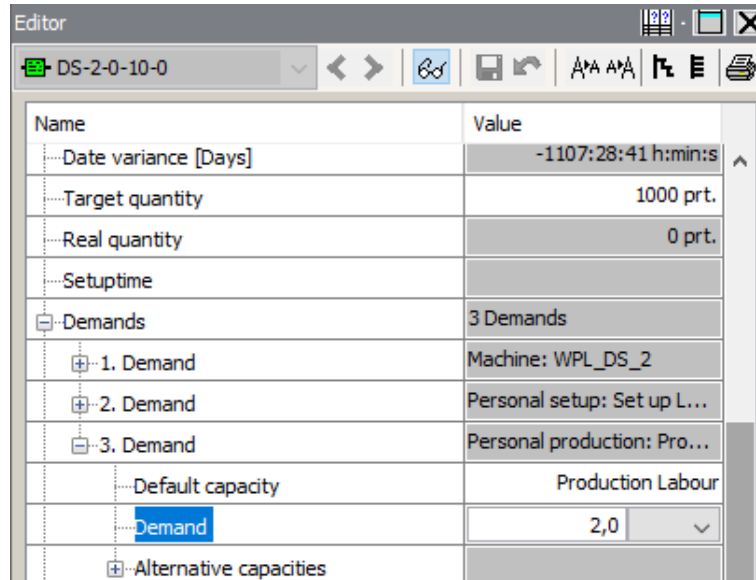
You can use the drop-down menu to select the appropriate resource.

### 2.1.4 Order configuration

Accessing the data (orders and operations) existing in the order management requires loading the data into the DOS module first. To do this, select the “Order import” command (📁) in the menu bar. The data existing in the order management are now loaded into the DOS module (in accordance with any filters set).

If you activated automatic personnel requirement generation, the workforce requirements for the orders imported will be determined from the labor times specified.

- i** You may also increase the required capacity by specifying the requirements in the operation properties. This requirements setting may be specified as a percentage or real number. However, this should only be used within the simulation for testing purposes since these settings will be lost when orders are updated.



Name	Value
Date variance [Days]	-1107:28:41 h:min:s
Target quantity	1000 prt.
Real quantity	0 prt.
Setup time	
Demands	3 Demands
1. Demand	Machine: WPL_DS_2
2. Demand	Personal setup: Set up L...
3. Demand	Personal production: Pro...
Default capacity	Production Labour
Demand	2,0
Alternative capacities	

If you defined a transfer quantity, this previously defined quantity is set for every operation imported. This enables maximum overlapping. For more detailed information about overlapping, refer to chapter 3.5 Overlapping.

### 2.1.5 User interface

When you start DOS for the first time, the DOS user interface appears with the default settings. Customize the user interface according to your needs and save the settings with an appropriate name. (See chapter 5.2 Function menu.)

- i** Save the default settings before you proceed with customizing the user interface. This enables you to restore the default settings in case you should make a mistake and cannot find out the reason.

## 2.2 Preparing and executing a simulation


To prepare the first simulation, proceed as follows:

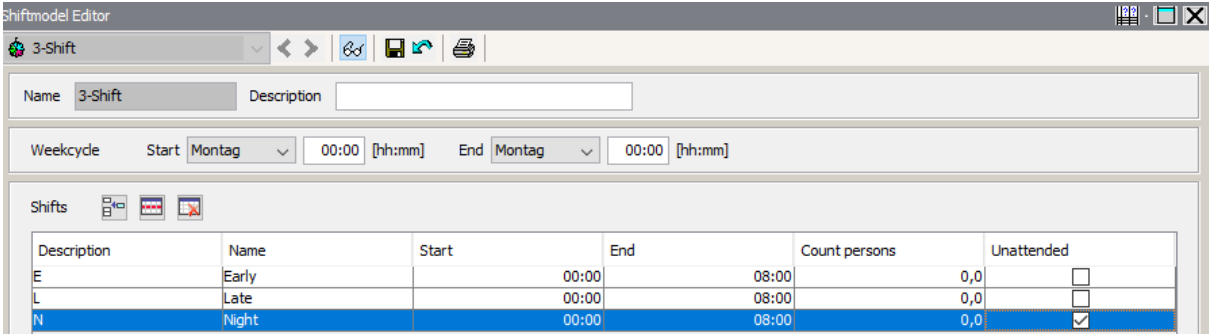
1. Define and assign a shift model.
2. Define work times for the personnel resources.
3. Initiate the simulation.
4. Customize the parameters (optionally).
5. Accept the simulation.




## 2.2.1 Defining and assigning a shift model

Define basic shift models and assign these to the individual levels within the work time hierarchy. In addition, define the non-working days (public holidays, etc.) at a hierarchy level as high as possible. Make sure that the periods defined and assigned are plausible since otherwise errors may occur. There are several ways of how to define and assign a shift model:

1. Change to the shift model folder in your planning area. Right-click and select "Create..." in the pop-up menu and then specify a name for the model. The new model appears in the shift model editor and you can use  to change to editing mode. Add a new shift and edit the name, week cycle, start, end, breaks and personnel requirements. Save the shift model you created in this way.



Description	Name	Start	End	Count persons	Unattended
E	Early	00:00	08:00	0,0	<input type="checkbox"/>
L	Late	00:00	08:00	0,0	<input type="checkbox"/>
N	Night	00:00	08:00	0,0	<input checked="" type="checkbox"/>

2. If some time models are already available in FORCAM FORCE™ Master data → Shift calendar → Shift definitions, you can integrate such time models into a shift model. You can create such a shift model in Master data → Shift calendar → Work time assignment → Week view. Once you have created a week view, you can import it using  (shift model synchronization). It will then be available in the DOS module at Master data → Webfam shift models. However, shift models created in this way cannot be modified any more in the DOS module.

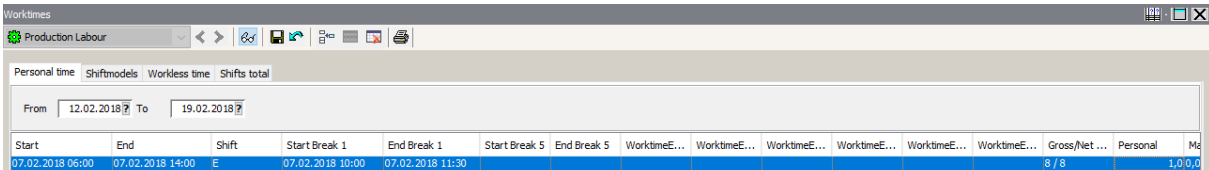
Once you have created a shift model, you can assign it to a resource using the work time editor.

For more information, refer to chapter 4.2 Work time planning and chapter 6.3 Shift model editor.

## 2.2.2 Defining work times for personnel resources

When the machine resources have been assigned a shift model, a corresponding shift model must also be assigned to the personnel resources.

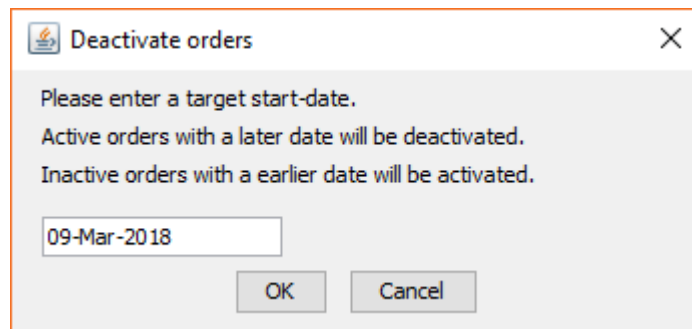
The procedure is the same as for defining and assigning a shift model for a specific workplace. You may choose between using a shift model created or imported for the assignment.




Start	End	Shift	Start Break 1	End Break 1	Start Break 5	End Break 5	WorktimeE...	WorktimeE...	WorktimeE...	WorktimeE...	WorktimeE...	Gross/Net...	Personal	Me
07.02.2018 06:00	07.02.2018 14:00	E	07.02.2018 10:00	07.02.2018 11:30								8 / 8	1,00,0	

### 2.2.3 Deactivating/activating orders

A set of orders may include some orders to be ignored in scheduling. You can deselect these individually using the “Deactivate” pop-up command. The order deselected will then appear in the “Inactive orders” folder. You can use the “Activate” pop-up command to reactivate an inactive order. It is also possible to activate/deactivate several orders collectively. The pop-up command “Timed activation/deactivation” in the planning area will open the following dialog:



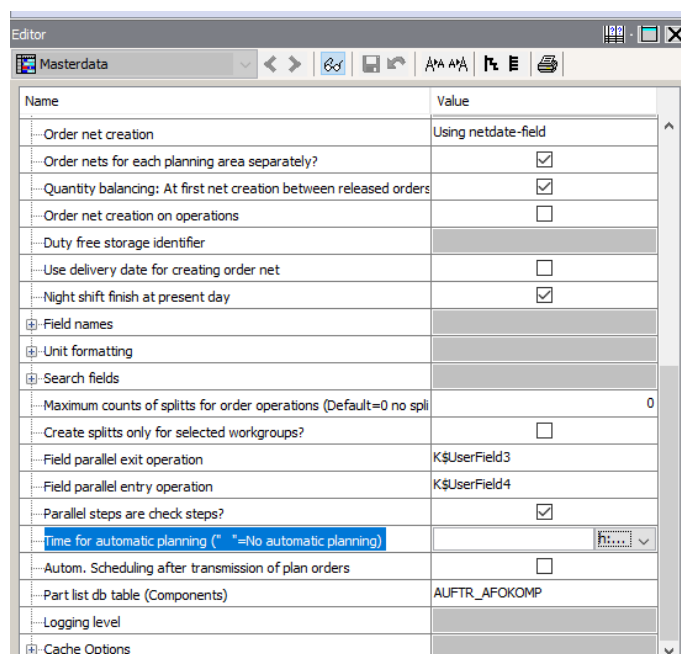
### 2.2.4 Initiating the simulation

After configuring the shift models and work times, initiate the simulation using the “Simulate” pop-up command in the appropriate planning area. Alternatively, you may start the simulation using the  button in the “Schedule board” component. A simulation may take a few minutes depending on the number of orders involved.

#### 2.2.4.1 Automatic timed simulation

In addition to manual initiation of a simulation, the DOS module lets you execute a simulation automatically at a specific point in time.

To configure an automatic simulation, open the master data in the editor. You can customize the time for automatic scheduling according to your individual needs. The simulation will be initiated at the set point in time and the result adopted automatically.

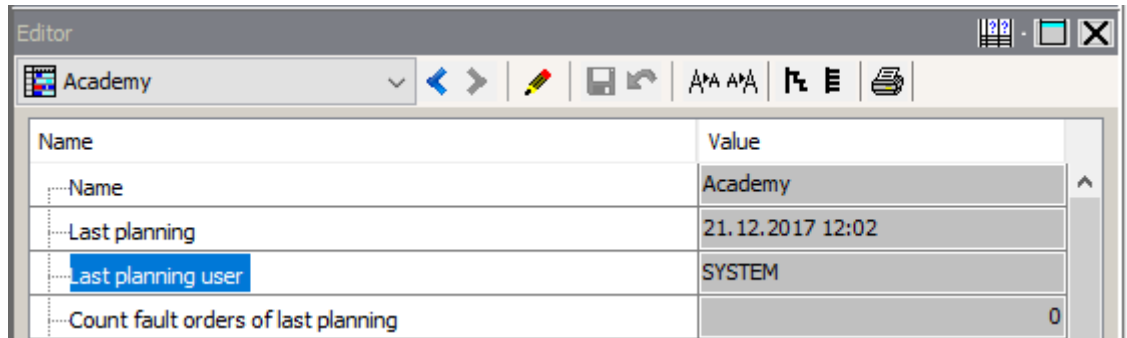


## Fundamental preparations

The following entries are available among the parameters of the shop floor area to verify execution:

- Last planning
- Last planning user
- Count fault orders of last planning

You can check these to find out whether the scheduled simulation was executed. Moreover, you can determine which user initiated the simulation.



Name	Value
Name	Academy
Last planning	21.12.2017 12:02
Last planning user	SYSTEM
Count fault orders of last planning	0

Parameter	Description
Last planning user	Shows who accepted the simulation data last. <ul style="list-style-type: none"> <li>— *USERNAME*: The simulation was accepted last by the user displayed.</li> <li>— Automatic: The simulation values were accepted by the automatic simulation.</li> </ul>
Count fault orders of last planning	= 0: All orders have been scheduled completely and without any errors. > 0: Errors occurred when scheduling orders (usually due to a lack of resources or shift capacity)

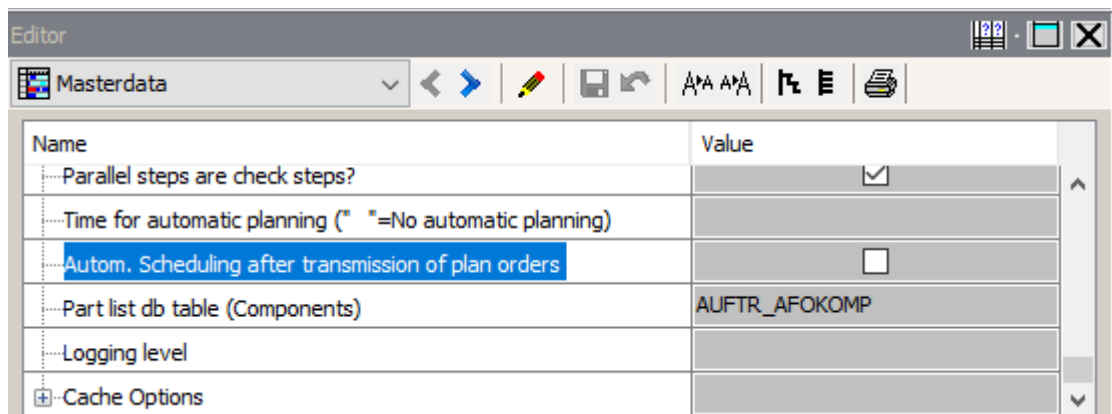
### 2.2.4.2 Automatic simulation after automatic planned order import

A distinction is made between individual and collective download of orders.

- Individual download:  
A single order is removed from the DOS module data pool and reimported.
- Collective download:  
All planned orders are imported into the DOS data pool at a defined point in time. Any previously existing planned orders are removed first.

On completion of a collective download, the planned orders imported in this way are automatically scheduled and written back.

Automatic scheduling can only be performed if it was activated in the master data.



For the technical process flow of a collective download, refer to chapter 9.4 Automatic collective download; for configuration, see chapter 8.3.2 Customization in k\_config\_kslnkr.cfg.

## 2.2.5 Customizing parameters

When a simulation has been initiated, you can customize the parameters of the individual objects in the simulation data. This customization is recommended if you are not completely satisfied with the result of the simulation or the process flows/sequences of production steps do not match the individual order priorities completely. Customization offers the following potential benefits:


- Reduction/extension of the production time by increasing/reducing the rate of capacity utilization
- Optimization of the order/operation processing sequence
- Different shift assignment which may result in an improved production flow
- Determining alternative workplaces for quicker processing

If you do not want to make any customization or if the result of the simulation meets your expectations, you can accept the simulated data immediately.

- ❗ Any customization should only be done to the simulation data! Any changes made to real data will not take any effect for the current simulation unless the simulation is deleted and re-created from scratch.

## 2.2.6 Accepting the simulation

Accept the simulation if its results meet the requirements and/or the timing of orders has been optimized. The results adopted can be viewed at all hierarchy levels of the system (from operator to management level).


To adopt the simulation results, click the  button on the schedule board. You may also adopt the simulation data using the pop-up command "Save simulation" in the simulation folder.

- ❗ Use the pop-up command "Save simulation" to save the simulation data in the database. The simulation will still be available after restarting the server and only be overwritten by another simulation.

## Fundamental preparations

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The simulation results can be viewed in the "Simulation" folder in the corresponding planning area. When accepting the simulation results, they are transferred to the real data and may be entered into the FACT tables at confirmation level, if applicable. Once accepted, they will not be available any more in the "Simulation" folder.

 If you should accept a simulation by mistake, you cannot undo the action!

## 3 Extended functions

In addition to the fundamental configuration of the Detailed Order Scheduling module, there are a number of extended functions available. These extended functions offer many advantages:

- Planning based on order category
- Priority rules for processing
- Determining alternative resources
- Splitting and overlapping of operations
- Multiple assignment of machines
- Fixing time and resources
- Considering setup times for planning
- Planning maintenance times

**i** If you want to benefit from one or more of these advantages for your planning tasks, you should make sure that the fundamental configuration of the DOS module has been carried out correctly and that it is running without any errors.

### 3.1 Order categories

Various categories of orders exist within an organization. Such a distinction is also made in the Detailed Order Scheduling module. However, only two order categories are distinguished here, i.e. production orders and planned orders.

Furthermore, orders may be distinguished by the order priority. In this case, the distinction is made between regular orders and urgent orders.

#### 3.1.1 Production orders

Production orders are regular orders from business, for example, for manufacturing a specific product or component. They are created for specific orders and initiated by a specific customer/ordering party.

#### 3.1.2 Planned orders

Planned orders, on the other hand, are also orders from business, but of a serial nature. Planned orders include, without limitation, covering dependent requirements. This means: Planned orders procure intermediate products required for manufacturing a specific end product.

##### 3.1.2.1 Definition of a planned order

A planned order may be defined in one of two ways:

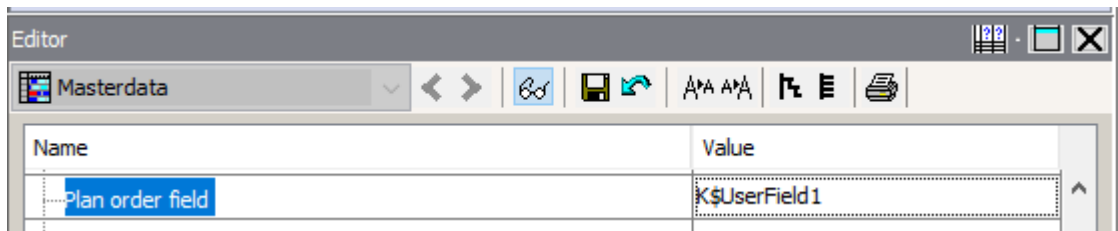
- Automatically
- Manually

## Extended functions

### 3.1.2.1.1 Automatic definition

A user field is assigned to the “Plan order field” in the master data. If this field is filled in during the order import, the order is automatically saved as a planned order. The content of this field is adopted from the ERP system or entered in FORCAM FORCE™ when creating an order.

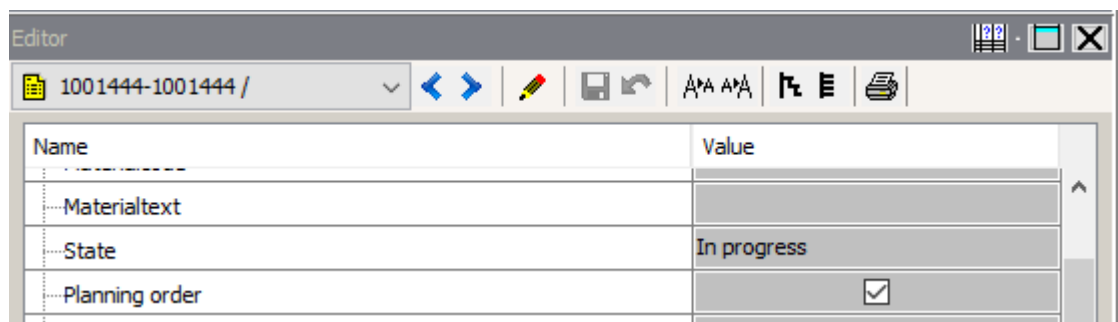
If the field is left blank, the order is adopted as a production order. If the field is not blank (regardless of the content), the order is marked as a planned order.




### 3.1.2.1.2 Manual definition

An order may also be defined manually as a planned order. This requires these two steps:

1. Open the appropriate order in the editor and change to editing mode.
2. Activate the “Planning order” parameter and save.



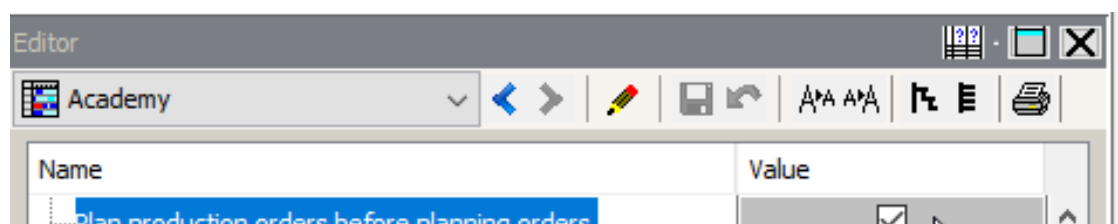
The planned order obtained in this way is marked yellow and can now be scheduled along with the other orders.

-  If the “Planning order” parameter is not available, you can enable it by setting the corresponding component option.

### 3.1.2.2 Scheduling planned orders

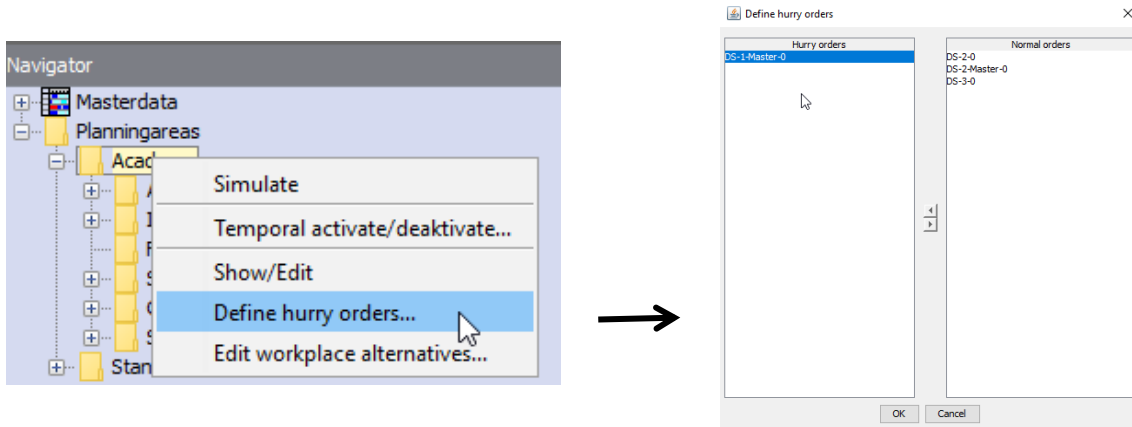
Planned orders are scheduled in the same way as production orders in the DOS module. You can use priority rules or settings in the planning area to schedule planned orders after production orders. This implies that production orders have priority.

If you do not define such rules, planned and production orders are treated equally in scheduling.

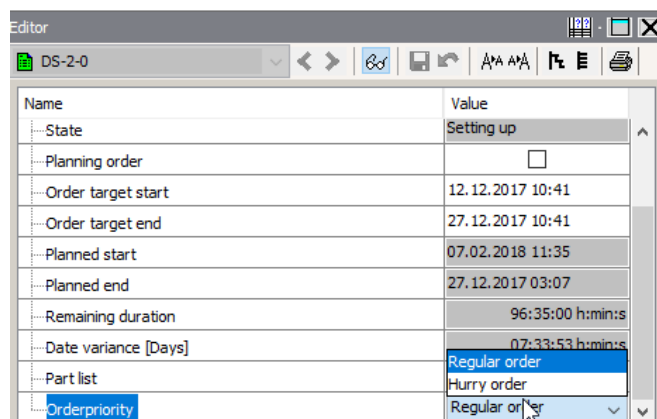


### 3.1.3 Order priorities

You can use the “Define urgent orders” command in the pop-up menu of a planning area to change orders into urgent orders. When you enter the command, a dialog window is displayed from which you can select the orders to be changed into urgent orders.



Another way to change orders into urgent orders is by means of the “Order priority” parameter in the order properties. For this purpose, open the appropriate order in the editor, change to editing mode and set the required order priority.



- i** If the “Order priority” parameter is not available, you can enable it by setting the corresponding component option.

#### 3.1.3.1 Regular order

A regular order is considered in scheduling according to its existing priorities and subject to the priority rules.

#### 3.1.3.2 Urgent order

An urgent order has a higher priority and is scheduled in a simulation as early as possible. If there are several urgent orders, the sequence is also controlled by the priority rules configured.

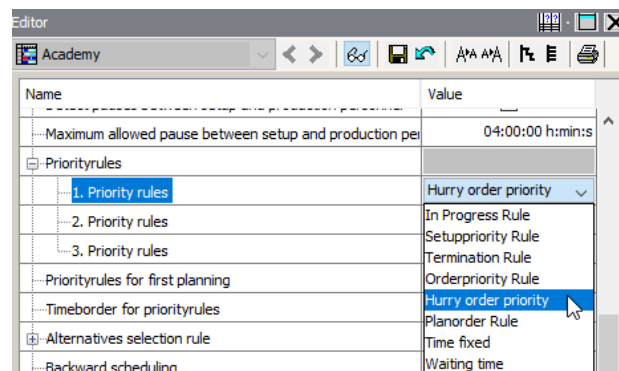


## 3.2 Configuring priority rules

In the DOS module, you can set up various priority rules for operations. They are valid for all resources and queues. Several priority rules are set up to handle situations where operations to be prioritized have the same priority.

The priority of a specific order or operation is determined during transfer from the ERP system. Priority rule setting is merely used for scheduling existing orders.

The priority can be selected in the corresponding planning area settings. (See also chapter 6.10.2.2 Planning area.)



### 3.2.1 In-progress rule

The in-progress rule assigns a higher priority to orders already started than to those not yet started. This is intended to ensure that all running orders are completed as soon as possible / on schedule.

### 3.2.2 Setup priority rule

The setup priority interacts with a workplace-specific setup matrix and the time buffer specified in the planning area.

Initially a check is made to determine whether operations are eligible for setup prioritizing at all. They are subdivided according to two groups to this effect:

- Operations beyond the time buffer (delayed)
- Operations within the time buffer (free buffer)

**i** Operations beyond the time buffer have always a higher priority since they are in delay!

Operations within the time buffer are eligible for setup optimization. This involves comparing the setup times of the preceding and subsequent operations. Operations with a shorter setup time are assigned a higher priority and are therefore processed first.

The time buffer mentioned is largely based on experience:

- The longer the time buffer, the more important is compliance with dates.
- The shorter the time buffer, the more important is setup optimization.

**i** If prioritizing is based on setup time, this should always appear before the scheduling priority in the priority rules.

### **3.2.3 Scheduling priority rule**

If prioritizing is based on dates, the free buffer time and the time taken for the operations to be processed are taken into account. The result obtained in this way is compared with other results of this nature. Hence, optimization does not only occur within the current operation but along the complete processing chain of the order.

### **3.2.4 Order priority rule**

This rule distinguishes only between urgent orders and regular orders. Urgent orders are processed more quickly than regular orders. Prioritizing within these two groups is performed by additional priority rules.

### **3.2.5 Planned order rule**

FORCAM FORCE™ supports both planned and production orders. With this rule, operations of production orders receive a higher weighting than those of planned orders and are therefore processed with preference. This results in planned orders being postponed.

### **3.2.6 Time fixed rule**

This rule causes fixed-time orders to be scheduled before orders without a fixed time.

### **3.2.7 Waiting time rule**

This rule schedules those orders with priority that are scheduled repeatedly. Orders scheduled for the first time have a lower priority and are scheduled later.

## **3.3 Alternative workplaces**

The next function is used when planning in workgroups. Alternative workplaces are used when bottlenecks or failures occur on machines. This means that production is transferred to other equivalent machines to avoid an interruption.

### **3.3.1 Determining alternative workplaces**

The “Maintain alternative workplaces” function is used for determining which workplaces are considered as alternative workplaces, if any. It is accessible in the pop-up menu of the Navigator. Proceed as follows:

1. Right-click on the appropriate planning area and select “Maintain alternative workplaces”.
2. In the upper half of the dialog window, you can now view all SAP workplaces available for the material selected by the material code if the “Order” parameter was selected. If you select the “All” parameter, all possible workgroups are displayed. When workgroups are displayed, the box at the bottom left shows all default workplaces (i.e. those pertaining to the group). The “Assigned workgroups” box shows all workplaces for which an alternative workplace was defined.

## Extended functions

Workplace alternative

Academy

**Combination selection**

Materialcode: 00625381

Assigned workgroups

Possible workgroups

☒ Order ☐ All

9580

9580

- All workplaces available are listed in the bottom half. The “Material code”, “Workgroup” and “Count tools” fields provide you again with the information about which material can be processed on which workplace.

## Extended functions

Workplace alternative

Academy

**Combination selection**

Materialcode: 00625381

Assigned workgroups: 9580

Possible workgroups:

☐ Order ☒ All

8990  
9010  
9120  
9340  
9580  
M\_SAP\_01  
M\_SAP\_02  
M\_SAP\_03  
M\_SAP\_04

**Workplace alternatives**

Materialcode: 00625381 Workgroup: 8990

Count tools [0=No restriction]: 0

Default workplaces:

M\_Line\_First  
M\_Line\_InBetween  
M\_Line\_Last  
WPL\_DC\_1  
WPL\_DC\_2


Workplace alternatives:

Existing workplaces:


WPL\_DS\_1  
WPL\_DS\_2  
WPL\_DS\_3  
WPL\_DS\_4

- Proceed by selecting (in editing mode) the appropriate workplace from the selection on the right.

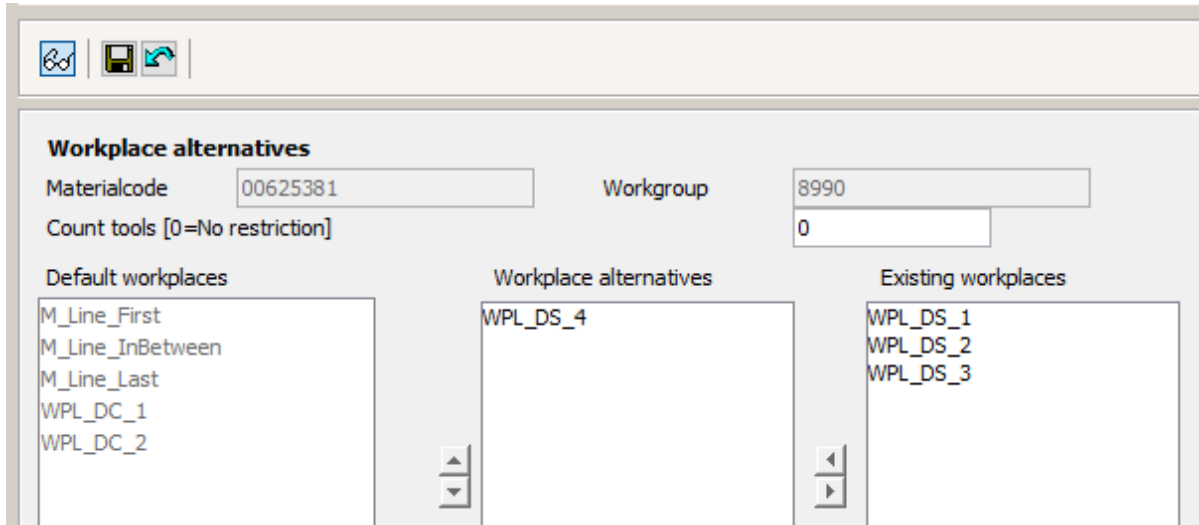


- Use  to move the order to the “Workplace alternatives” field. If you want to remove an alternative workplace from the selection, simply move it back.



- You may also define a sequence of alternatives. For this purpose, use  to move a selected alternative workplace up or down. The upper positions are used before the lower ones.

## Extended functions



The dialog box is titled "Workplace alternatives". It contains the following fields and lists:

- Materialcode:** 00625381
- Workgroup:** 8990
- Count tools [0=No restriction]:** 0
- Default workplaces:**
  - M\_Line\_First
  - M\_Line\_InBetween
  - M\_Line\_Last
  - WPL\_DC\_1
  - WPL\_DC\_2
- Workplace alternatives:**
  - WPL\_DS\_4
- Existing workplaces:**
  - WPL\_DS\_1
  - WPL\_DS\_2
  - WPL\_DS\_3

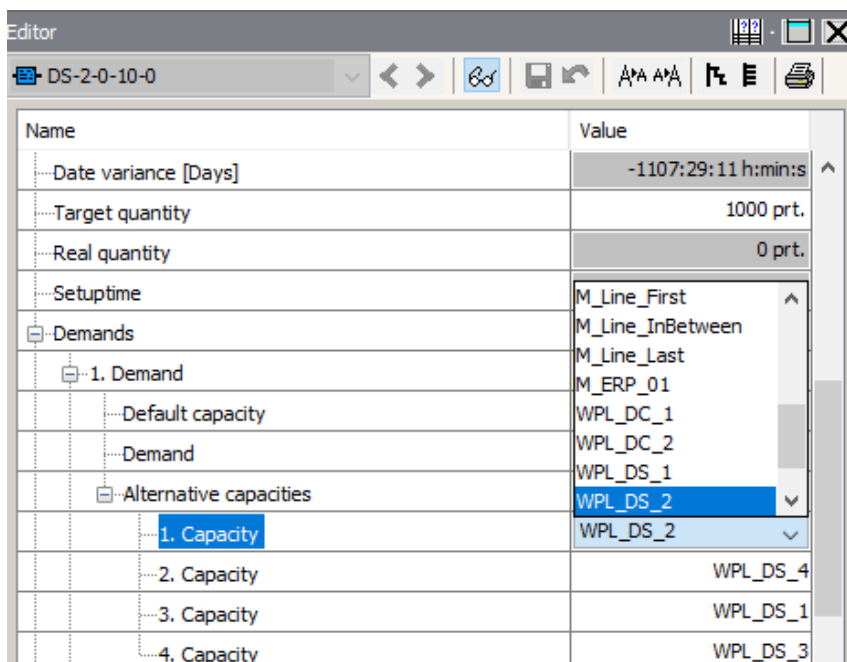
7. Finally select the number of available tools.
8. Save the changes.

Now you have an alternative workplace available for your selected machine in case of trouble or failure of the primary production machine.

However, in most cases it is not sufficient to simply select the alternatives. Rather, some rules are usually necessary according to which criteria an alternative workplace is selected by the simulation. You can define priority rules for this situation.

### 3.3.2 Priority rules for alternative workplaces

Alternative resources can be considered when simulating operations. This means that an operation may be performed on several machines (usually of the same type). These alternative workplaces are specified in the requirements for the operations and assigned priorities according to their sequence.

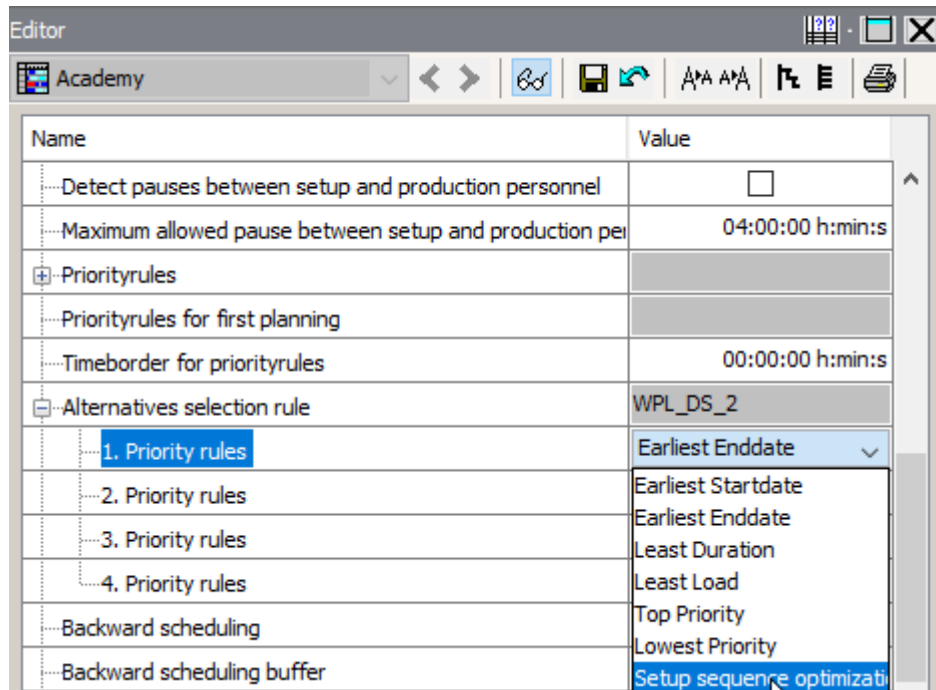


The "Editor" window shows a table with the following data:

Name	Value
Date variance [Days]	-1107:29:11 h:min:s
Target quantity	1000 prt.
Real quantity	0 prt.
Setuptime	
Demands	
1. Demand	
Default capacity	M_Line_First
Demand	M_Line_InBetween
Alternative capacities	M_Line_Last
1. Capacity	M_ERP_01
2. Capacity	WPL_DC_1
3. Capacity	WPL_DC_2
4. Capacity	WPL_DS_1
	WPL_DS_2
	WPL_DS_2
	WPL_DS_4
	WPL_DS_1
	WPL_DS_3

## Extended functions

If an operation is in the current queue for scheduling but cannot be processed on the default machine, the application checks all alternative resources for a possibility of scheduling it there. If the operation can only be scheduled on one of these resources at the specific point in time, it will be scheduled there. However, if several resources are available which could be used for scheduling the operation, certain selection rules are used for the actual scheduling process. These are defined in the planning area and can be assigned priorities.

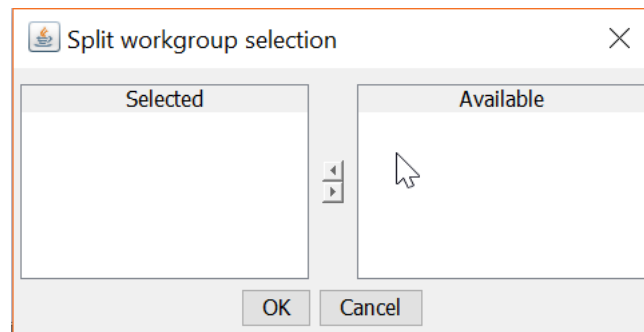


The following rules for alternatives exist:

Parameter	Description
Earliest start date	The alternative resource where the operation can be scheduled earliest will prevail.
Earliest end date	The alternative resource where the operation can be completed earliest will prevail.
Least duration	The alternative resource which has the shortest processing time will prevail.
Least load	The alternative resource which has currently the least load will prevail.
Top priority	The alternative resource which is first in the list of alternatives of the requirements will prevail.
Setup sequence optimization	The alternative resource with the shortest setup time will prevail.

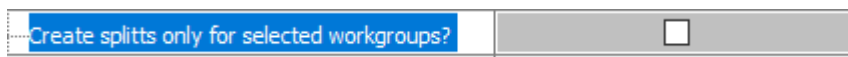
## 3.4 Automatic splitting of orders / operations

The DOS module makes it possible to split operations. The advantage is that an operation can be distributed to several machines, thereby reducing the processing time. In addition to the split which can be performed already with the order/operation data outside of the DOS module, automatic splitting can be activated in the DOS module. To do this, right-click on the master data in the Navigator to select the “Select split workgroups...” option from the pop-up menu. The dialog displayed offers a selection of workgroups for which a split should be enabled.



Each workplace of the workgroup will be specified automatically as an alternative in the machine requirements when splitting. In this way, it is possible to achieve a maximum degree of parallel processing of operations. However, this depends on the capacity utilization of the various machines. If the available capacity is insufficient, the split operations are scheduled on the machine(s) one after the other.

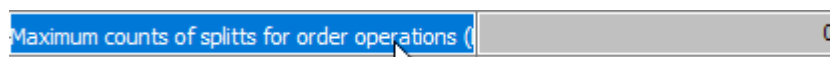
Moreover you can define in the master data if splitting will be available only for the selected workgroups. This is required particularly if there are alternative workplaces in other workgroups.



### 3.4.1 Number of splits

The number of splits an operation may have is also defined in the master data. This makes it possible to use less than the available resources of a split workgroup for an operation. This offers the advantage that the workgroup can process other operations as well.

If more workplaces are available within a workgroup than specified with the parameter, the number of splits is limited to the number specified with the parameter.



Note:

The method for multiple use described here refers to a workgroup but not to a workplace as described in chapter 3.6 Parallel processing / multiple assignment of machines!

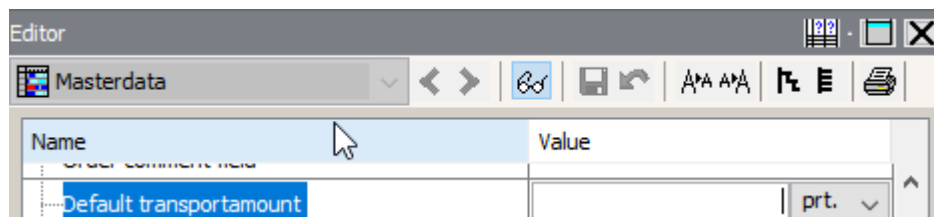
## 3.5 Overlapping

In the DOS module, orders can be distinguished by their link type.

On the one hand, there are orders with strictly linear link type, where one operation after the other is processed. An operation can only begin after the previous operation has been finished.

On the other hand, there are orders with linear link type where an operation may already start while the previous operation is still under processing. This is referred to as overlapping. Overlapping is essentially defined by the default transfer quantity in the master data.

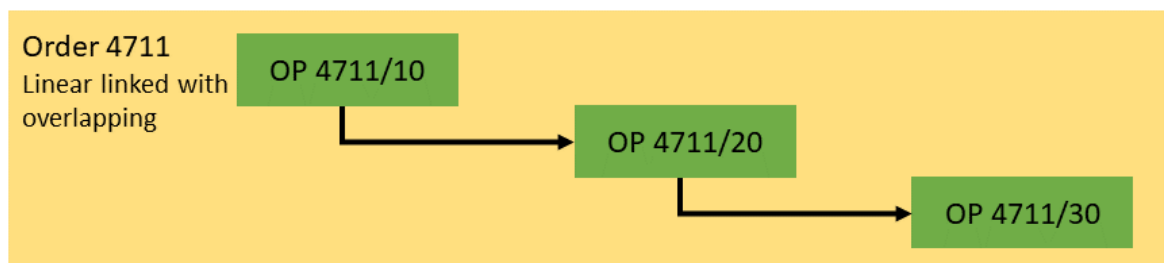
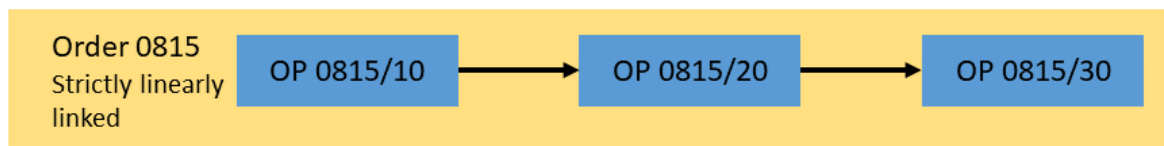
The default transfer quantity specifies the minimum number of a specific product. It must be reached to be able to proceed with the next production step.



### 3.5.1 Example

Order 0815 has three operations with strictly linear link type. Operation 20 can only start when operation 10 has been finished. The same applies accordingly to operation 30.

Order 4711 has three operations, too, but their link type is not strictly linear. If you set a transfer quantity for an operation, overlapping occurs. When the transfer quantity of operation 10 is reached, operation 20 starts. A transfer quantity is also defined for operation 20. When it is reached, operation 30 starts.



Overlapping makes it possible to process orders more quickly since successor operations can start earlier.



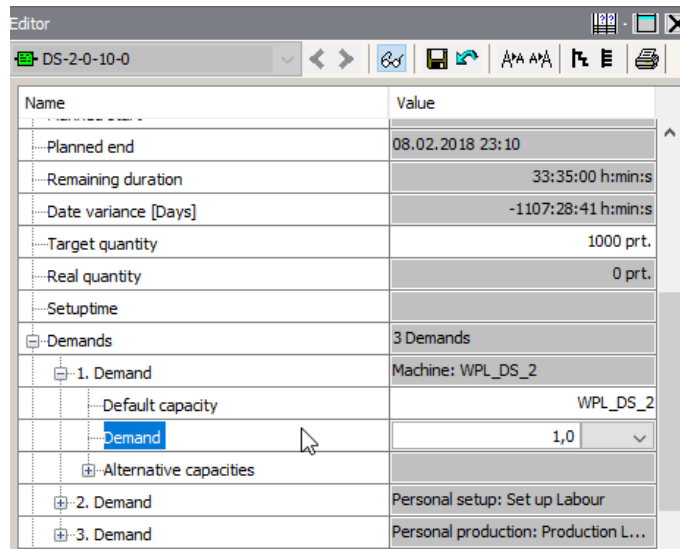
## 3.6 Parallel processing / multiple assignment of machines

Parallel processing relates to multiple use of a resource in parallel. Multiple use means that the selected machine serves more than one order/operation at the same time.

For multiple assignment, the physical aspects of a workplace need to be considered:


- A workplace has a limited capacity of 100%.
- The base capacity of a planning resource cannot be booked higher than 100%.
- If a resource is defined as a scheduling resource, the available capacity can be overbooked at will. However, this does not reflect the real situation!
- You can use other identical machines to increase the capacity by another 100% per machine.
- Overbooking the available capacity of 100% per workplace is not possible in reality.

The operation requirements are imported from SAP and defined as a fixed percentage of 100% of the resource base capacity. If you do not need the full capacity, you can configure it manually in the operation properties. If several operations do not require the full capacity, the reduced operation capacities can be accumulated. Operations with a maximum accumulated capacity of 100% can be processed in parallel on one machine.

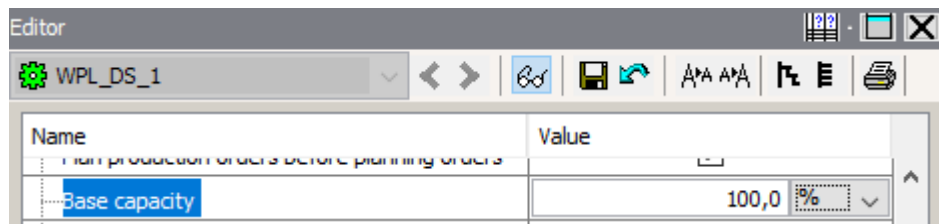


Name	Value
Planned end	08.02.2018 23:10
Remaining duration	33:35:00 h:min:s
Date variance [Days]	-1107:28:41 h:min:s
Target quantity	1000 prt.
Real quantity	0 prt.
Setuptime	
Demands	3 Demands
1. Demand	Machine: WPL_DS_2
Default capacity	WPL_DS_2
<b>Demand</b>	1,0
Alternative capacities	
2. Demand	Personal setup: Set up Labour
3. Demand	Personal production: Production L...

Another possibility for multiple assignment is increasing the base capacity. The base capacity of a resource is 100%. The base capacity can be increased by 100% for each additional identical machine. As a result, several operations with a capacity requirement of 100% each can also be scheduled in parallel.

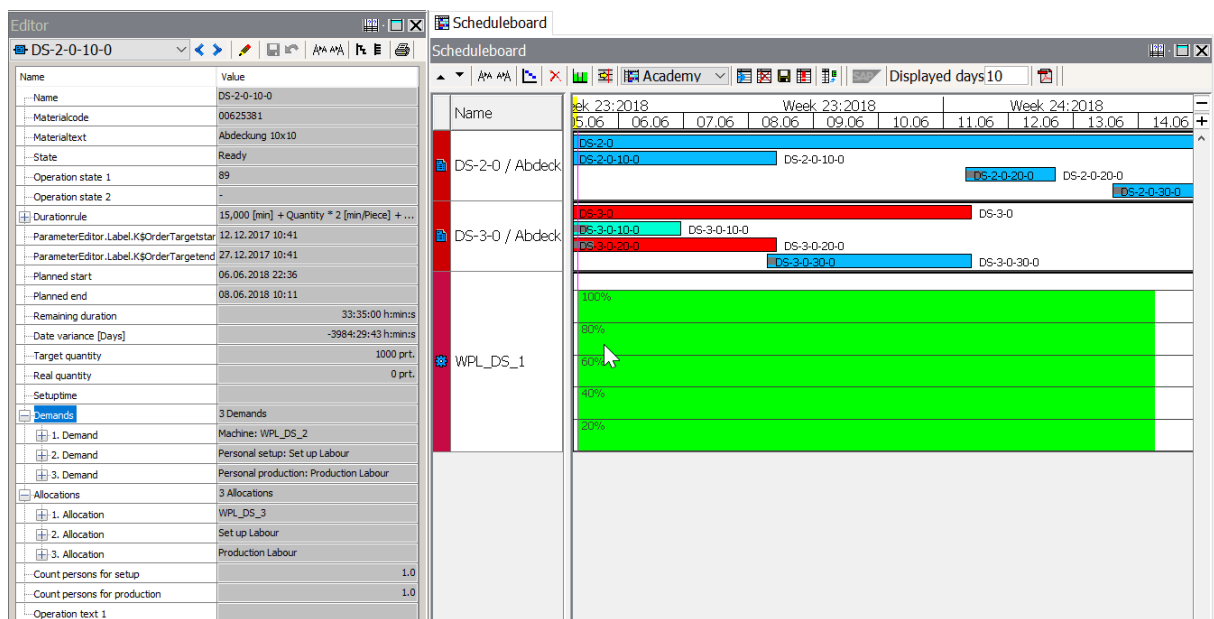
-  This type of multiple assignment simulates a workgroup in the form of a single workplace with the corresponding base capacity.

## Extended functions

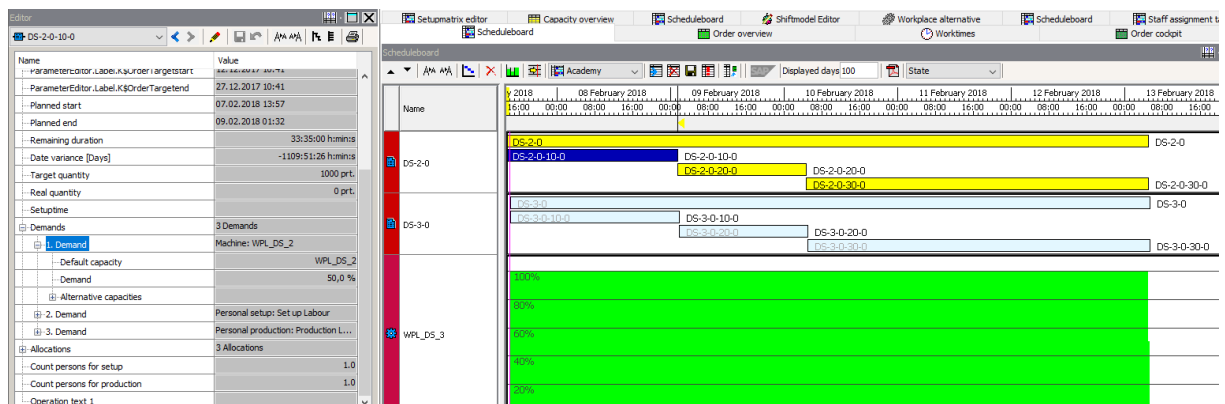


### 3.6.1 Example

Initially there are two orders scheduled on the same machine. Both orders start simultaneously and require 100% of the base capacity of the workplace. Owing to the limited available capacity, order 2 is scheduled after order 1.

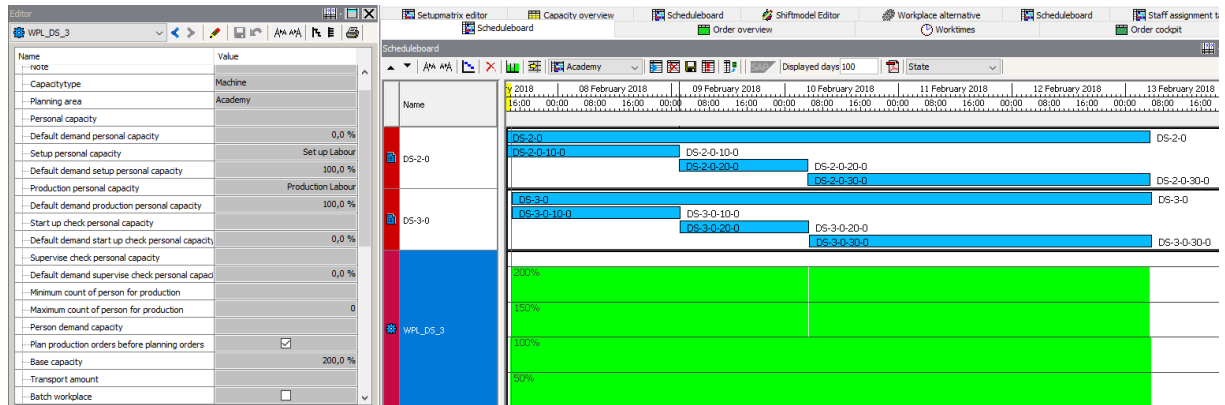


In the first example it is clearly evident that the resource is assigned two orders. The operations of the orders require 50% of the resource capacity each, thereby making full use of the available resources.



## Extended functions

In the second example, two identical machines are available. The operations require 100% of the base capacity of the resources each. Hence, 200% of the base capacity is utilized and multiple assignment is possible in reality.



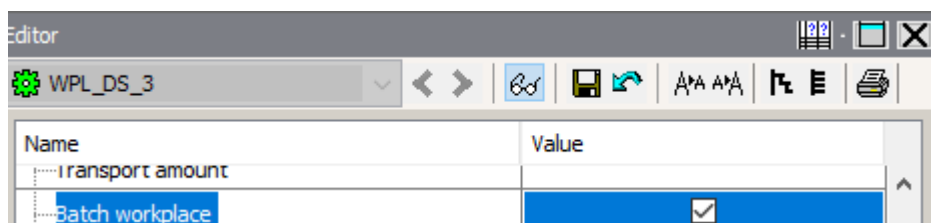
**i** There is a difference between parallel processing and splitting of orders:

- Multiple assignment:  
Several orders/operations are processed on a machine at the same time.
- Splitting:  
An operation is split and distributed to several machines and processed at the same time. A split order is handled like two identical orders and processed accordingly.

## 3.7 Batch workplaces

A batch workplace is a special type of workplace. It produces a fixed quantity of a product in one go. The time per unit is ignored in this case. Setting up a batch workplace in the DOS module is a simple action:

1. Open the appropriate resource in the editor.
2. Change to editing mode and activate the “Batch workplace” parameter.
3. Save this setting.



The number of parts to be processed simultaneously is set in the ERP system when defining the batch size. This size cannot be modified in the DOS module.

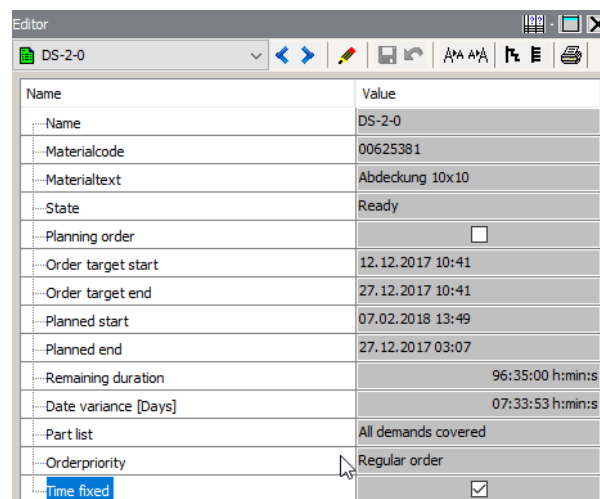
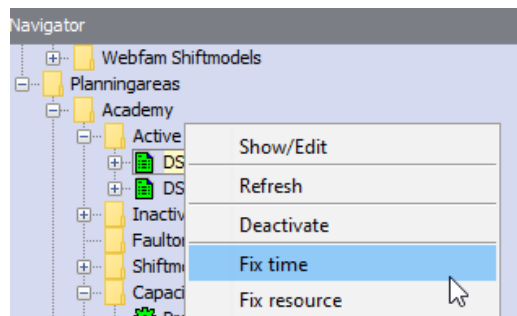
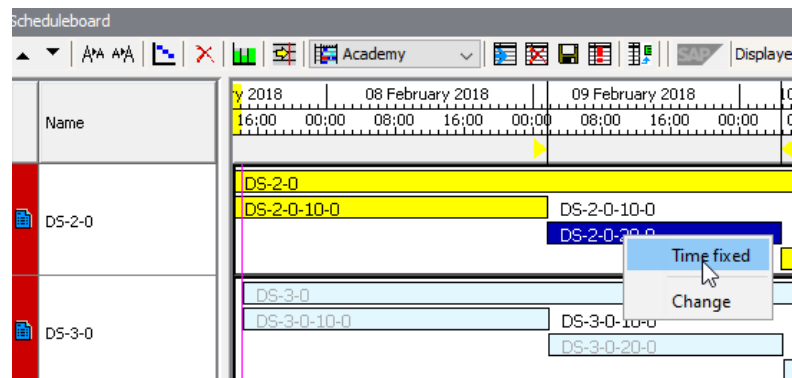
### 3.8 Fixing

You can use the schedule board or the properties of planned objects to fix a specific object with regard to timing or a specific resource.  
(See also chapter 6.2.3.2 Pop-up menu on order rows.)

#### 3.8.1 Fixing the timing

Fixing the timing is a 'soft' method. If you fix the timing of an order or operations, the start date cannot be scheduled earlier than the fixed value.

Fixing is possible by using either the schedule board or the Navigator with a right-click on the object to be fixed → "Fix time"/"Time fixed" or by means of the properties of the object to be fixed using the "Time fixed" option.

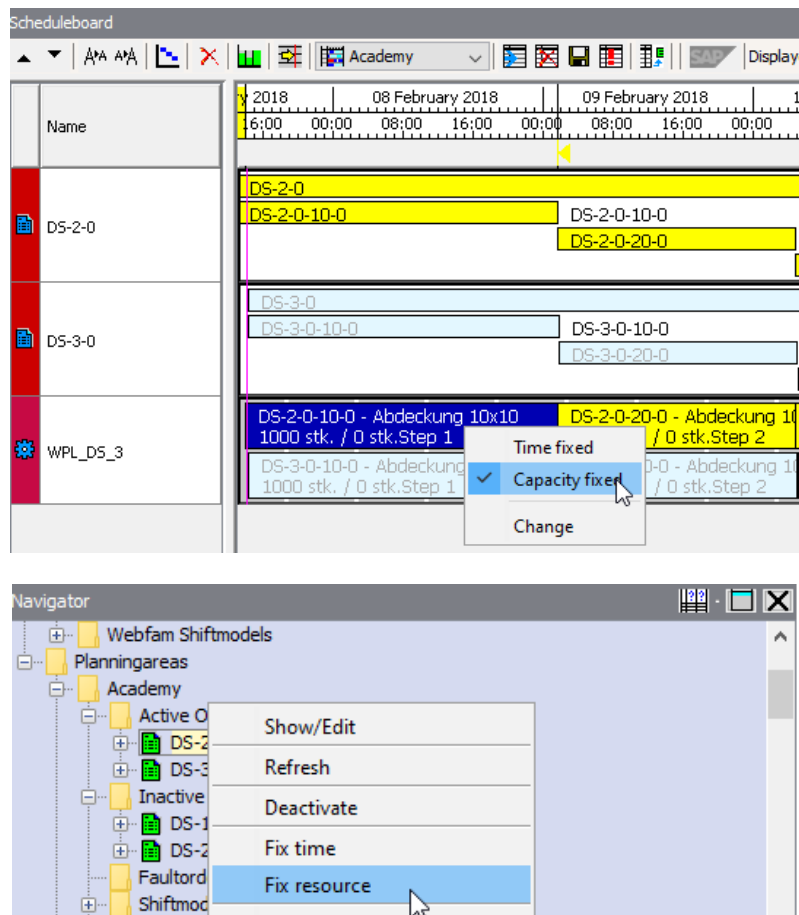


## Extended functions

### 3.8.2 Fixing of resources

Fixing of a resource is a 'hard' fixing method and only possible with resources. An order or operation is fixed to this resource and must not be scheduled by any other resource any more.

This is defined similar to fixing the timing by way of a pop-up menu for the resource in the schedule board or for the order in the Navigator.



## 3.9 Setup matrix editor

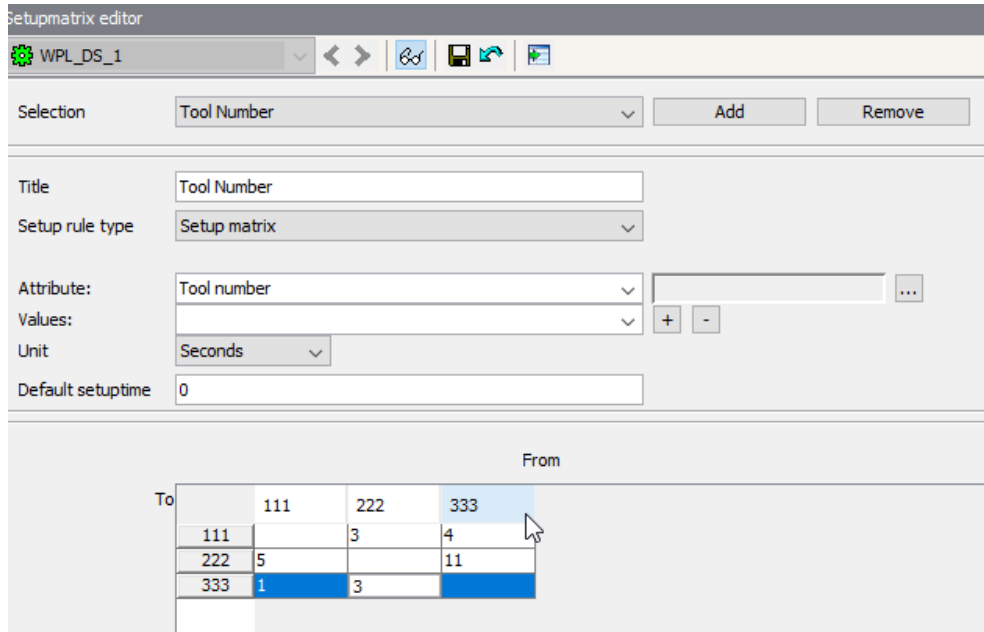
The setup matrix editor is used for specifying the setup times between different tools, work steps, etc. This can be done using a setup matrix or by simple comparison.

### 3.9.1 Simple comparison

The "Simple comparison" setup rule compares the selected characteristic (e.g. the material code) of two consecutive operations. If the material code in the second operation is the same, the setup time specified in the setup matrix editor is ignored for scheduling since the operations use the same material and therefore do not require any setup action on the machine.

If the material codes differ, the specified setup time is used.


### 3.9.2 Setup matrix




To	111	222	333
111		3	4
222	5		11
333	1	3	

The matrix shows the times it takes to change tools for different production materials. These specifications can be used to take setup times into account for scheduling and possibly combine and optimize operations with regard to their sequences.

The setup times should be defined with the following steps for different tools/machine configurations:


1. Open the setup matrix editor and change to editing mode.
2. Click "Add" and specify a name (e.g. Tool). You can change this name in the "Title" field.
3. Use "Setup matrix" as the setup rule type.
4. Select a characteristic (the material code by default) and specify the material code in the "Values" field.
5. Specify the default setup time including the correct time unit.
6. Click on  to add the specified material to the matrix in the rows and columns below.
7. You can now fill the individual fields of the matrix. If you want to have the matrix filled symmetrically, activate this option below the matrix.
8. Save your entries (changes). Your setup matrix is now ready for use.

If you want to delete a row from the setup matrix, specify the appropriate material code in the values field and click on . The specified row/column will be removed from the matrix. (See also chapter 6.11.1.13 Resources for opening the setup matrix editor.)

## 3.10 Maintenance

You can define individual maintenance intervals for resources of the “Machine” type. This will not modify the shifts defined, however, the capacity will be removed from the resource for the duration of maintenance.

A maintenance activity can be created manually as follows:


1. Load the resource for which you want to create a maintenance activity into the work time editor and change to editing mode.
2. Use  to add a new maintenance activity to the table.
3. Define start and end of the maintenance activity planned. You may also provide more detailed information in the description. To do this, click on the description field in the appropriate row.
4. Save the change you made to the maintenance table.

Worktimes		
WPL_DS_3		
Machine shifts Shiftmodels Workless time Maintenance Shifts total		
Start	End	Description
07.02.2018 00:00	09.02.2018 08:00	Maintenance

The maintenance activity will take place in the planned period and the machine will not be scheduled for any other purposes during this period.

Scheduleboard												
2018 08 February 2018 09 February 2018 10 February 2018 11 February 2018 12 February 2018 13												
Name	15:00	00:00	08:00	16:00	00:00	08:00	16:00	00:00	08:00	16:00	00:00	08:00
Production Labour	DS-2-0-10-0 - Abdeckung 10x10 1000 stk. / 0 stk.Step 1			DS-2-0-20-0 - Abdeckung 11 1000 stk. / 0 stk.Step 2			DS-2-0-30-0 - Abdeckung 10x10 1000 stk. / 0 stk.Step 3					
Set up Labour	DS-3-0-10-0 - Abdeckung 10x10 1000 stk. / 0 stk.Step 1			DS-3-0-20-0 - Abdeckung 11 1000 stk. / 0 stk.Step 2			DS-3-0-30-0 - Abdeckung 10x10 1000 stk. / 0 stk.Step 3					
WPL_DS_1	DS-2-0-10-0 - Abdeckung 10x10 1000 stk. / 0 stk.Step 1			DS-2-0-20-0 - Abdeckung 11 1000 stk. / 0 stk.Step 2								
WPL_DS_2	DS-3-0-10-0 - Abdeckung 10x10 1000 stk. / 0 stk.Step 1			DS-3-0-20-0 - Abdeckung 11 1000 stk. / 0 stk.Step 2								
WPL_DS_3	Maintenance						DS-2-0-30-0 - Abdeckung 10x10 1000 stk. / 0 stk.Step 3					
WPL_DS_4							DS-3-0-30-0 - Abdeckung 10x10 1000 stk. / 0 stk.Step 3					

The maintenance period appears with a distinct orange background on the schedule board. The scheduled maintenance activities will be included in the next simulation. Since production is not possible during maintenance periods, scheduling is arranged around these.

-  Maintenance activities scheduled will protract planned operations. This is governed by the dependencies among operations and orders. If there were none, it would be possible in this example to schedule operation 0-999-0 of Order1 before the maintenance activities because of its duration in production.

## 4 Dynamic scheduling in the DOS module

Dynamic scheduling makes it possible to arrange the orders chronologically and also to arrange the individual operations according to a defined sequence.

The DOS module achieves this using a queue. Orders initiated and their operations are directed into queues and processed sequentially.

The DOS module is provided with various planning types and priority rules to support and optimize this process. Resource-oriented personnel planning is another important aspect in the DOS module required for optimizing production scheduling.

### 4.1 Personnel planning / additional demand planning

In addition to planning the machine resource, other requirements such as personnel can also be planned in the DOS module. For this purpose, the DOS module supports simultaneous scheduling of several requirements of an operation. This kind of scheduling is also referred to as additional demand planning.


No explicit information about the various personnel requirements is transferred from the ERP system. The DOS module derives it indirectly from the labour time and time per unit specified.

Two configuration settings are required for activation.

1. Select the "Generate personnel requirements" parameter in the master data..
2. Load the appropriate machine into the editor and select the personnel resources to be planned simultaneously there.

The following personnel requirements types are defined:

- Personnel resource (to be scheduled for the complete duration)
- Setup personnel (to be scheduled from start for the setup time)
- Production personnel (to be scheduled from the end of setup time until end)
- Setup inspection personnel (to be scheduled from setup end for the setup inspection)
- Production inspection personnel (for the complete production time from the end of setup time)

 An operation can only be scheduled if all resources are available in sufficient capacity at planning time.

#### 4.1.1 Personnel resource

The "Personnel resource" requirements category is the simplest variant of personnel planning. The specified personnel resource is planned for the complete duration of the operation on the machine. The capacity requirements are determined from this relation:

$$\text{Capacity requirements} = \text{Labour time} / \text{Time per unit}$$



### 4.1.2 Setup and production personnel

Whenever planning production operations, differentiated scheduling of setup and production personnel is required. Special setup personnel (machine setters) are required for the setup phase. The duration of the setup phase is calculated from the setup times specified. After completion of the setup phase, setup personnel is only scheduled on a case-to-case basis for the duration of a setup inspection (see chapter 4.6.1 Planning).

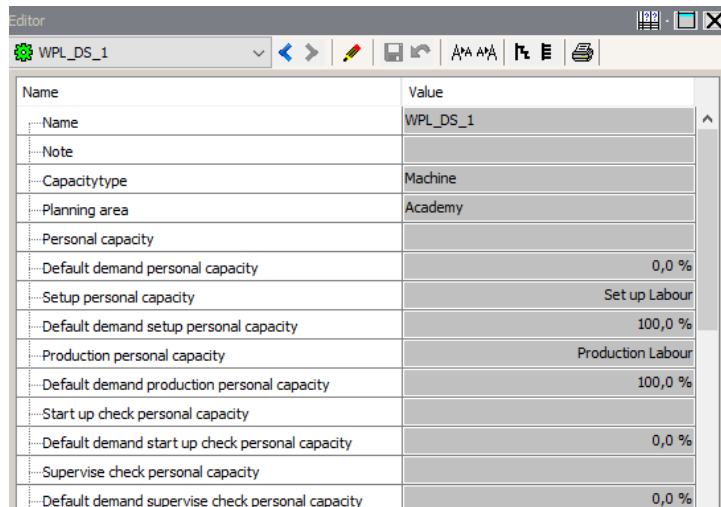
The setup phase is followed by the production phase, where the production personnel (machine operators) is assigned. The duration of the production phase is calculated by multiplying the time per unit with the remaining quantity to be produced.

To activate these two requirements, the definitions of the personnel resource types "Setup personnel" and "Production personnel" must be assigned to the corresponding workplace.

#### 4.1.2.1 Configuration

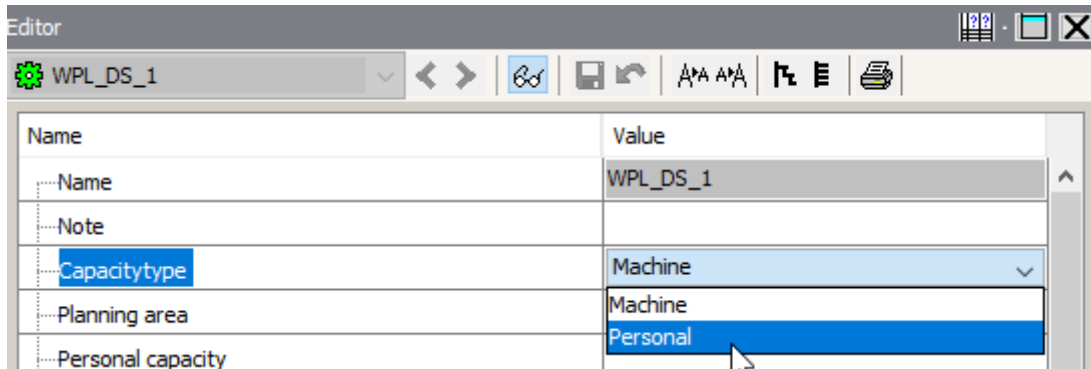
Several personnel resources can be defined for different tasks on each workplace.

To activate scheduling of setup and production personnel, the personnel resources have to be selected in the "Setup personnel resource" and "Production personnel resource" fields for each workplace.



Name	Value
Name	WPL_DS_1
Note	
Capacitytype	Machine
Planning area	Academy
Personal capacity	
Default demand personal capacity	0,0 %
Setup personal capacity	Set up Labour
Default demand setup personal capacity	100,0 %
Production personal capacity	Production Labour
Default demand production personal capacity	100,0 %
Start up check personal capacity	
Default demand start up check personal capacity	0,0 %
Supervise check personal capacity	
Default demand supervise check personal capacity	0,0 %

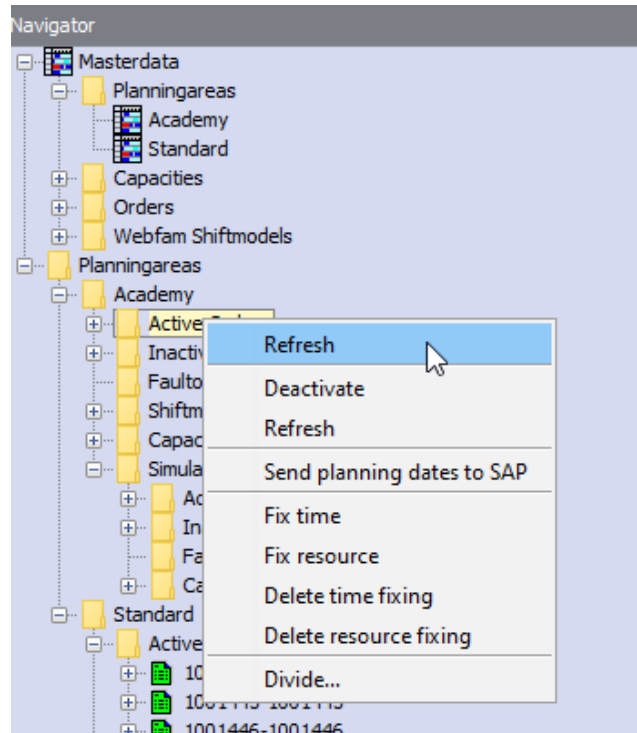
When creating a new personnel resource, make sure to set the resource type and define the work time.



Name	Value
Name	WPL_DS_1
Note	
Capacitytype	Machine
Planning area	Machine
Personal capacity	Personal

## Dynamic scheduling in the DOS module

The new configuration takes only effect for a simulation with existing orders after updating the existing order volume. This involves generating new setup and production personnel requirements for the operations.



### 4.1.3 Inspection personnel

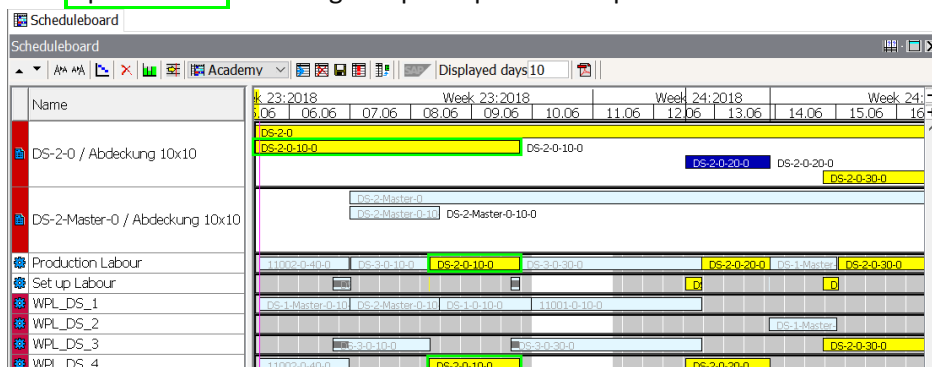
Inspection personnel is another category in addition to the setup and production personnel. The inspection personnel can additionally be subdivided according to two groups. It includes setup inspection personnel required to monitor the start-up phase (i.e. preparation) of the machine and take corrective action if any malfunction should arise. On the other hand, production inspection personnel monitor the running production and initiate corrective action if any trouble should arise.

For information on how to configure inspection personnel and create a related inspection operation, refer to chapter 4.6 Inspection operations.

### 4.1.4 Sample result of personnel planning

The following view shows a schedule board for order DS-2-0 with

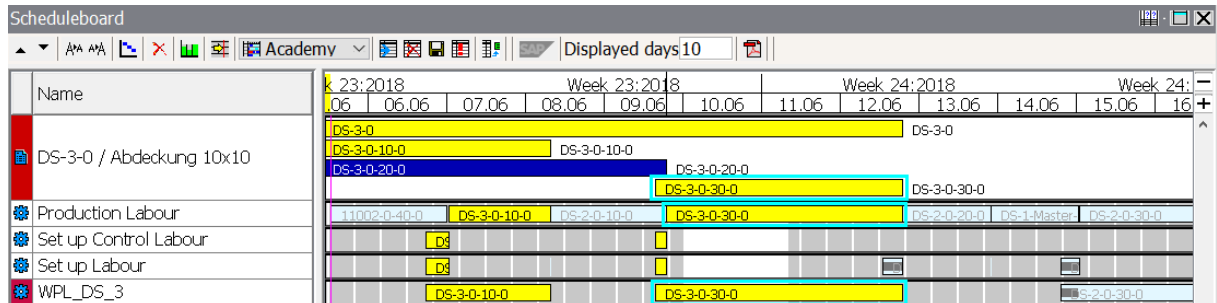
- **Operation 10** involving setup and production personnel resources.



## Dynamic scheduling in the DOS module

The following view shows a schedule board for order DS-3-0 with

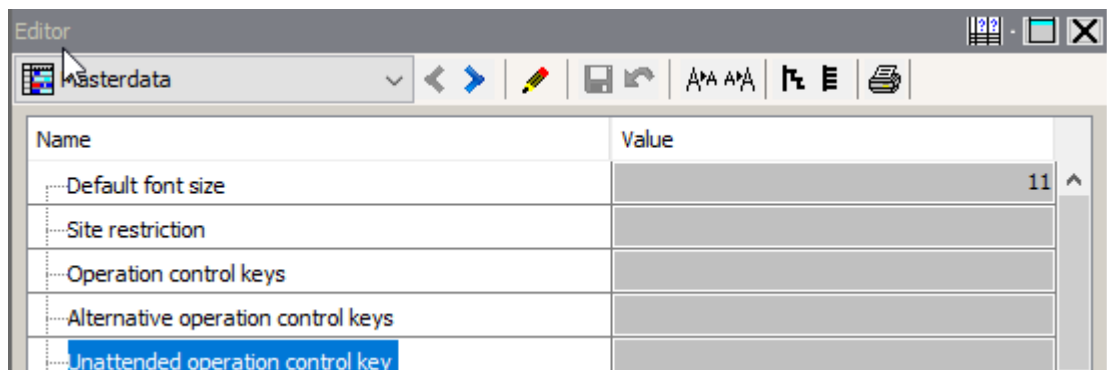
- **Operation 30** involving setup inspection, setup and production personnel resources.



### 4.1.5 Unmanned shifts

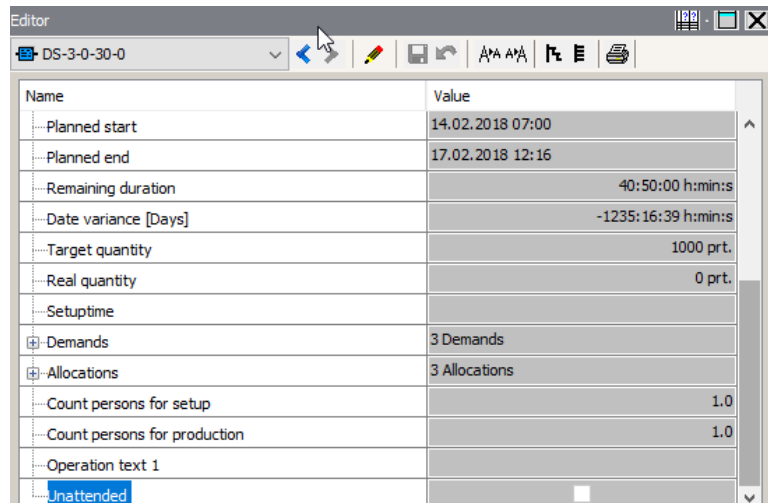
One of the objectives of dynamic scheduling is to consider unmanned shifts. This is useful to determine the period where an unmanned shift (ghost shift) could be scheduled, based on operations scheduling.

Planning of unmanned shifts does not involve scheduling of personnel requirements. This implies that the personnel pool capacity is not utilized during an unmanned shift. This is achieved by setting the "Unmanned" flag in the shift models and individual shifts of the workplaces and marking unmanned operation by means of the control key. Ghost shifts are treated in the same way as normal shifts for the purpose of computing the total work time.



Worktimes							
WPL_DS_1							
Machine shifts	Shiftmodels	Workless time	Maintenance	Shifts total			
WorktimeEditor.Pause4Start	WorktimeEditor.Pause4End	WorktimeEditor.Pause5Start	WorktimeEditor.Pause5End	Gross/Net duration	Capacity [%]	Unattended	Load [%]
				8 / 8	100,0 %	<input checked="" type="checkbox"/>	0,0 %
				8 / 8	100,0 %	<input type="checkbox"/>	0,0 %
				8 / 8	100,0 %	<input checked="" type="checkbox"/>	92,3 %

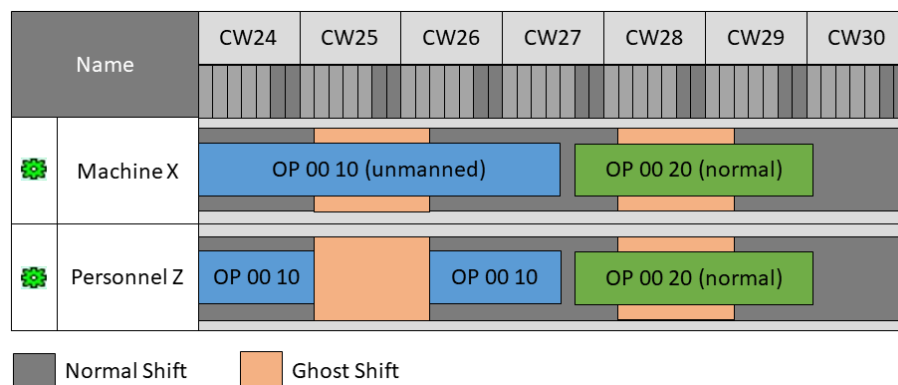
## Dynamic scheduling in the DOS module



Name	Value
Planned start	14.02.2018 07:00
Planned end	17.02.2018 12:16
Remaining duration	40:50:00 h:min:s
Date variance [Days]	-1235:16:39 h:min:s
Target quantity	1000 prt.
Real quantity	0 prt.
Setuptime	
Demands	3 Demands
Allocations	3 Allocations
Count persons for setup	1.0
Count persons for production	1.0
Operation text 1	
Unattended	<input type="checkbox"/>

The following functions are available to cover these requirements:

- A flag in the shift model indicating the shift ID considered as a potential ghost shift.
- Identification of operations that are eligible for an unmanned shift.
- Extended scheduling procedure for ghost shift planning:
  - If an unmanned operation is planned on a machine in a ghost shift, a personnel requirement is not scheduled for the period of the ghost shift. However, the personnel requirement must be scheduled for unmanned operations in normal shift periods.
  - A normal operation is also scheduled normally with a personnel requirement in a "potential" ghost shift.



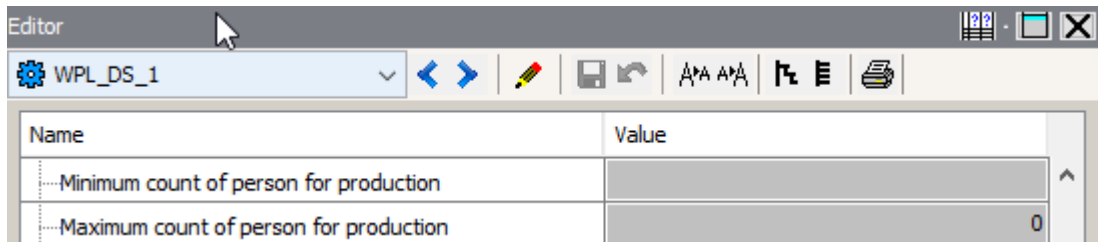
These definitions imply that shift models with ghost shifts are only effective on machines. A flag is required on both the operation and the shift to determine whether scheduling of an operation draws on the personnel resource.

- The ERP system transfers a flag (qualification) for the operation specifying whether the operation can be run without operator. This flag may also be set later in the operation data in the DOS module for testing purposes.
- A flag must be assigned to the shift in the shift model indicating whether the shift may be an unmanned one (ghost shift).

#### 4.1.6 Dynamic personnel planning on assembly workplaces

Operations on assembly workplaces can be performed employing a flexible number of persons. However, the duration of the operation depends on the number of persons employed (scheduled).

Two new configuration parameters have been introduced for dynamic production personnel planning:



Parameter	Description
Minimum count of persons for production	<p>The minimum number of persons on an assembly workplace to be scheduled for operations on this workplace.</p> <p>= 0: Operation is planned with the number of persons derived from time per unit and labour time.</p> <p>&gt; 0: An extended scheduling logic is activated for the workplace.</p>
Maximum count of persons for production	<p>The maximum number of persons on an assembly workplace to be scheduled for operations on this workplace.</p> <p>= 0: Operation is planned with the number of persons derived from time per unit and labour time.</p> <p>&gt; 0: An extended planning logic is activated for the workplace.</p>

**i** To activate dynamic production personnel planning, both parameters must be set > 0!

To be able to activate the function:

- The minimum and maximum numbers of persons must be > 0.
- The minimum number must be ≤ the maximum number.
- A personnel requirement must exist for the "Personnel resource" or "Production personnel resource" with a number of persons (Time per person/Time per unit) in the operation.

**i** If the conditions relating to minimum and maximum numbers are not fulfilled, the default number of persons specified for the operation is used for scheduling.

Normally, the ERP system transfers a machine time  $t_e$  and a personnel time per unit  $t_p$  to FORCAM FORCE™. The ratio of these two values results in the number of persons to be planned:  $\text{Number}_{\text{Pers}}$ . The formula is:

$$\text{Number}_{\text{Pers}} = \text{Machine time } t_e / \text{Personnel time per unit } t_p$$

## Dynamic scheduling in the DOS module

When an operation is about to be scheduled, this is done with a step-by-step approach, beginning with **Number of persons = MaxPers**. If this attempt is unsuccessful, the number of persons is decremented by 1 and another scheduling attempt is made. This continues until scheduling is successful or the number of persons has reached the minimum value. In the latter case, scheduling of the operation is repeated later.

The time per unit to be considered is determined as follows:

$$t_e(\text{Number}_{\text{PersPlanning}}) = (t_e * \text{Number}_{\text{Pers}}) / \text{Number}_{\text{PersPlanning}}$$

### 4.1.6.1 Example

Let us assume for operation 00 10:

Workplace X:

**$t_e=10$  min/unit**

**$tp=40$  min/unit  $\rightarrow$  NumberPers = 4**

**MaxPers = 6**

(A maximum of 6 persons can work in parallel.)

The following scheduling attempts are made for operation 00 10 on workplace X:

1st attempt

$$\text{Number}_{\text{PersPlanning}} = 6 \quad \rightarrow \quad t_e(6) = (10 \text{ min/unit} * 4) / 6 = 6.67 \text{ min/unit}$$

2nd attempt

$$\text{Number}_{\text{PersPlanning}} = 5 \quad \rightarrow \quad t_e(5) = (10 \text{ min/unit} * 4) / 5 = 8.00 \text{ min/unit}$$

3rd attempt

$$\text{Number}_{\text{PersPlanning}} = 4 \quad \rightarrow \quad t_e(4) = (10 \text{ min/unit} * 4) / 4 = 10.00 \text{ min/unit}$$

4th attempt

$$\text{Number}_{\text{PersPlanning}} = 3 \quad \rightarrow \quad t_e(3) = (10 \text{ min/unit} * 4) / 3 = 13.33 \text{ min/unit}$$

5th attempt

$$\text{Number}_{\text{PersPlanning}} = 2 \quad \rightarrow \quad t_e(2) = (10 \text{ min/unit} * 4) / 2 = 20.00 \text{ min/unit}$$

6th attempt

$$\text{Number}_{\text{PersPlanning}} = 1 \quad \rightarrow \quad t_e(1) = (10 \text{ min/unit} * 4) / 1 = 40.00 \text{ min/unit}$$

### 4.1.6.2 Staff assignment table

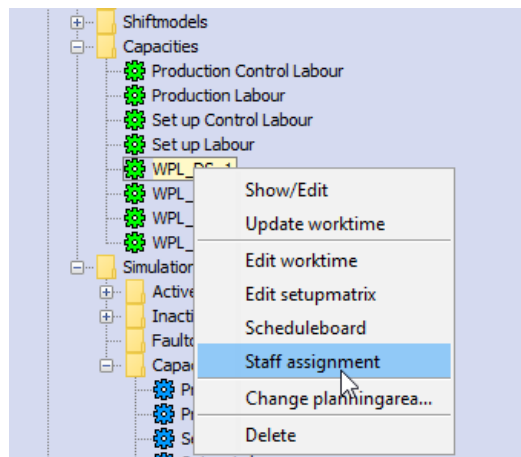
The staff assignment table has an important role in dynamic personnel planning. You can use the staff assignment table to define the requirements for specific times in the production cycle. If dynamic personnel planning is activated, a check is initially performed to determine if personnel counts are provided for specific time buffers.

If this is true, dynamic planning is applied with the number of persons specified in the table, if an appropriate time buffer exists.

Otherwise the number of persons specified in the master data parameters are used.

You can open the staff assignment table via the pop-up menu of the appropriate resource in the editor.

## Dynamic scheduling in the DOS module



In addition to the minimum and maximum numbers of persons, you can also set the time buffer along with the personnel count.

The time buffer and personnel count parameters are used for defining a specific number of persons for a fixed period (relating to the time buffer).

This means for the table:

The selected number of persons is required for the selected period.

This means for the following figure:

- If there are 3 days or less in the time buffer, 8 persons must be available for this workplace.
- If there are 5 days or less in the time buffer, 7 persons are required.
- If there are 10 days left in the time buffer, 5 persons are required.
- With a time buffer of up to 20 days left before the target end, the workplace can be covered by 4 persons.

Staff assignment table

WPL\_DS\_1

Minimum count of person for production		Maximum count of person for production	
4		8	
Date variance [Days] <=	Personal count		
3,00	8		
5,00	7		
10,00	5		
20,00	4		

The maximum number of persons in the row corresponds to the maximum number of persons for production. If you should select a higher number, an error message will appear when saving.

### 4.1.6.2.1 Functional principle

The staff assignment table is processed like some kind of "Alternatives" processing. The minimum and maximum numbers of persons are very important and specify the upper and lower limits of scheduling.

First a check is made whether 8 persons are available for operation at the selected workplace. If this is true, the resource is scheduled.

If not, a check is made whether 7 persons can be used for operation. If this is true, the resource is scheduled. If it is not possible to assign 7 persons to the workplace, an attempt is made with 6 persons.

## Dynamic scheduling in the DOS module

This procedure begins with the maximum number of persons required for production. If it is not possible to assign the minimum number of persons to the resource, resource scheduling is postponed.

### 4.2 Planning of work times

	Short term (< 4 weeks)	Long term (> 4 weeks)
Machine	<ul style="list-style-type: none"> <li>– Assignment to single shift</li> <li>– Unmanned flag</li> <li>– Manual adjustment of shift limits</li> <li>– Bulk definition using workplace hierarchies</li> </ul>	<ul style="list-style-type: none"> <li>– Bulk definition using workplace hierarchies</li> <li>– Shift models for long periods</li> <li>– Site-specific factory calendars</li> </ul>
Personnel pools	<ul style="list-style-type: none"> <li>– Assignment to single shifts</li> <li>– Number of persons per shift</li> <li>– Manual adjustment of shift limits</li> </ul>	<ul style="list-style-type: none"> <li>– Shift models with fixed and nearly unlimited personnel count across all shifts</li> </ul>
Planning-related	Personnel Limited (actual) personnel count per shift	Machine Personnel requirement to be determined by utilizing the maximum machine capacity

When specifying work times or shifts, a distinction must be made between machine and personnel pools. Another distinctive criterion is the planning horizon and the associated level of detail. Here, this is subdivided according to short term and long term.

Within the long-term range, generally an ergonomically easier definition of work time is required, which applies to many resources and a long planning horizon.

For machines/workplaces, the possibility of bulk definition is important, utilizing the workplace hierarchy. This is about assigning simple shift models for a long period of validity at the level of site/area/machine group. The definition of a shift model at any of these levels applies to all subordinate workplaces.

Similarly, it should be possible to define a shift model for the personnel pools in the long-term range for a longer period. Since the long-term range of personnel pools is rather characterized by determining the requirements, a virtually unlimited personnel count should be assumed per shift. In the long-term range, the machine and its shift model govern the scheduling process.

In the short-term range, the shift definitions must be detailed. Here, shift model definitions are insufficiently detailed. For this reason, single shifts provide the basis for working arrangements for both machine and personnel pools. The delimitation between short and long term is variable and defined for each resource by the single shift definitions.

For machines, the "Unmanned" flag and the shift time limits for shift start and end can be set for single shifts. It is also possible to delete or manually create single shifts. These details may also be set in the workplace hierarchy.



For personnel pools, the focus of single shift configuration in the short-term range is on configuring the personnel count per shift and the shift time limits for shift start and end. It is also possible to delete or manually create single shifts. In the short-term range, planning is governed by the personnel pools and their precise actual personnel count per shift.

The shift models configured in the ERP system reflect only the long-term/machine range. For this reason (and because the currently available work time transfer from ERP to FORCAM FORCE™ is based on the transfer of single shifts and the dynamic modification of work times in the ERP module is virtually limited to defining the factory calendars), a transfer of the ERP data is not implemented and double administration is accepted in the long-term/machine range, considering the definition options in DOS/FORCAM FORCE™.

### **4.2.1 Short-term and long-term scheduling**

Two modes of work time planning are distinguished in the DOS module:

- Short-term scheduling
- Long-term scheduling

In both cases you can use one or more shift models to map a specific work time model.

#### **4.2.1.1 Short-term scheduling**

Short-term scheduling is performed in the personnel/machine shifts tab. In the short-term range, single shifts can be defined for each resource for a defined period. Single shift definitions override global shift model definitions. This makes it possible to schedule special shifts or delete/change individual shifts.

(See chapter 6.1.1.2.1 Personnel shifts.)

#### **4.2.1.2 Long-term scheduling**

Long-term scheduling is performed in the Shift models tab.

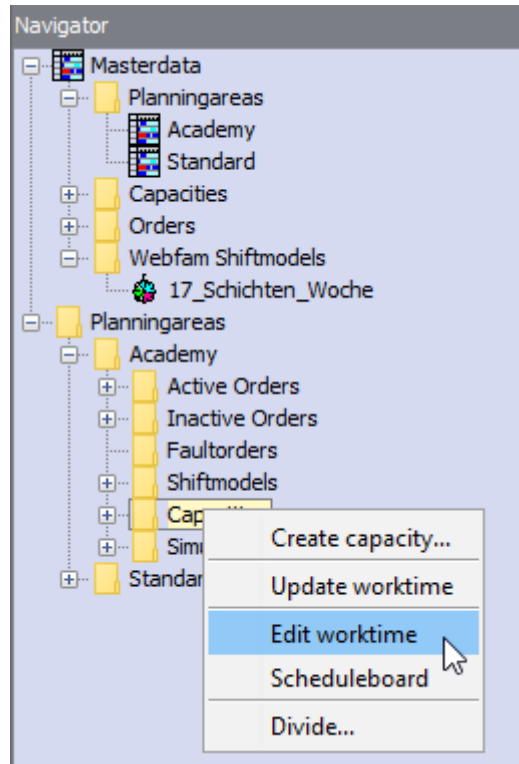
In the long-term range, a shift model can be scheduled for a very long period. This becomes effective after short-term scheduling.


(See also chapter 6.1.1.2.3 Shift models.)

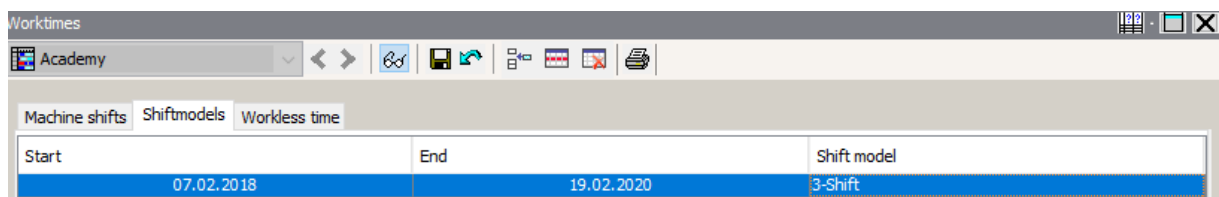
### 4.2.2 Area-related work time

The area-related work time is a work time model that is valid for all workplaces of the selected planning area. It is defined in four steps:

1. Right-click on "Resources" in the appropriate planning area in the Navigator to open the pop-up menu and select "Edit work time".



2. When the work times editor opens, change to editing mode, use  to add a new row and select the period in which you want the selected shift model to be valid.
3. If some non-working days apply, specify these days in the "Non-working days" tab.
4. Save your settings.



The selected shift model will now be adopted by default by all workplaces of the planning area. If you want to use different shift models for specific workplaces or run completely different shifts, it is recommended to create a work time hierarchy.

### 4.2.3 Work time hierarchy

You can find the work time hierarchies in the Navigator in Planning area → \*Name of Planning Area\* → Work time hierarchy. These hierarchies are created in FORCAM FORCE™ and used for defining work times and/or shifts. Various shift models can be applied at the various hierarchy levels (i.e. elements such as site, department, etc.). Lower-level workplaces automatically adopt the global definition of the higher-level hierarchy element.

If a resource is created without an allocation, it is not included in a work time hierarchy and may be allocated (if desired). It is also possible to create additional hierarchy levels.

Proceed as follows:

1. Right-click on "Work time hierarchy" → "Create".
2. Right-click on the appropriate resource → "Change hierarchy allocation"

A work time hierarchy is useful for

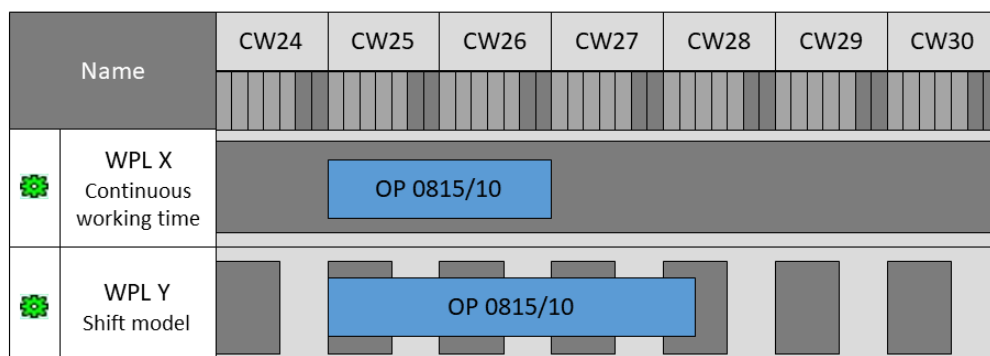
- a better overview of various machine/personnel shifts.
- easier recognition of bottlenecks.
- controlled acquisition of work time data.

## 4.3 Resource planning types

When scheduling an operation, the shift model (available capacity) of the workplace is taken into account. If an operation is scheduled on a workplace with a continuous shift model (7 days with 3 shifts without breaks), the busy time (i.e. bar length) results from the formula:

$$\text{Busy time} = \text{Net scheduled time} = \text{Setup time} + (\text{Time per unit} * \text{Target quantity})$$

However, if the workplace has a shift model involving work time interruptions (e.g. 5 days with 2 shifts and breaks), the busy time expands so that the sum of work time ranges covered is equivalent to the net scheduled time.

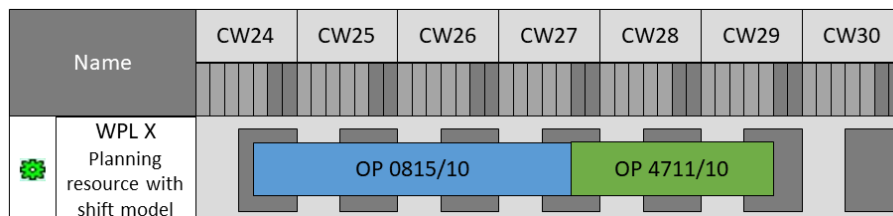


There are three different approaches to resource planning:

- Planning-based
- Scheduling-based
- Neither planning nor scheduling based

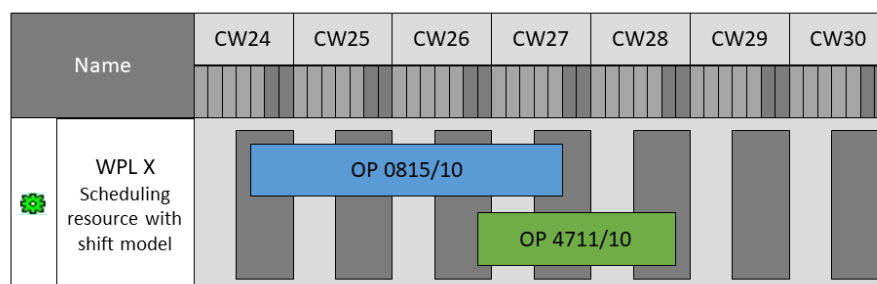
### 4.3.1 Planning resources

If a resource is configured as a planning resource, the defined capacity (normally 100%) must not be over-planned. The operations to be planned which usually have a capacity requirement of 100% can only be scheduled on the resource strictly one after the other. Moreover, the busy time is strictly imputed to the shift capacity and based on the shift limits.



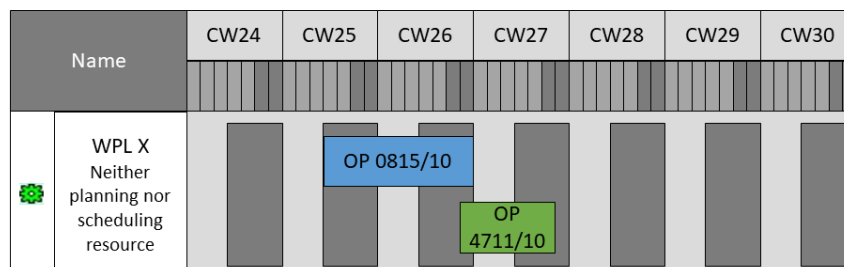
### 4.3.2 Scheduling resources

If a resource is configured as a scheduling resource, the defined capacity may be overbooked at will. This may result in multiple assignments. However, the busy time is strictly imputed to the shift capacity and based on the shift limits.



### 4.3.3 Neither planning nor scheduling resource

The defined capacity of a resource which is neither a planning nor a scheduling resource may be overbooked at will. The busy time is equivalent to the net scheduled time and is not based on any shift model.



## 4.4 Resource utilization

A resource has two characteristics that may need to be changed, depending on its use. These characteristics are the base capacity and the rate of capacity utilization.


#### 4.4.1 Base capacity

The base capacity indicates how much capacity of a resource is available. There are different ways of viewing this.

1. A single machine has a base capacity of 100%.
2. A machine group consisting of N machines has a base capacity calculated as follows:  
 $N * 100\%$ .
3. A single person has a base capacity of 100%.
4. A personnel group consisting of X persons has a base capacity calculated as follows:  
 $X * 100\%$ .

Conclusions:

- The base capacity of a resource is equivalent to its quantity.
- If a resource is required for several orders/operations at the same time, the base capacity needs to be increased by the additional requirement.
- If an order/operation requires only a certain share of the base capacity, this can be assigned exactly to the total base capacity.

 If the base capacity was set incorrectly, the error message "Requirement(s) cannot be planned!" appears in the simulation. (See also chapter 7.2.1 Requirements cannot be planned.)

#### 4.4.2 Rate of capacity utilization

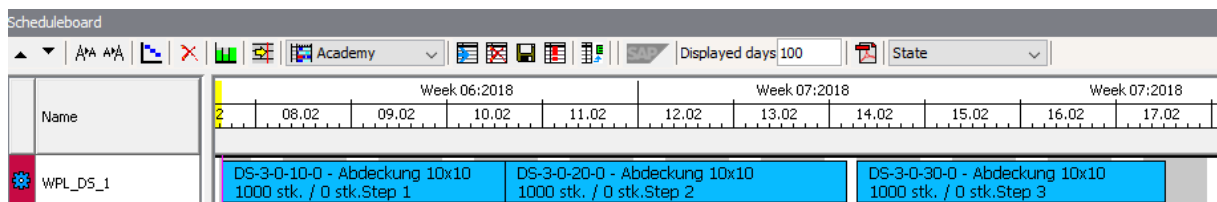
In contrast with the base capacity, the rate of capacity utilization indicates the extent to which the selected resource is claimed, or its utilization.

Any change in the rate of capacity utilization will always involve a change in processing time. This processing time may also influence the selection of alternatives. If two machines are mutual alternatives but have different rates of capacity utilization, the order/operation will choose one of them. The further scheduling result depends on the priority rules selected. (See also chapter 3.2 Configuring priority rules.)

The essential effects of the rate of capacity utilization can be illustrated best in the schedule board.

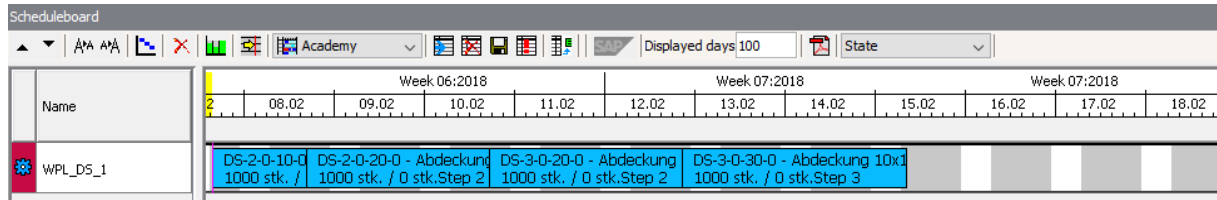
##### 4.4.2.1 Example in schedule board

This example involves two production orders with three operations each. For a better overview, all operations are reflected individually in the schedule board. The board shows that production begins in early September in 2011 and both orders are completed by the end of February in 2013. The rate of capacity utilization of the production machine 123456 is about 100%.



## Dynamic scheduling in the DOS module

If you set the rate of capacity utilization to 200%, the load on the machine doubles. Only half the time is required to complete both orders. Potential bottleneck situations or urgent orders can be handled more quickly and efficiently by selecting a higher rate of capacity utilization. The disadvantage of a high rate of capacity utilization (exceeding 100%) is that the additional load makes the machine more susceptible to defects and failures.



However, if you reduce the rate of capacity utilization, the production time increases accordingly. Operating a machine at a reduced rate of capacity utilization offers the advantage that the machine is only fully loaded in bottleneck situations, which reduces the general risk of overloading.

## 4.5 Inspection operations

### 4.5.1 Planning

An inspection operation is an additional working step reflected in the schedule board as a parallel operation. It is used to check the other operation running in parallel, combines the setup inspection with the production inspection and requires only personnel resources. Setup inspection personnel is assigned for the duration of the setup inspection and production is monitored by production inspection personnel. Machine resources are not allocated.

Using an inspection operation in the routing requires the following items in the ERP system:

- Parallel flag (Parameter for activating parallel operations)
- Exit operation (previous operation)
- Entry operation (subsequent operation)

The required auxiliary personnel time can be derived from the setup and production personnel times. Characteristics:

- Setup inspection personnel is only scheduled for the duration of the setup inspection. This duration is derived from the setup time of a parallel inspection operation.
- Production inspection personnel is only scheduled for production. The capacity requirement is determined from the time per unit of a parallel inspection operation.

#### 4.5.1.1 Example

For the setup inspection, an inspection time (for machine start-up) must also be planned in addition to the machine setup time and production time. This is reflected in the following operations.

Operation	Description	Setup time $t_r$	Standard time $t_e$	Operation exit	Operation entry
00 10	Production operation	3 hours = 2 hours setup + 1 hour setup inspection	20 min / part	-	-
00 20	Production operation	2 hours = 1 hour setup + 1 hour setup inspection	20 min / part	-	-
00 30	Inspection operation	1 hour setup inspection	1 min / part (accompanying inspection)	00 10	00 20

In the production operations 00 10 and 00 20, the setup time includes the time for both plain setup activities and setup inspection. The actual production time is then determined from the standard time. The fitter must be scheduled for the setup time. The operator must be scheduled for the production time. The machine must be allocated for the complete cycle (setup and production). Inspection operation 00 30 includes the inspection person's allocation. The actual setup inspection is included in the setup time.

The standard time includes a  $t_e$  value which, by computing the quotient

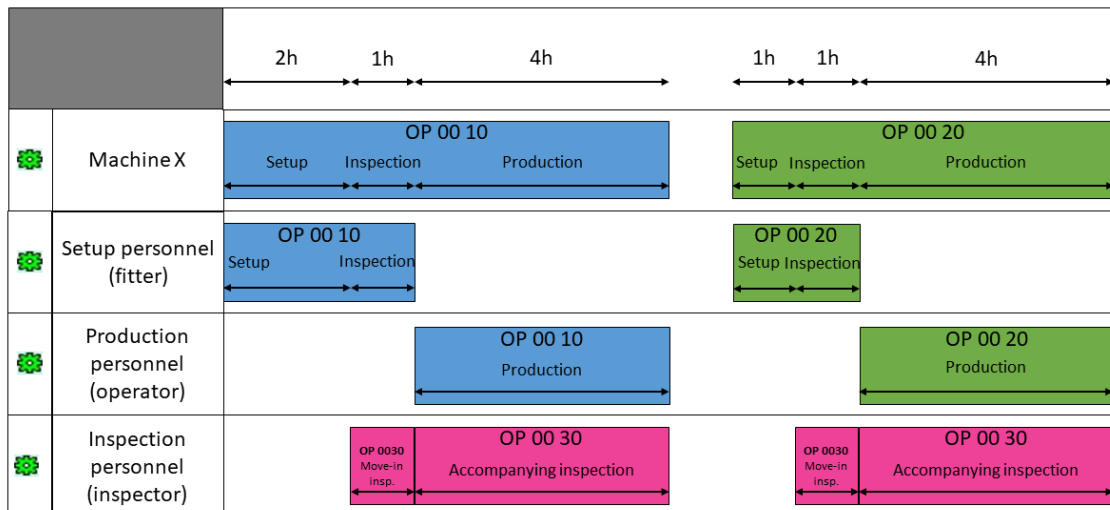
**$t_e(\text{operation 00 30}) / t_e(\text{operation 00 10}) = X\%$  or  $t_e(\text{operation 00 30}) / t_e(\text{operation 00 20}) = Y\%$**  results in inspection personnel allocation. The inspection personnel should be scheduled for the complete cycle of each production operation with the load determined (X or Y).

## Dynamic scheduling in the DOS module

When adopting the operation data from the ERP system, the production operation is provided with a reference to its inspection operation. The relevant requirements are created as a function of

- the configuration of the workplace
- the definition of an inspection operation
- the setup and production times configured

The example results in the following planning sequence:

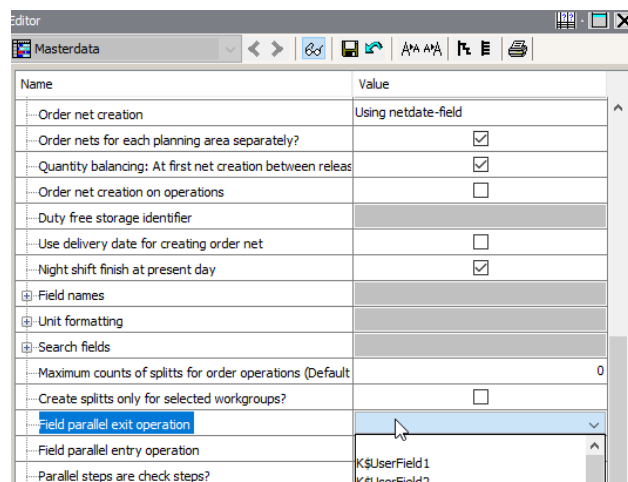


### 4.5.1.2 Confirmation messages

Only confirmation messages regarding production operations are processed in the DOS module. Confirmation messages relating to an inspection operation are not considered.

## 4.5.2 Configuration

The configuration for inspection operations is similar to the configuration for setup and production personnel.

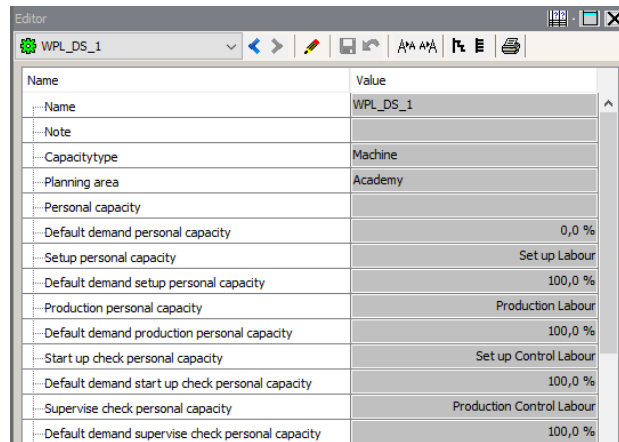


However, first the DB user fields must be specified which store the exit and entry operations in the inspection operation.



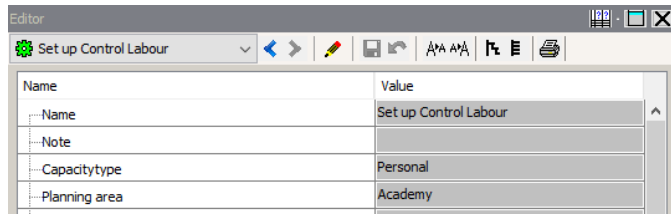
## Dynamic scheduling in the DOS module

These must be specified in the master data using the parameters "Field parallel exit operation" and "Field parallel entry operation".



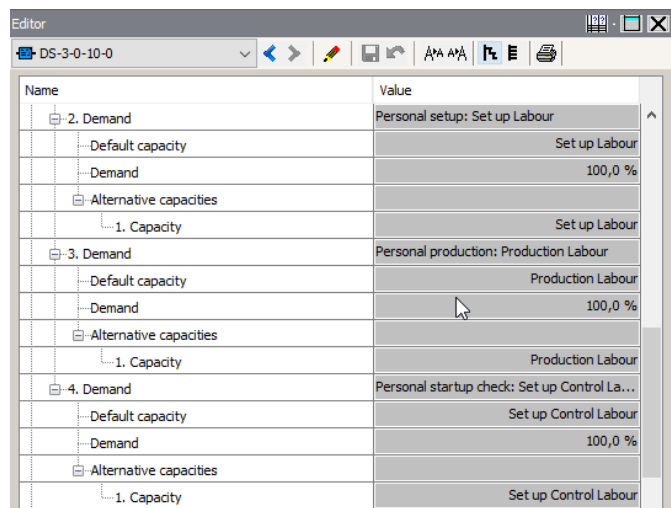
Name	Value
Name	WPL_DS_1
Note	
Capacitytype	Machine
Planning area	Academy
Personal capacity	
Default demand personal capacity	0,0 %
Setup personal capacity	Set up Labour
Default demand setup personal capacity	100,0 %
Production personal capacity	Production Labour
Default demand production personal capacity	100,0 %
Start up check personal capacity	Set up Control Labour
Default demand start up check personal capacity	100,0 %
Supervise check personal capacity	Production Control Labour
Default demand supervise check personal capacity	100,0 %

To activate scheduling of setup and production personnel, the personnel resources have to be selected in the "Setup inspection personnel resource" and "Production inspection personnel resource" fields for each workplace.



Name	Value
Name	Set up Control Labour
Note	
Capacitytype	Personal
Planning area	Academy

The resources required for this must be created, or the capacity of existing resources increased accordingly. When creating a new personnel resource, make sure to set the resource type to "Personnel" and define the work time in a shift model.



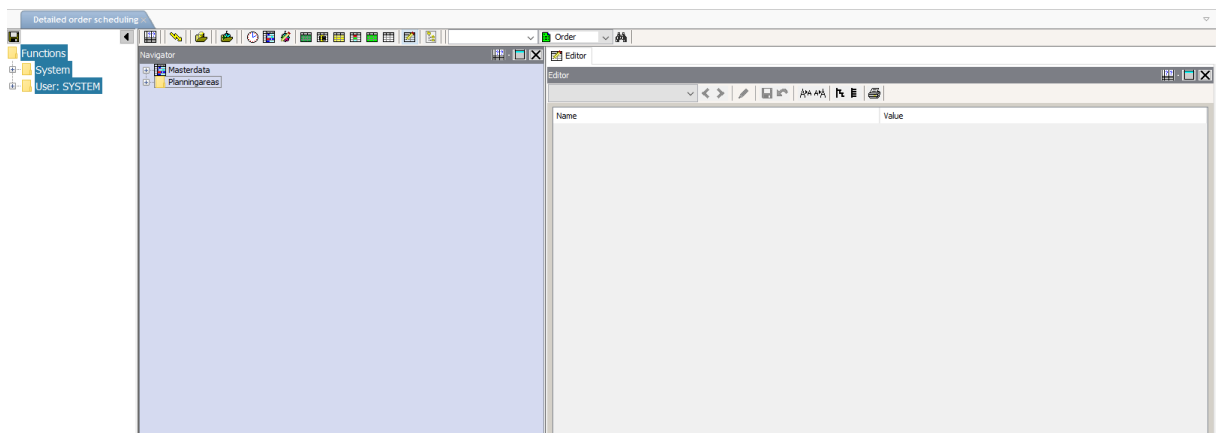
Name	Value
2. Demand	Personal setup: Set up Labour
Default capacity	Set up Labour
Demand	100,0 %
Alternative capacities	
1. Capacity	Set up Labour
3. Demand	Personal production: Production Labour
Default capacity	Production Labour
Demand	100,0 %
Alternative capacities	
1. Capacity	Production Labour
4. Demand	Personal startup check: Set up Control La...
Default capacity	Set up Control Labour
Demand	100,0 %
Alternative capacities	
1. Capacity	Set up Control Labour

The new configuration takes only effect for a simulation with existing orders after updating the existing order volume. This involves generating new setup and production personnel requirements for the operations.

## 5 User interface

The user interface of the DOS module is structured according to three large segments:

- Menu bar: to call commands and components
- Function menu: to open individual views
- Components window: to view and edit components



### 5.1 Menu bar









The menu bar is composed of two essential types of elements:

- Commands
- Components

## 5.1.1 Controls

### 5.1.1.1 Commands

Parameter	Description
 Update	The user interface content is reloaded from the DOS module server. If a change occurred on the server, e.g. due to a confirmation message, or if a new order was transferred from the ERP system, the icon flashes in red (  ), indicating that the content displayed is not up to date anymore.
 DB import	Imports all orders from the database into the DOS module. This function has been provided for reinitializing the DOS module or problem solving and <b>should not</b> be executed in normal operation.
 Resource import	Transfers all resources from the database into the DOS module. This function has been provided for reinitializing the DOS module or problem solving and <b>should not</b> be executed in normal operation.
 Shift model import	Transfers existing shift models from the database into the DOS module. This function has been provided for reinitializing the DOS module or problem solving and <b>should not</b> be executed in normal operation.
 Component options	You can use the component options to make a number of specific settings. These are settings related to the display or regarding the content.

### 5.1.1.2 Components

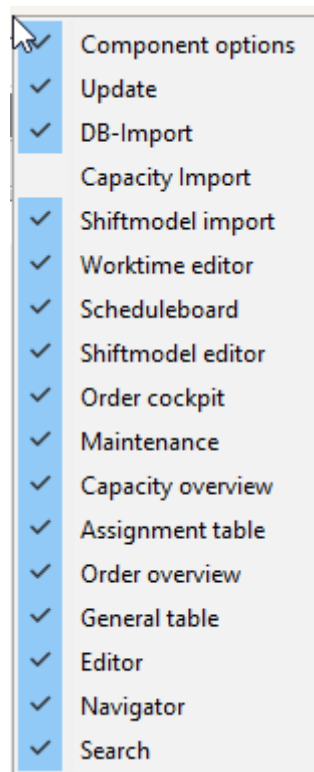
The components are described in more detail in chapter 6.

### 5.1.1.3 Configuration

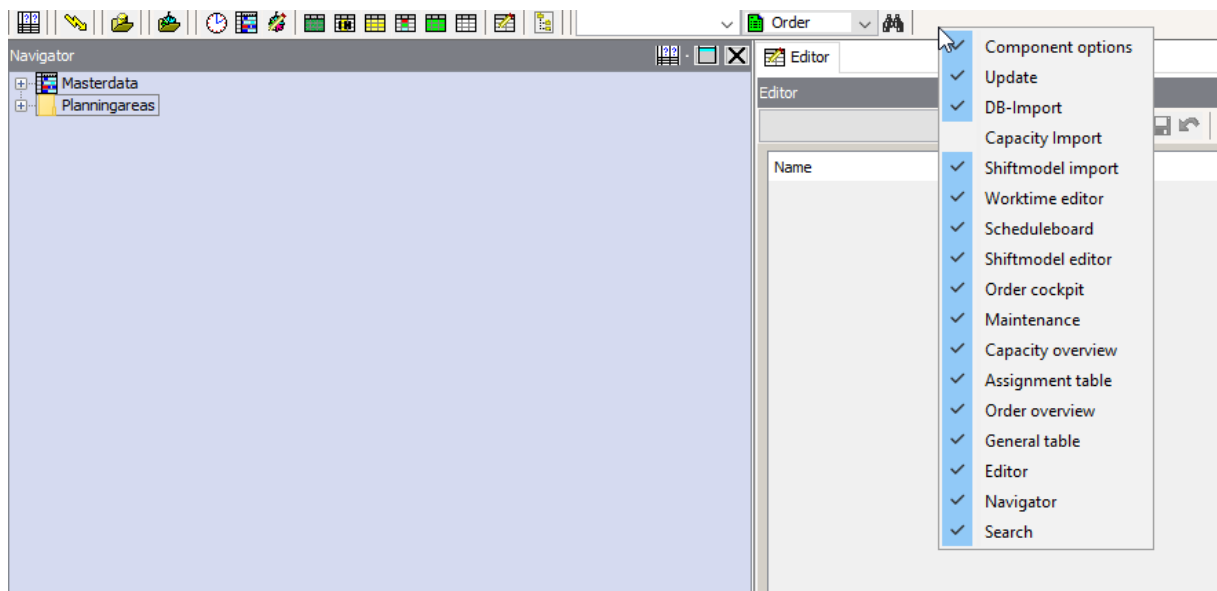
The menu bar can be customized according to the user's requirements. You can show or hide individual elements. Right-click to open a menu in which all buttons appear. Set a check mark to show the selected option in the menu bar. Remove the check mark to remove the button from the menu bar.


The buttons appear in a fixed order and arrangement which cannot be modified by the user.

## User interface



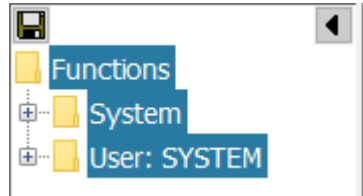
You can customize the menu bar functions by clicking on each option.



 If you should accidentally remove all buttons from the menu bar, it will disappear, and you will need to reload the currently used function!

## 5.2 Function menu

You can select and arrange the individual view components at will to obtain a customized window which you can save as a function. The functions saved are then available for selection in the function menu.



You can save functions at system level or at user level. Saving includes the arrangement, the configuration and – for certain components (schedule board, tables) – the reference to elements shown, such as orders and resources.

You may group functions in folders, if necessary. To do this, use the "Create folder" pop-up command in the function tree.

### Summary

- Functions are customized configurations of windows.
- You can define functions at will.
- You may group functions in folders.
- Functions are available for selection in the left-hand area of the screen.
- Functions are stored in `.\FLS\user\*USERNAME*\components\Desktop.ser`



### 5.2.1 Creating a function

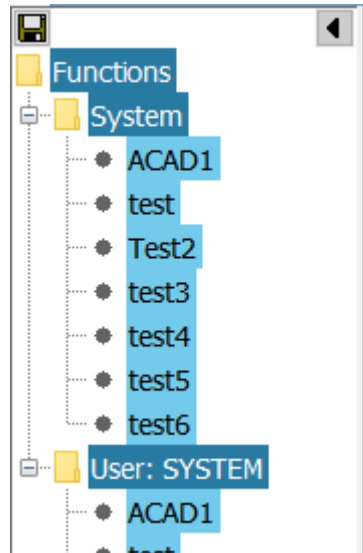
You can create a function by modifying an existing function or beginning with an empty window.

Creating a new function involves these steps:


1. Configuring the menu bar
2. Selecting components
3. Arranging the components
4. Configuring the individual components
5. Setting the focus view for each component
6. Saving the function

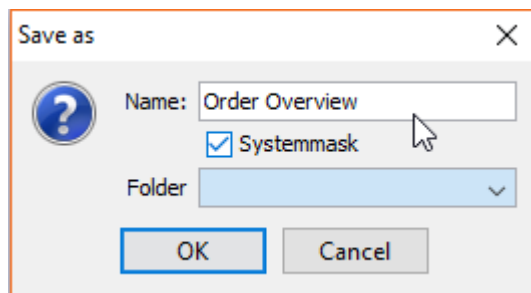
### 5.2.2 Selecting a function

The existing functions can be shown by clicking the  button (on the left of the menu bar). Both system-level and user-level functions are available for selection. Double-click on a function to load and display it. You can hide the function tree by clicking the  button.



### 5.2.3 Saving a function

Click the  button to save the current component configuration. An input window will appear and prompt you to enter a name for the function. You can also select the folder in which you want to save the function.






Parameter	Meaning
System screen	The function saved will be available to all users of DOS.
Folder	The folder where you want to save the function.

### 5.2.4 Deleting a function

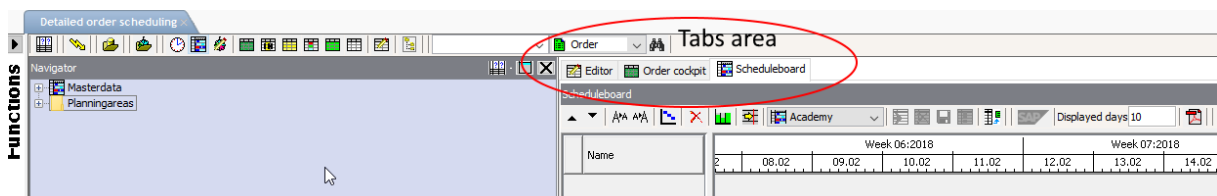
You can delete a function via the pop-up menu by right-clicking on the function to be deleted and selecting the "Delete" command.

## 5.3 Component window

Icons	Function/description
 Component options	Opens the options available for the component selected.
 Detach component	Moves the selected component out of the tabs area or moves it back into the tabs area.
 Close component	Closes the selected component. To open it, you need to select it in the menu bar.

All components are opened in the component window. Once selected, the components are opened in the central tabs area. You can open the editor only once. All other components can be opened multiple times.

In addition, a tabs area is provided where the individual components are opened initially.




### 5.3.1 Selecting components

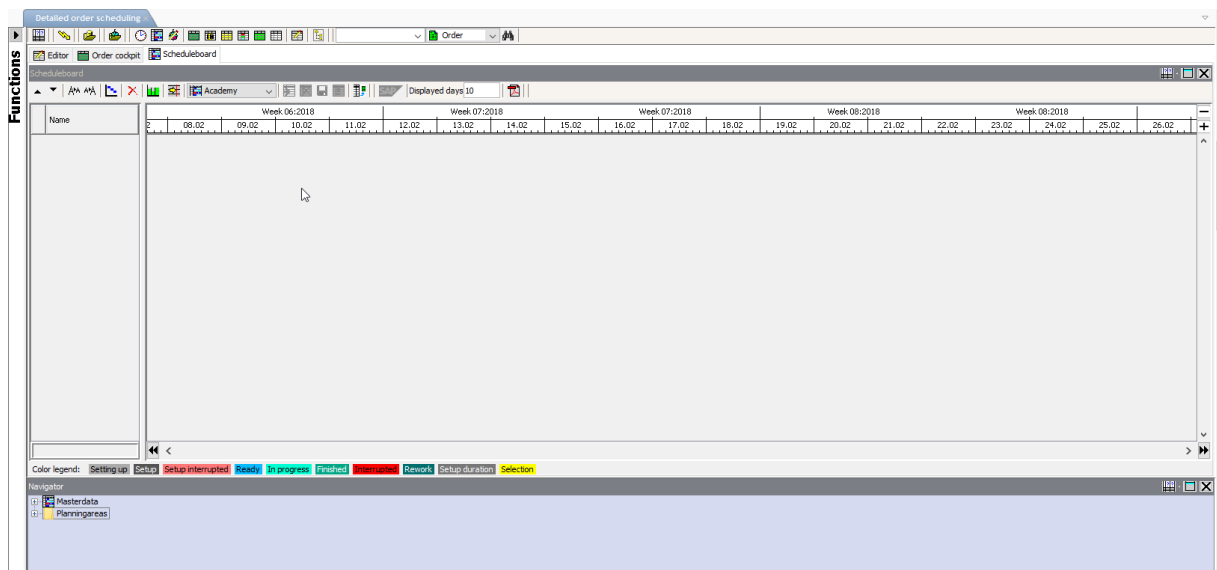
You can select the different components and their special configurations in the menu bar. See also chapter 5.1.1.3 Configuration for component selection and chapter 5.3.3 Configuring components.


### 5.3.2 Graphic arrangement

The overall screen is structured according to a grid pattern in which you can arrange the components at will. The display area contains a central tabs area which cannot be hidden. If there is no component open in the tabs area, it remains visible as a blank window.

Positioning a component within the grid pattern requires detaching it first from the tabs area. To do this, click the  button.

## User interface

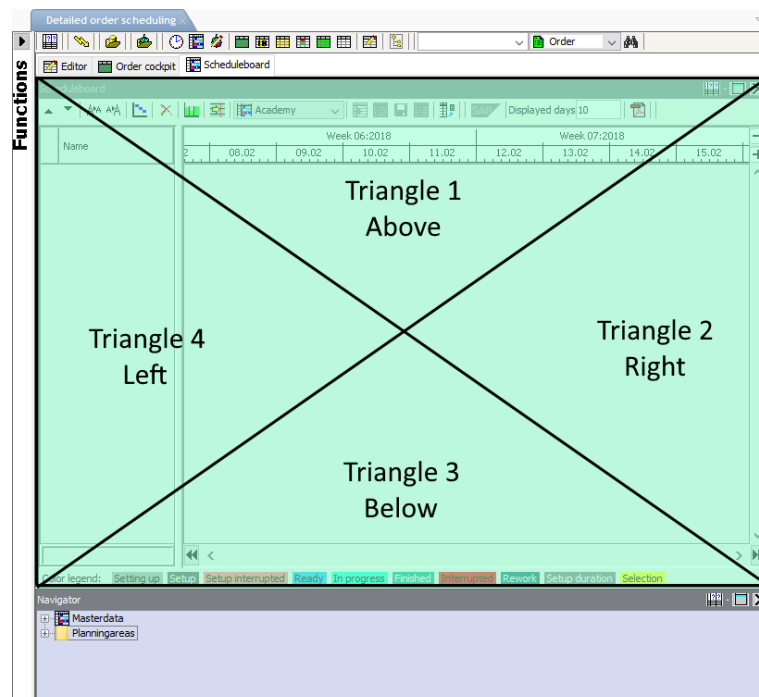


Subsequently the component (here, the Navigator) is arranged below the tabs area. If you want to reinsert a component into the tabs area, click the  button again in the header.

Use drag & drop for further positioning: Press and hold the left-hand mouse button on the grey header. When moving, a frame appears which you can drag using the mouse. When you release the mouse button, the window adopts the new position.

The mouse pointer defines the new position. The following rule applies:

- The new position is always relative to a target component at the current mouse pointer position.
- Imagine diagonal lines across the target component. These lines form 4 triangles.



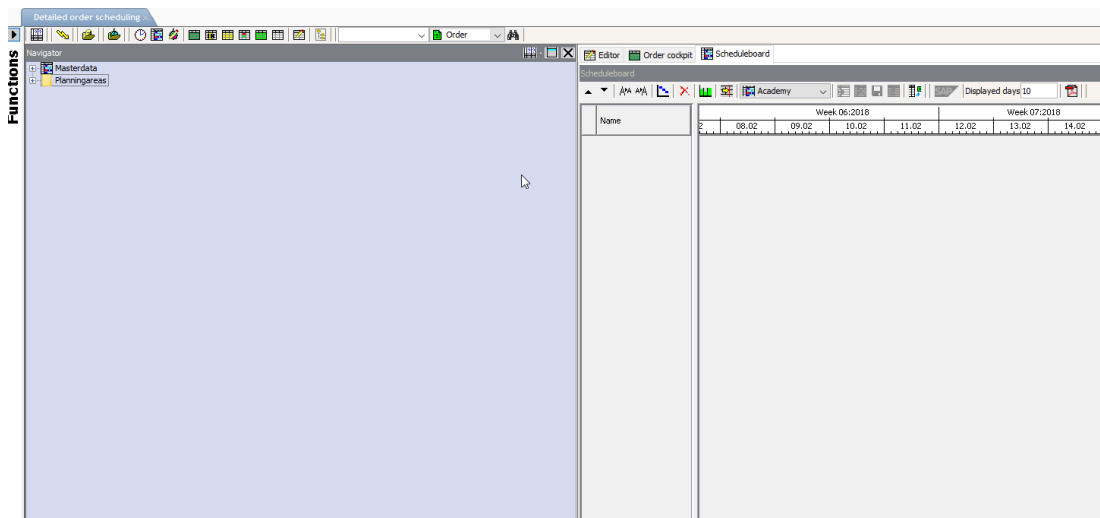


## User interface

The new position is as follows, depending on the triangle in which the mouse pointer is positioned and where you release the mouse button:

- Above the target component (triangle 1)
- On the left of the target component (triangle 2)
- Below the target component (triangle 3)
- On the right of the target component (triangle 4)


If you now want to move the Navigator to the left of the tabs area, position the mouse pointer to the grey header of the Navigator, press and hold the left-hand mouse button, move the mouse pointer into the target triangle 4 and release the mouse button.

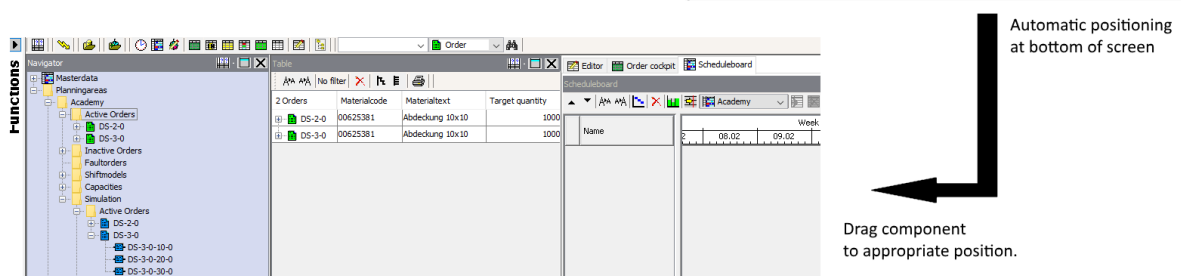
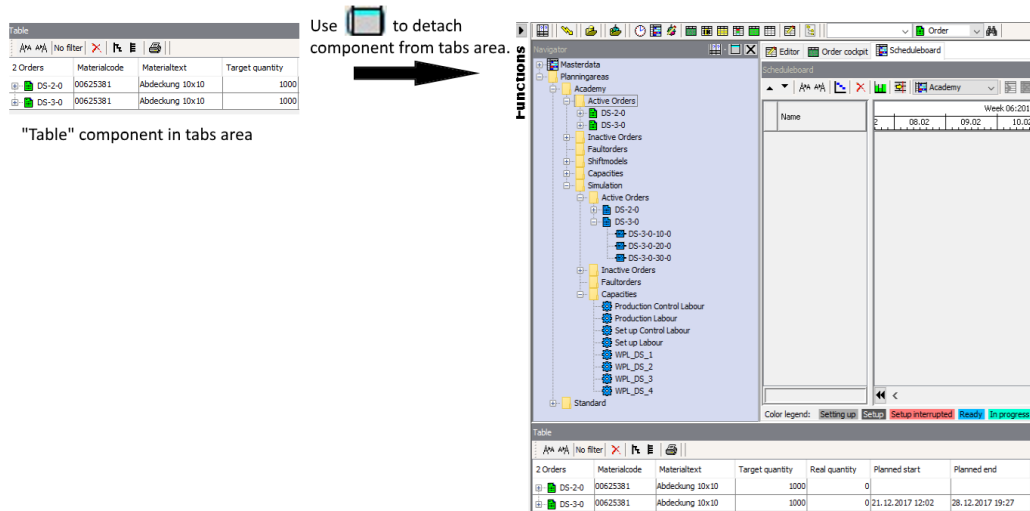


You can resize the two areas as necessary: Position the mouse on the partition line between the components so that a double arrow symbol (↔) appears. Press and hold the left-hand mouse button and drag the line to the appropriate position.


## User interface

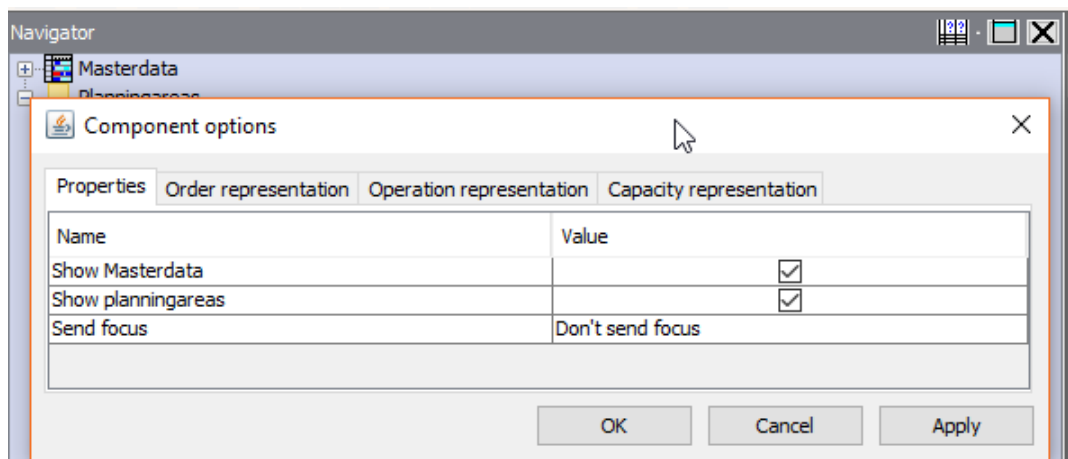
### 5.3.2.1 Example

1. Select a component and move it to the tabs area using the mouse.
2. Click the  button to detach the component from the tabs area.
3. Position the "Table" component using drag & drop.



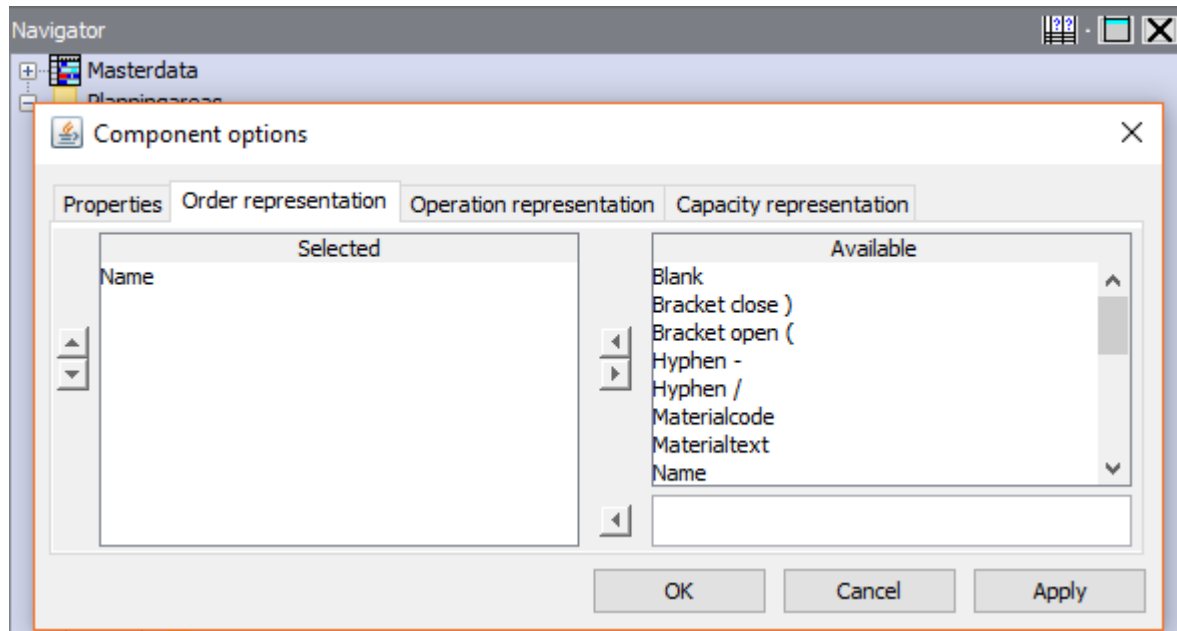
### 5.3.3 Configuring components



In the following example, only the scheduling tree of the Navigator is going to be displayed. This can be achieved by hiding the menu tree in the component options  of the Navigator, deselecting the corresponding parameter.



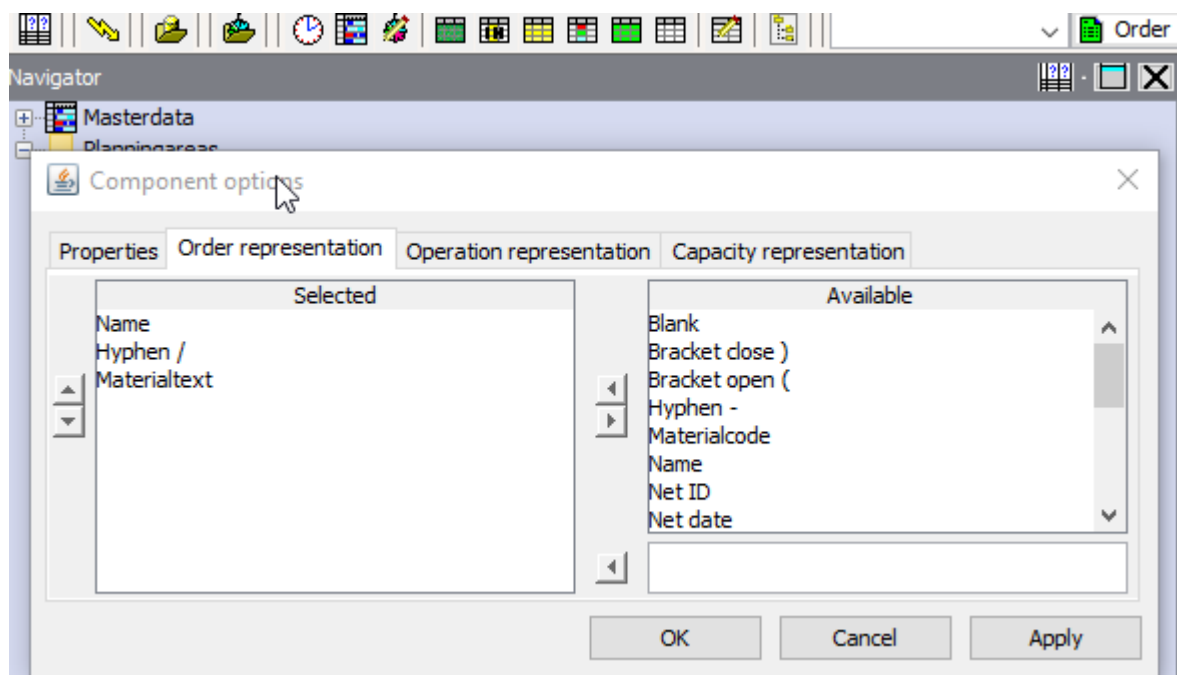
## User interface

In addition, the appearance of the orders can be modified. This can be set in the component options dialog of the Navigator in the "Order representation" tab.



The parameters to be shown are listed in the right-hand column. After selection, you can move the parameters to the other side using the arrow buttons . Those parameters you do not want to display any more can be hidden in the same way. You can use the arrow buttons  to set the order in which the parameters are displayed.

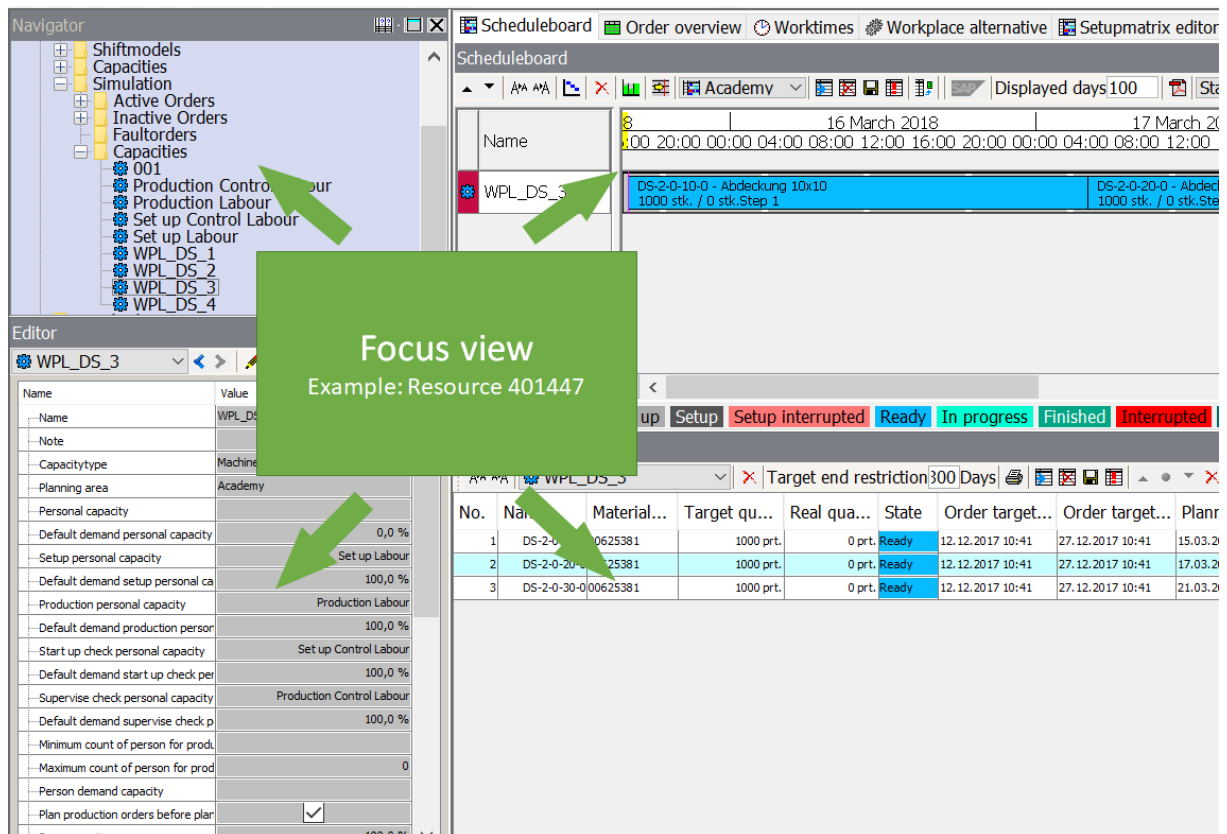
When you have selected the appropriate parameters, the configuration is adopted and the view of the objects changes automatically.



### 5.3.4 Focus view

Usually the selection of information to be displayed is made by drag & drop operations. This involves using the left-hand mouse button to drag an object, e.g. an order, to the editor, table or schedule board in the Navigator.

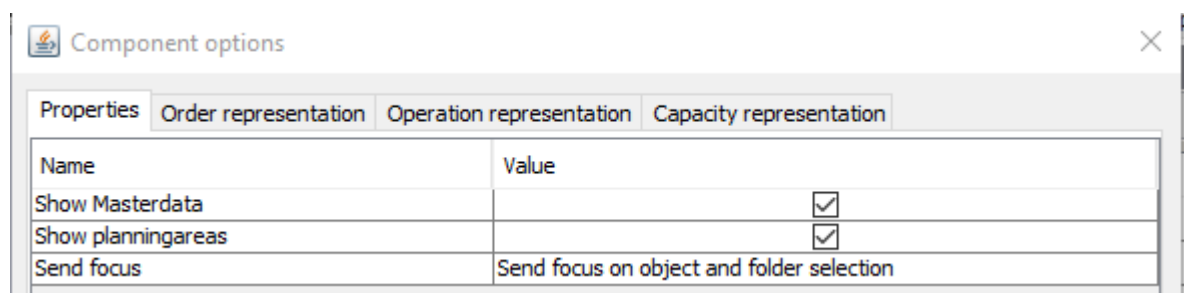
The DOS module interface offers an additional focus view to enable the exchange of information by selecting objects such as order, operation or resource. The focus view is filled by making such selections. Whenever the focus view changes, individual components are notified and can adapt their content automatically to the current selection.



**The focus is used for inter-component updating of views.**












However, to avoid "oversensitive" responses to selections in the display, the link to the focus view can be configured individually for each component.

You can configure the component options to define whether a component places its selection into the focus view or responds to a change in the focus view.



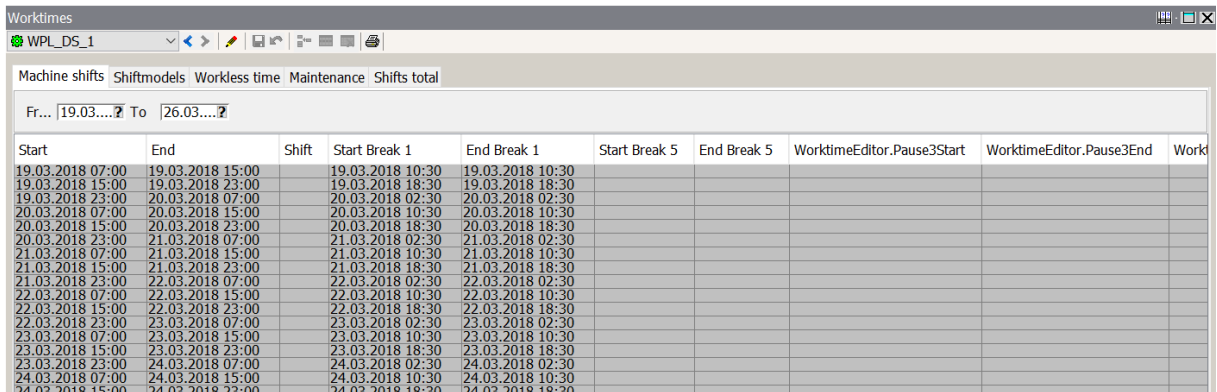
## 6 Components

Objects can be displayed in different ways within the components:

Icon	Description
	Orders
	Operations
	Planned orders
	Planned operations
	Resources
	Simulation orders
	Simulation operations
	Planned simulation orders
	Planned simulation operations
	Simulation resources
	Shift models

### 6.1 Work time editor

You can make settings for work times and shift models in the work time editor.



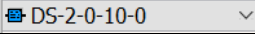










The screenshot shows the 'Worktimes' window with a toolbar and tabs for 'Machine shifts', 'Shiftmodels', 'Workless time', 'Maintenance', and 'Shifts total'. The 'Machine shifts' tab is active, displaying a table with columns for Start, End, Shift, Start Break 1, End Break 1, Start Break 5, End Break 5, WorktimeEditor.Pause3Start, WorktimeEditor.Pause3End, and WorktimeEditor.Pause3End. The table contains data for various dates in March 2018, showing shifts and breaks.

Start	End	Shift	Start Break 1	End Break 1	Start Break 5	End Break 5	WorktimeEditor.Pause3Start	WorktimeEditor.Pause3End	WorktimeEditor.Pause3End
19.03.2018 07:00	19.03.2018 15:00		19.03.2018 10:30	19.03.2018 10:30					
19.03.2018 15:00	19.03.2018 23:00		19.03.2018 18:30	19.03.2018 18:30					
19.03.2018 23:00	20.03.2018 07:00		20.03.2018 02:30	20.03.2018 02:30					
20.03.2018 07:00	20.03.2018 15:00		20.03.2018 10:30	20.03.2018 10:30					
20.03.2018 15:00	20.03.2018 23:00		20.03.2018 18:30	20.03.2018 18:30					
20.03.2018 23:00	21.03.2018 07:00		21.03.2018 02:30	21.03.2018 02:30					
21.03.2018 07:00	21.03.2018 15:00		21.03.2018 10:30	21.03.2018 10:30					
21.03.2018 15:00	21.03.2018 23:00		21.03.2018 18:30	21.03.2018 18:30					
21.03.2018 23:00	22.03.2018 07:00		22.03.2018 02:30	22.03.2018 02:30					
22.03.2018 07:00	22.03.2018 15:00		22.03.2018 10:30	22.03.2018 10:30					
22.03.2018 15:00	22.03.2018 23:00		22.03.2018 18:30	22.03.2018 18:30					
22.03.2018 23:00	23.03.2018 07:00		23.03.2018 02:30	23.03.2018 02:30					
23.03.2018 07:00	23.03.2018 15:00		23.03.2018 10:30	23.03.2018 10:30					
23.03.2018 15:00	23.03.2018 23:00		23.03.2018 18:30	23.03.2018 18:30					
23.03.2018 23:00	24.03.2018 07:00		24.03.2018 02:30	24.03.2018 02:30					
24.03.2018 07:00	24.03.2018 15:00		24.03.2018 10:30	24.03.2018 10:30					
24.03.2018 15:00	24.03.2018 23:00		24.03.2018 18:30	24.03.2018 18:30					

## Components

### 6.1.1 Controls

#### 6.1.1.1 Menu bar

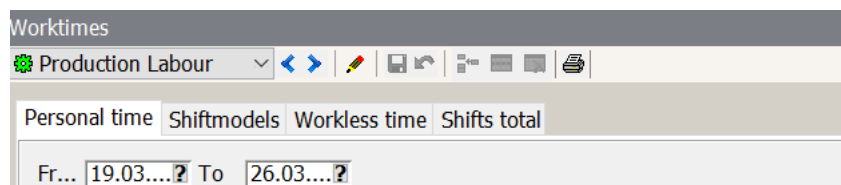
Icon	Function/description
 DS-2-0-10-0	Shows work times and shift models for specific resources
	Shows work times/shift models of the previous resource
	Shows work times/shift models of the next resource
	Editing mode: Change entries in tables
	Viewing mode: Entries cannot be edited (default)
	Saves the entries changed
	Discards all changes made
	Inserts a new row in a table
	Deletes the selected row from the table
	Deletes the complete table content
	Prints the current table

#### 6.1.1.2 Tabs

There are two different tab views: A personnel view and a machine view. These are described separately below, depending on whether there are different ones.

##### 6.1.1.2.1 Personnel time

In the "Personnel time" tab, you can specify and edit work times in the form of shifts. You can do this by selecting a shift model and the working hours. This tab is used for short-term work scheduling.



The resulting table provides the user with information about start and end of work, shift assignment, start and end of breaks, work time, number of personnel and information about capacity utilization. The user may also edit these data.

Exceptions are work time and maximum and average capacity utilization.

## Components

Worktimes

Production Labour

Personal time Shiftmodels Workless time Shifts total

Fr... 19.03.... To 26.03....

Start	End	Shift	Start B...	End Br...	Start B...	End Br...	Workti...
15.03.2018 00:00	15.03.2018 08:00	E					

Calendar for March 2018. Date selected: 15.03.2018. Time selected: 00:20.

Apply Cancel

### 6.1.1.2.2 Machine shifts

Machine shift definitions are nearly the same as personnel shift definitions. However, the number of personnel is complemented by information about capacity and the option of unmanned operation of the machine. This tab is also used for short-term work scheduling.

Worktimes

WPL\_DS\_1

Machine shifts Shiftmodels Workless time Maintenance Shifts total



Fr... 19.03.... To 26.03....

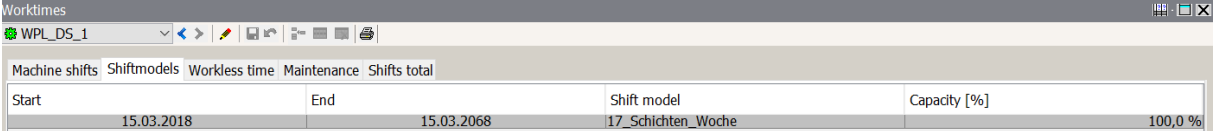
Start	End	Shift	Start Break 1	End Break 1
19.03.2018 07:00	19.03.2018 15:00		19.03.2018 10:30	19.03.2018 10:30
19.03.2018 15:00	19.03.2018 23:00		19.03.2018 18:30	19.03.2018 18:30
19.03.2018 23:00	20.03.2018 07:00		20.03.2018 02:30	20.03.2018 02:30
20.03.2018 07:00	20.03.2018 15:00		20.03.2018 10:30	20.03.2018 10:30
20.03.2018 15:00	20.03.2018 23:00		20.03.2018 18:30	20.03.2018 18:30
20.03.2018 23:00	21.03.2018 07:00		21.03.2018 02:30	21.03.2018 02:30
21.03.2018 07:00	21.03.2018 15:00		21.03.2018 10:30	21.03.2018 10:30
21.03.2018 15:00	21.03.2018 23:00		21.03.2018 18:30	21.03.2018 18:30
21.03.2018 23:00	22.03.2018 07:00		22.03.2018 02:30	22.03.2018 02:30
22.03.2018 07:00	22.03.2018 15:00		22.03.2018 10:30	22.03.2018 10:30
22.03.2018 15:00	22.03.2018 23:00		22.03.2018 18:30	22.03.2018 18:30
22.03.2018 23:00	23.03.2018 07:00		23.03.2018 02:30	23.03.2018 02:30
23.03.2018 07:00	23.03.2018 15:00		23.03.2018 10:30	23.03.2018 10:30
23.03.2018 15:00	23.03.2018 23:00		23.03.2018 18:30	23.03.2018 18:30
23.03.2018 23:00	24.03.2018 07:00		24.03.2018 02:30	24.03.2018 02:30
24.03.2018 07:00	24.03.2018 15:00		24.03.2018 10:30	24.03.2018 10:30
24.03.2018 15:00	24.03.2018 23:00		24.03.2018 18:30	24.03.2018 18:30

## Components



### 6.1.1.2.3 Shift models

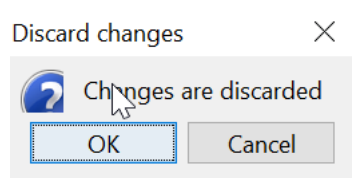
Use the "Shift models" tab to make settings for long-term work scheduling.

First activate editing mode by clicking the  button. Another click on  creates a new row. Select start and end and then the shift model. Subsequently select the capacity level to be used.



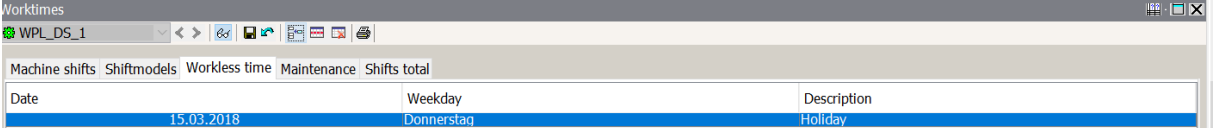
Start	End	Shift model	Capacity [%]
15.03.2018	15.03.2068	17_Schichten_Woche	100,0 %

Save the changes by clicking on  and exit editing mode by clicking on . If you should forget saving, a prompt appears to remind you that any changes would be discarded.



### 6.1.1.2.4 Non-working days

You can use the "Non-working days" tab to define days without work. You can specify the date in editing mode. You can provide additional information about the date in the description.



Date	Weekday	Description
15.03.2018	Donnerstag	Holiday

### 6.1.1.2.5 Shifts total

This tab lists all shift data defined and can be viewed by the user.

Editing is not possible.

Again, a distinction is made between personnel shifts and machine shifts.

### 6.1.1.2.6 Capacity intervals (option)

This tab provides the user with an overview of work times and capacities in use (or personnel employed). Editing is not possible here.

### 6.1.1.2.7 Maintenance

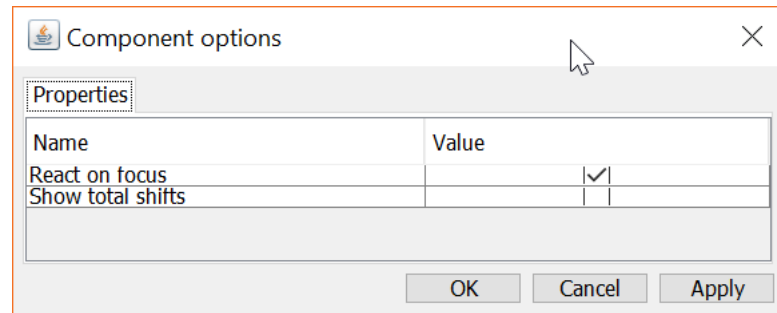
This tab appears only with the machine shifts and is similar to the "Non-working days" tab. Here you can specify maintenance work for the machine. The machine will not be available at these times. These maintenance times will be considered in scheduling and the machine will not be scheduled in these periods.



Start	End	Description
15.03.2018 00:00	16.03.2018 08:00	Maintenance



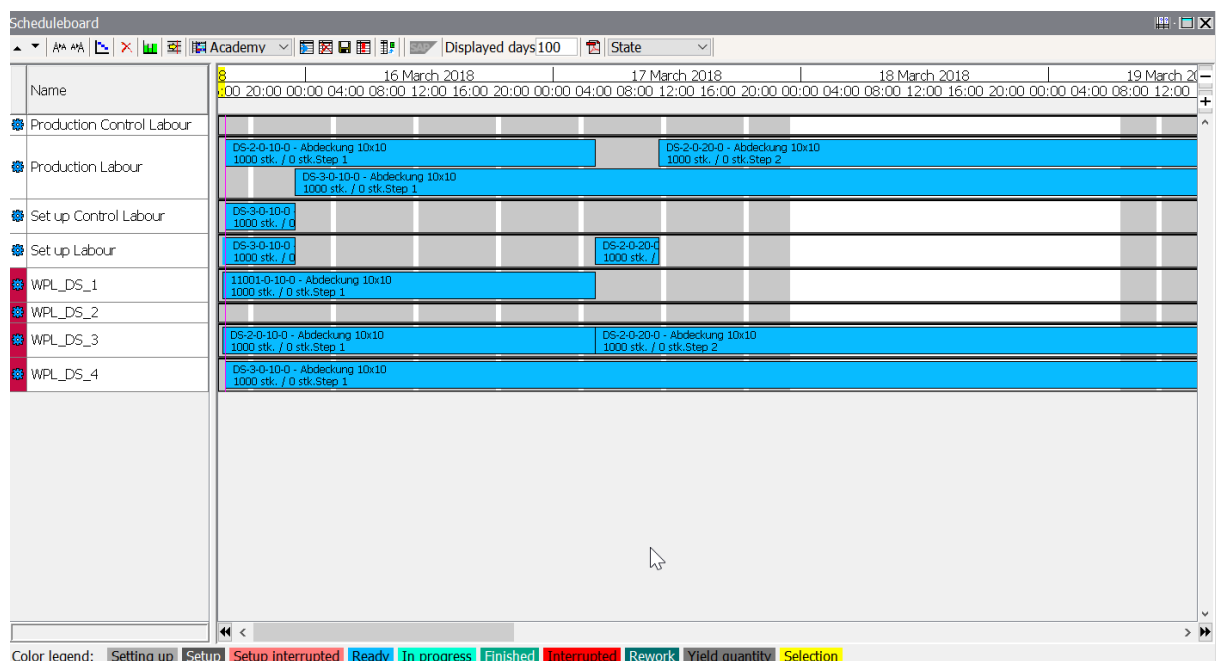
## 6.1.2 Component options




Parameter	Description
React on focus	The editor always shows the currently focused element.
Show total shifts	Activates the "Capacity intervals" tab.

## 6.2 Schedule board

The schedule board is used for graphic chronological display of orders and/or resource allocations. You can also make manual changes in the course of planning.



You can place orders or resources into the schedule board by drag & drop from the Navigator tree.

You may also include objects into the schedule board from the focus view. Use the  button to remove any objects previously added to the view. If you included several objects into the view, you can scroll them using the vertical scroll bar.

The current time scale is shown above the schedule board. You can use the horizontal scroll bar and the arrow buttons to shift the time scale to the past or future. Use the plus button to zoom into the current time scale, use the minus button to zoom out of the current time scale.

## Components

















In addition, the schedule board features 3 special lines:

- Red (continuous): Current point in time
- Yellow (continuous): End of scheduling dead time
- Blue (dashed): Last planning run

See also chapter 6.10.2.2 Planning area.

### 6.2.1 Controls

#### 6.2.1.1 Menu bar





Icon	Function/description
	Move selected row up
	Move selected row down
	Reduce font and block size
	Increase font and block size
	Show operations in order row one below the other
	Delete all rows
	Show resource rows as capacity diagram
	Scroll to current time
	Select production site
	Start simulation
	Delete simulation
	Save simulation
	Show fault orders
	Deactivate orders
	Activate orders
Displayed days 100	Set specified time scale
	Export schedule board to PDF file

#### 6.2.1.2 Time scale

Icon	Function/description
-	Reduce time scale (compress)
+	Increase time scale (expand)

#### 6.2.1.3 Bottom scroll bar

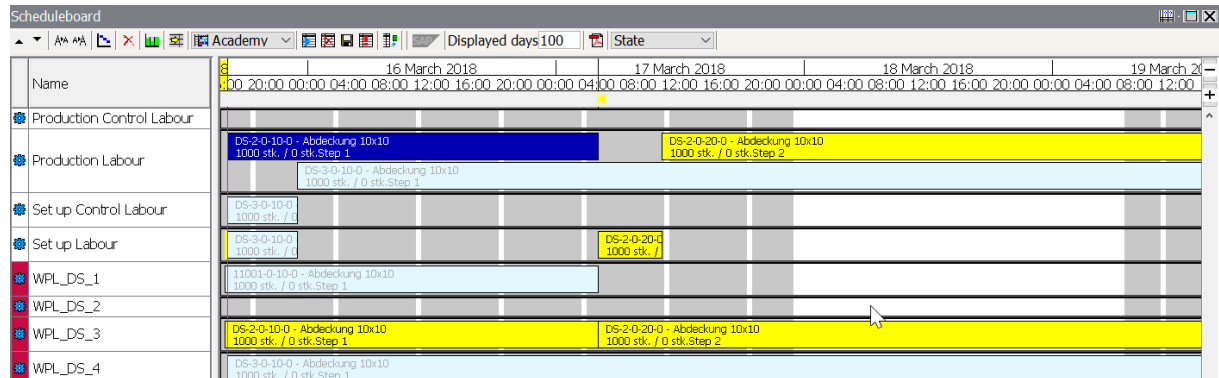
The schedule board loads the data to be displayed for a specified time range in the background. However, this time range is larger than the time window displayed to enable quick scrolling.

Icon	Function/description
	Scroll time scale towards the past
	Scroll time scale towards the future
	Move time range loaded towards the past. The data are re-read.
	Move time range loaded towards the future. The data are re-read.

## Components





### 6.2.1.3.1 Selection

Whenever you select an operation or order by clicking with the mouse, it appears in blue with red diagonal lines. In addition, all operations assigned to the same order (or order network, as applicable) are marked in yellow. You may modify the marking color in the component options.



### 6.2.2 Color background marking of objects in the schedule board

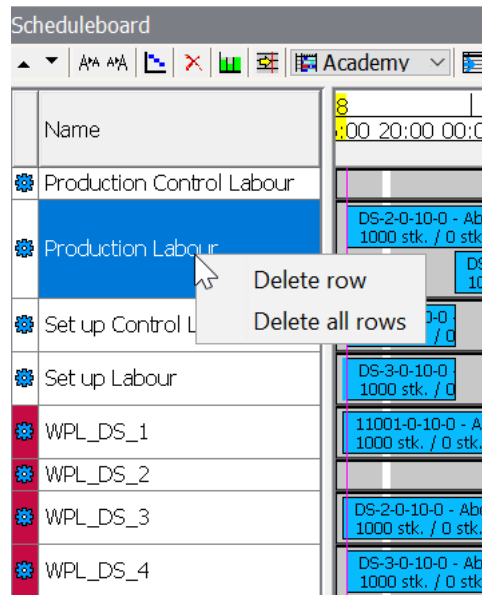
Objects may be marked with a specific background color in the schedule board. This background color enhances readability and applies to both real and simulation objects.


Object/color	Description
 Order/operation/resource – White	No error occurred in the simulation.
 Order/operation – Red	A red background color indicates that the time buffer has been exceeded. The order/operation is in delay.
 Resource – Red	There is a problem with the resource displayed.
 Resource – Black	The resource contained in the schedule board does not exist (any more).

## 6.2.3 Pop-up menus

### 6.2.3.1 Pop-up menu on left-hand table

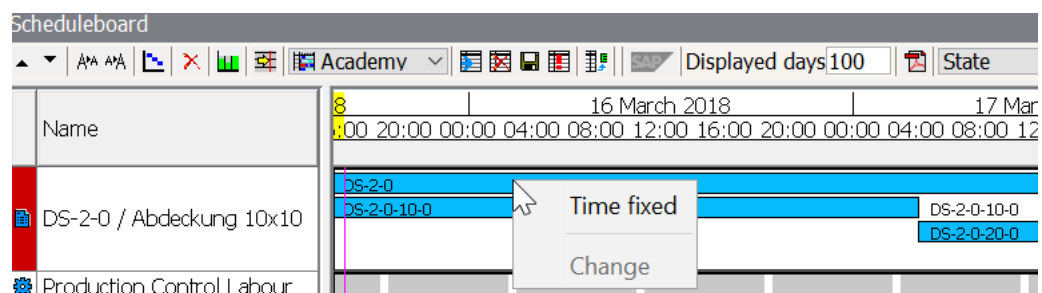
You can open a pop-up menu in the left-hand column containing the order and resource names by pressing the right-hand mouse button.



Parameter	Description
Delete row	Deletes the currently selected row.
Delete all rows	Deletes all rows (same as  ).

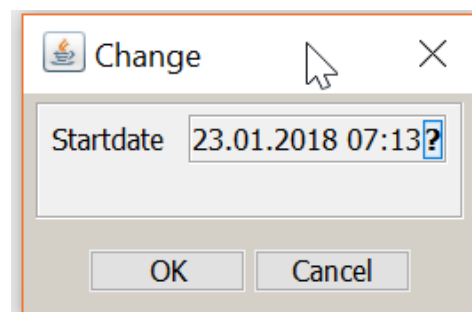
### 6.2.3.2 Pop-up menu on order rows

You can open a pop-up menu by clicking on an order/operation in the order row by pressing the right-hand mouse button.



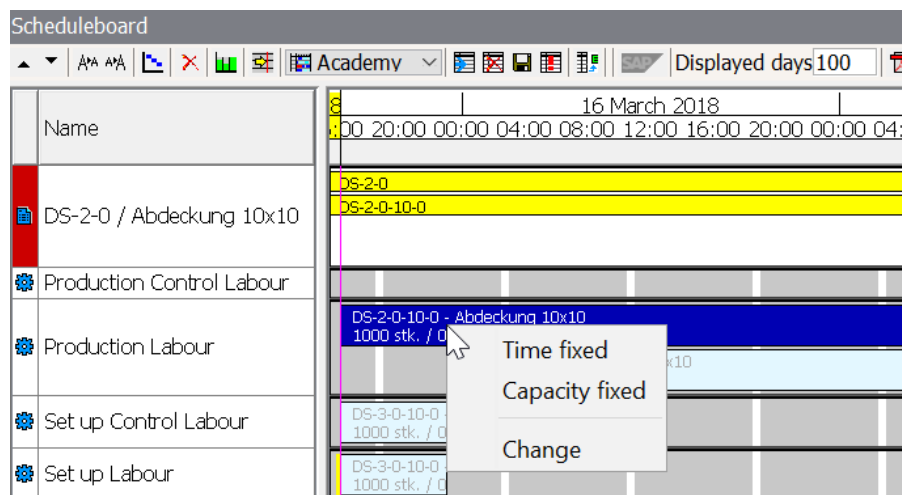
## Components

Parameter	Description
Time fixed	Fixes the start date of the operation; it must not be scheduled earlier.
Change	You can move the operation to another date specified as shown below. The operation will be fixed there depending on the configuration and re-scheduled as necessary. The schedule board must be in simulation mode to be able to select this function.
Deactivate	Deactivates the selected order. (Only available in resource planning mode.)



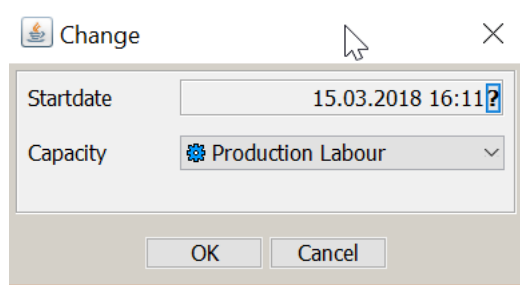
### 6.2.3.3 Pop-up menu on resource rows

You can open a pop-up menu on an operation in the resource row by pressing the right-hand mouse button.



## Components

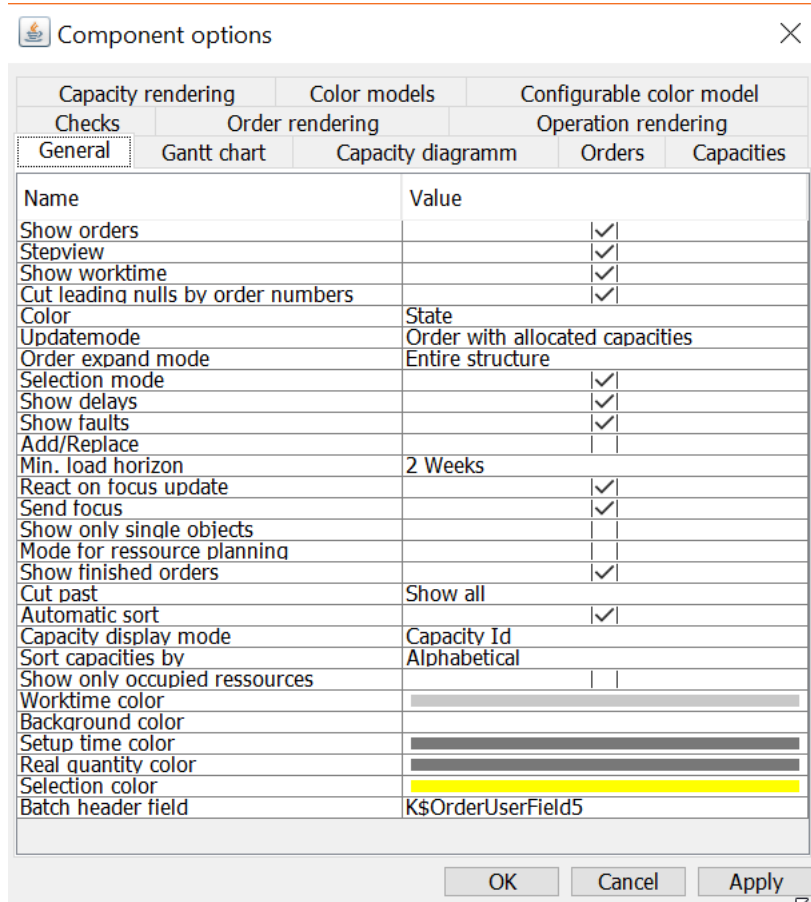
Parameter	Description
Time fixed	Fixes the start date of the operation; it must not be scheduled earlier.
Resource fixed	Fixes the operation to the current resource; the operation must not be scheduled with another resource any more.
Change	You can move the operation to another date or resource specified as shown below. The operation will be fixed there depending on the configuration and re-scheduled as necessary. The schedule board does not need to be in simulation mode for this.
Deactivate	Deactivates the selected operation. (Only available in resource planning mode.)



## Components

### 6.2.4 Component options

#### 6.2.4.1 General



Capacity rendering		Color models		Configurable color model	
Checks		Order rendering		Operation rendering	
General		Gantt chart	Capacity diagramm	Orders	Capacities
Name	Value				
Show orders	<input checked="" type="checkbox"/>				
Stepview	<input checked="" type="checkbox"/>				
Show worktime	<input checked="" type="checkbox"/>				
Cut leading zeros by order numbers	<input checked="" type="checkbox"/>				
Color	State				
Update mode	Order with allocated capacities				
Order expand mode	Entire structure				
Selection mode	<input checked="" type="checkbox"/>				
Show delays	<input checked="" type="checkbox"/>				
Show faults	<input checked="" type="checkbox"/>				
Add/Replace	<input type="checkbox"/>				
Min. load horizon	2 Weeks				
React on focus update	<input checked="" type="checkbox"/>				
Send focus	<input checked="" type="checkbox"/>				
Show only single objects	<input type="checkbox"/>				
Mode for resource planning	<input type="checkbox"/>				
Show finished orders	<input checked="" type="checkbox"/>				
Cut past	Show all				
Automatic sort	<input checked="" type="checkbox"/>				
Capacity display mode	Capacity Id				
Sort capacities by	Alphabetical				
Show only occupied resources	<input type="checkbox"/>				
Worktime color	<input type="color"/>				
Background color	<input type="color"/>				
Setup time color	<input type="color"/>				
Real quantity color	<input type="color"/>				
Selection color	<input type="color"/>				
Batch header field	K\$OrderUserField5				

OK Cancel Apply

Parameter	Description
Show orders	Operations do not appear in resource rows. So the work time alone can be visualized.
Step view	If this option is selected, all operations appear in the order row one below the other with a legend written out next to the bar.
Show work time	Enables/disables background color marking of work time
Cut leading zeros of order numbers	Leading zeros of order numbers are not displayed.
Color	Selects the color pattern for the bar display of operations.

## Components

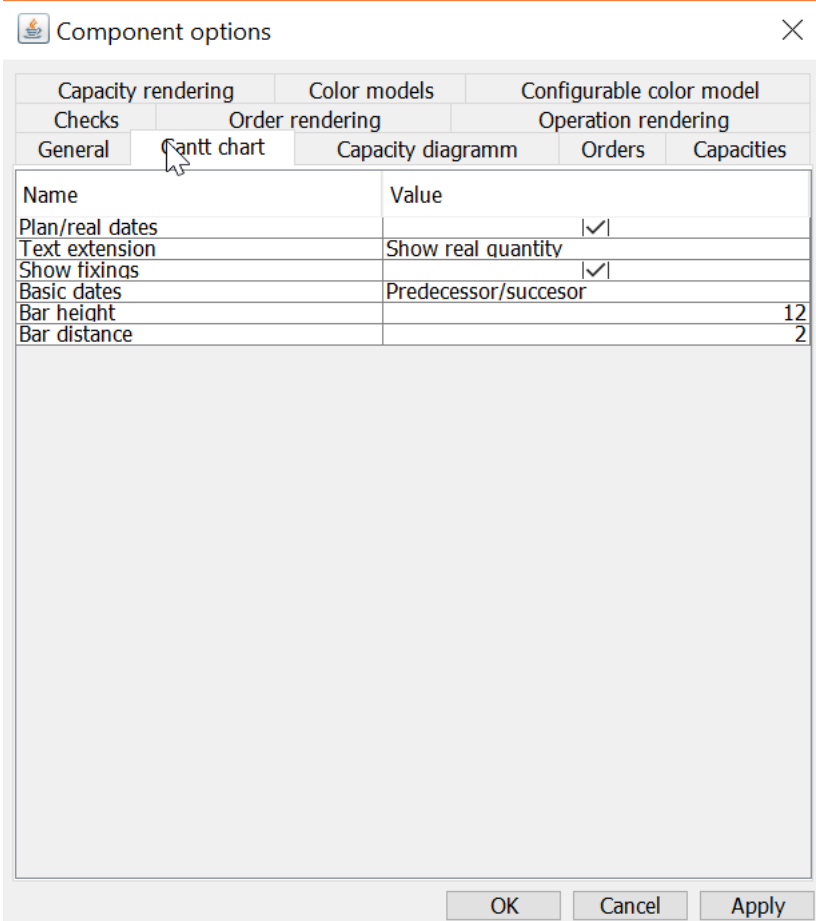
Parameter	Description
Update mode	<p>When an order is dragged to the schedule board:</p> <ul style="list-style-type: none"> <li>Single: An order row opens.</li> <li>Order with allocated resources In addition to the order row, additional rows show the resources allocated by its operations.</li> <li>Order with network partners and resources allocated In addition to the order row, additional rows show the resources allocated by its operations and its network partners.</li> </ul>
Order expand mode	<p>When an order is dragged to the schedule board:</p> <ul style="list-style-type: none"> <li>None Only one bar appears for the order.</li> <li>Work steps only Only its operations but not the order itself appear as bars.</li> <li>Partial structure An order and its operations are shown.</li> <li>Entire structure All other orders of the order network appear as bars.</li> </ul>
Selection mode	If activated, the selection of an operation and/or order causes all its orders to be marked in orange color in the operation and/or order network.
Show delays	Marks delayed orders/operations in red in the left part of the table.
Show faults	Marks faulty resources in red in the left part of the table.
Add/Replace	If selected, new elements inserted will overwrite the current content.
Min. load horizon	The time range of resource data read in. For order rows, the order and all operation data are read completely.
React on focus update	Displays element of focus view automatically.
Send focus	Places the selected object into the focus view.
Show only single objects	This option prevents that a work time hierarchy can be transferred to the schedule board by drag & drop.
Mode for resource planning	Adds the "Deactivate" function to the pop-up menu; it can be used to deactivate selected orders (moving them to the "Inactive orders" folder).
Show finished orders	Shows finished orders as well.
Cut past	Disables showing past information.
Automatic sort	<p>Sorts the rows by:</p> <ul style="list-style-type: none"> <li>Orders</li> <li>Machine resources</li> <li>Personnel resources</li> </ul> <p>If this option is deselected, new elements are inserted at the top of the schedule board.</p>



## Components

Parameter	Description
Resource display mode	Provide resource row with caption: Resource ID Resource name ID and name
Sort resources by	Automatic sorting of resources <ul style="list-style-type: none"> <li>— Alphabetical</li> <li>— Display index of resource</li> </ul>
Work time color	Color of work time entries
Background color	Color of row background
Setup time color	Color of setup time bar
Real quantity color	Color of real quantity bar
Selection color	Color of selected operation

### 6.2.4.2 Gantt chart



The screenshot shows the 'Component options' dialog box with the 'Gantt chart' tab selected. The dialog has a title bar with a close button (X) and a small icon. Below the title bar are several tabs: 'Capacity rendering', 'Color models', 'Configurable color model', 'Checks', 'Order rendering', and 'Operation rendering'. Under 'Order rendering', there are sub-tabs: 'General', 'Gantt chart' (selected), 'Capacity diagramm', 'Orders', and 'Capacities'. The 'Gantt chart' tab contains a table with the following data:

Name	Value
Plan/real dates	<input checked="" type="checkbox"/>
Text extension	Show real quantity
Show fixings	<input checked="" type="checkbox"/>
Basic dates	Predecessor/succesor
Bar height	12
Bar distance	2

At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Apply'.

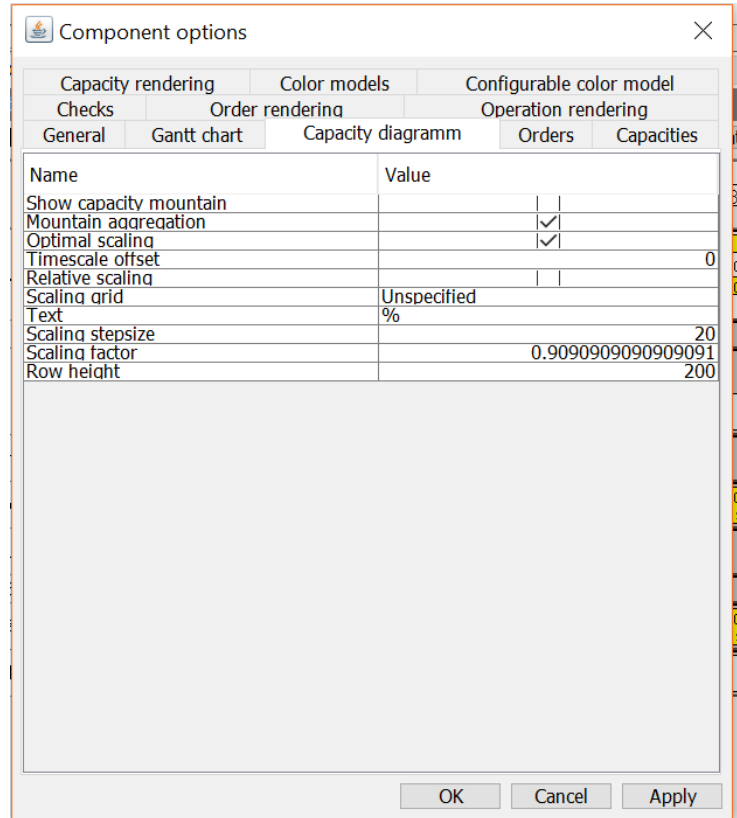
## Components

Parameter	Description
Plan/real dates	When an operation starts, the operation bar ranges from real start to anticipated real end; otherwise the bar ranges from planned start to planned end.
Text extension	<ul style="list-style-type: none"> <li>— None</li> <li>— Show setup times The setup time is displayed as a bar within the operation bar.</li> <li>— Show real quantity The real quantity is displayed as text and as a bar within the operation bar.</li> </ul>
Show fixings	Fixings are indicated as colored corners on the right. <ul style="list-style-type: none"> <li>— Time fixed (top right)</li> <li>— Resource fixed (bottom right)</li> </ul>
Basic dates	When selecting an operation, its basic dates are shown in the time scale: <ul style="list-style-type: none"> <li>— None No limit</li> <li>— Earliest start/latest end Red limiting arrows</li> <li>— Predecessor/successor Yellow limiting arrows</li> </ul>
Bar height	Specifies the height of the operation bar
Bar distance	Vertical distance between bars for parallel assignments

## Components

### 6.2.4.3 Capacity diagram

These capacity diagram options relate only to resource rows.



Name	Value
Show capacity mountain	<input type="checkbox"/>
Diagram aggregation	<input checked="" type="checkbox"/>
Optimal scaling	<input checked="" type="checkbox"/>
Time scale offset	0
Relative scaling	<input type="checkbox"/>
Scaling grid	Unspecified
Text	%
Scaling step size	20
Scaling factor	0.90909090909091
Row height	200

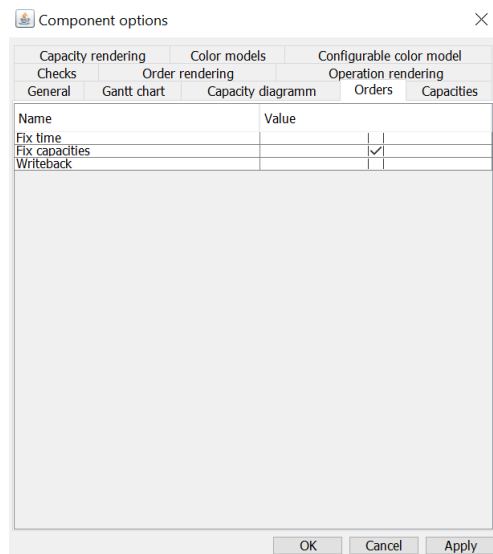
Parameter	Description
Show capacity diagram	Shows resources in the form of a capacity diagram.
Diagram aggregation	Shows all operations individually; otherwise only the total capacity utilization is displayed in each grid section.
Optimal scaling	Adjusts the scale automatically to the maximum values occurring within the time range.
Time scale offset	Hour offset of grid in relation to 0 o'clock.
Relative scaling	If activated, the planned work time is applied as a 100% reference per time interval. If deactivated, 100% are equivalent to 24 hours/day.
Scaling grid	Display and evaluation according to: <ul style="list-style-type: none"> <li>— Unspecified</li> <li>— Day</li> <li>— Week</li> <li>— Month</li> </ul>
Text	Scaling unit
Scaling step size	Basic scale, usually 100 [%]
Scaling factor	Factor indicating the share of the display height occupied by the scaling step size.
Row height	Specifies the row height in pixels

## Components

### 6.2.4.4 Orders

If you use a command or drag & drop to make a change to an operation in the order row, the following options control the additional actions performed with the change.

Any interaction will open a simulation in the background in which the change is initially applied.

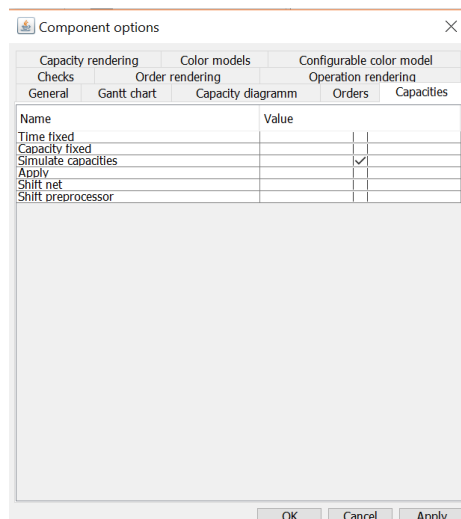


Name	Value
Fix time	<input type="checkbox"/>
Fix capacities	<input checked="" type="checkbox"/>
Writeback	<input type="checkbox"/>

Parameter	Description
Fix time	In case of a shift in time, the time of the operation is fixed in the new place.
Fix resource	In case of a shift in time, the operation is fixed in the new place for all resources already allocated.
Write back	When the change is completed, the simulation is immediately written back and deleted.

### 6.2.4.5 Resources

If you use a command or drag & drop to make a change to an operation in the resource row, the following options control the additional actions performed with the change. Any interaction will open a simulation in the background in which the change is initially applied.



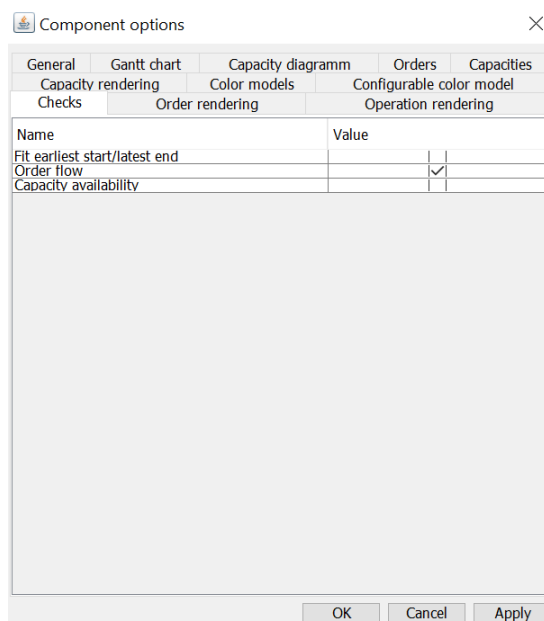
Name	Value
Time fixed	<input type="checkbox"/>
Capacity fixed	<input type="checkbox"/>
Simulate capacities	<input checked="" type="checkbox"/>
Apply	<input type="checkbox"/>
Shift net	<input type="checkbox"/>
Shift preprocessor	<input type="checkbox"/>

## Components

Parameter	Description
Time fixed	In case of a shift in time, the new time of the operation is fixed.
Resource fixed	In case of a shift in time, the operation is fixed in the new position for all resources already allocated.
Simulate resource	The operation shifted, the operations of its order and, if applicable, the operations conflicting with the operation shifted at its new position are simulated.
Apply	When the change is completed, the simulation is immediately written back and deleted.


### 6.2.4.6 Checks

When moving operations manually by drag & drop, the following checks can be made on-line and prevent moving to inadmissible time ranges.



Component options	
General	
Capacity rendering	
Checks	
Name	Value
Fit earliest start/latest end	
Order flow	<input checked="" type="checkbox"/>
Capacity availability	

Parameter	Description
Fit earliest start/latest end	A movement in time is only admissible within the limits of earliest start/latest end.
Order flow	A movement in time is only admissible within the limits of predecessor/successor. Caution: If the operation is out of these limits by automatic scheduling, it is initially placed within these limits when moving.
Capacity availability	The operation can only be moved to a range in which a capacity is defined for the resource according to the time model.

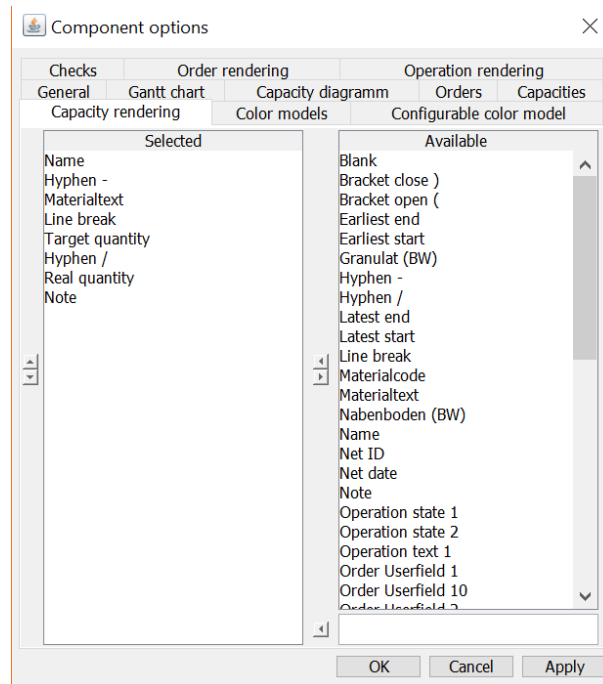
-  If the operation is out of the limits of earliest start/latest end by automatic scheduling, it is initially placed within these limits when moving.

## Components

### 6.2.4.7 Order representation

The "Order representation" option can be used to define the text displayed in the order bar and its tool tip.

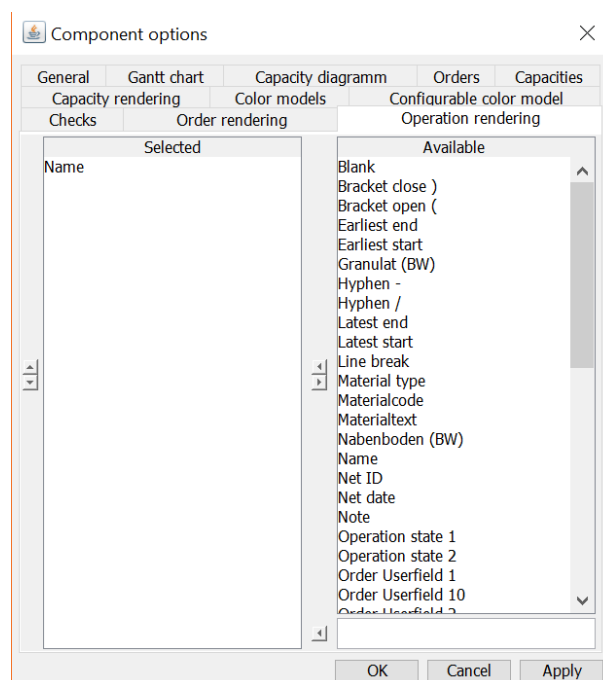
The parameters configured for the order are composed in the list on the left to form the output text.



### 6.2.4.8 Operation representation

The "Operation representation" option can be used to define the text displayed in the operation bar and its tool tip.

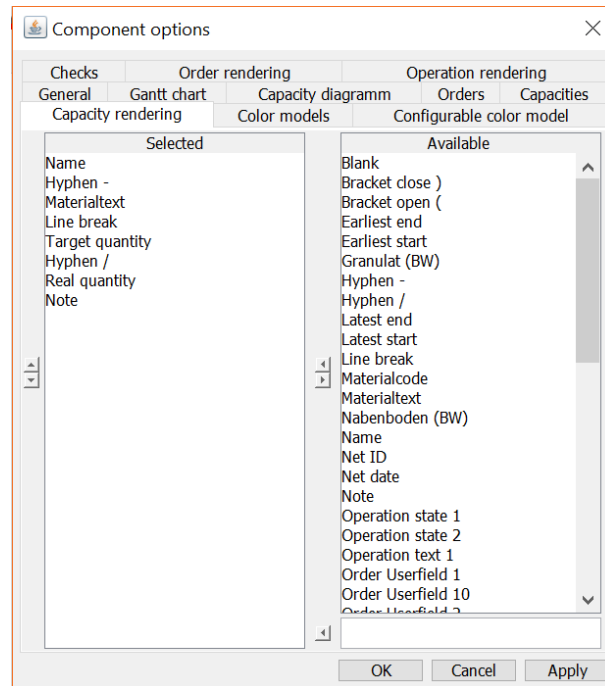
The parameters configured for the operation are composed in the list on the left to form the output text.



## Components

### 6.2.4.9 Resource representation

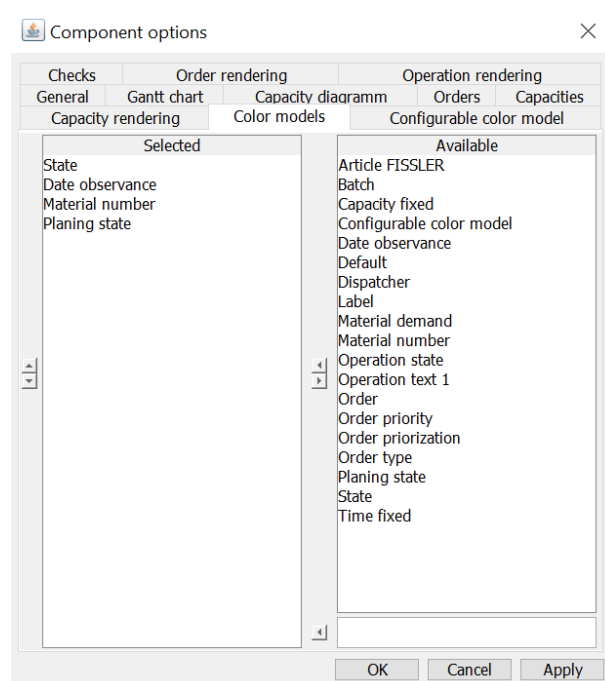
The "Resource representation" option can be used to define the text displayed in the resource bar and its tool tip. The parameters configured for the resource are composed in the list on the left to form the output text.



 For personnel resources with multiple operation, the scheduled capacity can be included.

### 6.2.4.10 Color models

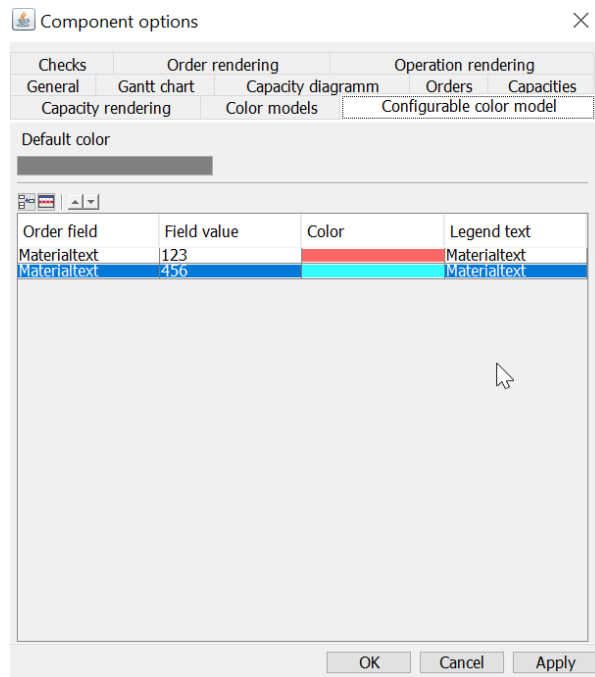
The "Color models" option can be used to set the color of the resource bars. The parameters configured for the resource are composed in the list on the left to form the output text.



## Components

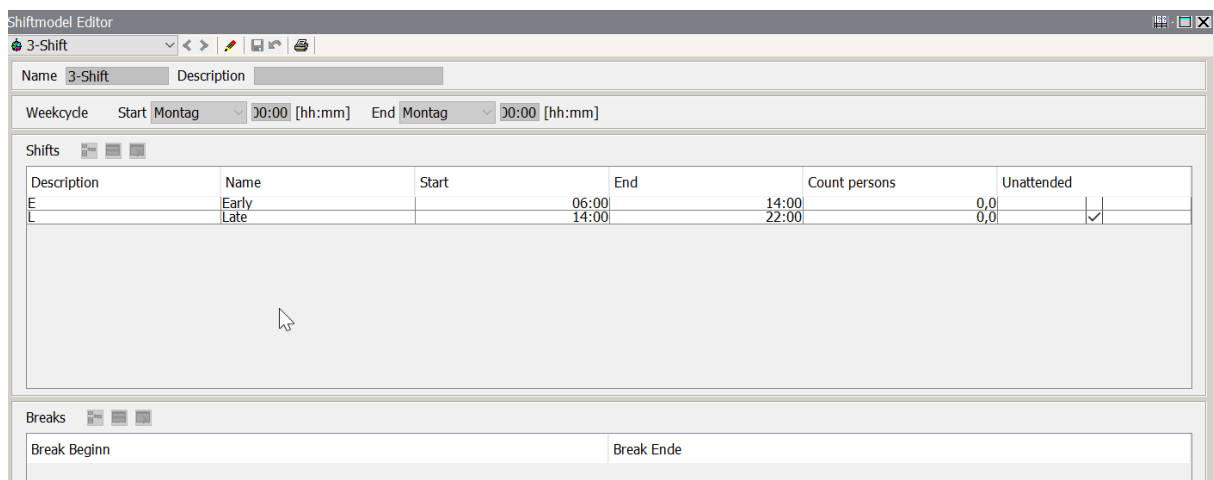
### 6.2.4.11 Configurable color model

The "Configurable color model" option can be used to freely configure the colors of the bars. You can define the color to be used for the bar for any field value in an operation field. For example, you may not need a full material code and a partial one is sufficient. If you specify several criteria, the topmost criterion determines the color. If no criterion applies, the bar appears in the configurable default color.



## 6.3 Shift model editor

The shift model editor is used to create and edit DOS shift models.



You can specify a description and the week cycle of the shift model in editing mode. The week cycle is the period in which the shift model applies.











## Components

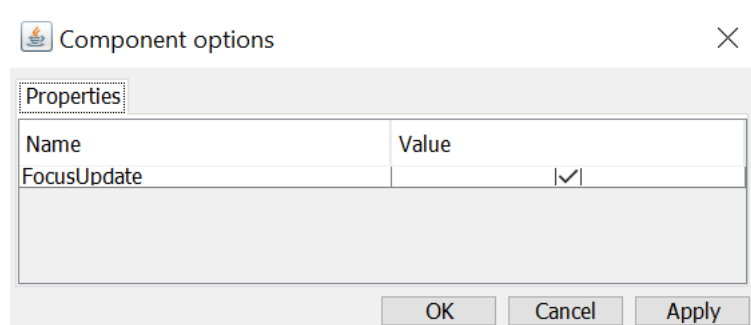
You can use the 'Add shift' button to create a new shift. Then you can specify the shift ID and the start and end of the shift in the table. You can delete the shift selected using the 'Delete shift' button. Use the 'Delete all' button to delete all shifts.

Standard shifts provided in the DOS module are E (Early), L (Late) and N (Night).

### 6.3.1 Controls

Icon	Function/description
 3-Shift	Shows the shift model selected
	Shows the previous shift model
	Shows the next shift model
	Editing mode: Edit entries in the shift model
	Viewing mode: Entries cannot be edited (default)
	Save the entries changed
	Discards all changes made
	Prints the current table

### 6.3.2 Component options





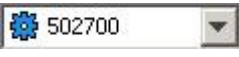

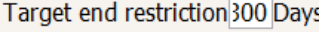







Parameter	Description
Focus update	Places the selected object into the focus view.

## 6.4 Order cockpit

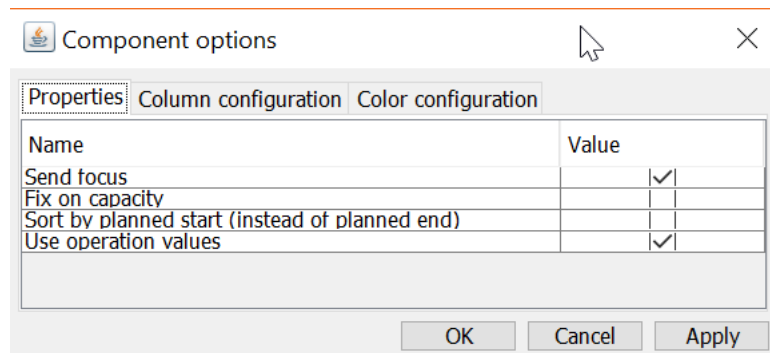
The order cockpit is used for overall monitoring of orders. It shows all orders to be handled by a specific resource. The simulation and color selection make it possible to obtain a lot of information quickly and easily. The order cockpit can also be used to modify the sequential priorities.

Order cockpit										
APA APA		Production Labour	Target end restriction	300 Days						
No.	Name	Material...	Target qu...	Real qua...	State	Order target...	Order target...	Planned start	Planned end	Date variance ...
1	DS-2-0-10-0	00625381	1000 prt.	0 prt.	Ready	12.12.2017 10:41	27.12.2017 10:41	15.03.2018 15:56	17.03.2018 04:01	-82,81
2	DS-2-0-20-0	00625381	1000 prt.	0 prt.	Ready	12.12.2017 10:41	27.12.2017 10:41	17.03.2018 04:01	21.03.2018 01:51	-85,42
3	DS-2-0-30-0	00625381	1000 prt.	0 prt.	Ready	12.12.2017 10:41	27.12.2017 10:41	21.03.2018 01:51	24.03.2018 09:51	-86,97

## 6.4.1 Controls

Icon	Function/description
	Reduce font and block size
	Increase font and block size
	Shows the currently selected resource. Use the arrow and the drop-down menu to show several resources quickly one after the other.
	Clear all orders from the current view
	Shows all orders that have a target end within X days (here, 300 days), counting from the current date.
	Print the current table
	Start simulation
	Delete simulation
	Save simulation
	Show fault orders
	Move order within the sequence <ul style="list-style-type: none"> <li>Up arrow: Move up</li> <li>Down arrow: Move down</li> </ul>
	Searches all fields of the cockpit of the currently displayed orders for the value, name, date, etc. specified.

## 6.4.2 Component options

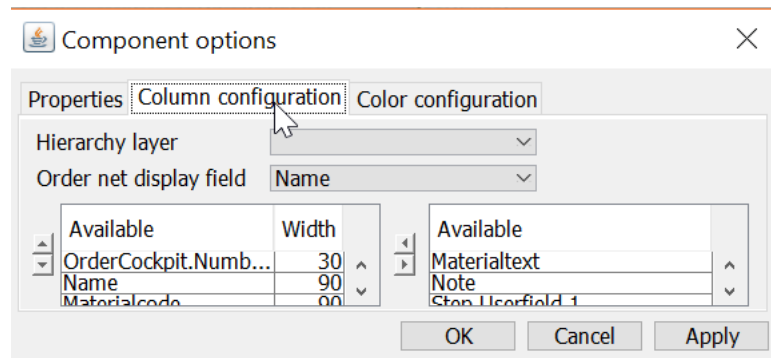


Name	Value
Send focus	<input checked="" type="checkbox"/>
Fix on capacity	<input type="checkbox"/>
Sort by planned start (instead of planned end)	<input type="checkbox"/>
Use operation values	<input checked="" type="checkbox"/>

### 6.4.2.1 Properties

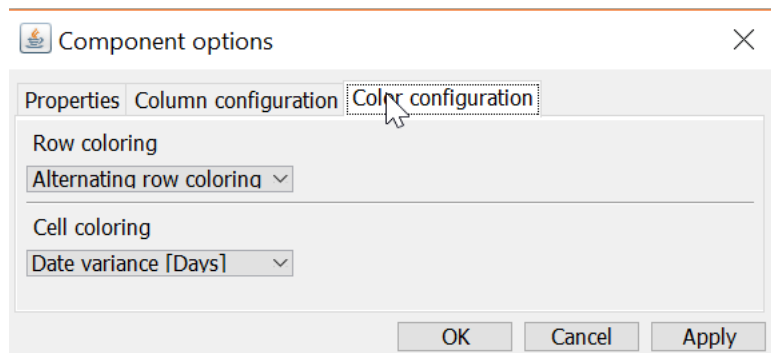
Parameter	Description
Send focus	Places the selected object into the focus view.
Fix on capacity	Fixes an order on the selected resource. It cannot be used by any other order then.
Sort by planned start (instead of planned end)	Sorts the orders displayed by their planned start rather than their planned end.

### 6.4.2.2 Column configuration



Parameter	Description
Hierarchy layer	The orders are assigned to their associated hierarchy levels, depending on the selection.
Order network display field	Specifies the information to be displayed. The width of the columns can be freely defined.

### 6.4.2.3 Color configuration



Parameter	Description
Row coloring	<p>You can use a specific color configuration for the overall view of orders.</p> <ul style="list-style-type: none"> <li>— No row coloring: The rows differ only with regard to the "Status" and "Time buffer" columns.</li> <li>— Alternating row coloring: The colors of the rows alternate for better legibility.</li> <li>— Planned order: Highlights planned orders in white; all other orders have a green background.</li> <li>— Material requirements: All orders have a green background as long as there is sufficient material available; otherwise in red.</li> </ul>

## Components

	<ul style="list-style-type: none"> <li>— Status: Adjusts the row color to the status color of each order.</li> <li>— Time buffer: Adjusts the rows to the color of the time buffer of each order.</li> </ul>
Cell coloring	<p>The overall view of network orders can be adjusted with an extension similar to individual orders:</p> <p>User defined row coloring: The color background of the rows can be adjusted individually for certain parameters.</p>

## 6.5 Maintenance table

The maintenance table informs about scheduled maintenance of a resource. Core information is where and when maintenance will be carried out. A description offers additional information about maintenance.

The information is obtained from the input into the "Work times" component and presented here separately in a clearly arranged view.

Maintenance			
AAA AAA	WPL_DS_3	X	Print
Workpl...	Start	End	Descripti...
WPL_DS_3	07.02.2018 00:00	09.02.2018 08:00	Maintenance

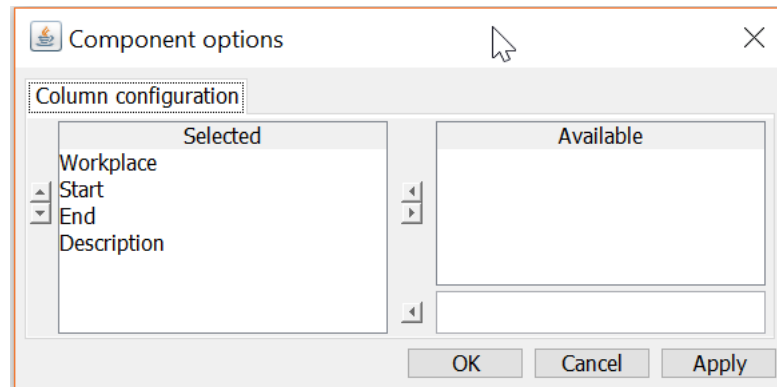
For information about maintenance data input, refer to chapter 6.1.1.2.7 Maintenance.

Place the resource into the component window using drag & drop. All maintenance activities scheduled for the resource are displayed instantly.



### 6.5.1 Controls

Icon	Function/description
AAA	Reduce font and block size
AAA	Increase font and block size
502700	Name of the resource currently displayed
X	Delete all
Print	Prints the current table

## 6.5.2 Component options



In the component options you can only set which information should be displayed about

maintenance. You can also use the  and  buttons to set the items individually with regard to order and availability.






## 6.6 Capacity overview

The capacity overview shows capacity indicators about the individual resources within a selected period.

Capacity overview											
APA APA	×	12.03.201...	19.03.201...	?							
Name	Orders	Count s...	Sum setu...	Sum producti...	Planned du...	Base cap...	Utilization...	Available	Free cap...	Usage ...	Bottleneck m...
WPL_DS_1	1	1	00:15:00	33:20:00	33:35:00	100,0 %	100,0 %	52:30:00	18:55:00	63,9 %	
WPL_DS_2	0	0	00:00:00	00:00:00	00:00:00	100,0 %	100,0 %	60:00:00	60:00:00	0,0 %	
WPL_DS_3	2	2	06:25:00	45:08:19	51:33:19	100,0 %	100,0 %	52:30:00	00:56:40	98,2 %	
Sum	3	3	06:40:00	78:28:19	85:08:19	300,0 %	300,0 %	165:00:00	79:51:40	162,1 %	
Production Control Labour	0	0	00:00:00	00:00:00	00:00:00	100,0 %	100,0 %	105:00:00	105:00:00	0,0 %	
Production Labour	3	0	00:00:00	90:11:38	51:18:19	100,0 %	100,0 %	52:30:00	01:11:40	97,7 %	
Set up Control Labour	1	1	06:15:00	00:00:00	06:15:00	100,0 %	100,0 %	52:30:00	46:15:00	11,9 %	
Set up Labour	3	3	12:40:00	00:00:00	12:40:00	100,0 %	100,0 %	52:30:00	39:50:00	24,1 %	

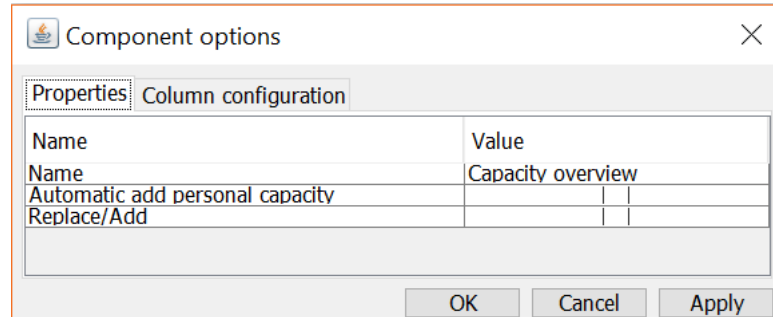
You can configure the content and order of the columns shown. Click on column headers to sort the table according to the column content.

### 6.6.1 Controls

Icon	Function/description
	Reduce font and block size
	Increase font and block size
	Delete all rows
	Select a start and end date/time for viewing
	Prints the current view

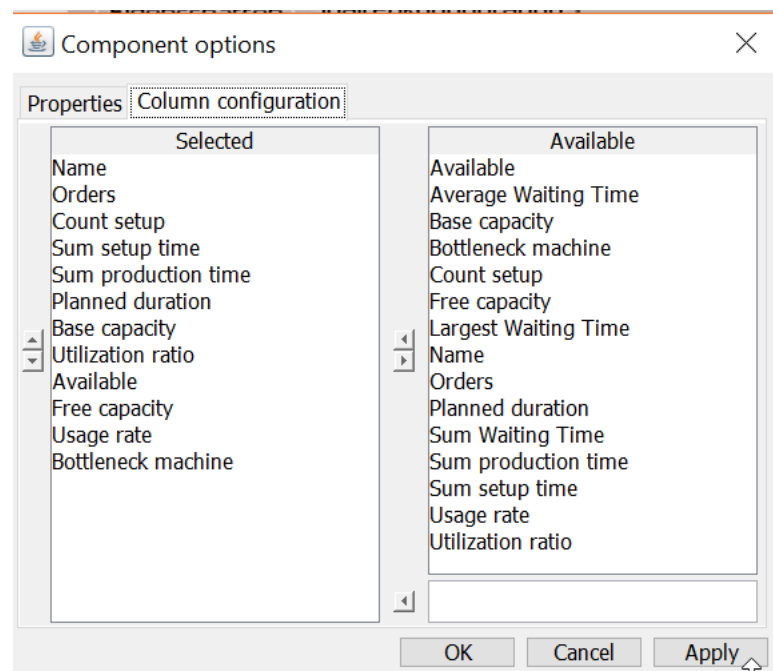
## 6.6.2 Component options

### 6.6.2.1 Properties





Parameter	Description
Name	Title of the table; becomes active only after opening the interface again.
Automatic add personnel capacity	If a machine resource is added to the table, the associated defined personnel resource is added automatically.
Replace/Add	If selected, new elements inserted will overwrite the current content.

### 6.6.2.2 Column configuration



There is a default configuration for columns. However, you can modify it individually using

the  and  buttons with regard to order and availability.

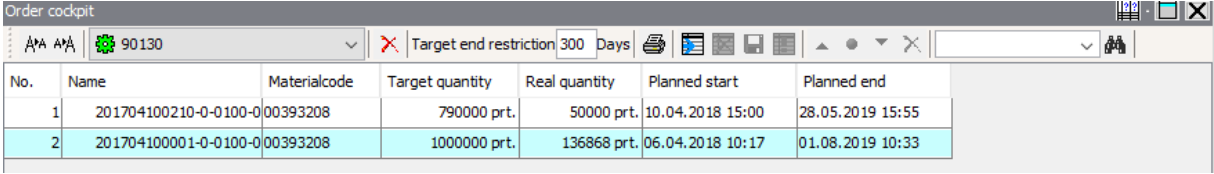
## Components

Parameter	Description
No. of operations	Number of operations utilizing the resource in the selected period
Count setup	Number of setup operations that occurred
Base capacity	<ul style="list-style-type: none"> <li>Capacity of the resource = Number of machines</li> <li>Single machine = 100%</li> <li>Machine group = <math>N \times 100\%</math></li> <li>Personnel group = 4 persons = 400 %</li> </ul>
Utilization factor	Quotient of planned capacity / sum of operation capacity
Average waiting time	Average waiting time of all operations for the resource in the relevant period
Free capacity	Capacity of the resource not in use by operations
Max. waiting time	Maximum waiting time of the operations for the resource in the relevant period
Max. average waiting time	<p>Only one cell of the column is highlighted in red. This means that the resource is identified as a bottleneck machine. The background of this is the value of the average waiting time relating to the operations on the resource. The waiting time results from the difference between the earliest time/date where the operation could have been scheduled and the planned start date determined.</p> <p>The resource with the longest average waiting time is colored in red in the list.</p>
Name	Displays the resource name
Rate of capacity utilization	<p>Factor considered when calculating the processing time</p> <p>= 80 % =&gt; Time per unit is greater by a factor of 100/80</p> <p>= 120 % =&gt; Time per unit is less by a factor of 100/120</p> <p>If two machines are mutual alternatives, but one of them is slower/faster, you can take this into account here.</p>
Sum operation capacity	Sum of busy times of operations allocated
Sum production time	Sum of production times within the period viewed
Sum setup time	Sum of setup times within the period viewed
Sum waiting time	Sum of waiting times of all operations for the resource in the relevant period
Planned duration	The sum of durations defined by the time model of the resource (planned work time).

## Components





### 6.7 Machine assignment

The machine assignment screen shows the planned operation allocation of a resource. Click on column headers to sort the table according to the column content. You can configure the columns and their arrangement individually via the component options. You can also display the number of personnel scheduled.

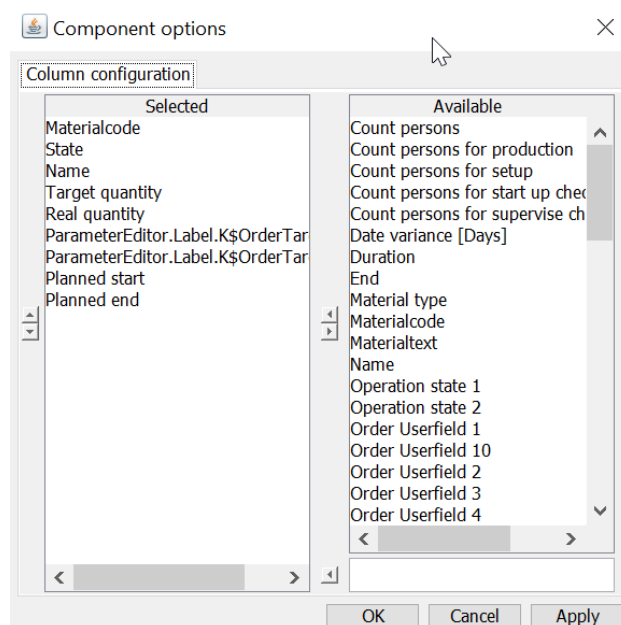




No.	Name	Materialcode	Target quantity	Real quantity	Planned start	Planned end
1	201704100210-0-0100-0	00393208	790000 prt.	50000 prt.	10.04.2018 15:00	28.05.2019 15:55
2	201704100001-0-0100-0	00393208	1000000 prt.	136868 prt.	06.04.2018 10:17	01.08.2019 10:33

#### 6.7.1 Controls

Icon	Function/description
	Reduce font and block size
	Increase font and block size
<input type="text" value="502700"/>	Name of the resource currently displayed
	Delete all rows
	Prints the current view

#### 6.7.2 Component options




There is a default configuration for columns. You can also use the  and  buttons to set their order and availability.



## Components






### 6.8 Order overview

The order overview is a special view providing an overview of dates in different colors and sort sequences. You can arrange orders or operations here, depending on the type added to the table. Click on column headers to sort the table according to the column content.



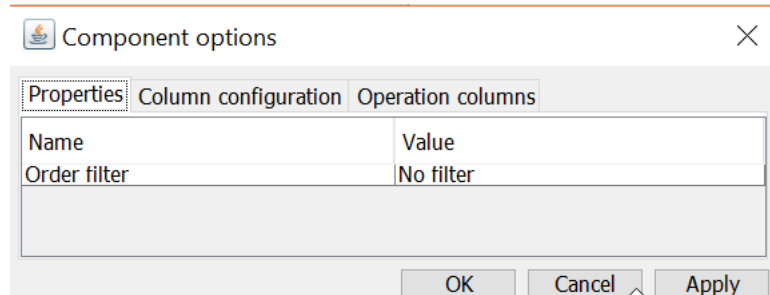
Name	State	Material...	Materialtext	Target qu...	Real qua...	Orderpri...	Order target...	End	Remaining d...	Date variance ...
DS-3-0 / Abdeckung 10x10	Ready	00625381	Abdeckung 10x10	1000 prt.	0 prt.	Regular order	28.12.2017 01:00	22.03.2018 17:51	113:35:00	-84,70
DS-2-0 / Abdeckung 10x10	Ready	00625381	Abdeckung 10x10	1000 prt.	0 prt.	Regular order	27.12.2017 10:41	24.03.2018 09:51	107:35:00	-86,97
11001-11001 /	In progress				1000 prt.	Regular order			33:35:00	

#### 6.8.1 Controls

Icon	Function/description
	Reduce font and block size
	Increase font and block size
	Shows the currently selected order filter.
	Delete all rows
	Prints the current table

#### 6.8.2 Component options

##### 6.8.2.1 Properties



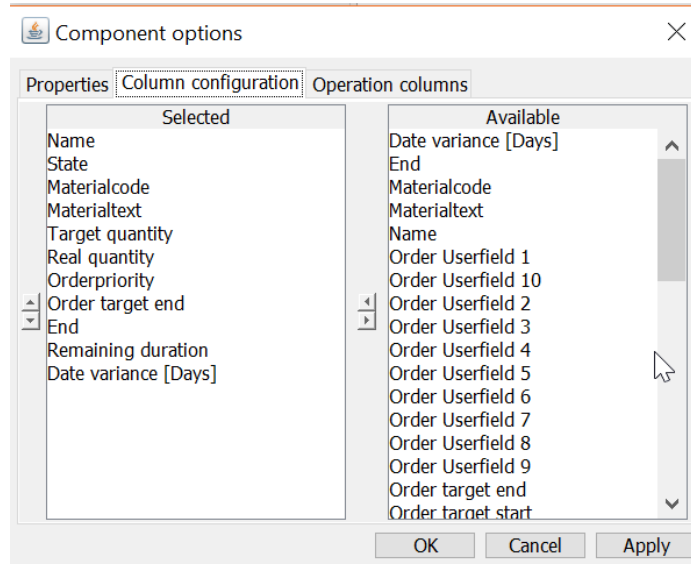
Name	Value
Order filter	No filter



Parameter	Description
Order filter	<p>Here you can configure a filter at order header level:</p> <ul style="list-style-type: none"> <li>— No filter All orders are displayed.</li> <li>— Only orders without successor (in order network)</li> <li>— Only orders without predecessor (in order network)</li> <li>— Only delayed orders</li> </ul>

## Components

### 6.8.2.2 Column configuration

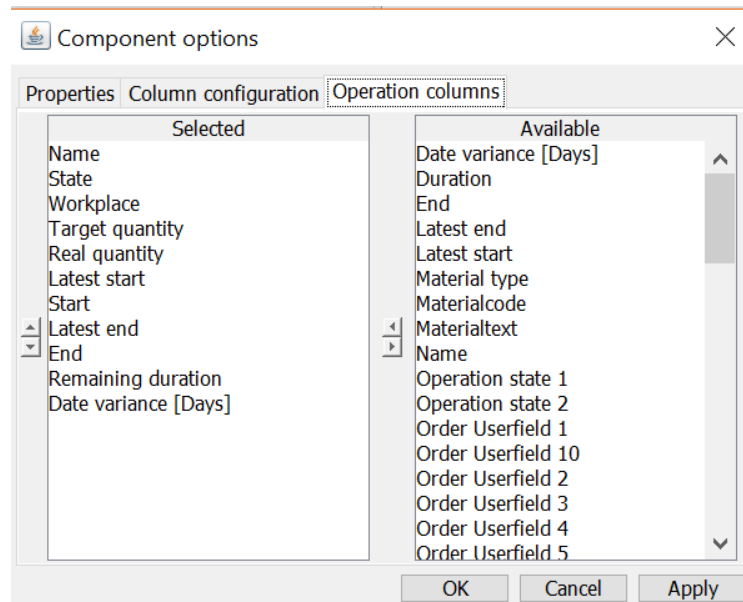
You can configure the columns shown for the order representation.





There is a default configuration for columns. However, you can also use the  and  buttons to set their order and availability individually.

### 6.8.2.3 Operation column configuration

You can configure the columns shown for the operation display.



There is a default configuration for columns. However, you can also use the  and  buttons to set their order and availability individually.

## Components

### 6.9 General table

In the general table you can display data related to orders, operations and resources in table format. You can freely configure the content and sequence. If you display orders, you can use drill-down functions in the table to show associated information, e.g. operations, predecessor or successor orders, depending on the configuration.

Table							
2 Orders	Material...	Materialtext	Target qu...	Real qua...	Planned start	Planned end	Date variance ...
DS-2-0 / Abdeckung 10x10	00625381	Abdeckung 10x10	1000	0	15.03.2018 15:56	24.03.2018 09:51	-86,97
DS-2-0-10-0	00625381	Abdeckung 10x10	1000	0	15.03.2018 15:56	17.03.2018 04:01	-82,81
DS-2-0-20-0	00625381	Abdeckung 10x10	1000	0	17.03.2018 04:01	21.03.2018 01:51	-85,42
DS-2-0-30-0	00625381	Abdeckung 10x10	1000	0	21.03.2018 01:51	24.03.2018 09:51	-86,97
DS-3-0 / Abdeckung 10x10	00625381	Abdeckung 10x10	1000	0	15.03.2018 16:11	22.03.2018 17:51	-84,70
DS-3-0-10-0	00625381	Abdeckung 10x10	1000	0	15.03.2018 16:11	19.03.2018 23:21	-82,94
DS-3-0-20-0	00625381	Abdeckung 10x10	1000	0	19.03.2018 23:21	20.03.2018 03:11	
DS-3-0-30-0	00625381	Abdeckung 10x10	1000	0	19.03.2018 23:21	22.03.2018 17:51	-84,70

#### 6.9.1 Controls

Icon	Function/description
	Reduce font and block size
	Increase font and block size
No filter	Shows the currently used order filter.
	Delete all rows
	Shows all entries of all orders (expand)
	Shows only orders without entries (collapse)
	Prints the current table

#### 6.9.2 Component options

The properties which define the basic functions of the table are available as options. The remaining option tabs are provided for configuring the columns for the element types shown.

**Component options**

Operation column config

Capacity column config

Properties

Order column config

Name	Value
Listen to focus	<input checked="" type="checkbox"/>
Name	Table
Propagate focus	<input checked="" type="checkbox"/>
Tree table	<input checked="" type="checkbox"/>
Replace/Add	<input type="checkbox"/>
Order mode	Operations
Order filter	No filter
Expand on add	<input type="checkbox"/>
Order net mode	<input type="checkbox"/>
Delete content on close	<input type="checkbox"/>

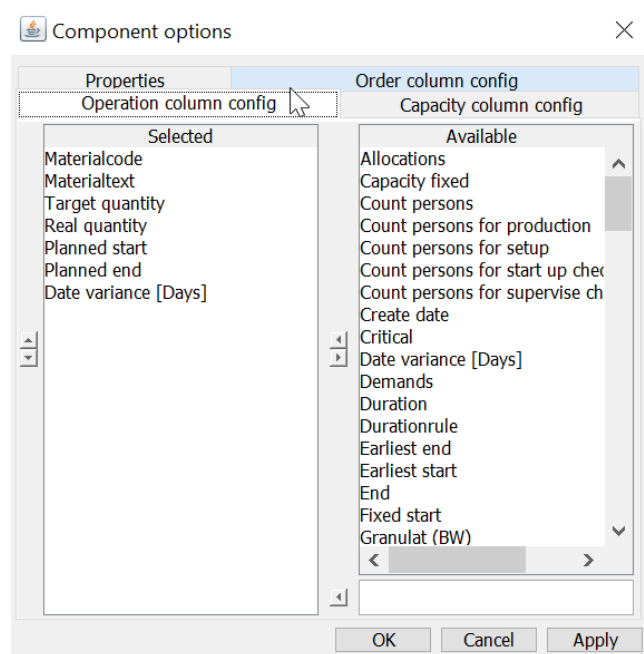
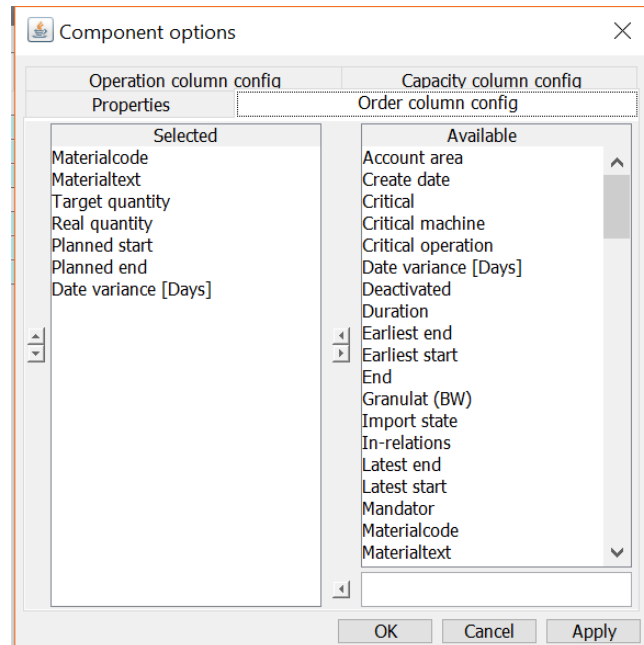
**6.9.2.1 Properties**

Parameter	Description
Listen to focus	The editor always shows the currently focused element.
Name	Title of the table; becomes active only after opening the dialog.
Propagate focus	When a row is focused, the associated element is placed on the focus view and thereby automatically displayed in other windows.
Tree table	Provides a drill-down for order display.
Replace/Add	If selected, new elements inserted will overwrite the current content.
Order mode	If the "Tree table" option is selected, this option sets the type of drill-down applied to an order. Operations (of order) Predecessor orders (in order network) Successor orders (in order network)
Order filter	Here you can configure a filter at order header level: <ul style="list-style-type: none"> <li>— No filter All orders are displayed.</li> <li>— Only orders without successor (in order network)</li> <li>— Only orders without predecessor (in order network)</li> <li>— Only delayed orders</li> </ul>
Expand on add	If "Replace/Add" is active: The new element added by drag & drop is immediately inserted in its expanded form.  If "Replace/Add" is inactive: The new element is added and all table elements are expanded.
Order network mode	Shows the selected orders as order networks.
Delete content on close	When the DOS module is closed, the content is removed from the table.

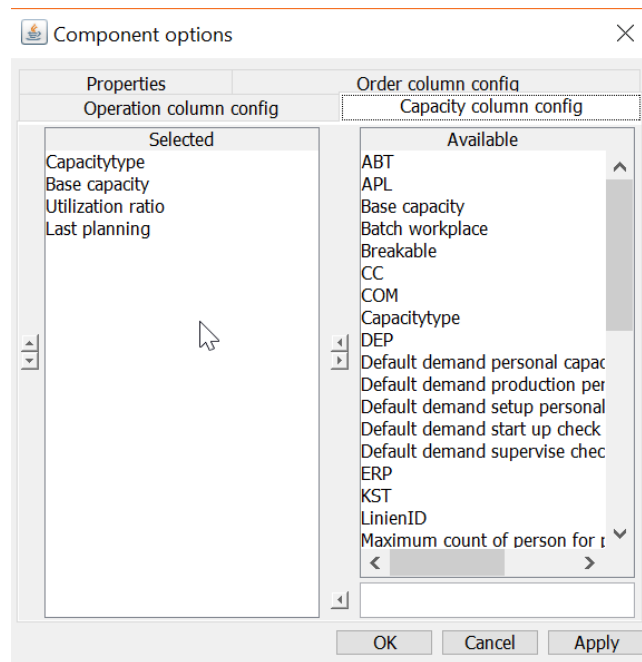
## Components

### 6.9.2.2 Column configuration

The remaining option tabs control the parameters to be displayed along with each element type.



## Components



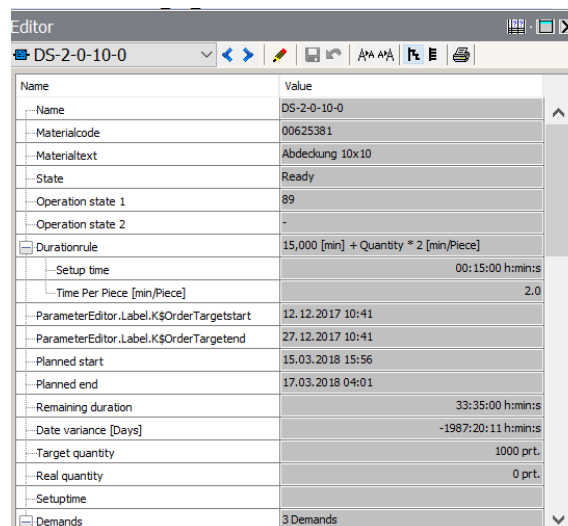
Element types are:

- Order
- Operation
- Resource














Individual parameters are shown by moving them to the left-hand area or hidden by moving them to the right-hand area. The arrow buttons on the left can be used to set the sequence of parameters.

## 6.10 General editor

The general editor is structured as a two-column value editor with hierarchical parameter structures. It displays the specific properties or master data of an object, depending on the object type (order, operation, etc.).



### 6.10.1 Controls

Icon	Function/description
 DS-2-0-10-0 	Shows the object currently used (resource, order, material, etc.)
	Shows properties/master data of the previous object
	Shows properties/master data of the next object
	Editing mode: Change properties/master data
	Viewing mode: Entries cannot be edited (default)
	Saves the entries changed
	Discards all changes made
	Reduces font and block size
	Increases font and block size
	Shows all entries (expand)
	Shows only higher-level entries (collapse)
	Prints the current properties/master data

### 6.10.2 Object types

#### 6.10.2.1 Master data

The master data parameters control

- the import behaviour of the complete DOS module
- the structure of the operation networks and order networks
- distinguishing criterion of planned orders
- text mapping of operation user fields
- units and conversion of industrial to clock minutes
- configuration of parallel inspection operations
- logging behaviour of the DOS module
- splitting and overlapping

## Components

Editor

Masterdata

Name	Value
Default font size	11
Site restriction	
Operation control keys	
Alternative operation control keys	
Unattended operation control key	
Planningbase	Workplace
All workplaces of the group are alternatives	<input type="checkbox"/>
Plan order field	
Order comment field	
Default transportamount	
Queue time options	
Queue time field	K\$UserField1
Queue time unit field	K\$UserField2
Queue time in predecessor?	<input checked="" type="checkbox"/>
Setup time in industry minutes?	<input type="checkbox"/>
Piece time in industry minutes?	<input type="checkbox"/>
Global Efficiency	1.0
Use piece time from TEB_MATNR?	<input checked="" type="checkbox"/>
Delete finished orders when refreshing	<input type="checkbox"/>
Planning component options	
Netdate field	K\$UserField3
Order net creation	Using netdate-field
Order nets for each planning area separately?	<input checked="" type="checkbox"/>
Quantity balancing: At first net creation between released orders and afterwar	<input checked="" type="checkbox"/>
Order net creation on operations	<input type="checkbox"/>
Duty free storage identifier	
Use delivery date for creating order net	<input type="checkbox"/>
Night shift finish at present day	<input checked="" type="checkbox"/>
Field names	
Step Userfield 1	
Step Userfield 2	
Step Userfield 3	



## Components

The functions of the essential parameters are:

Parameter	Description
Site restriction	Only orders with the specified site IDs are included in scheduling.
Operation control keys	Only operations with the specified control keys are included in scheduling.
Alternative operation control keys	Operations with these control keys are considered in scheduling as alternative operations. The workplace / workgroup is added to the list of alternatives of the base operation.
Unmanned operation control key	Operations with these control keys can be scheduled without personnel in specifically designated shifts.
Planning base	<p><b>Planning base = Workgroup</b></p> <ul style="list-style-type: none"> <li>— Resource import: Only workgroups (Workplace_LEVEL1) are adopted as resources.</li> <li>— Order import: Only the workgroup in the operation (AUFTTR_AFO.WorkplaceGRP field) is evaluated for machine requirement generation.</li> </ul> <p><b>Planning base = Workplace</b></p> <ul style="list-style-type: none"> <li>— Resource import: Only workplaces (Workplace_LEVEL0) are adopted as resources.</li> <li>— Order import: If a workplace is specified in the operation (AUFTTR_AFO.APL field), it is used in the machine requirements and there are no alternatives. If a workplace is not specified in the operation but the workgroup (AUFTTR_AFO.APLGRP field) is specified, all workplaces of the workgroup are entered as alternatives in the machine requirements of the operation.</li> </ul> <p><b>Important:</b> If APLGRPMIX is going to be used, the DOS module must not write back the workplace to the AUFTTR_AFO table since the next order update would otherwise eliminate the alternatives.</p>
All workplaces of the group are alternatives	All workplaces of the selected workgroup are mutual alternatives and may be used one in place of the other.
Planned order field	<p>A user field in the order specifying whether it is a planned order or not.</p> <p>The content of this field is adopted from the ERP system or entered in FORCAM FORCE™ when creating an order. If the field is left blank, the order is adopted as a production order. If the field is not blank (regardless of the type of content), the order is marked as a planned order.</p>

## Components

Parameter	Description
Order comment field	In the order cockpit, the "Comment" column can be added in the column configuration. The comment entered there is written into the selected user field in a simulation and when adopting the simulation.
Default transfer quantity	The global transfer quantity from which overlapping of predecessor/successor is possible.
Queue time options	Fields from the AUFTR_AFO table from which the queue times are adopted.
Setup time in industrial time units?	Specifies the setup time in industrial time units: 100 industrial time units = 1 clock hour or clock minutes: 60 clock minutes = 1 clock hour
Time per unit in industrial time units?	Specifies the time per unit in industrial time units: 100 industrial time units = 1 clock hour or clock minutes: 60 clock minutes = 1 clock hour
Use time per unit from TEB_MATNR?	Should the time per unit of the operation from SAP or from the TEB_MATNR table be used?
Delete finished orders when refreshing	If an order is found to be finished because all of its scheduled operations are finished when refreshing, it is deleted from scheduling.
Netdate field	Key figure indicating an order network array.
Order network creation	<ul style="list-style-type: none"> <li>— No order networks: Order networks are not generated.</li> <li>— Netdate field: All orders with the same network date field are potential mutual network partners.</li> <li>— Quantity balancing: Network generation is governed by the workplace which is the first to make the required quantity available. Existing warehouse stock is utilized for scheduling and then the search for a potential supplier is initiated.</li> </ul>
Order network creation on operations	Network creation is applied at operation level, i.e. orders may initiate a successor order/operation even though they are not yet finished. In other words, all operations can be mutually networked.
Use delivery date for creating order network	Network creation alternative, if a network cannot be generated: If the requirement is not covered, a predefined availability date is used. This is a fixed basic date. Purchased parts may also be considered for delivery dates since it is not defined whether the required material originates from in-house production or external suppliers.
Night shift finish at present day	Sets the end of the night shift. If this option is selected, a night shift ends on the same day it began.
Field names	Texts to be displayed along with the individual operation user fields.

## Components

Parameter	Description
Unit formatting	The units to be used for displaying weights, volumes or lengths.
Search fields	You can set the fields to be used in a search.
Maximum number of splits for operations	Specifies the number of machines that may be used for a split order/operation in the workgroup.
Create splits only for the selected workgroups	If active, splits are only used in the selected workgroups.
Field parallel exit operation	Operation user field containing the first operation that is parallel to the operation. Used in the inspection operations area.
Field parallel entry operation	Operation user field containing the last operation that is parallel to the operation. Used in the inspection operations area.
Time for automatic scheduling	Defines a time where a simulation is performed including write-back (time-controlled)
Automatic scheduling after planned order transfer	When the existing planned orders are updated, a simulation is automatically initiated and written back (event-controlled).
DB table of bills of material (components)	Selects the database to be used by the DOS module to obtain the bill of material, or the table into which the ERP system writes its data.
Log level	<p>The log level defines the level of detail of background logging. It should be noted that a high degree of detail may slow down a simulation. The level of detail increases with these options in descending order.</p> <ul style="list-style-type: none"> <li>— Error Error messages</li> <li>— Info Information</li> <li>— Warn Warnings</li> <li>— Debug Debugging</li> </ul> <p>These logs can be used to determine user, time and content of any change or action in the DOS module.</p>
Cache options: Clear read cache	If this field is active and data are saved, the internal cache is cleared and all elements cleared are re-read from the database (e.g. orders, operations, shift models, work times, ...).

#### 6.10.2.2 Planning area

The planning area summarizes all configuration data that are relevant for scheduling.

Editor

Academy

Name

Value

Name	Academy
Last planning	21.12.2017 12:02
Last planning user	SYSTEM
Count fault orders of last planning	0
Insert new orders in active folder	<input checked="" type="checkbox"/>
Generate personal demand	<input checked="" type="checkbox"/>
Create capacities as planning capacities	<input checked="" type="checkbox"/>
<input type="checkbox"/> Writeback to FACT database tables	<input checked="" type="checkbox"/>
Writeback workplace	<input checked="" type="checkbox"/>
Writeback workplace group	<input checked="" type="checkbox"/>
Writeback planned dates to target dates	Never
New Operation state, if state is previously less	0
Create operation splits	<input type="checkbox"/>
Hide inactive operations on terminal	<input checked="" type="checkbox"/>
Send plan dates for planning orders	<input type="checkbox"/>
Send plan dates for production orders	<input checked="" type="checkbox"/>
Use planned workplace for next planning	<input checked="" type="checkbox"/>
Consider only net order time restrictions	Only net start and...
Planning dead time	00:00:00 h:min:s
Plan production orders before planning orders	<input checked="" type="checkbox"/>
Plan tools	<input type="checkbox"/>
Setup sequence optimization	<input type="checkbox"/>
Keep target start at prioritisation of sequence	<input checked="" type="checkbox"/>
Propagate yield quantity on finished operations	<input type="checkbox"/>
Detect pauses between setup and production personnel	<input type="checkbox"/>
Maximum allowed pause between setup and production personnel	04:00:00 h:min:s
<input type="checkbox"/> Priorityrules	
1. Priority rules	Hurry order priority
2. Priority rules	Orderpriority Rule
3. Priority rules	Termination Rule
Priorityrules for first planning	

## Components

The functions of the essential parameters are:

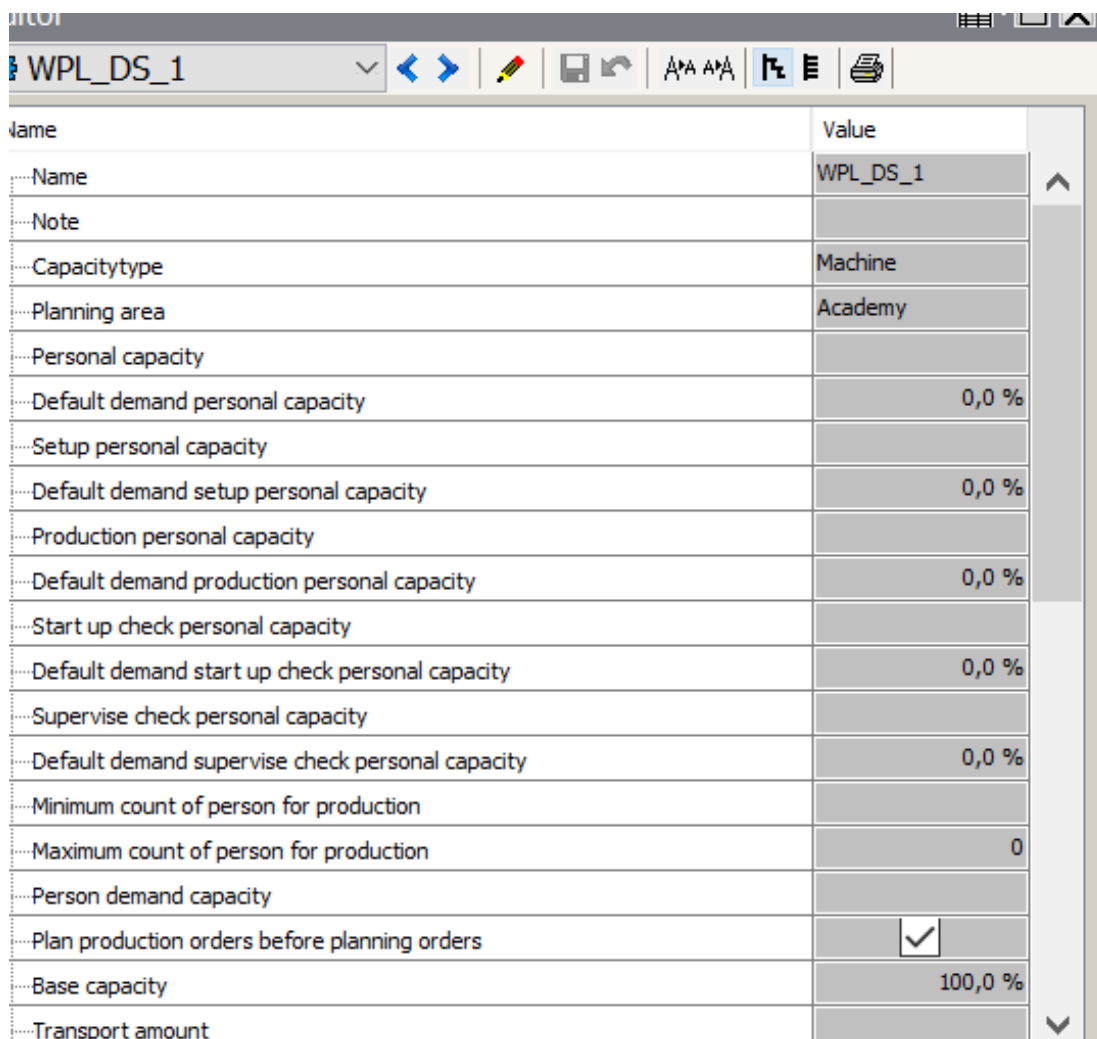
Parameter	Description
Insert new orders in active folder	When importing new orders, they are automatically added to the active ones. If this option is deactivated, orders imported are added to the inactive ones.
Generate personnel requirement automatically	When reading operations, a personnel requirement is automatically calculated from the labour time if a personnel resource is defined on the associated machine.
Create resources as planning resources	When creating and reading resources, they are automatically defined as planning resources.
Write back to FACT database tables	You can specify whether the data are written to the FACT tables when adopting a simulation. The data written can be specified with the following options.
Write back workplace/group	You can define to write back the workplace allocation of the simulation.
Write back planned dates to target dates	You can specify that planned dates are written to the target dates of the FACT tables.
New operation status if previous status is less	When a simulation is successful and written back, all operations are assigned a predefined status. As a precondition, its status must have been less than the predefined one. This option controls the visibility of operations on the terminal.
Create operation splits	If this option is active, operations are automatically split if permitted by the resources.
Send planned dates for planned orders	If this option is selected, the planned dates of planned orders are sent to the ERP system.
Send planned dates for production orders	If this option is selected, the planned dates of production orders are sent to the ERP system.
Consider only network order time restrictions	You may select: <ul style="list-style-type: none"> <li>— Each order start and only network end</li> <li>— Only network start and only network end</li> <li>— Each order start and each order end</li> </ul> (See also chapter 4.5.2.3 Configurations for basic date definition.)
Planning dead time	The sequences of operations between the current scheduling time and the specified scheduling dead time are not changed during the simulation.
Schedule production orders before planned orders	Forces planned orders to queue after all production orders. Any priority rules of planned orders are suppressed.
Plan tools	Takes the limited number of tools into account; maximum parallel processing (of a material/workplace combination) is restricted; hidden "tool" resource requirement.
Keep target start at prioritisation of sequence	This option additionally considers the target start date for sequence prioritisation. You can use this in the order cockpit to set priorities independently of the target start date.

## Components

Parameter	Description
Priority rules	The list of priority rules to be observed in a simulation. The "Scheduling priority" should always be included. (See also chapter 3.2 Configuring priority rules.)
Time buffer for priority rule	If you select "Setup priority", you have to specify the time buffer from which optimization of setup time is applied.
Rules for selection of alternatives	Various rules for finding alternatives for machine allocation. (See also chapter 3.3 Alternative workplaces.)
Scheduling resources	Resources listed here are scheduled without capacity limitation but with a shift model.
Planning resources	Resources listed here are scheduled with capacity limitation and with a shift model.
Number ...	Current data for the planning area

### 6.10.2.3 Resources

The resources parameters predominantly comprise parameters that are relevant for scheduling:



Name	Value
Name	WPL_DS_1
Note	
Capacitytype	Machine
Planning area	Academy
Personal capacity	
Default demand personal capacity	0,0 %
Setup personal capacity	
Default demand setup personal capacity	0,0 %
Production personal capacity	
Default demand production personal capacity	0,0 %
Start up check personal capacity	
Default demand start up check personal capacity	0,0 %
Supervise check personal capacity	
Default demand supervise check personal capacity	0,0 %
Minimum count of person for production	
Maximum count of person for production	0
Person demand capacity	
Plan production orders before planning orders	<input checked="" type="checkbox"/>
Base capacity	100,0 %
Transport amount	

## Components

Parameter	Description
Name	FACT ID of the resource
Note	Name of the resource
Resource type	The type of resource: Machine or Personnel
Planning area	The planning area assigned the resource. The resource can only be used for scheduling orders of this area.
Personnel resource (on this machine)	Specifies a personnel resource used for scheduling in connection with the machine. This information is used when generating a personnel requirement in parallel with the machine requirement. The personnel resource usually specifies a qualification or the manpower of a (sub-) area.
Setup personnel resource (on this machine)	Specifies a setup personnel resource used for scheduling in connection with the machine. This information is used when generating a personnel requirement for the setup time in parallel with the machine requirement. The setup personnel resource usually specifies a qualification or the manpower of a (sub-) area.
Production personnel resource (on this machine)	Specifies a production personnel resource used for scheduling in connection with the machine. This information is used when generating a production personnel requirement for the plain production time in parallel with the machine requirement. The production personnel resource usually specifies a qualification or the manpower of a (sub-) area.
Setup inspection personnel resource (on this machine)	Specifies a setup inspection personnel resource used for scheduling in connection with the machine. This information is used when generating a setup inspection personnel requirement between setup and production in parallel with the machine requirement. The personnel resource usually specifies a qualification or the manpower of a (sub-) area.
Production inspection personnel resource (on this machine)	Specifies a production inspection personnel resource used for scheduling in connection with the machine. This information is used when generating a production inspection personnel requirement for the plain production time in parallel with the machine requirement. The production inspection personnel resource usually specifies a qualification or the manpower of a (sub-) area.
Minimum number of persons for production	The minimum number of persons on an assembly workplace to be scheduled for operations on this workplace. = 0: Operation is scheduled with the number of persons derived from time per unit and labour time. > 0: An extended scheduling logic is activated for the workplace.
Maximum number of persons for production	The maximum number of persons on an assembly workplace to be scheduled for operations on this workplace. = 0: Operation is scheduled with the number of persons derived from time per unit and labour time. > 0: An extended scheduling logic is activated for the workplace.
Base capacity	Capacity of the resource = Number of machines Single machine = 100% Machine group = N x 100%

## Components

Parameter	Description
	Personnel group = 4 persons = 400 %
Transfer quantity	Defines a quantity of products necessary for the successor operation to start.
Batch workplace	A batch workplace is a workplace where a certain quantity can be produced in one go. The piece count is not important for this production type. The resulting calculation formula is: Duration = Time per unit There is no multiplication with the piece count.
Display format	Display format in the schedule board Default setting: Personnel resource Capacity-based display with personnel scaling Capacity-based format: Machine resource Gantt chart
Display index	Display index in the schedule board. Permits controlled sorting of rows in the schedule board.
Rate of capacity utilization	Factor considered when calculating the processing time = 80 % => Time per unit is greater by a factor of 100/80 = 120 % => Time per unit is less by a factor of 100/120 If two machines are mutual alternatives, but one of them is slower/faster, you can take this into account here.
Interruptible	If an operation can be interrupted on a machine, e.g. for the weekend, it can be resumed at the beginning of the next week. Uninterruptible operations on a machine require scheduling the operation completely within an uninterrupted time interval. For example, a thermal treatment operation cannot be simply interrupted at shift end.
Move operation already initiated with its remaining duration	If this option is selected, any active operations assigned the resource are re-scheduled together with their remaining duration to the current simulation time. If this option is deselected, any active operations are not re-scheduled in a simulation.
Machine / workplace	Specifies the machine identification of the resource.
Group	The group to which the resource pertains.
Segment	The segment to which the resource is assigned.
Department	Shows the department in which the resource is located.
Plant	Specifies the plant in which the resource is located.
Site	Specifies the location of the plant.



#### 6.10.2.4 Order

Name	Value
Name	DS-2-0
Materialcode	00625381
Materialtext	Abdeckung 10x10
State	Ready
Planning order	<input type="checkbox"/>
Order target start	12.12.2017 10:41
Order target end	27.12.2017 10:41
Planned start	15.03.2018 15:56
Planned end	24.03.2018 09:51
Remaining duration	107:35:00 h:min:s
Date variance [Days]	-2087:10:11 h:min:s
Part list	All demands covered

Some of the following parameters are master data and not explained in more detail here. Others reflect data produced during scheduling. These are:

Parameter	Description
Planned order	Specifies whether an order is a planned order or not
Target start	Target start of an order, predefined by the SAP system
Target end	Target end of an order, predefined by the SAP system
Planned start	Planned start of an order, determined from the earliest planned start of an operation of the order
Planned end	Planned end of an order, determined from the latest planned end of an operation of the order
Time buffer	The difference between target end and planned end
Order post-edges	Shows the post-edges of the order selected. Post-edges are pointers to the subsequent order.
Order pre-edges	Shows the pre-edges of the order selected. Pre-edges are pointers to the previous order.
Post-edges	Shows the post-edges within the order. These refer to the subsequent order operation.
Output node	Specifies which subsequent orders/operations are initiated by the order
Transition time	The time that passes between consecutive operations until the subsequent operation starts.
Type	Specifies the link type existing between two operations. Start-start edge: Both operations start simultaneously. End-end edge: Both operations end simultaneously. End-start edge: Operation must be finished before subsequent operation starts.

## Components

Parameter	Description
Company code	A term from the SAP system
Pre-edges	Shows the pre-edges within the order. These refer to the preceding order operation.
Input node	Specifies which orders/operations initiate the order.
Total buffer time	Shows the buffer time available for the order.
Import status	Indicates whether the order import was o.k./successful or not
Critical	Checks the buffer time for a negative value. If yes, this option is deactivated automatically.
Critical operation	Indicates the operation where the buffer time value turned negative.
Critical machine	Indicates the machine assigned to the critical operation.
Client	A term from the SAP system
Original planned start	Shows the original time value of the "Start" parameter before the simulation. This is used for comparison with the value from the simulation. If the simulation is adopted, the simulation value becomes the new original planned start value.
Original planned end	Shows the original time value of the "End" parameter before the simulation. This is used for comparison with the value from the simulation. If the simulation is adopted, the simulation value becomes the new original planned end value.
PPS target start	PPS target start is the first date for SAP planned start transferred from the ERP system. It is used as a reference value to indicate any deviation from the original start date. It is not modified any more after order import.
PPS target end	PPS target end is the first date for target end transferred from the ERP system. It is used as a reference value to indicate any deviation from the original end date. It is not modified any more after order import.
Planned duration	Indicates the overall duration of the order. It is calculated as follows: Overall duration = Planned end – Planned start
Bill of material	List of input materials. This information is used to find the network predecessors for order network generation.
User fields 1-10	Information fields that can optionally be loaded from the ERP system. You can modify the name of each field via the master data properties.
Time fixed	Fixes the time of the order, i.e. it cannot start earlier than the time fixed.

## Components

### 6.10.2.5 Operation

Editor

DS-2-0-10-0

Name	Value
Name	DS-2-0-10-0
Materialcode	00625381
Materialtext	Abdeckung 10x10
State	Ready
Operation state 1	89
Operation state 2	-
Durationrule	15,000 [min] + Quantity * 2 [min/Piece]
Setup time	00:15:00 h:min:s
Time Per Piece [min/Piece]	2.0
ParameterEditor.Label.K\$OrderTargetstart	12.12.2017 10:41
ParameterEditor.Label.K\$OrderTargetend	27.12.2017 10:41
Planned start	15.03.2018 15:56
Planned end	17.03.2018 04:01
Remaining duration	33:35:00 h:min:s
Date variance [Days]	-1987:20:11 h:min:s
Target quantity	1000 prt.
Real quantity	0 prt.
Setuptime	
Demands	3 Demands
1. Demand	Machine: WPL_DS_2
Default capacity	WPL_DS_2
Demand	100,0 %
Alternative capacities	
1. Capacity	WPL_DS_2
2. Capacity	WPL_DS_4
3. Capacity	WPL_DS_3
2. Demand	Personal setup: Set up Labour
Default capacity	Set up Labour
Demand	100,0 %
Alternative capacities	

## Components

Some of the following parameters are master data and not explained in more detail here. Others reflect data produced during planning. These are:

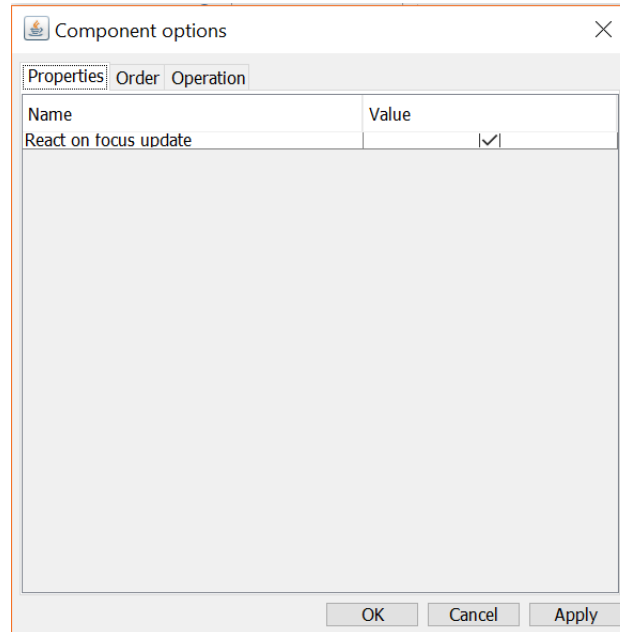
Parameter	Description
State	Specifies the status of an operation.
Operation state	Specifies the status of the operation. The status is the same as the one in the operation administration. Planned: 10 Started: 50 Released: 45 Partially finished: 80 Prepare setup: 46 Transfer quantity reached: 83 Setup prepared: 47 Completed for restart: 89 Setting up: 48 Completed: 90 Set up: 49 Aborted: 91
Duration rule	A calculation rule for the processing time. The rule is composed of a constant component and the time per unit. The constant is the setup time.  This rule changes for a batch workplace. In this case, the batch formula is used and the processing time results from the time per unit.
Planned start	Planned start of the operation determined during scheduling
Planned end	Planned end of the operation determined during scheduling
Remaining duration	Time remaining that is necessary to complete the production order
Time buffer	Difference between target end and planned end
Target quantity	Specifies the number of products to be produced
Real quantity	Indicates the number of products already produced
Setup time	The time the machine needs for setup
Requirements	This section defines the requirements for an operation. Machine and personnel requirements are defined here depending on the overall system configuration and the specific machine resource. The machine requirement results directly from the workplace or workgroup field of the operation. The personnel requirement is defined if personnel requirement generation has been configured a personnel resource has been configured for the machine resource and a labour time per unit exists for the operation. The capacity requirement of the personnel resource is calculated by the quotient of personnel time per unit/machine time per unit.  You can edit the machine and personnel requirements to add or remove alternative resources.
Allocations	This field comprises allocations of resources included in scheduling, their start and end dates and the quantity allocated as a percentage.

## Components

Parameter	Description
Personnel	Specifies the number of personnel required for production. This information is derived from the allocation quantities. The related formula is: Quantity / 100.
Post-edges	Shows the post-edges within the operation. These refer to the subsequent operation.
Unmanned	You can use this option to configure whether an operation should be performed with or without personnel.
Pre-edges	Shows the pre-edges within the operation. These refer to the previous operation.
Earliest start	Specifies the earliest start date/time of the operation.
Earliest end	Specifies the earliest end date/time of the operation.
Fixing point	Indicates the point in time to which the operation is fixed in time.
Lead order ID	The lead order ID is a unique identification code of an order network and is based on the network origin.
Planned machine	Indicates the machine from the assignment.
Total buffer time	Shows the buffer time available for the order.
Import status	Indicates whether the order import was o.k./successful or not
Inspection operation	This information comes from the ERP system and indicates whether the selected operation is subject to inspection or not.
Materials staging time	The materials staging time is derived from the bill of material, if it is set. This date/time works as an additional fixing value from the bill of material and is used for conditional display and control of the material flow.
Parallel operation exit	Used for inspection operations and specifies the operation preceding the inspection operation.
Parallel operation entry	Used for inspection operations and specifies the operation following the inspection operation.
Planned duration	The planned duration specifies the total time scheduled and required for processing the operation.
Planning area	The planning area shows where the operation is located and processed.
Spare fields 1-10	Additional information fields. May also contain customised functions. Are very often used as volatile message fields.
Resource fixed	Specifies whether an operation is fixed to a specific resource or not. If it is fixed to a resource, it cannot be used for scheduling by any other orders/operations any more.
Latest start time	Specifies the latest start date/time of the operation.
Latest end time	Specifies the latest end date/time of the operation.
Fault message	Shows the fault currently reported by the production data acquisition system.
User fields 1-10	Information fields that can optionally be loaded from the ERP system. You can modify the name of each field via the master data properties.
Waiting time	The waiting time is the difference between the earliest possible scheduling date/time and actual scheduling.
Transfer quantity	Defines a quantity of products necessary for the successor operation to start.
Time fixed	Fixes the time of the operation, i.e. it cannot start earlier than the time fixed.
Associated inspection operation	This field specifies which inspection operation is associated with the selected operation.

### 6.10.3 Component options

#### 6.10.3.1 Properties

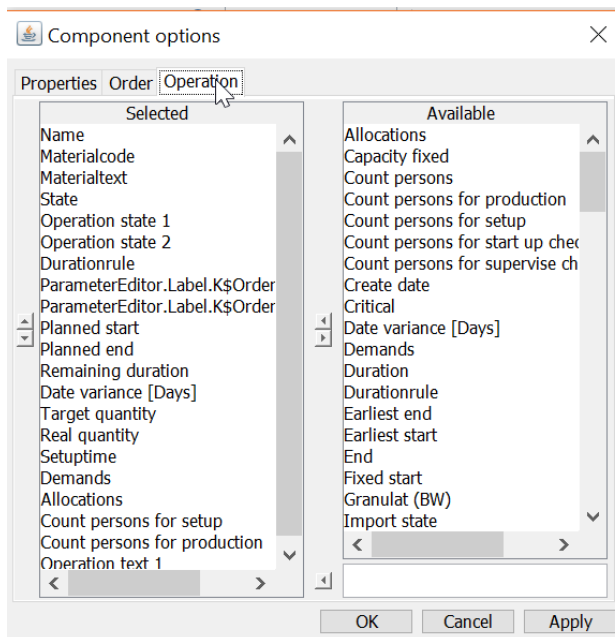
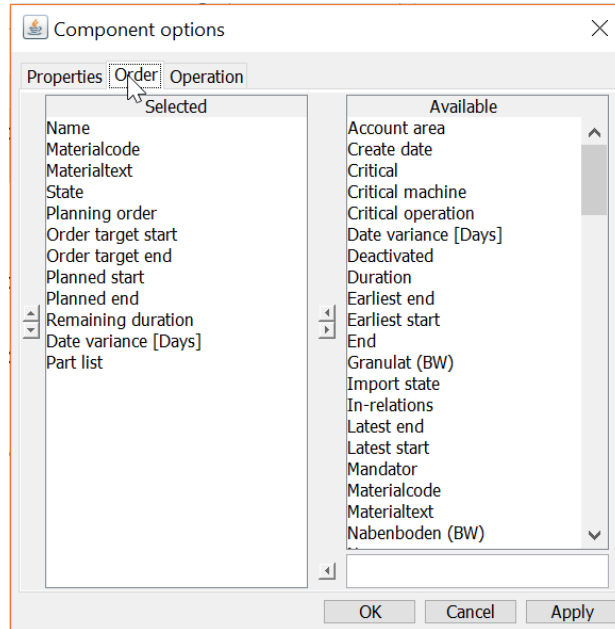


Parameter	Description
React on focus update	The editor always shows the currently focused element.

## Components

### 6.10.3.2 Display filters

The remaining option tabs control the parameters to be displayed along with each element type.



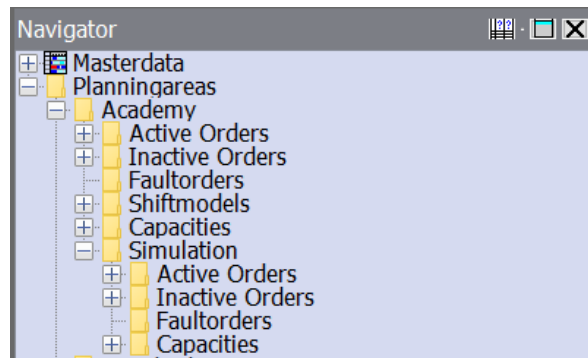
Element types are:

- Order
- Operation

Individual parameters are shown by moving them to the left-hand area or hidden by moving them to the right-hand area. The arrow buttons on the left can be used to set the sequence of parameters.

## 6.11 Navigator tree

The Navigator is the central point for operation of the DOS module. It structures the various data areas of the DOS module according to a tree structure.



The various branches are:

Parameter	Description
Master data	Folder containing all global system objects; mainly used for configuring the overall system
Planning areas	A folder for managing the different planning areas
Resources	A folder containing all area-related resources within the system
Orders	A folder containing all orders within the system
Webfam shift models	A folder containing the shift models defined in FORCAM FORCE™
Planning areas	A folder accommodating all planning areas and where the actual simulation commands are executed.
Academy	Folder of the Academy sample planning area
Active orders	Folder containing new and planned orders
Inactive orders	Folder containing orders removed from scheduling. These orders do not claim any resource and cannot be visualised in the schedule board since they do not comprise any planned dates and machine assignments.
Fault orders	A folder containing incorrect orders; errors are currently only determined when reading the orders from the FACT dataset. This may be, for example, missing requirements or target ends.
Work time hierarchy	Folder containing the work time hierarchy
Shift models	Folder containing the shift models defined locally in the planning area
Resources	Folder containing all resources of a planning area such as machine and personnel
Simulation	Folder containing the orders and capacities generated by the simulation
Simulation/ Active orders	Folder containing all active orders under simulation
Simulation/ Inactive orders	Folder containing all inactive orders under simulation
Simulation/ Fault orders	Folder containing all orders resulting in errors during simulation. Note that the cause of errors may not only be attributable to the order but also the resources to be scheduled due to insufficient capacity.
Simulation/ Work time hierarchy	Folder containing the simulation work time hierarchy
Simulation/ Resources	Folder containing all resources utilized in the simulation by the orders scheduled.



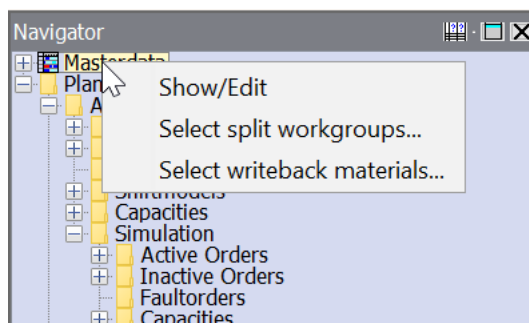
## Components

You can right-click on a folder or element contained therein (order, operation, resource) to open a pop-up window with available commands. These are listed and explained below. For some of the folders and elements in the Navigator which have object character (master data, planning area, order, operation, resource) you can open the editor directly by a double-click with the left-hand mouse button.

The Navigator tree is also used as a source for drag & drop actions: Keep the left-hand mouse button pressed and drag the element to the editor or schedule board.

### 6.11.1 Pop-up menus

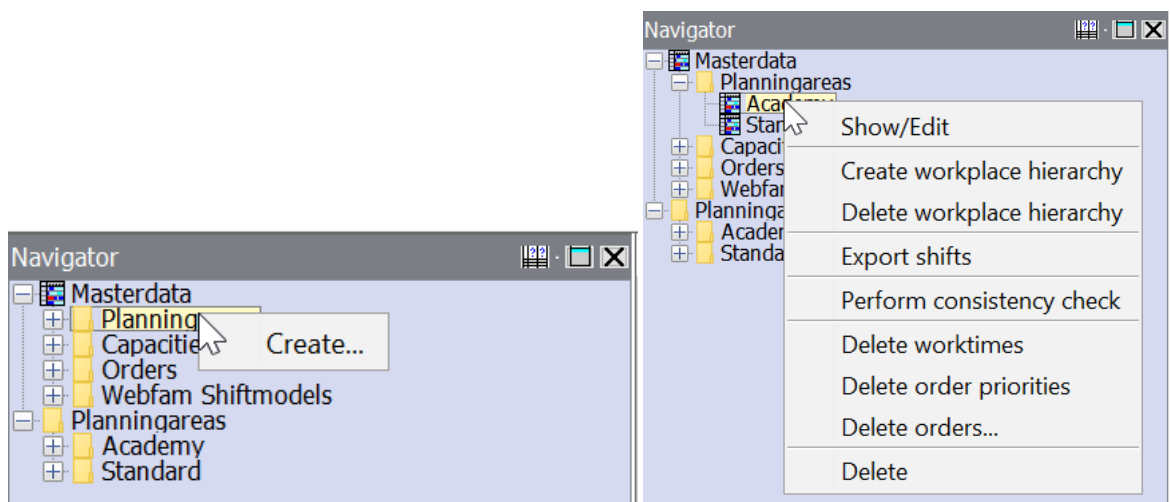
#### 6.11.1.1 Master data



Parameter	Description
Show/Edit	Opens the "Master data" object in the general editor.
Select split workgroups	A dialog box opens where you can define various workplaces as split workgroups. These can split operations among each other depending on the available capacity.
Select writeback materials	Material filter for transferring order data to SAP

#### 6.11.1.2 Planning areas

The "Planning areas" folder is used for creating, deleting and configuring planning areas.

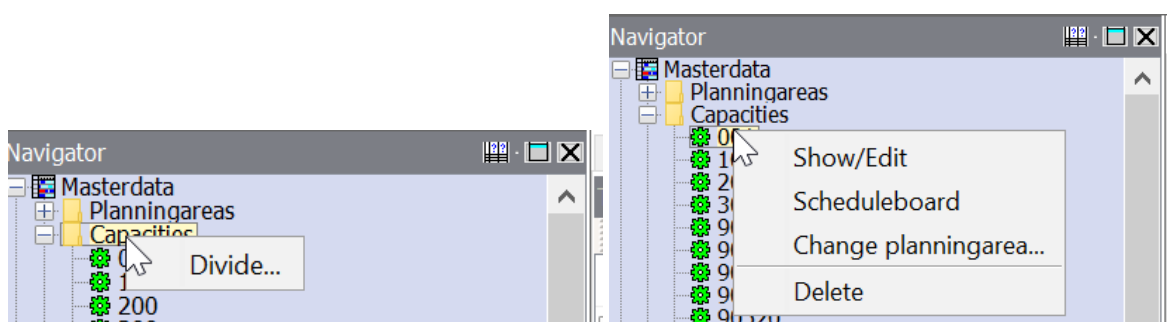


## Components

Parameter	Description
Create	Creates a new planning area with a user-defined name.
Create workplace hierarchy	The "Create workplace hierarchy" command is used for transferring the hierarchical structure of the planning area from FORCAM FORCE™ as a template for the workplace hierarchy. If a workplace hierarchy should already exist before executing the command, it will be overwritten together with the work time definitions contained therein.
Delete workplace hierarchy	The "Delete workplace hierarchy" command is used for deleting the current workplace hierarchy together with the work time definitions contained therein. All resources are arranged flat under the "Workplace hierarchy" folder. However, work time definitions made with resources will be kept.
Export shifts	Use the "Export shifts" command to initiate shift export to the tables of the reporting area (SCHI_KAL). Only shifts of resources of the "Machine" type are exported. All future shifts are deleted and re-transferred in the export operation. Shifts of the current day remain unchanged.
Perform consistency check	Use the "Perform consistency check" command to initiate an internal consistency check of the object references saved. Obsolete object references (not referencing any existing object any more) will be deleted. You should consider this command as a kind of emergency command!
Delete work times	Use the "Delete work times" command to delete all work time definitions in the workplace hierarchy and resources.
Delete order priorities	Deletes the existing order priorities and sets all orders to the same priority status.
Delete orders	Deletes orders of the planning area selectively.

### 6.11.1.3 Resources folder

Used for inter-area display of the resources available. Resources can only be created in the individual planning areas to keep an immediate reference to the area.

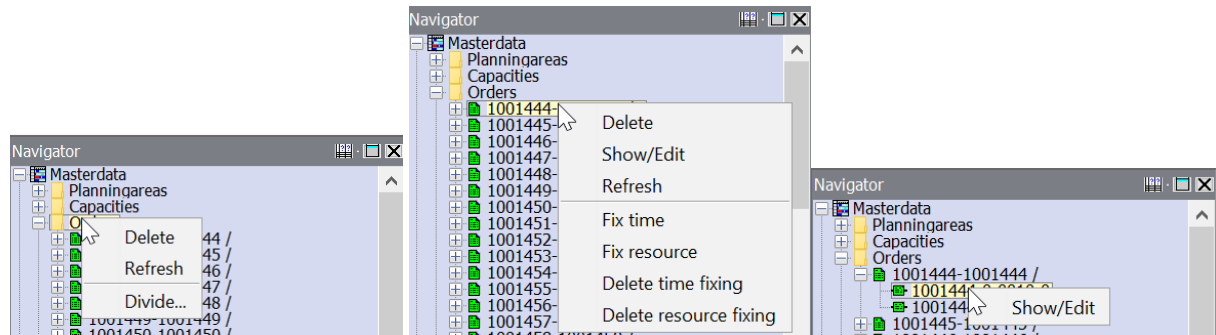


Parameter	Description
Divide...	Subdivides the resource tree according to resource types (machine, personnel) and other resource characteristics.
Show/Edit	Opens the resource in the editor.
Schedule board	Shows the resource in the schedule board.
Change planning area...	Moves the resource to a different planning area.
Delete	Deletes the selected resource. All orders scheduled with this resource are removed from schedule!

## Components

### 6.11.1.4 Orders

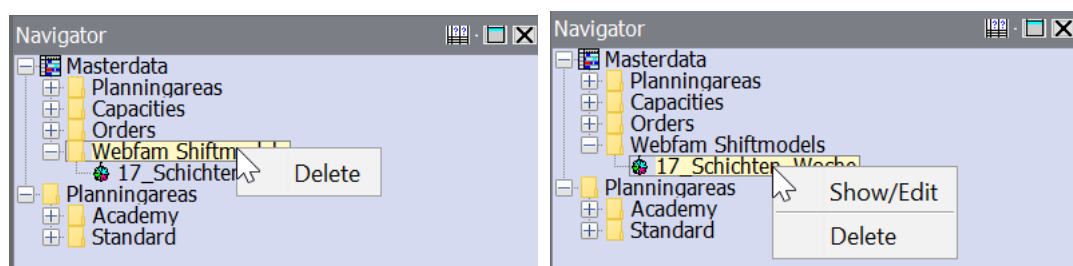
The "Orders" folder lists all orders.



Parameter	Description
Delete	Deletes all orders, or the selected order.
Refresh	When refreshing, the data of one or all orders are reloaded from the database to the DOS module <b>without</b> generating any new orders.
Divide...	Structures the tree according to specific characteristics of the orders.
Show/Edit	Opens the order in the editor.
Fix time	Fixes the time of the order/operation, i.e. it cannot start earlier than the time fixed.
Fix resource	Fixes an order on the selected resource. It cannot be used by any other order/operation then.
Delete time fixing	Deletes all existing time-fixing criteria from orders/operations. Orders/operations may also start before the time fixed.
Delete resource fixing	Deletes all existing resource-fixing criteria. Resources can then be used again by other orders/operations.

### 6.11.1.5 Webfam shift models

The "Webfam shift models" folder contains all shift models from FFServer.



Parameter	Description
Show/Edit	Opens the shift model in the editor.
Delete	Deletes all shift models or the selected one.

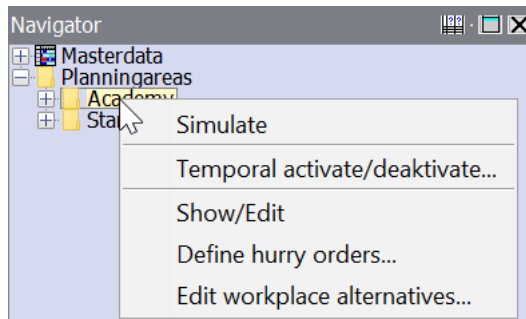
### 6.11.1.6 Planning areas

Lists all planning areas. You cannot execute any commands in this folder.

## Components

### 6.11.1.7 Planning area xyz

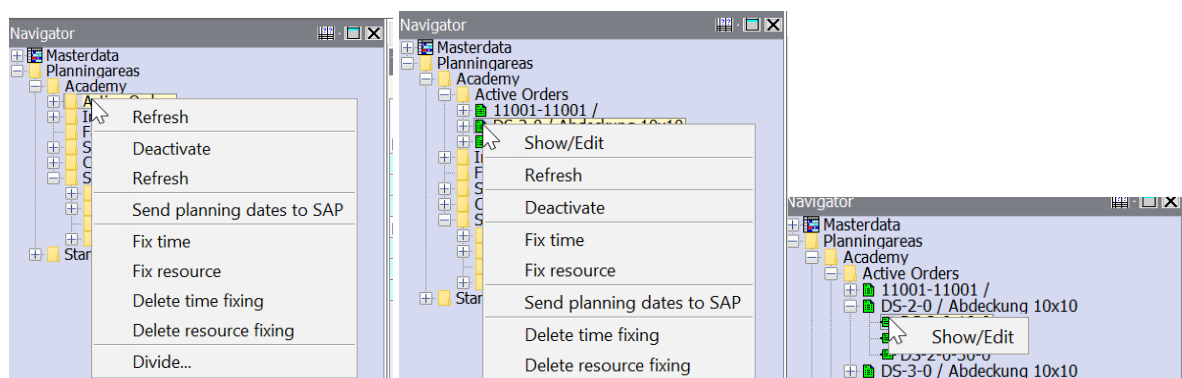
The folder represents an individual and separate planning area.



Parameter	Description
Simulate	Initiates a simulation including all active orders.
Show/Edit	Opens the editor with the configuration data of the planning area.
Define urgent orders...	Opens a dialog for defining urgent orders.  Urgent orders are provided with a priority at order header level which applies to all operations of the order. If the order priority rule is applied during scheduling, urgent order operations are handled with preference above all other operations. If two urgent order operations compete, their priorities will decide.
Edit workplace alternatives	Opens a component to set up alternative workplaces.  Alternative workplaces are used in case of failures or bottlenecks. In such a case, certain parts can be produced on different machines even though initially only one machine may have been intended for it.

### 6.11.1.8 Active orders

The "Active orders" folder lists all scheduled or new orders assigned to the planning area.

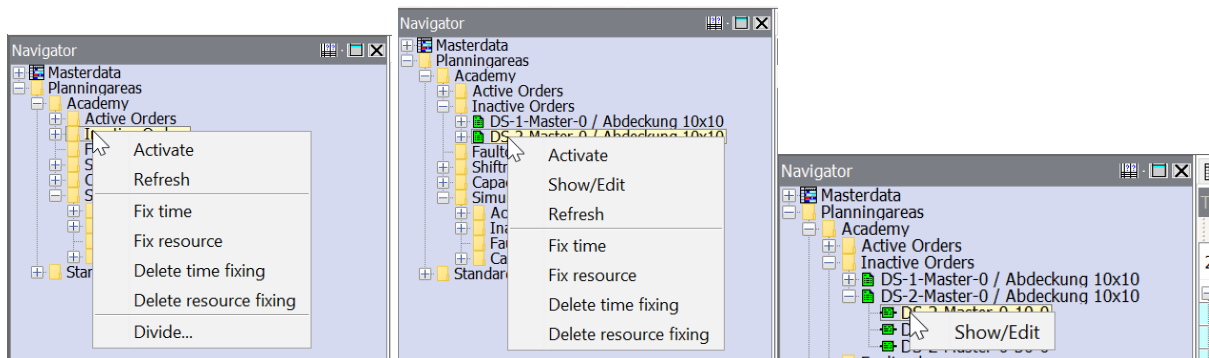


## Components

Parameter	Description
Refresh	The order is compared with the data contained in the database.
Deactivate	The "Deactivate" command is used for removing one or more orders from schedule, i.e. resource allocations are cleared and the orders are placed into the "Inactive orders" folder.
Fix time	Fixes the time of the order/operation, i.e. it cannot start earlier than the time fixed.
Fix resource	Fixes an order on the selected resource. It cannot be used by any other order/operation then.
Delete time fixing	Deletes all existing time-fixing criteria from orders / operations. Orders/operations may also start before the time fixed.
Delete resource fixing	Deletes all existing resource-fixing criteria. Resources can then be used again by other orders/operations.
Show/Edit	The order or operation is displayed in the editor.
Divide...	The "Active orders" folder can be further subdivided according to the order characteristics.

### 6.11.1.9 Inactive orders

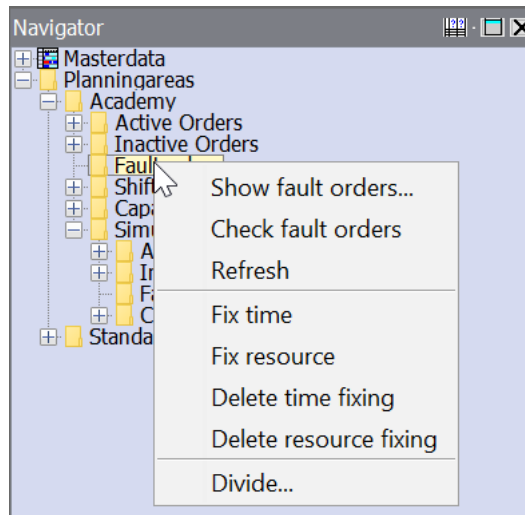
The "Inactive orders" folder lists all orders currently removed from scheduling.



Parameter	Description
Activate	Place the order(s) into the "Active orders" folder for simulation.
Refresh	The order is compared with the data contained in the database.
Show/Edit	The order or operation is displayed in the editor.
Fix time	Fixes the time of the order/operation, i.e. it cannot start earlier than the time fixed.
Fix resource	Fixes an order on the selected resource. It cannot be used by any other order/operation then.
Delete time fixing	Deletes all existing time-fixing criteria from orders/operations. The orders/operations may also start before the time fixed.
Delete resource fixing	Deletes all existing resource-fixing criteria. Resources can then be used again by other orders/operations.
Divide...	The "Inactive orders" folder can be further subdivided according to the order characteristics.

## 6.11.1.10 Fault orders

Orders that caused errors during transfer from the FACT dataset are stored in the "Fault orders" folder.



Parameter	Description
Show fault orders	Opens a list of orders that produced errors including the cause.  This is a list which displays the order, error ID, error text and the cause of the error.
Check fault orders	Checks all orders that produced errors for whether the cause of the error still persists. If there is no error any more, the order is placed into the "Active orders" folder.
Refresh	The order is compared with the data contained in the database.
Fix time	Fixes the time of the order/operation, i.e. it cannot start earlier than the time fixed.
Fix resource	Fixes an order on the selected resource. It cannot be used by any other order/operation then.
Delete time fixing	Deletes all existing time-fixing criteria from orders/operations. Orders/operations may also start before the time fixed.
Delete resource fixing	Deletes all existing resource-fixing criteria. Resources can then be used again by other orders/operations.
Divide...	The "Fault orders" folder can be further subdivided according to the order characteristics.
Show/Edit	The order or operation is displayed in the editor.

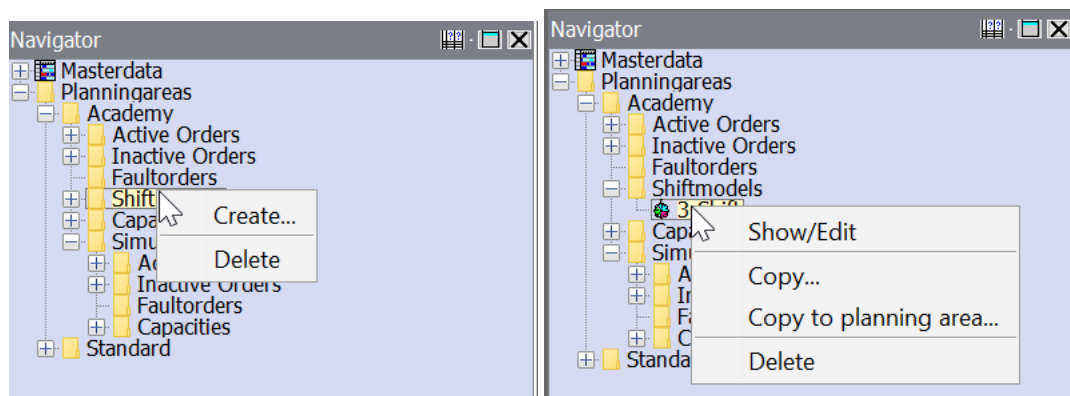
## Components

### 6.11.1.11 Work time hierarchy

Parameter	Description
Update work time	The work time model of all resources of the planning area is re-calculated.
Edit work time	Opens the work time editor and shows the work time definition of the hierarchy level.
Personnel requirements	Shows the personnel requirements for the selected (and all subordinate) hierarchy level(s) in a separate table.
Create...	Creates a new work time hierarchy.
Delete...	Deletes the selected work time hierarchy.
Show/Edit	The order or operation is displayed in the editor.
Change hierarchy assignment	Moves the currently selected resource to a different work time hierarchy by a selection dialog.

### 6.11.1.12 Shift model

The "Shift models" folder lists all local shift models of the planning area.

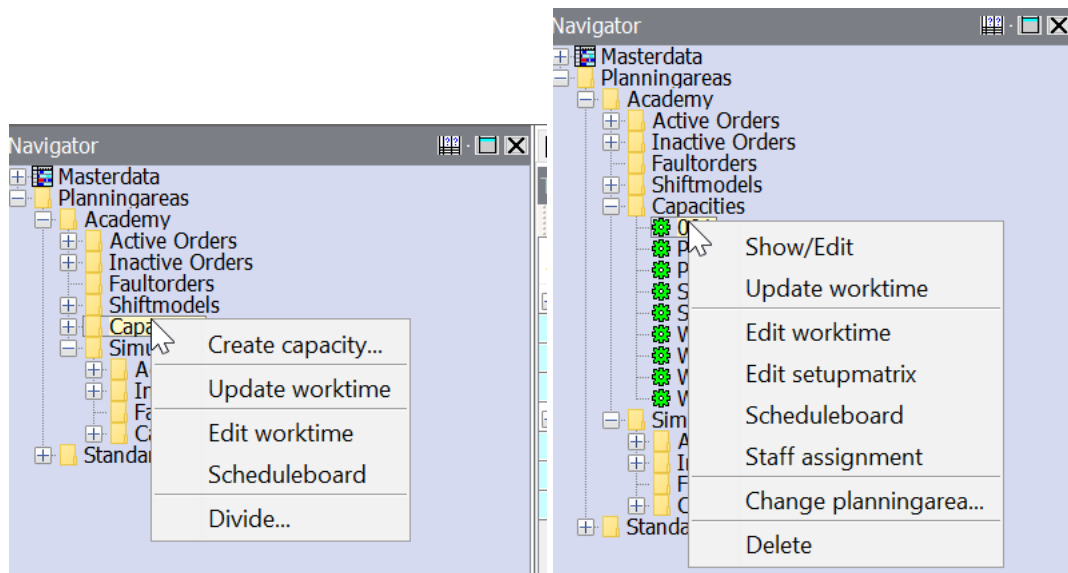


Parameter	Description
Create...	Creates a new shift model with a name to be specified.
Delete	Deletes an existing shift model.
Show/Edit	Opens the shift model in the shift model editor.
Copy	Creates a template for a new shift model based on a copy of the selected one.
Copy to planning area	Creates a template for a new shift model in a selected planning area based on a copy of the selected one.

## Components

### 6.11.1.13 Resources

The "Resources" folder lists all local resources assigned to the planning area.



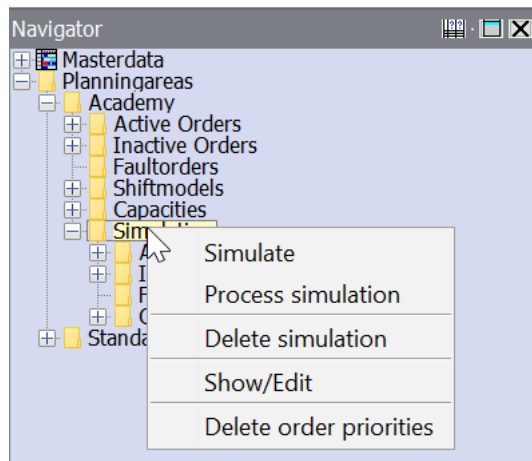
Parameter	Description
Create resource	Creates a new resource in the planning area.
Update work time	Re-calculates the work time model of the selected resource.
Edit area work time	A work time model that is automatically valid for all workplaces of the area can be defined at planning area level. This model can be refined with regard to resources.
Schedule board	Opens a new schedule board and shows the allocation of the selected resource.
Divide...	The folder can be further subdivided according to the resource characteristics.
Show/Edit	Opens the editor and shows the resource characteristics.
Edit work time	Opens the work time editor and shows the work time definition of the resource.
Edit setup matrix	Opens the setup matrix editor and shows the setup matrix of the selected resource.
Staff assignment	Opens the staff assignment table and provides an overview of the number of personnel required and the time buffer.
Change planning area	Moves the resource to a different planning area.
Delete	Deletes a resource.



## Components

### 6.11.1.14 Simulation

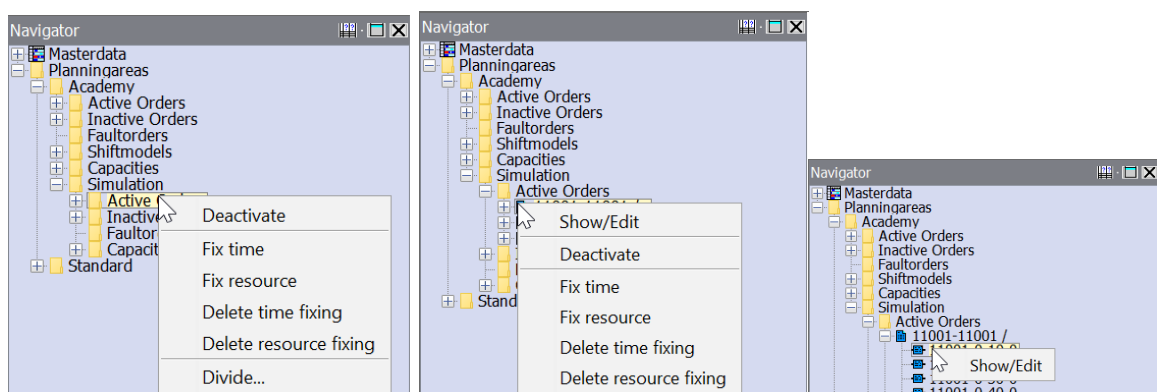
The "Simulation" order contains all orders, resources, work time hierarchies and shift models copied for simulation purposes.



Parameter	Description
Simulate	Executes a repeated simulation of all orders in the simulation area.
Process simulation	Writes back all simulation data to the DOS real data.
Save simulation	Simulations are only kept in the DOS server memory. When the server service is terminated, all simulations are lost. This function can be used to save the current simulation in the database so that it is still available after restarting the server. However, another simulation will overwrite it.
Delete simulation	Deletes all simulation orders and resources.
Show/Edit	Opens the editor and shows the simulation data.
Delete order priorities	Deletes the order priorities defined in the simulation data.

### 6.11.1.15 Simulation – Active/Inactive orders

The folders for active and inactive orders list all orders copied for simulation. The following functions are available in the pop-up menu:

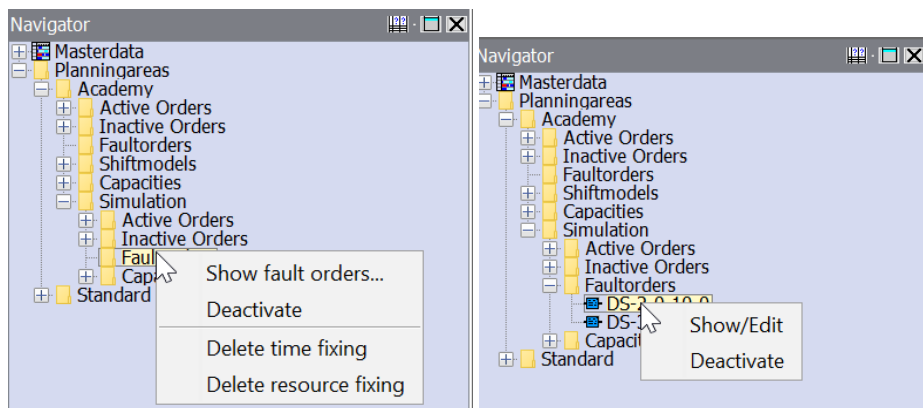


## Components

Parameter	Description
Deactivate	The "Deactivate" command is used for removing one or more orders from schedule, i.e. resource allocations are cleared and the orders are placed into the "Inactive orders" folder.
Fix time	Fixes the time of the order/operation, i.e. it cannot start earlier than the time fixed.
Fix resource	Fixes an order on the selected resource. It cannot be used by any other order/operation then.
Delete time fixing	Deletes all existing time-fixing criteria from orders/operations. Orders/operations may also start before the time fixed.
Delete resource fixing	Deletes all existing resource-fixing criteria. Resources can then be used again by other orders/operations.
Divide...	The active/inactive orders folders can be further subdivided according to the order characteristics.
Show/Edit	The order or operation is displayed in the editor.
Activate	Places the order(s) into the "Active orders" folder.

### 6.11.1.16 Simulation – Fault orders

If an error occurs during the simulation of orders, the relevant orders of the current simulation are listed in the "Fault orders" folder.



Parameter	Description
Show fault orders...	Opens the fault orders folder to display the list. It contains all orders that produced an error, including error code, description and cause.
Fix time	Fixes the time of the order/operation, i.e. it cannot start earlier than the time fixed.
Fix resource	Fixes an order on the selected resource. It cannot be used by any other order/operation then.
Delete time fixing	Deletes all existing time-fixing criteria from orders/operations. Orders/operations may also start before the time fixed.
Delete resource fixing	Deletes all existing resource-fixing criteria. Resources can then be used again by other orders/operations.
Show/Edit	The order or operation is displayed in the editor.
Deactivate	The "Deactivate" command is used for removing one or more orders from schedule, i.e. resource allocations are cleared and the orders are placed into the "Inactive orders" folder.

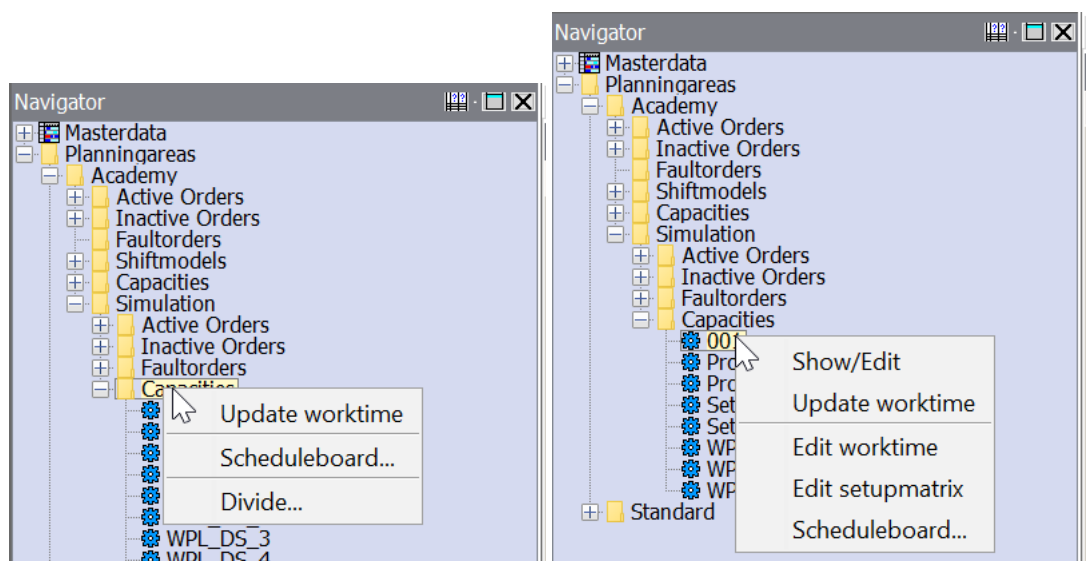
## Components

### 6.11.1.17 Simulation – Work time hierarchy

Parameter	Description
Update work time	The work time model of all resources of the simulation is re-calculated.
Edit work time	Opens the work time editor and shows the work time definition of the selected hierarchy level.

### 6.11.1.18 Simulation – Resources

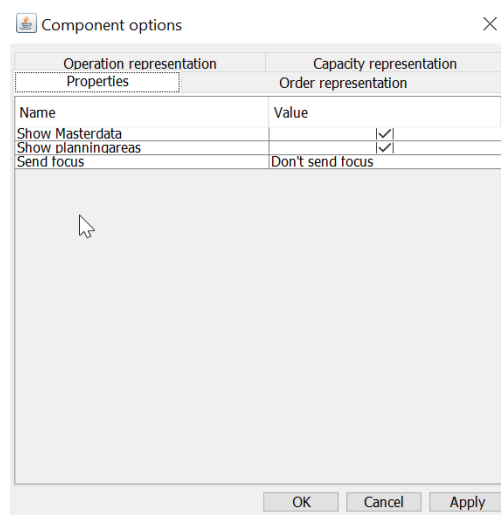
The "Simulation – Resources" folder lists all resources copied for simulation. Only those resources are copied for simulation which are referenced by the orders simulated.



Parameter	Description
Update work time	Re-calculates the work time model of the selected resource.
Schedule board	Opens a new schedule board and shows the allocation of the selected resource.
Divide...	The folder can be further subdivided according to the resource characteristics.
Show/Edit	Opens the editor and shows the resource characteristics.
Edit work time	Opens the work time editor and shows the work time definition of the resource.
Edit setup matrix	Opens the setup matrix editor and shows the setup matrix of the resource.

## 6.11.2 Component options

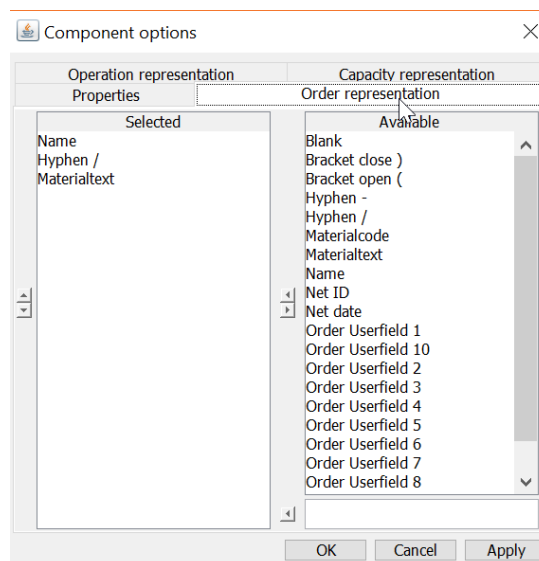
### 6.11.2.1 Properties



Parameter	Description
Show master data	Use this option to show or hide the "Master data" menu tree.
Show planning areas	Use this option to show or hide the "Planning areas" folder.
Send focus	When a row is focused, the associated element is placed on the focus view and thereby automatically displayed in other windows.

### 6.11.2.2 Order representation

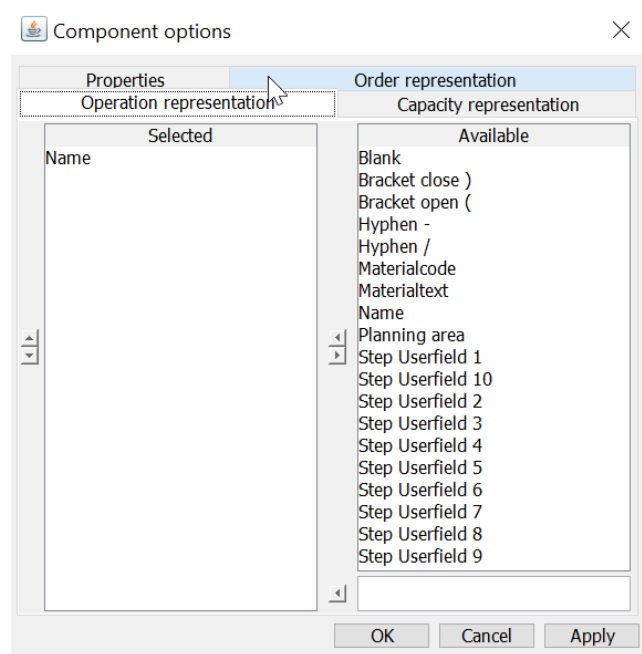
Use the "Order representation" tab to configure which attributes of an order are used for labelling order objects.



## Components

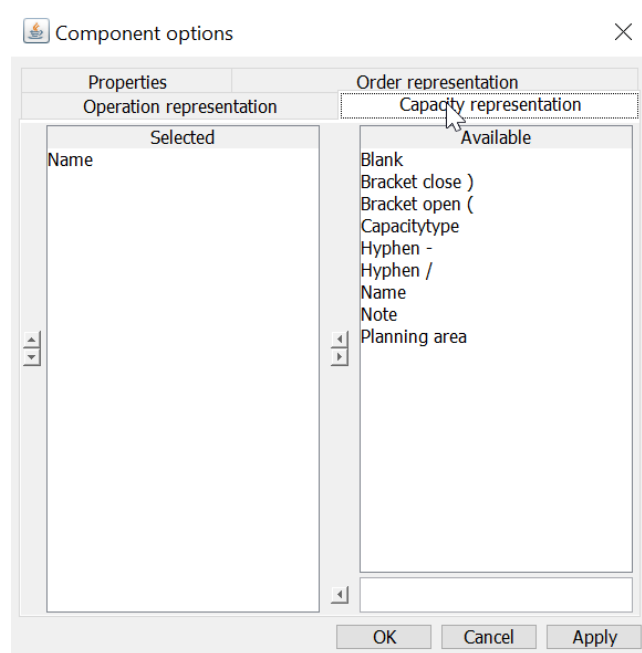
### 6.11.2.3 Operation representation

Use the "Operation representation" tab to configure which attributes of an operation are used for labelling operation objects.




### 6.11.2.4 Capacity representation

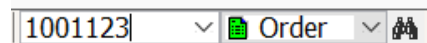
Use the "Capacity representation" tab to configure which attributes of a resource are used for labelling resource objects.



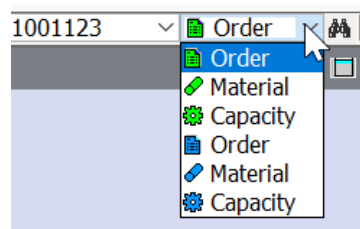
### 6.12 Search


The search component does not have a component window of its own. It does not have any component options, either.

Enter the term you want to find into the first field. This may be an order, material or resource in simulation or not. Search operations are saved and can be repeated using the  button.

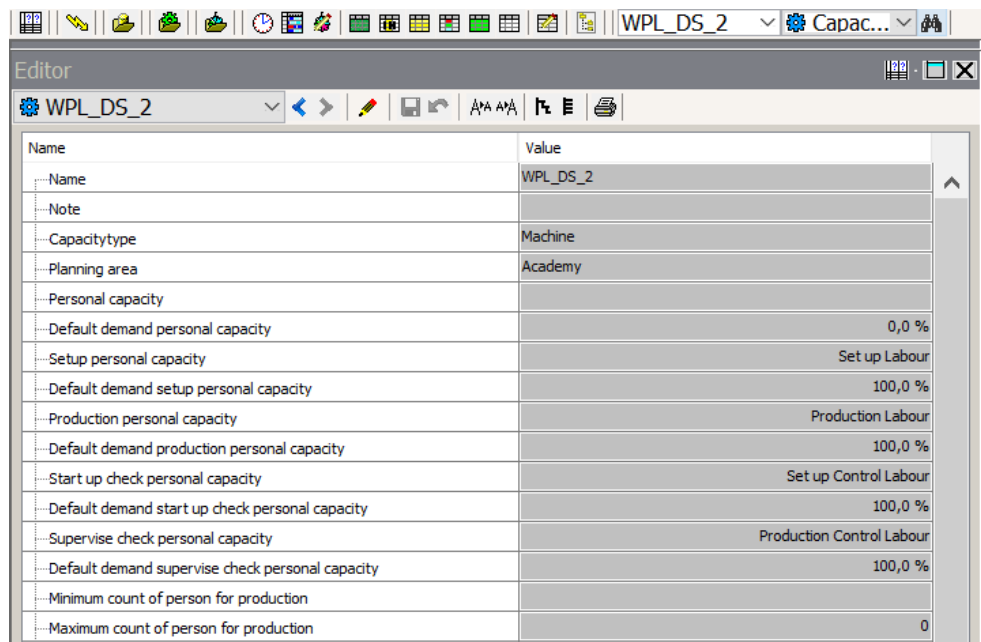


The second field specifies the type for the search.

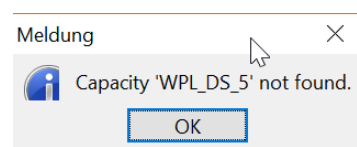


Use the  button to start the search. You may also press the Enter key to start the search after typing the search term.

When a search is completed successfully, the object found is placed into the focus view and appears in all components responding to the focus.



If the search should not find a match, the DOS module outputs a message to this effect.



## 7 Troubleshooting

This chapter describes common issues and difficulties. It provides steps for solutions to such issues.

### 7.1 General

#### 7.1.1 Menu bar disappeared

The menu bar disappears if all commands and components are hidden.

**Solution:**

Load an existing function. This will restore the menu bar.




(For information about loading, refer to chapter 5.2.2 Selecting a function.)


#### 7.1.2 Parameter does not appear in editor

If a parameter of an order or operation does not appear in the editor, it must be activated for editing.

**Solution:**

To display a parameter in the editor, proceed as follows:

1. Open the editor. ()
2. Open the component properties. ()
3. Select the "Order" or "Operation" tab.
4. Find and select the missing parameter in the right-hand column.
5. Click on the small arrow to the left () to move the parameter into the left-hand column.
6. Click "Accept" and then "OK" to confirm. This will update the editor display and show the missing parameter.

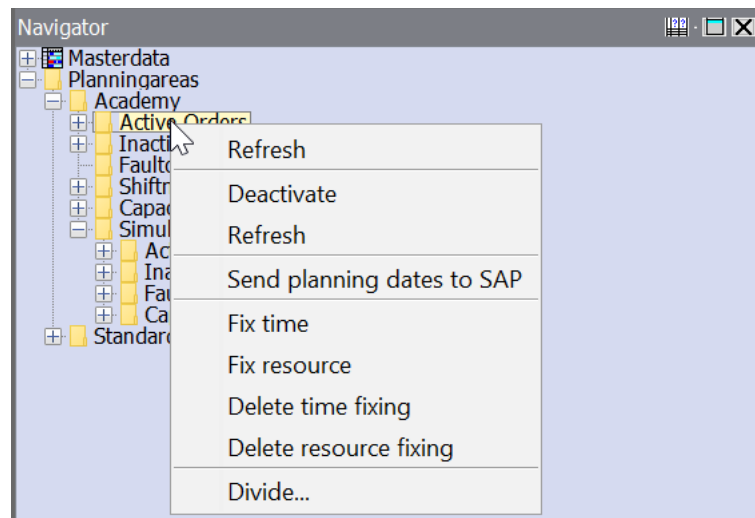
 Proceed inversely to hide a parameter.



#### 7.1.3 Incorrect order data

If any order data should be incorrect in the DOS module, this is due to errors in the database.

**Solution:**

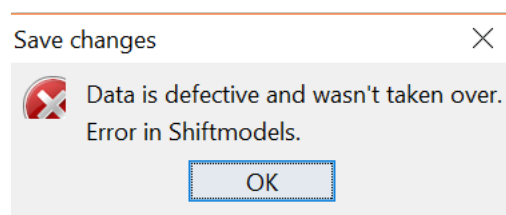
Verify the order data in the order data management module and correct them there as necessary. Subsequently update the order data in the DOS module using the "Refresh" command in the order pop-up menu.



-  Do not use the  (Order import) command. Otherwise all existing order data would be overwritten by the data from the order data management module (see also chapter 5.1.1.1 Commands).

#### 7.1.4 Incorrect shift model data

When assigning a personnel or machine shift model, the following error message may appear:



This error message may have one of the following causes:

- Time frame of short-term work scheduling exceeded:  
For short-term work scheduling, a period of **10 weeks** is provided. This time frame is available for scheduling. If the period is exceeded, the above error message is generated. Everything to be scheduled after this period is configured in the "Shift model" tab of the work time component (see also chapter 6.1 Work time editor).
- No shift model selected:  
If you should forget to select a shift in the "Shift model" tab when configuring long-term scheduling, the data are also incorrect. The error is eliminated by selecting a shift.

#### 7.1.5 Resource not in planning area

Two different situations need to be distinguished:

- The resource has not been imported.
- The resource is located in a different planning area.

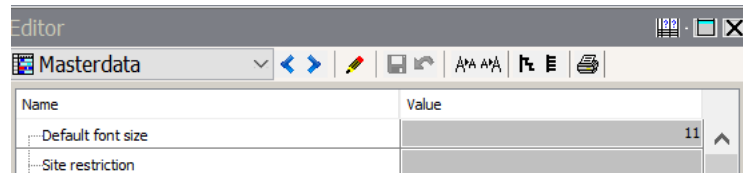


## Troubleshooting

### 7.1.5.1 Resource not imported

Failure to import a resource may be due to filter settings in the master data. Proceed as follows to check this:

1. Open the master data in the editor.
2. Check the "Site restriction" parameter setting. If a restriction is active, only those resources and orders are imported that are related to the selected plant.



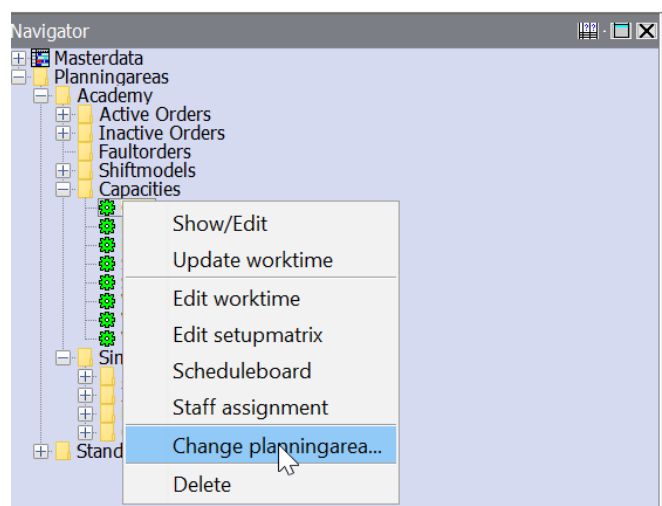
3. Change this restriction in editing mode as necessary and save your changes.
4. Re-import the resources into the DOS module.

**i** When importing resources, all existing work time assignments of the re-imported resources are deleted and need to be reassigned!

### 7.1.5.2 Resource in a different planning area

If a required resource has been placed into a different planning area, proceed as follows:

1. Open the planning area containing the resource in the Navigator and go to the "Resources" folder.
2. Click on the resource and right-click to open the pop-up menu.
3. Select "Change planning area..." and then the appropriate planning area in the next dialog.



4. Confirm by clicking "OK". The resource is now available in the selected planning area in "Resources".

### 7.1.6 Order cockpit comment input


If you type an invalid character when entering a comment, a message appears. Pressing the Enter key for a line break produces an invalid character which is not accepted by the order cockpit. Check your input and use a different character as necessary.

### 7.1.7 Changed settings are not automatically adopted


It may happen that new settings made are not immediately visible in the current view after making the change. This is true, for example, for the presentation of objects in the Navigator.

**Solution:**

Update the view by

- re-entering the data (using drag & drop or the focus view) or
- reducing and re-expanding the menu tree in the Navigator or
- clicking the update button .

### 7.1.8 Order inactive after import along with a red exclamation mark

It may happen after an order import that orders and operations appear with a red exclamation mark () on their icon. These orders are automatically placed into the "Inactive orders" folder since the order/operation data are incomplete or incorrect.


**Solution:**

Find and eliminate the cause triggering this error message. You can find the cause in the operation properties under the "Import status" parameter.

Message	Description
OK	No error occurred during import.
No requirements	No requirements are specified for the operation. Possible cause: Operation split or incorrect master data
No requirements specified in one or more operations	No requirements are specified for one or more operations. Checking the operations and modifying the operation data as necessary may solve the problem.
One or more operations require a resource from a different planning area	The requirements specified are assigned to a different planning area. This error is eliminated by moving the associated resources or moving the order.

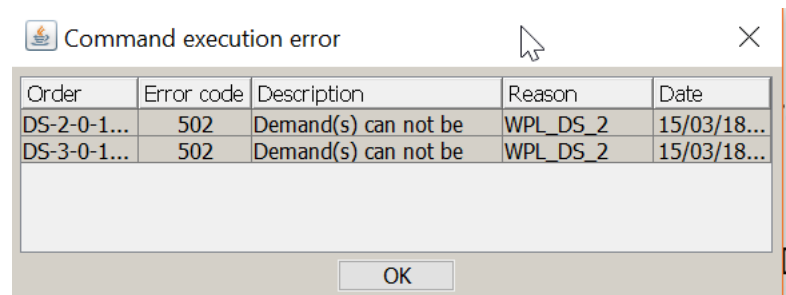
 A separate message informing about any incorrect/incomplete order data is not generated!

## 7.2 Simulation

All operations which produce an error during the simulation are stored in the "Fault orders" folder and can be viewed there. However, this applies to the currently executed simulation only. You can display the error message again during the simulation run by clicking the  button.

### 7.2.1 Requirement(s) cannot be scheduled

The most frequent error message in the simulation area is this one:




It means that the requirements specified for the operation cannot be scheduled with the resources specified.

The relevant order/operation is displayed in the "Order" column. The resource producing this error appears in the "Reason" column.

Reasons are very often due to incorrect master data. This may be:

- The duration (scheduling period) is too large:
  - Incorrect quantity factor in time per unit
  - Incorrect time unit in setup time or time per unit
- Insufficient capacity available for a resource declared as a requirement:
  - Shift model validity must be extended
  - Increase in base capacity


 Whenever this error occurs, all operations following the incorrect one will not be scheduled.

## 7.2.2 No presentation possible

Scheduleboard									
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		12:00 16:00 20:00 00:00 04:00 08:00 12:00 16:00 20:00 00:00 04:00 08:00 12:00							
DS-2-0 / Abdeckung 10x10		No presentation possible!		No presentation possible!		No presentation possible!			
DS-3-0 / Abdeckung 10x10									

If the message "No presentation possible" appears in scheduling, this is due to incomplete master data. Proceed as follows:

1. Check whether you have already defined a planned start and planned end in the master data.
2. Initiate a simulation and accept it. The data are written to the order/operation.
3. The simulation data include planned starts and planned ends. When you re-load the order/operation into the schedule board, the scheduling data generated in the simulation are displayed.

 Writing back changes the start and end dates in the original order/operation!