



# Digital Planning Board

Version 5.12

*Manual*



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# 1 About this document

This document describes the use of the Digital Planning Board app in FORCE MES FLEX (simply referred to as MES FLEX below).

- ① For better readability, we generally use the generic masculine in the text. The phrasing, however, is equally inclusive of all genders and intended to address all persons equally.

## 1.1 Target group

In this manual, we assume that you have knowledge in the use of MES FLEX. If you do not have sufficient knowledge in this area, take the time to familiarize yourself with the basics.

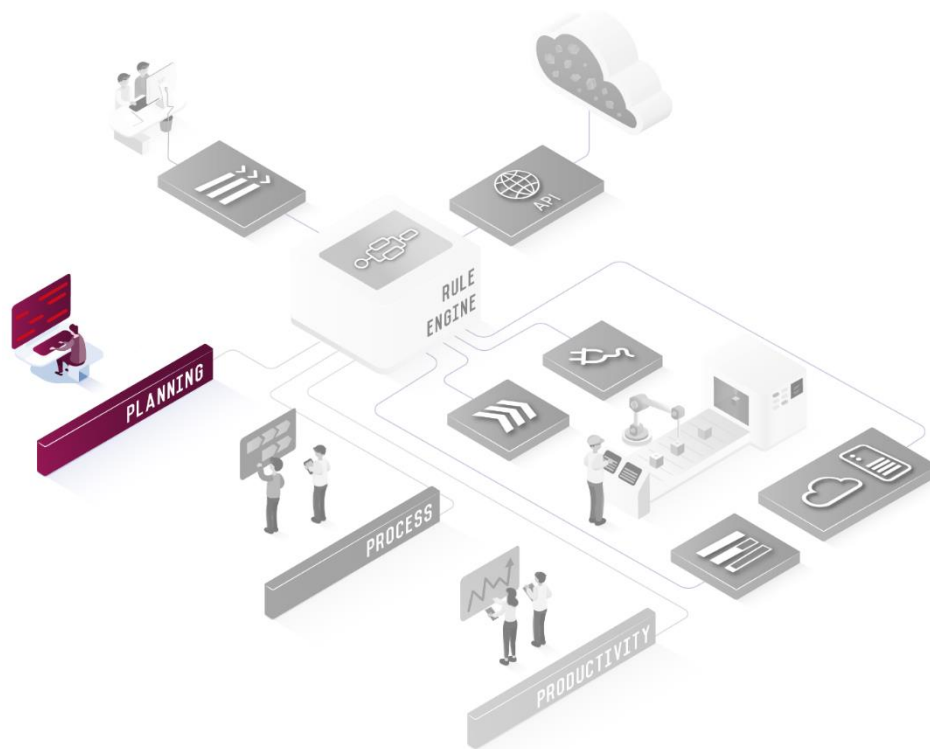
- ① We recommend that you use our Academy: <https://forcam.com/academie/>  
The FORCAM Academy provides the knowledge to effectively use the methods for digital transformation and the technologies for the Smart Factory.  
Based on lean manufacturing and TPM methods, our institute team will guide you to initiate changes in your company and to use the technologies appropriately.

## 2 Concept

### 2.1 General product description

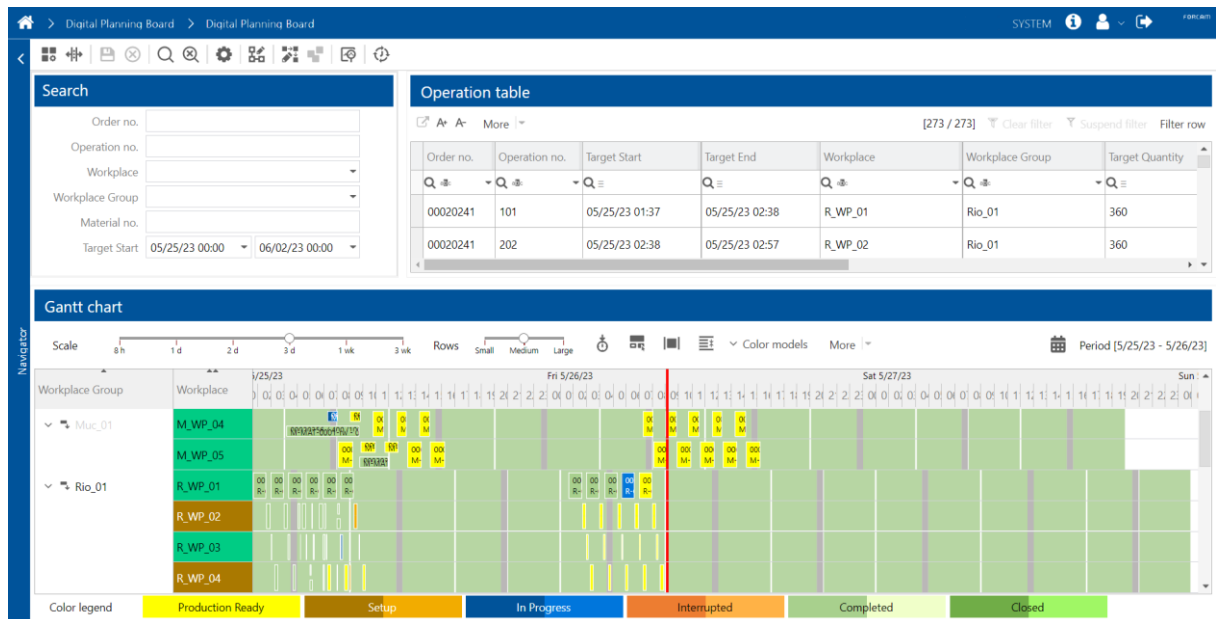
With its planning apps, FORCAM provides functionalities for production planning. These include the Detailed Order Scheduling and the Digital Planning Board. This document describes the handling of the Digital Planning Board app (abbreviated DP).

The Digital Planning Board can be used for detailed planning. However, it is particularly useful for plan adjustments and ad hoc planning on the shop floor. By using live data from the machines and manual workplaces, the Digital Planning Board also serves as a tool for monitoring production progress, thus increasing transparency in production.




**Fig. 1: The place of the planning apps within the FORCAM environment**

The Digital Planning Board is a tool for planning, managing and monitoring operations. The combination of a detailed tabular display and an intuitive Gantt chart provides a clear overview of the operations and also displays data relevant to production (see Fig. 2).



**Fig. 2: Sample screen of the Digital Planning Board**

-  The standard version of FORCE MES FLEX includes operation management (see section 6). To be able to use operation management efficiently, operation search and the operation table are also enabled to a limited extent. The full scope of the Digital Planning Board as described in this manual is only available if the app is acquired in addition.

## 2.2 Use cases

The functions of the Digital Planning Board can be grouped according to three basic use cases:

- **Monitoring:** Live monitoring of all current processes in an overview
- **Detailed scheduling:** Production planning for the next hours or days
- **Dispatching & scheduling:** Ad hoc planning, e.g. to respond to unplanned events

### Monitoring

In monitoring mode, the Digital Planning Board can only be viewed, no planning can be made. Processes and their statuses are visible at a glance and important information can be read directly.

In the operation table, information on operations can be searched for and displayed.

The live status of production and current planning is displayed in the Gantt chart.

The automatic cycle of the monitoring mode presents the status or phase of the operation at a certain point of time and shows when they change. There is no interaction with the operations – such as replanning – in this mode. However, visual adjustments such as changing the color model or resizing the chart are possible at any time.

### Detailed scheduling

Planners can use the Digital Planning Board to carry out detailed scheduling and adjust the entire planning scope as well. They have an overview of a manageable range of time and a certain number of workplaces and can see at a glance the number and relationships of operations. This facilitates efficient and uncomplicated planning.

Feedback loops that influence planning, e.g. through production meetings, can be easily incorporated and planning can be manually adjusted. The Digital Planning Board allows for any spontaneous necessary replanning at any time.

**Dispatching and scheduling**

Production personnel – such as crew leader or shift supervisor – can easily adapt the detailed scheduling to the technical details of the workplace. For example, when ad hoc rescheduling is required due to a machine or material failure, it is not necessary to call in a planner first. The Digital Planning Board thus offers the possibility of coping with failure scenarios directly.

## 3 Structure and basic functions

### 3.1 Components of the Digital Planning Board

The Digital Planning Board is displayed in a customizable dashboard (see section 3.4 “Dashboard”). There are currently four dashboard components – operation search, operation table, Gantt chart and capacity view – that can be shown or hidden and resized individually in height and width.

The operation **Search** filters the operations or workplaces displayed according to specific search parameters to filter out less relevant data. The search range can be configured to show further search parameters or hide existing parameters. For more details, refer to section 3.5 “Operation search”.

The **Operation table** lists the corresponding workplace and order for each operation in tabular form in the default setting and specifies further data such as dates or quantities. It is generally possible to remove or add columns. For this purpose, many additional columns showing appropriate data are available in the configuration menu. For more information and configuration options, refer to section 3.6 “Operation table”.

The **Gantt chart** provides a clear depiction of operations per workplace on a time axis. Here, operations can be moved manually at any time to adjust production planning in a flexible and timely manner. Each operation is displayed as a bar, the color of which changes dynamically according to a configured rule. For example, the color changes when a deadline is missed, or the color saturation increases or decreases depending on progress.

The chart offers numerous options for customization. The Gantt chart and its numerous visualization options are described in detail in section 3.7 “Gantt chart”.

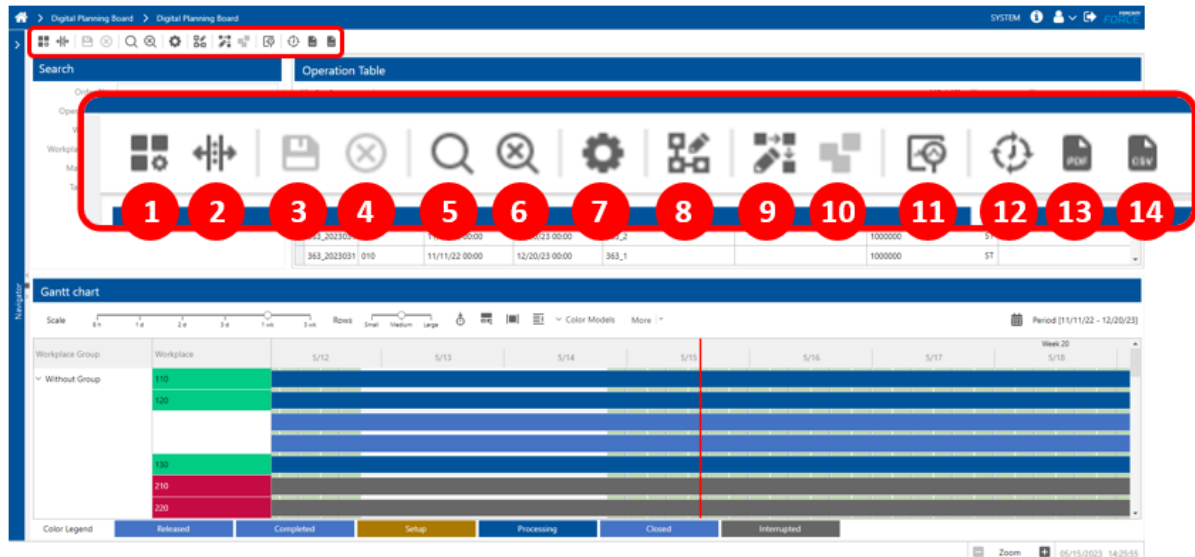
The **Capacity view** is another table that displays information specific to the capacity of a workplace. Production-relevant data such as the number of all operations, capacity workload, production and waiting periods and availability are displayed for each workplace.

Hence, the capacity view contains data from production that is relevant to production planning and significantly supports operation planning. For more information, refer to section 3.8 “Capacity view”.



## 3.2 Function bar

The function bar is always displayed in the DP. The following screenshot shows the complete function bar.

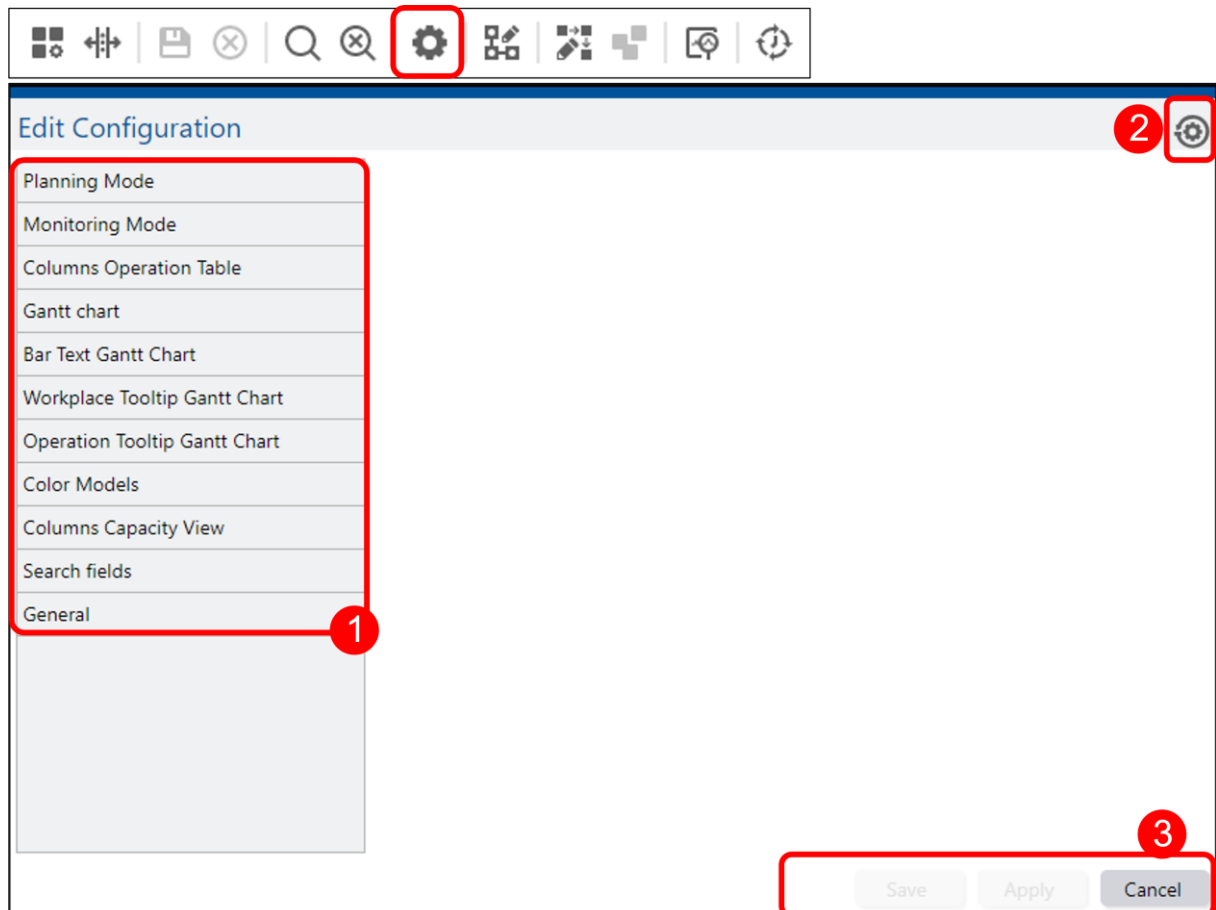


**Fig. 3: Function bar**

- (1) **Edit Dashboard:** Activates the dashboard editing functions
- (2) **Enable / Disable resizing:** Activates or deactivates size adjustment of individual dashboard components, respectively
- (3) **Apply Change:** Saves any changes made in planning mode (see item (9))  
(button is grayed out and inactive if there is no change.)
- (4) **Discard Change:** Cancels any changes made in planning mode (see item (9))  
(button is grayed out and inactive if there is no change.)
- (5) **Search:** Starts the search according to the search filter
- (6) **Reset Search Filter:** Clears the search filter
- (7) **Change Configuration:** Opens the configuration menu
- (8) **Open planning element editor:** Opens the operation block editor
- (9) **Activate / Deactivate Planning Mode:** Activates or deactivates planning mode, respectively
- (10) **Restore ERP value:** Resets the planned values to the ERP values
- (11) **Activate / Deactivate actual data mode:** Activates or deactivates display of live data from production, respectively
- (12) **Activate / Deactivate Monitoring Mode:** Activates or deactivates automatic cyclic update of the information displayed, respectively
- (13) **Export Table and Gantt as PDF:** Exports the current view including the operation table, the Gantt chart currently displayed and the capacity view as an image  
(button appears only when the focus is on the operation table, Gantt chart or capacity view.)
- (14) **Export as CSV:** Exports the operation table or capacity view as a table  
(button appears only when the focus is on the operation table or capacity view.)

### 3.3 Configuration menu

The configuration menu (see Fig. 4) provides a synopsis of most settings of the Digital Planning Board.



**Fig. 4: Configuration menu**

(1) Configuration editing for:

**Table 1: Summary of configuration options**

Content	Description
<b>Planning Mode</b>	Various settings of functions supporting planning, particularly activation/deactivation of functions
<b>Monitoring Mode</b>	Setting the refresh interval in monitoring mode
<b>Columns Operation Table</b>	Specify the table columns to be displayed, including order, column width and alignment of contents
<b>Gantt chart</b>	Setting various visual representation options for the Gantt chart
<b>Bar Text Gantt Chart</b>	Definition of the information to be displayed on the operation bars in the Gantt chart


Content	Description
<b>Workplace Tooltip Gantt Chart</b>	Definition of the information to be displayed in the tooltip for the workplace in the Gantt chart
<b>Operation Tooltip Gantt Chart</b>	Definition of the information to be displayed in the tooltip for the operation bars in the Gantt chart
<b>Color Models</b>	Configuration and creation of color models that can also be used for the operation table
<b>Columns Capacity View</b>	Specify the table columns to be displayed, including order, column width and alignment of contents
<b>Search fields</b>	Specify the table columns to be displayed, including their order
<b>General</b>	Other setting options

(2) **Reset to Default Configuration:** Reset to the configuration as delivered

 It is not possible to undo restoring the default configuration!

(3) If any changes are made to the configuration menu, these are saved or discarded.

- Save: The menu will be closed thereafter.
  - Accept: The menu will remain open.
- If there are no changes, the button is grayed out.
- Cancel: Any changes are discarded and the menu is closed.

 The data are reloaded automatically after any change to the configuration. Dynamic data are recalculated accordingly.

## 3.4 Dashboard

The Dashboard is at the core of the Digital Planning Board.

The user defines which ones of the four components **Search**, **Operation table**, **Gantt chart** and **Capacity view** are displayed in the Dashboard. Their arrangement and size can be customized individually.

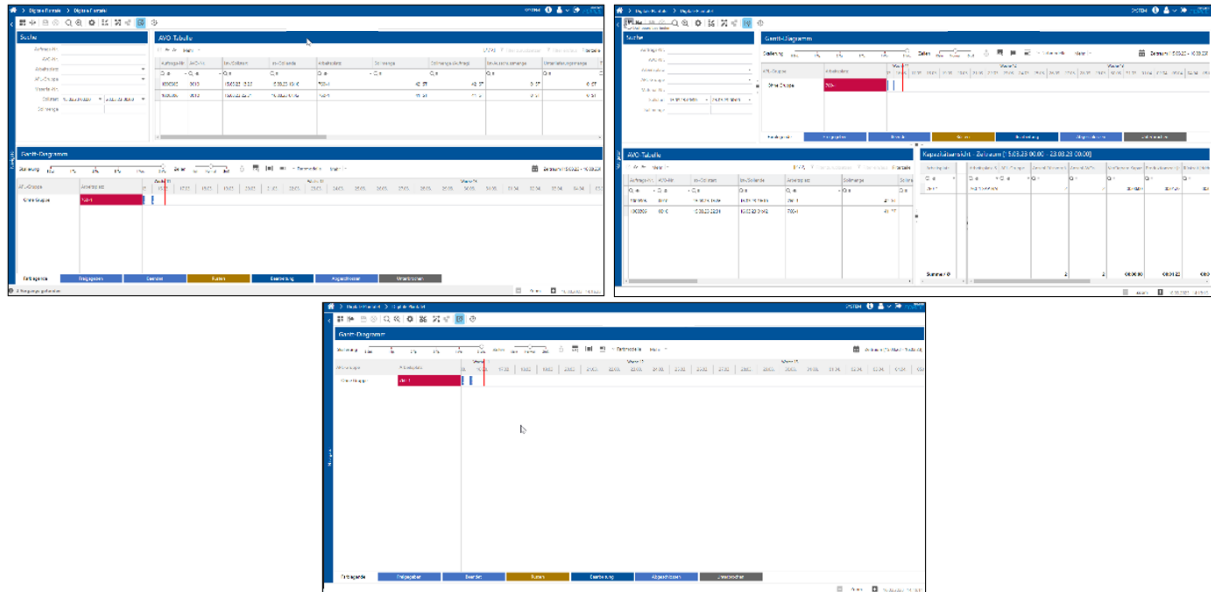


Fig. 5: Example of a Dashboard

## Edit Dashboard

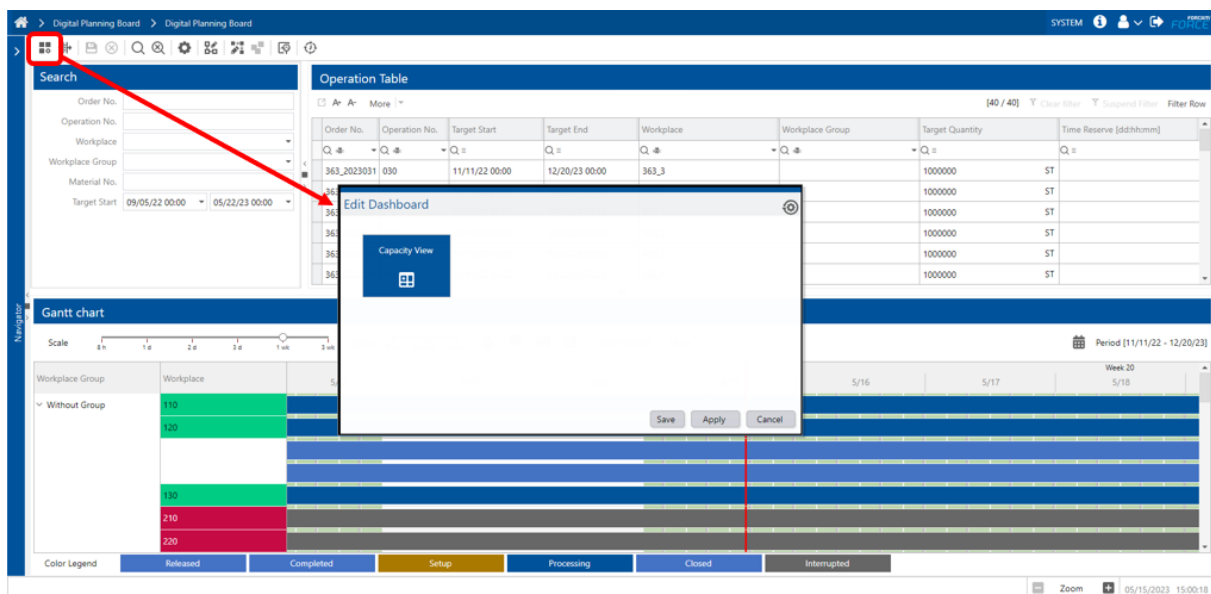


Fig. 6: Edit Dashboard: Dashboard with dialog window


### To edit the Dashboard:

1. Click the **Edit Dashboard** button in the function bar.
2. Use drag-and-drop to move the appropriate component from the dialog window into the Dashboard. Position the component directly to the desired place.

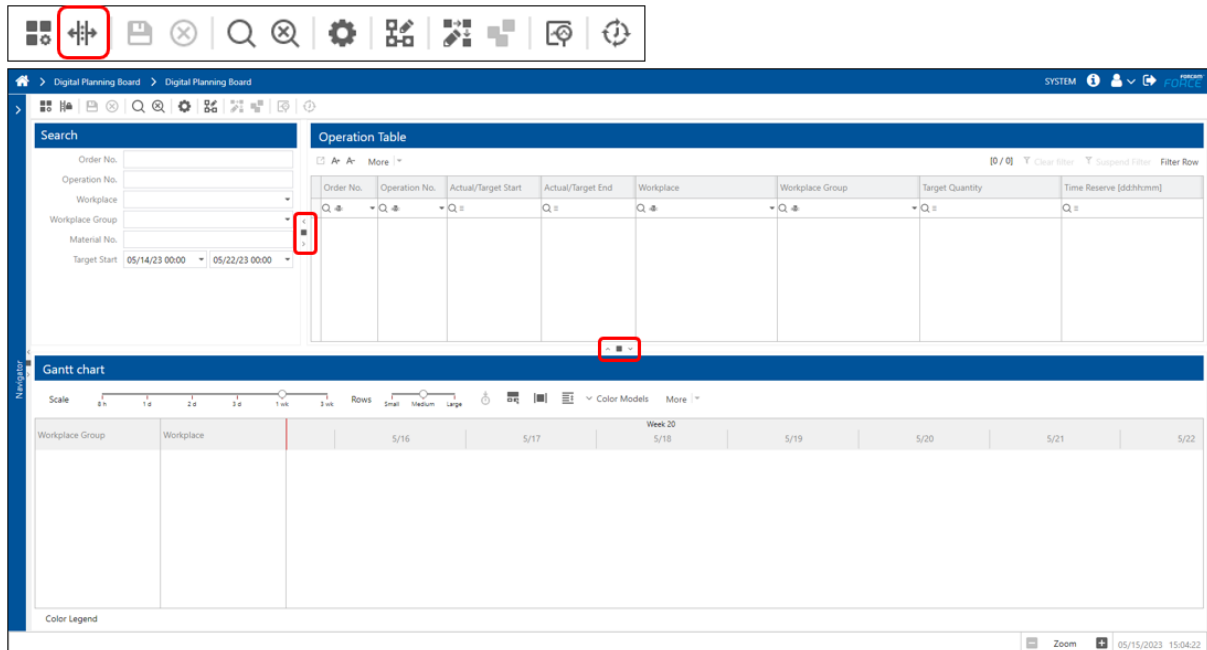
OR:

Use drag-and-drop to move those components which you do not want any more in the Dashboard to the dialog window.

**i** You can change the position of components within the Dashboard by selecting them and using drag-and-drop. The new position is indicated by a red frame.

-  You can move the dialog window so that it is not in the way. If you select a Dashboard component located behind, the dialog window becomes transparent.

## Resizing in the Dashboard



**Fig. 7: Resizing function active**

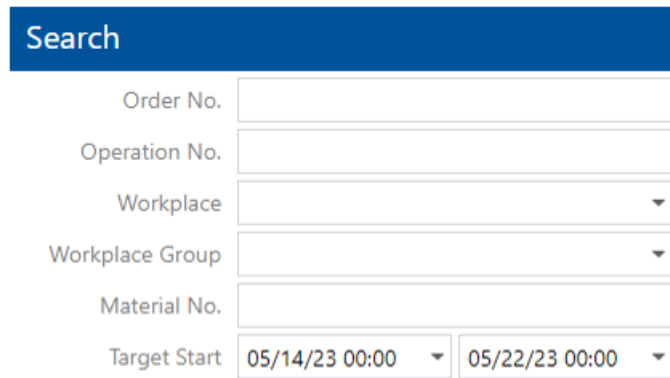
Resizing is activated or deactivated, respectively, by clicking the **Enable / Disable Resizing** button in the function bar. Use the arrow keys to extend a component horizontally or vertically. Clicking on the small rectangle restores the original position. You can change the width / height of the component individually by keeping the mouse key pressed and moving the separation line.

## 3.5 Operation search

The essential component of the Digital Planning Board is the operation search.

A search must be performed to display data in the various components.

The search refers exclusively to operations matching the search criteria specified. In addition to specific operation attributes such as operation number or order number, you can also search by attributes linked to operations, e.g. material text or order attributes.



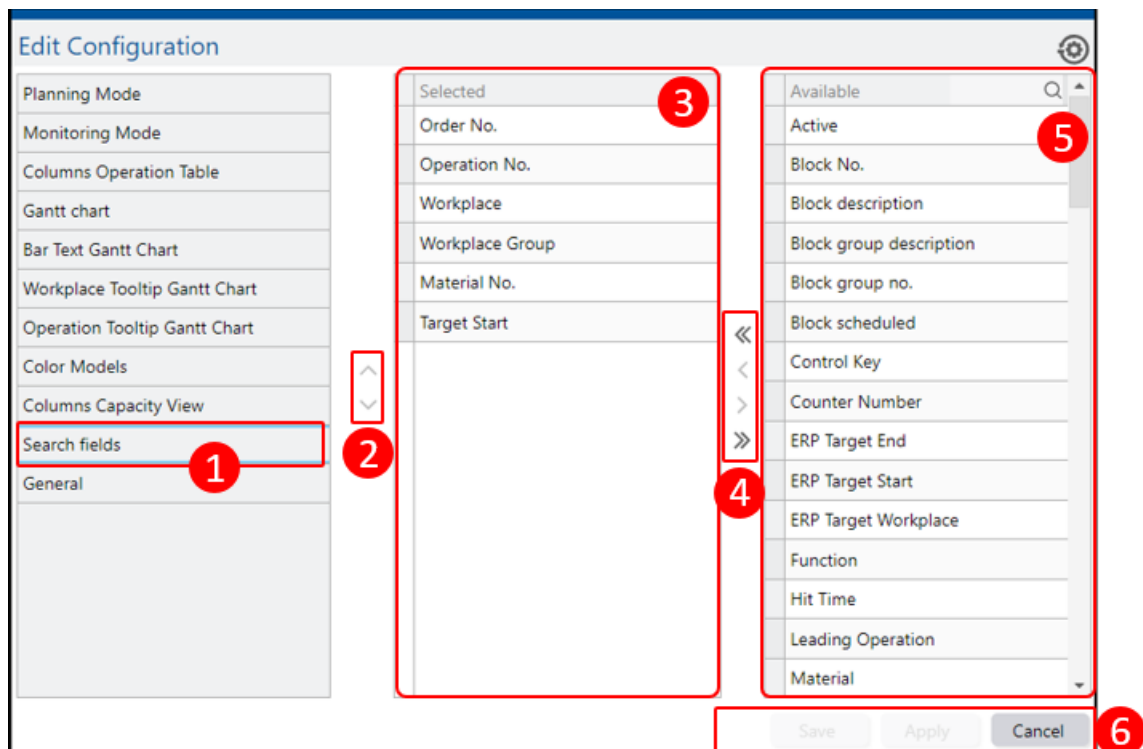
The Search dialog box contains the following fields:

- Order No. (text input)
- Operation No. (text input)
- Workplace (dropdown menu)
- Workplace Group (dropdown menu)
- Material No. (text input)
- Target Start (date range selector with two date inputs: 05/14/23 00:00 and 05/22/23 00:00)

**Fig. 8: Example of an operation search**

### Configuring search fields

Many different order and operation fields are available for an operation search. The search fields are defined in the configuration menu.



**Fig. 9: Configuration of operation search**

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar. On the left in the dialog field, click **Search fields** (1).

#### To configure an operation search:

1. Select the appropriate search criterion in the **Available** area (5).
2. Use the arrow buttons (4) to move your search criteria into the **Selected** area (3).
  - Single arrows: Adopt only selected search criteria.
  - Double arrows: Adopt all existing search criteria.

OR:

Double-click on the appropriate search criterion.

3. Click **Save** or **Apply** (6).

**To change the sequence of search criteria:**

1. Select a search criterion in the **Selected** area (3).
2. Use the arrow buttons (2) to move the search criterion.
3. Click **Save** or **Apply** (6).

**Perform a search**

The operation search function has a simple substring search in most of the fields. A substring search means that the search specified by the user searches for a string. This means, for example, that a search for "1" will find "1" and also "100" or "123456789" – i.e. all values containing at least one "1". Many search fields – e.g. workplace, order number, etc. – allow entering several substring criteria separated by commas. For example, entering "1000, 4700, KT200" in the order number field will search for those operations, the order number of which contains one of the three substrings.


The search fields do not need to be filled in to be able to start a search.


**To execute a search:**

1. Fill in the search fields as necessary.
2. Click the lens button (**Search**) in the function bar.

OR:

Press the Enter key while the cursor is in the operation search area.

 Searching for operations without specifying a search term or with insufficient ones may result in very many operations being loaded. If you do not restrict the time range, operations from the past may also be displayed. This can result in a very long loading time. For this reason, you should choose your search criteria cautiously.

 The search determines which data are displayed in the Digital Planning Board and which operations are considered in planning operations. Hence, the search defines the initial planning range.

## 3.6 Operation table

The operation table shows the results of the operation search.

Many attributes and data can be displayed for each operation. You can define those to be displayed in the configuration menu.

This comprises direct order or operation data ("static" data or attributes) as well as dynamic data from the ongoing production and also calculations based on the present data.

Some of these attributes have a color defined all across the system (e.g. operation phase, status).

The corresponding fields appear in these colors to highlight specific information at a glance.

Order no.	Operation no.	Target Start	Phase code	Status Code	Target End	Workplace	Phase	Workplace Group
00020125	502	16/05/23 05:07	1	1	16/05/23 06:08	R_WP_15	Production Ready	Rio_01
00020138	301	16/05/23 05:11	2	11	16/05/23 05:16	R_WP_03	Completed	Rio_01
00020138	301	16/05/23 05:16	2	11	16/05/23 05:22	R_WP_13	Completed	Rio_01
00020127	200	16/05/23 05:17	1	1	16/05/23 06:24	M_WP_02	Production Ready	Muc_01
00020126	202	16/05/23 05:18	1	1	16/05/23 05:37	R_WP_02	Production Ready	Rio_01
00020128	100	16/05/23 05:21	2	11	16/05/23 07:02	M_WP_01	Completed	Muc_01
00020138	501	16/05/23 05:22	1	1	16/05/23 05:56	R_WP_15	Production Ready	Rio_01
00020126	302	16/05/23 05:37	1	1	16/05/23 05:46	R_WP_03	Production Ready	Rio_01

**Fig. 10: Example of an operation table**

### 3.6.1 Column configuration in the operation table

Many different order and operation fields are available for the operation table. You can select the information on operations displayed in the operation table in the configuration menu.

**Edit Configuration**

Planning Mode

Monitoring Mode

**Columns Operation Table** 1

Gantt chart

Bar Text Gantt Chart

Workplace Tooltip Gantt Chart

Operation Tooltip Gantt Chart

Color Models

Columns Capacity View

Search fields

General

2 3 4 5 6 7

Selected	Width	Alignment
Order No.	90	Left
Operation No.	110	Left
Target Start	150	Left
Target End	150	Left
Workplace	10%;180	Left
Workplace Group	10%;180	Left
Target Quantity	10%;180	Left
Time Reserve	10%;180	Left
Block No.	10%;180	Left
Time per unit	10%;180	Left

Available

Active

Actual End Time

Actual Quantity Pro...

Actual Rework Quan...

Actual Scrap Quantity

Actual Setup Time

Actual Start Time

Actual Training Start

Actual Training Time

Actual Yield Quantity

Actual production ti...

Actual setup start

Alternative Operation

Auto start ID

Block description

Save Apply Cancel

**Fig. 11: Configuration of operation table columns**

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar. On the left in the dialog field, click **Columns Operation Table** (1).

**To configure the operation table:**

1. Select the appropriate columns in the **Available** area (6).
2. Use the arrow buttons (5) to move columns to the **Selected** area (3).
  - Single arrows: Adopt only selected columns.



- Double arrows: Adopt all existing columns.
- OR:
- Double-click on the appropriate columns.
- 3. Click **Save** or **Apply** (7).


**To change the sequence of columns:**

1. Select a column in the **Selected** area (3).
2. Use the arrow buttons (2) to move the column.
3. Click **Save** or **Apply** (7).

You can also configure the width and alignment of the information within the columns in the configuration menu in **Width** and **Alignment** (4).


**Other configuration options****To enlarge the column width only temporarily:**

1. Position the mouse pointer on the separating line of a column.
  - A double arrow appears.
2. Press and hold the left-hand mouse key and move the column size as you need.

 This change is only kept until the next loading process in the Digital Planning Board. For a persistent adjustment of the column width, use the configuration menu.

**To change the sequence of columns temporarily:**

Use drag-and-drop to move the column to the desired position.

 This change is only kept until the next loading process in the Digital Planning Board. For a persistent change of the column sequence, use the configuration menu.

**To change the operation table view:**

Click on **A+** or **A-** in the operation table header to change the font and table size.


**Color model in the table:**

The color model currently used in the Gantt chart is also used in the operation table.

It is possible to fix columns at their place. These columns will always appear on the left in the table and do not disappear when scrolling to the right.

**To fix or release columns:**

1. Use the right-hand mouse key to click into the appropriate column in the operation table.
2. Select **Pin Column**.

 The columns will always appear on the left in the table and do not disappear when scrolling to the right.

OR:

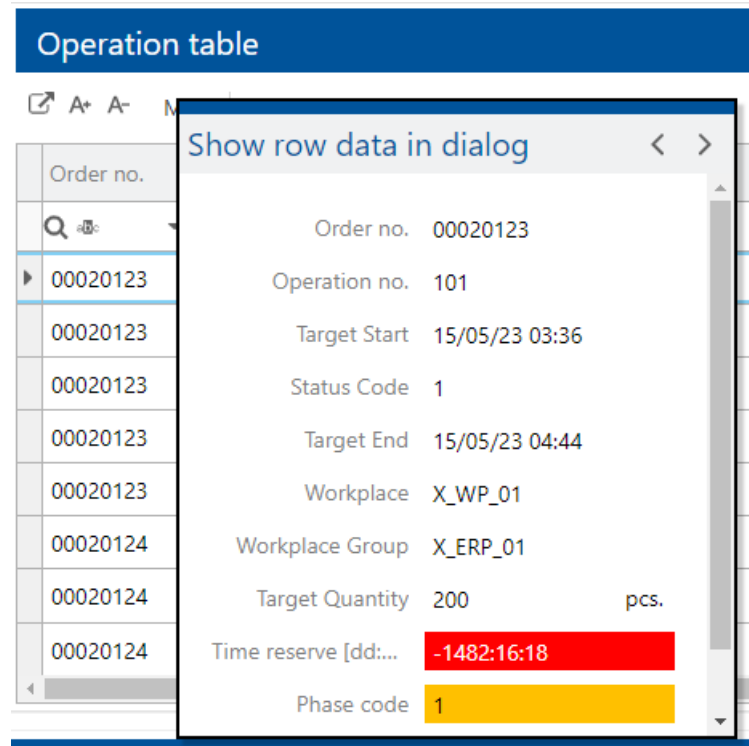
Select **Unpin Column**.

**To show row data in dialog:**

Operations can also be shown in a dialog. To do this, an operation must be selected.

Click the **Show row data in dialog** button (see Fig. 12).

Use the arrows at the top right of the dialog window to move among the lines in the table.



**Fig. 12: Show row data in dialog**

### 3.6.2 Standard filters and sorting functions

The operation table offers several options for further filtering and sorting the data loaded in the table (see Fig. 13 and Fig. 14).

Operation Table						
A+ A- More			[1098 / 1098]		<input type="button" value="Clear filter"/> <input type="button" value="Suspend Filter"/> <input type="button" value="Filter Row"/>	
Order No.	Operation No.	Actual/Target Start	Actual/Target End	Workplace	Workplace Group	Target Quantity
<input type="text" value="Q"/> <input type="button" value="Q"/>	<input type="text" value="Q"/> <input type="button" value="Q"/>	<input type="text" value="Q"/> <input type="button" value="Q"/>	<input type="text" value="Q"/> <input type="button" value="Q"/>	<input type="text" value="Q"/> <input type="button" value="Q"/>	<input type="text" value="Q"/> <input type="button" value="Q"/>	<input type="text" value="Q"/> <input type="button" value="Q"/>
1002325	0010	12/17/21 11:11	12/20/21 15:25	BRAUEN		37.853
1002325	0010	12/20/21 15:34	12/20/21 15:34	BRAUEN		37.853
1002340	0010	12/20/21 15:38	12/20/21 17:06	BRAUEN		14.555
1002340	0010	12/21/21 16:31	12/21/21 16:42	BRAUEN		14.555
1002325	0010	12/21/21 16:42	12/21/21 16:42	BRAUEN		37.853
1002325	0020	12/21/21 16:42	12/21/21 16:59	BRAUEN		37.853
1002325	0030	12/21/21 16:59	12/21/21 17:14	BRAUEN		37.853
1002325	0040	12/21/21 17:14	01/05/22 20:07	BRAUEN		32.673
1002325	0010	01/05/22 20:16	01/05/22 20:20	BRAUEN		37.853
1002323	0010	01/05/22 20:24	01/05/22 20:25	BRAUEN		2.500
1002323	0020	01/05/22 20:28	01/05/22 20:30	BRAUEN		2.500

**Fig. 13: Standard filtering options in the operation table**

The filtering options in the column headers depend on the type of dataset filtered. You can pause each filter by clicking on the lens and reactivate it by clicking again.

In addition, you can reset the filters, enable or disable all filters and show or hide the filter line.

#### To apply a filter:

1. Enter the desired filter in the top line next to the lens of a column.  
**OR:**  
 For columns with quantity specifications, a dialog opens: Enter a quantity as predefined.  
**OR:**  
 For columns with date information, a dialog opens: Enter a date as predefined or select it from the drop-down-menu on the right.
2. You can select additional filter options from the drop-down-menu on the left-hand column edge. In addition to *Equal to*, *Starts with*, etc., regular expressions are also available.

Operation table			
<div> <span>↗</span> <span>A+</span> <span>A-</span> <span>More</span> <span>▼</span> <span>[273 / 273]</span> <span>🔍 Clear filter</span> <span>🔍 S</span> </div>			
Order no.	Operation no.	Actual/Target Start	Actual/Target End
🔍 abc	🔍 abc	🔍	🔍
00020241	701	05/25/23 06:23	05/25/23 07:04
00020257	701	05/25/23 07:08	05/25/23 07:33
00020242	701	05/25/23 07:43	05/25/23 08:24
00020258	701	05/25/23 08:08	05/25/23 08:33
00020243	701	05/25/23 09:03	05/25/23 09:44
00020259	701	05/25/23 09:08	05/25/23 09:33
00020260	701	05/25/23 10:08	05/25/23 10:33
00020244	701	05/25/23 10:23	05/25/23 11:04
00020245	701	05/25/23 11:43	05/25/23 12:24
00020246	701	05/25/23 13:03	05/25/23 13:44

**Fig. 14: Sorting in the operation table**

Alphanumeric sorting or sorting by date based on a table column can be performed by the user by clicking on the respective column name. An arrow indicates the sort direction (ascending or descending). Clicking again changes the sort direction.

Multiple sorting is possible for up to 4 columns.

The sort order is indicated by the number of arrows. One arrow indicates first-order sorting, two arrows indicate second-order sorting, etc.

The direction of the arrows indicates the sort direction (ascending or descending).

**To sort several columns:**

1. Click into the header of the column by which to sort first.
  - a. Click again if necessary, if you want to change the sort direction.
2. Press and hold the control key (Ctrl).
3. Click into the headers of the columns by which to sort next.
  - a. Click again if necessary, if you want to change the sort direction.



Click the columns in the order you want to sort by.

- a. Click again if necessary, if you want to change the sort direction.



The sort order cannot be changed afterwards.  
It must be redefined completely, if necessary.



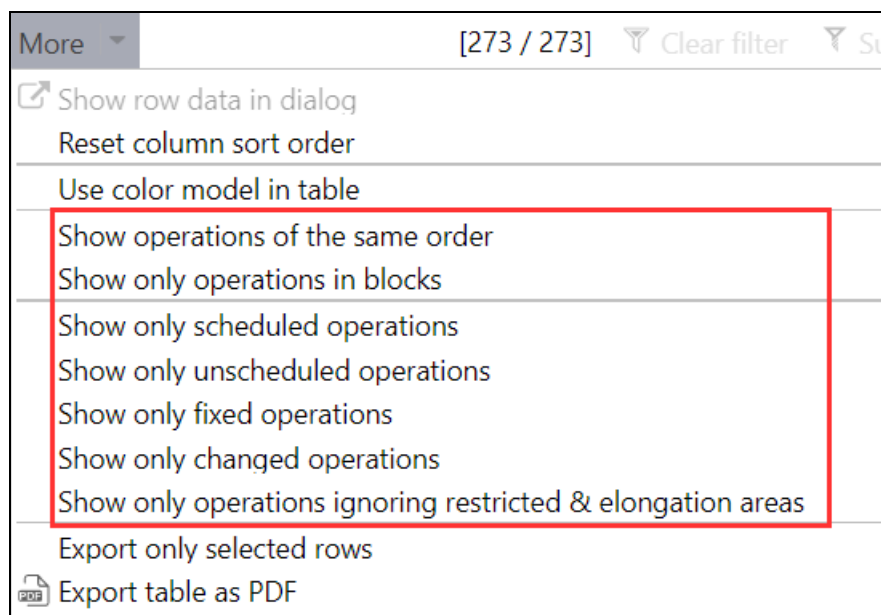
You can change the sort direction afterwards by keeping the control key pressed and clicking into the column header.

**To reset the column sort setting:**

1. Open the **More** menu.
  2. Click on **Reset column sort order**.
- Columns are sorted in ascending order by actual/target start date.

**3.6.3 Technical filters**

The datasets in the operation table can also be filtered according to technical criteria. These technical filters are available via the **More** menu in the table.



**Fig. 15: Operation table technical filters**

- **Show operations of the same order:** An operation must be selected. This filter can be combined with other filters.
- **Show only operations in blocks:** All operations are shown that are included in operation blocks. This filter can be combined with other filters.
- **Show only scheduled operations:** All operations replanned after ERP import or after creation with the Digital Planning Board or Detailed Order Scheduling are displayed. This filter can be combined with these filters: **Show operations of the same order** and **Show only operations in blocks**.

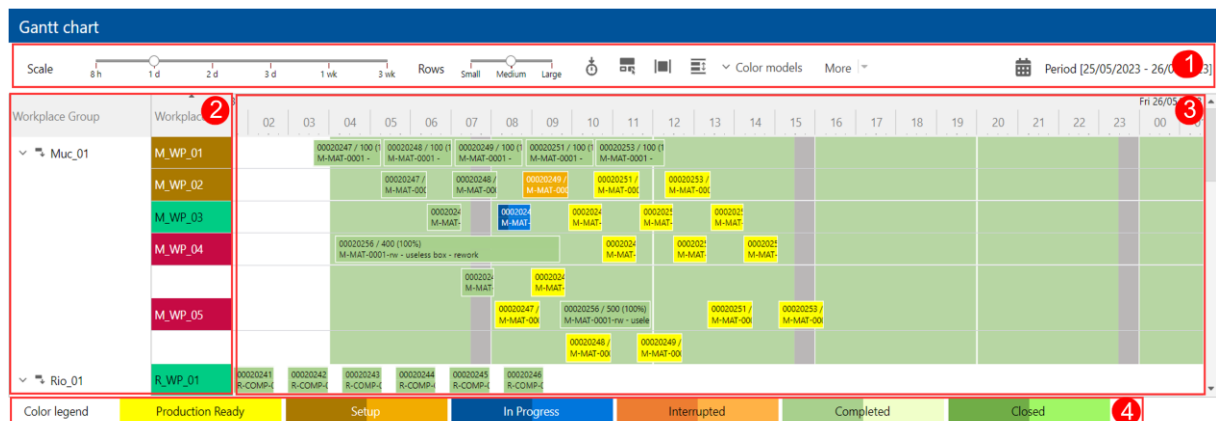
- **Show only unscheduled operations:** All operations not yet replanned after ERP import or after creation with the Digital Planning Board or Detailed Order Scheduling are displayed. This filter can be combined with these filters: **Show operations of the same order** and **Show only operations in blocks**.
- **Show only fixed operations:** All operations that are not available for planning are displayed. This includes the following operations:
  - Operations fixed in the current planning session
  - Operations in these phases: *Processing*, *Setup*, *Closed* or *Completed*
  - Operations with a remaining quantity of 0 or minus
  - Operations that form part of a block not completely loaded

This filter can be combined with these filters: **Show operations of the same order** and **Show only operations in blocks**.

- **Show only changed operations:** All operations planned in the current planning session are displayed. The changes must not have been saved yet. This filter can be combined with these filters: **Show operations of the same order** and **Show only operations in blocks**.
- **Show only operations ignoring restricted & elongation areas:** All operations planned explicitly by the user to shift-free times are displayed. This filter can be combined with these filters: **Show operations of the same order** and **Show only operations in blocks**.

### 3.7 Gantt chart

The essential function of the Gantt chart is to show the chronological sequence of the operations in a graphic format as bars on a time axis. The operations are assigned to the workplaces that appear in accordance with their workplace hierarchy. The background of the Gantt chart shows shift and maintenance information.



**Fig. 16: Elements of the Gantt chart in the Digital Planning Board**

**(1) Function bar of the Gantt chart**

The function bar is arranged at the top of the Gantt chart and offers several interactions to users, e.g. time zoom or selection of information visualized quickly by color coding.

**(2) Workplace display**

The workplace display is arranged on the left of the Gantt chart and shows workplaces and workplace groups. All workplaces which do not belong to a workplace group are summarized in the group called *Without Group*.

An icon indicates in each workplace group whether it is a workplace group with Pull, Auto-

Split or Serial Auto-Split.

Workplace groups and workplaces can be sorted alphanumerically.

The background color of the workplace and a tooltip for the workplace make more information quickly available to the user. The background color and tooltips can be configured.

### (3) Operation display

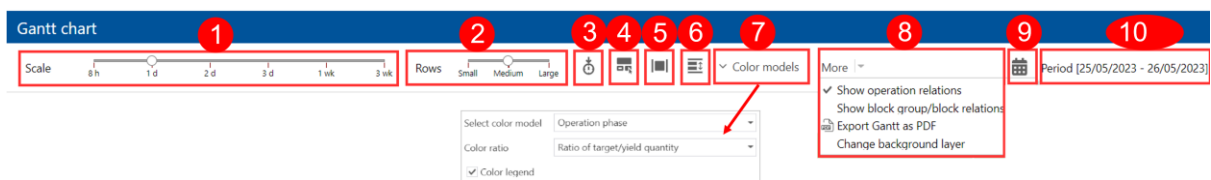
The operation display is the main element in the Gantt chart and shows the allocation of workplaces and workplace groups in the form of bars on a time line. The bars are provided with both labels and tooltips that can be configured (see section 3.7.2). The color of the bars depends on the color model selected (see section 3.9). The length of the bars is defined by their planned processing time. Moreover, the Gantt chart facilitates interactive planning with very simple methods. The planning functions are described in section 5.2.

### (4) Color legend

The color legend explains the colors used for displaying the operations in the Gantt chart.

## 3.7.1 Function bar of the Gantt chart

The function bar of the Gantt chart shown in the following screenshot offers the functions described below.



**Fig. 17: Function bar of the Gantt chart**

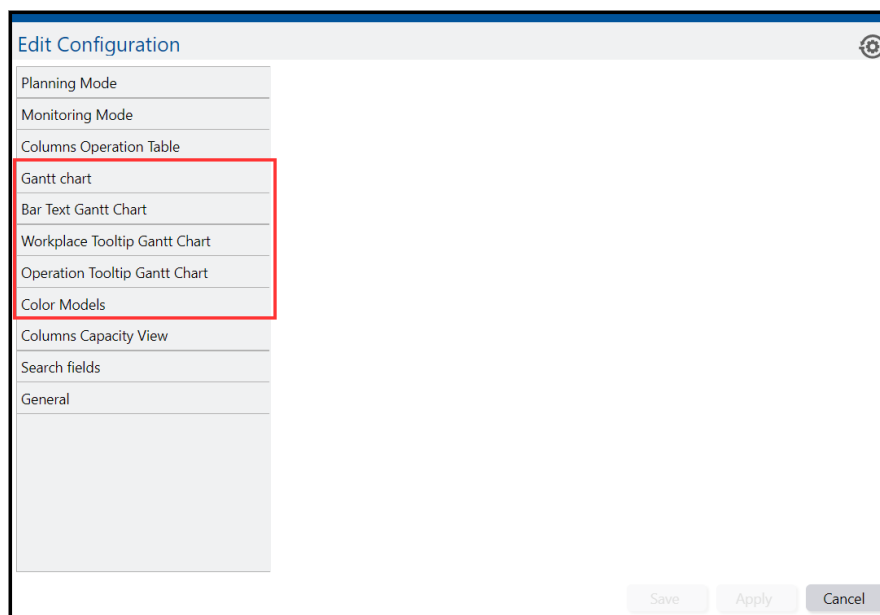
- (1) **Displayed time period on the time axis:** The time scale of the Gantt chart can be set to six fixed levels ranging from 8 hours to 3 weeks.
- (2) **Row height of the time axis:** The height of the operation bars and the workplace rows in the Gantt chart can be set to three fixed heights. In the large setting, the visibility of the bars and their labels is very good but you can show fewer workplaces at a time.
- (3) **Jump to current time:** The user can go quickly back to the current time.
- (4) **Join / Separate operation in table and Gantt chart:** When selecting an operation in the table, joining selects and visualizes the associated operation in the Gantt chart and vice versa.
- (5) **Align start time of the operation to the left / Do not align according to start time:** Works only if joining between table and Gantt chart is active and has the effect that an operation selected in the table is not only selected and becomes visible in the Gantt chart but also aligns the complete Gantt chart to the left at this operation.
- (6) **Expand rows / Merge rows:** This function is only applicable if at least two operations are on one workplace in parallel. In the extended view, the operations appear in separate rows. In the merged view, the operation bars are reduced so that they all fit into one row. If there are multiple parallel operations, the merged view may cause the operations to become so slim that they are not properly visible any more.
- (7) **Color models:** The background color of the operation bars can highlight different information by selecting a color model (see section 3.9).
- (8) **More menu:**
  - **Show operation relations:** Highlights all operations pertaining to an order. The criterion is that they have the same order number. For every selected operation (in operation table or in Gantt chart), all operations pertaining to the same order are highlighted in

the Gantt chart by a color frame. The setting of this function can be adjusted in the configuration menu (see section 3.7.2).

- **Show block group/block relations:** Highlights all operations pertaining to a block or block group (identical block number / block group number). For every selected operation (in operation table or in Gantt chart), all operations pertaining to the same block or block group are highlighted in the Gantt chart by a color frame. The setting of this function can be adjusted in the configuration menu (see section 3.7.2). For more details about operation blocks and operation block groups, refer to section 5.5.
  - **Export Gantt as PDF:** You can export the Gantt chart currently displayed as a 1:1 copy into a PDF file (see section 3.10.1).
  - **Change background layer:** Used for changing between the shift and maintenance background layers in the Gantt chart (see section 3.7.2).
- (9) **Jump to date:** This function can be used to go directly to a specific date within the date scale loaded. This is a convenience function that permits going to the desired date and time without scrolling.
- (10) **Period:** Shows the date / time scale for which data were loaded in the Gantt chart and in the operation table. This depends on the operation search executed and the data available in the system.

### 3.7.2 Configuration of the Gantt chart

The Gantt chart configuration offers numerous options for arranging the information and the way they are displayed according to the user's wishes and requirements.



**Fig. 18: Configuration elements for the Gantt chart**

A detailed summary of the configuration options available for the Gantt chart is provided below in Table 2.

All configuration options are available via the configuration menu (see section 3.3).

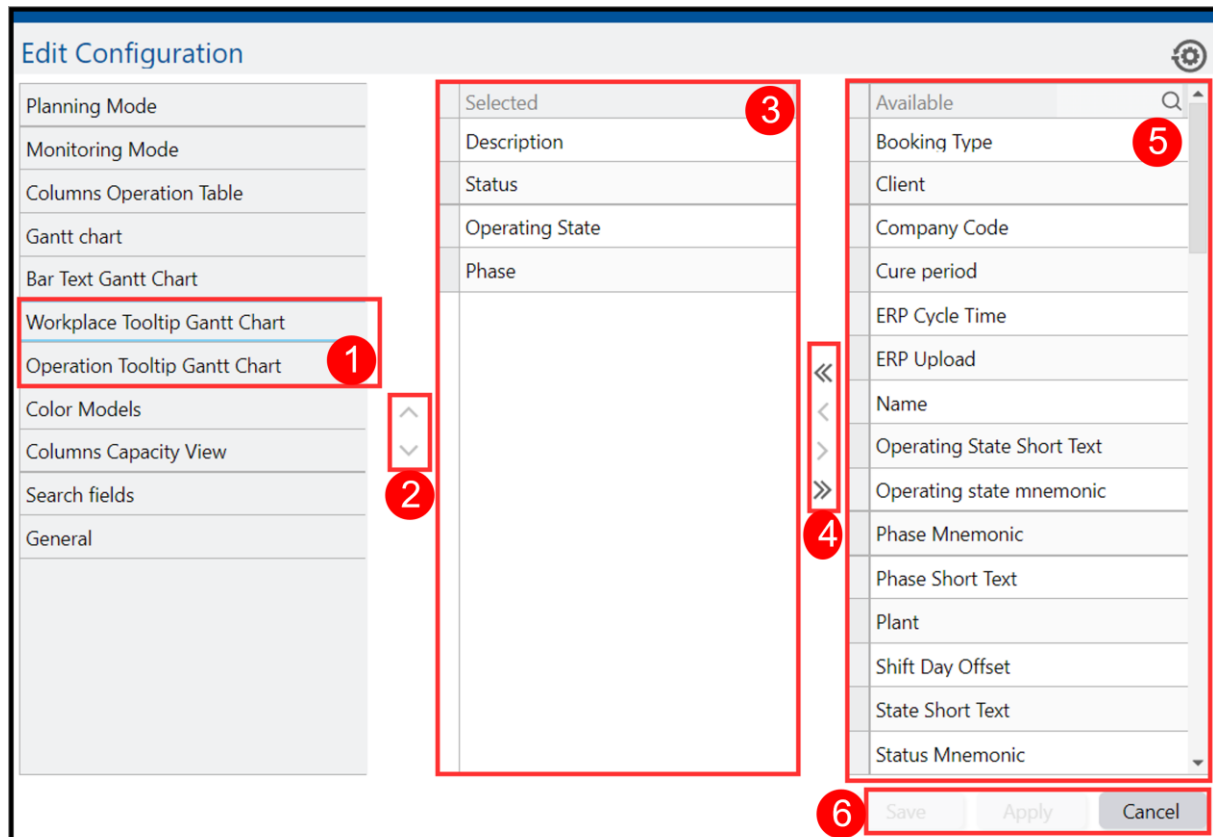
Table 2: Summary of configuration options for the Gantt chart

Summary of configuration options for the Gantt chart		
Gantt chart	Gantt chart	<b>Week Day Format</b>
		<b>Font Size</b> It is recommended to use a standard font size of 10.
		<b>Visible Margin of Rows [px]</b> The distance from the operation bar to the top and bottom row edge. If the distance is small (about 3 pixels), information on shifts and maintenance events is visible behind the operation bars.
		<b>Use status color for workplace column</b> The background of the workplace cell is set to the color of an appropriate workplace attribute (refer to workplace information).
		<b>Color Saturation [%]</b> The color transparency of operation bars. The information behind them is more or less visible. 100%: Operation is not transparent. 0%: Operation is completely transparent.
		<b>Selection Border Thickness</b>
		<b>Selection Border Color</b>
		<b>Additional selection marker</b> The operation bar selected is marked additionally by a large cross.
	Tooltip	<b>Display Tooltip</b>
		<b>Highlight first item</b>
		<b>Height [px]</b> It is recommended to use a height of 300 pixels initially.
		<b>Width [px]</b> It is recommended to use a width of 300 pixels initially.
		<b>Delay [ms]</b> It is recommended to use a setting of 2,000 ms.
	Shift Information	<b>Color Saturation [%]</b>
		<b>Display Shifts</b>
		<b>Shifts color</b>
		<b>Display Shift Breaks</b>
		<b>Shift breaks color</b>
	Maintenance Information	<b>Display Maintenance</b>
		<b>Color for Planned Maintenance Interval</b>
		<b>Color for Unplanned Maintenance Interval</b>
	<b>Operations relations</b> Defines the representation of operations of the same order.	<b>Selection Border Thickness</b>
		<b>Selection Border Color</b>
		<b>Additional selection marker</b>
	<b>Block Group/Block Relations</b> Defines the representation of operations of the same operation block group or the same operation block.	<b>Selection Border Thickness</b>
		<b>Selection Border Color</b>
		<b>Additional selection marker</b>



Summary of configuration options for the Gantt chart		
	<b>Workplace information</b>	Selects the indicator color to be used for a workplace cell. Available options are status, phase or operating state.
<b>Bar Text Gantt Chart</b> Definition of the information to be displayed on the operation bars in the Gantt chart		Different attributes and data are available for display within an operation bar. The individual values can be grouped or separated and distributed to a maximum of two lines as necessary.
<b>Workplace Tooltip Gantt Chart</b> Definition of the information to be displayed in the tooltip for the workplace column in the Gantt chart		
<b>Operation Tooltip Gantt Chart</b> Definition of the information to be displayed in the tooltip for the operation bars in the Gantt chart		
<b>Color Models</b> Configuration and creation of color models that can also be used for the operation table		<b>Default Color Models</b> Only color models defined here are available in the color model selection in the header of the Gantt chart. To enhance the clarity of the arrangement, you can leave only the required color models and remove others.
		<b>Custom Color Models</b>

## Configuring tooltips



**Fig. 19: Configuring tooltips in the Gantt chart**

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar. In the left-hand dialog field, click **Workplace Tooltip Gantt Chart** or **Operation Tooltip Gantt Chart** (1).

### To configure the tooltips:

1. Select the appropriate attribute in the **Available** area (5).
2. Use the arrow buttons (4) to move attributes into the **Selected** area (3).
  - Single arrows: Adopt only selected attributes.
  - Double arrows: Adopt all existing attributes.

OR:


Double-click on the appropriate attribute.

3. Click **Save** or **Apply** (6).

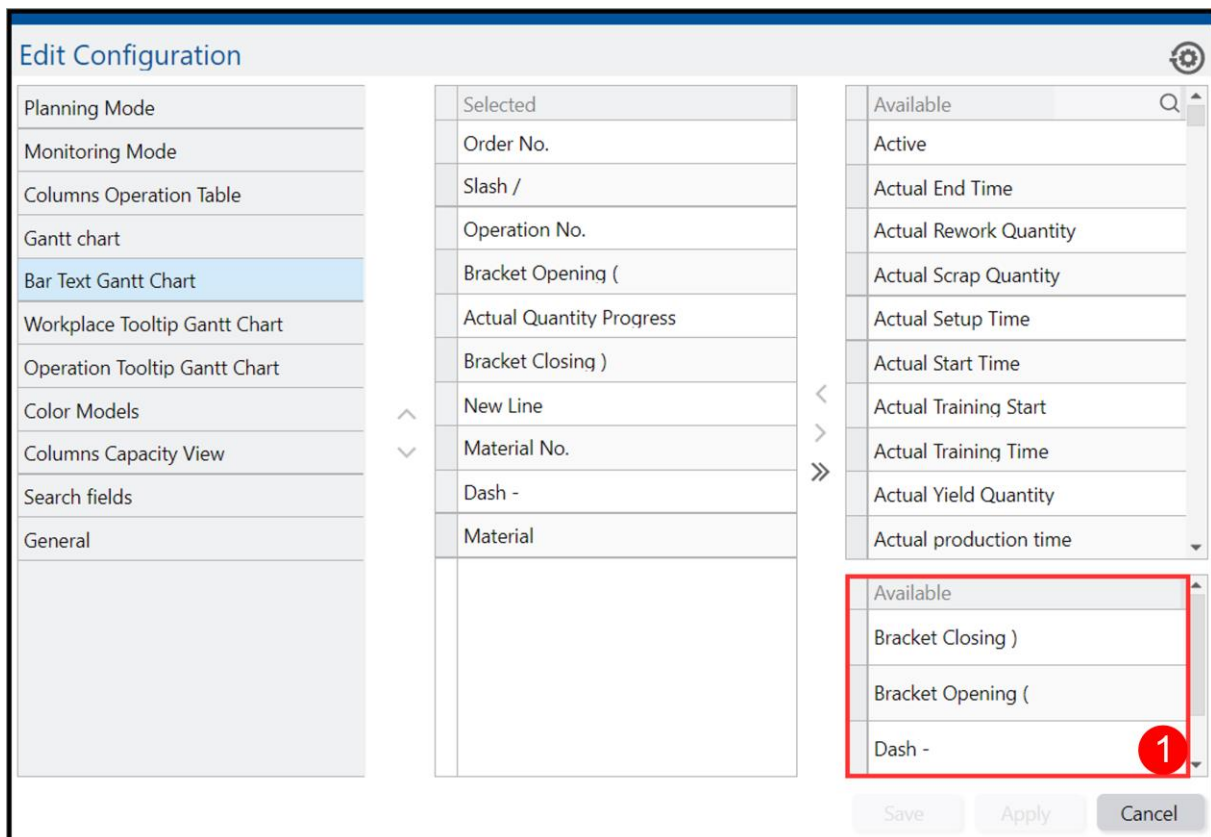
### To change the sequence of attributes:

1. Select an attribute in the **Selected** area (3).
2. Use the arrow buttons (2) to move the attribute.
3. Click **Save** or **Apply** (6).

## Configuring bar text in Gantt chart

 There is a particular characteristic to be noted when configuring the **Gantt chart bar text**. You should make use of the available separators (Fig. 20, (1)) to make a distinct separation between the data displayed.

The data appear as plain text in the operation bar. Without separators, all information will appear as a string without separation.



**Fig. 20: Configuration of Gantt chart bar text**

To configure the bar text, proceed similarly as for tooltip configuration.


- ❗ The **New Line** separator can only be used once, since the Digital Planning Board can only display 2 lines max.

### Shift and maintenance information

- ⚠ Shift and maintenance information is only available for the configured generation range of the system.
- ❗ The information is displayed on 3 levels in the Gantt chart.
  - Level 1: Operation bar
  - Level 2: Shift information
  - Level 3: Maintenance information
 Levels 1 and 2 can be configured with transparency but not level 3.
- ❗ Levels 2 and 3 can be interchanged.
 

**Path:** Function bar of the Gantt chart > **More** menu > Change Background Layer
- ❗ Two shifts on a workplace are delimited by a thin white line. The non-shift and non-maintenance time is always transparent, i.e. the white background is visible.

## Workplace information

 You can link the background color of a workplace to the following workplace properties:

- Operating state
- Phase
- Status

To do this, go to **Gantt chart** and select the **Gantt chart** option. Place a check mark at the **Use status color for workplace column** option.














Subsequently go to **Gantt chart** and select the **Gantt chart** option. Select the appropriate option for the workplace information.

## 3.8 Capacity view

The capacity view shows key figures for workplaces that can be used as indicators for bottleneck workplaces.

Key figures are calculated and displayed about the utilization of individual workplaces and as totals or averages across all workplaces within the selected period.


The operation search defines the selected period for which key figures are calculated. The effective time range is shown in the header of the capacity view.

Capacity View - Period [25/05/2023 00:00 - 02/06/2023 00:00]												
Workplace	Workplace Desc	Workplace Grp	Number of Setup	Number of Opera	Avail Capacity [dc	Production Time [	Setup Time [dd:hh	Processing Time [	Free Capacity [dd	Capacity Rate [%]	Idle Time [dd:hh:zz	
												
M_WP_01	Assemble case	Muc_01	10	10	06:06:00	00:16:40	00:00:10	00:16:50	05:13:10	11.2	00:00:00	
M_WP_02	Integrate motc	Muc_01	10	10	06:06:00	00:11:06	00:00:10	00:11:16	05:18:43	7.5	00:00:00	
M_WP_03	Mount switch	Muc_01	10	10	06:06:00	00:08:20	00:00:03	00:08:23	05:21:36	5.6	00:00:00	
M_WP_04	Solder and adc	Muc_01	11	11	06:06:00	00:13:53	00:00:03	00:13:57	05:16:03	9.3	00:00:00	
M_WP_05	EOL Check	Muc_01	11	11	06:06:00	00:13:20	00:00:05	00:13:25	05:16:34	9.0	00:00:00	
R_WP_01	Provide raw m	Rio_01	11	11	06:06:00	00:11:00	00:00:11	00:11:11	05:18:49	7.5	00:00:00	
R_WP_02	Cutting	Rio_01	15	15	06:06:00	00:03:58	00:00:06	00:04:04	06:01:55	2.7	00:00:00	
R_WP_03	Print	Rio_01	15	15	06:06:00	00:01:59	00:00:02	00:02:01	06:03:58	1.4	00:00:00	
Sum / Ø			237	273	131:21:28	07:22:31	00:04:05	08:02:36	123:18:51	6.1	00:00:00	

**Fig. 21: Capacity view**

The capacity view shows a forward-looking assessment of the future situation and planning. The objective is to assess the plan for the future and derive any necessary planning/rescheduling activities. For this reason, the planned times are always used for calculating the key figures.

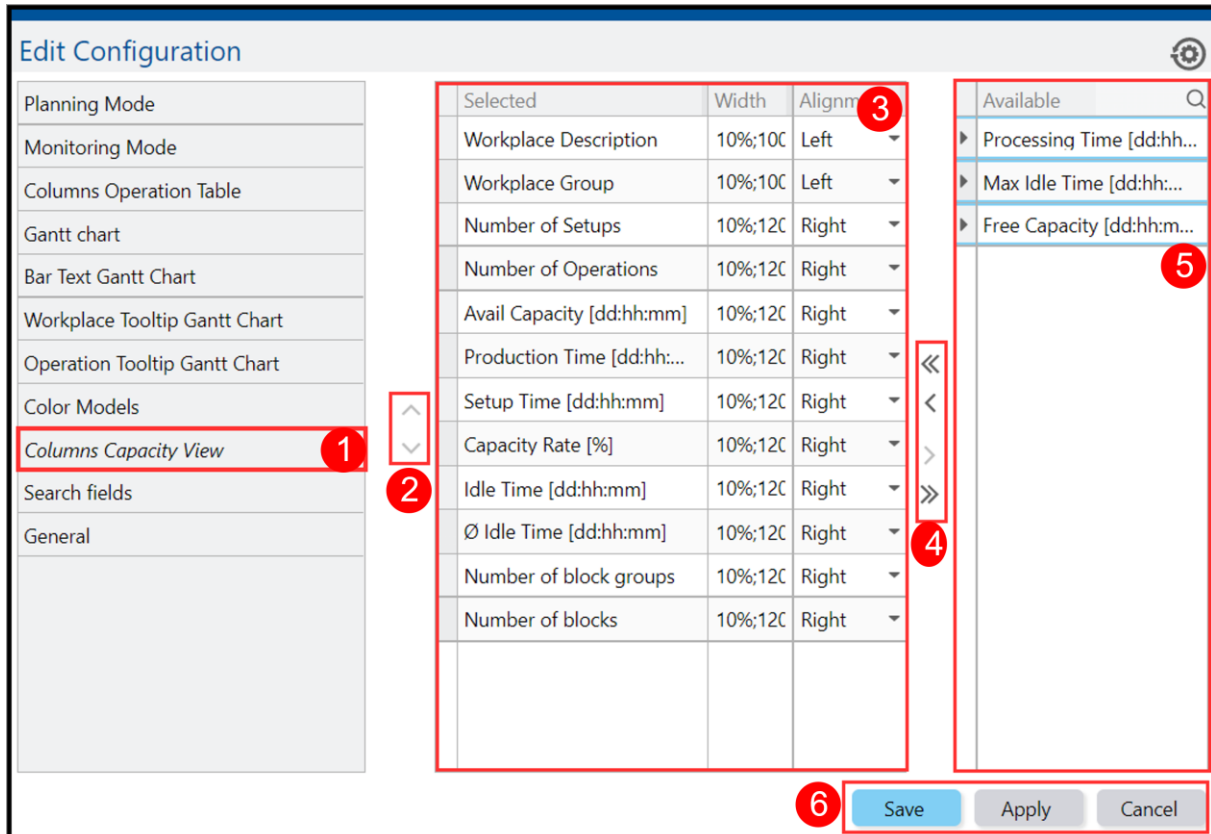
The table columns are defined in the configuration menu (Change Configuration) in the function bar in **Columns Capacity View**. Apart from selecting the columns to be displayed and their order, you can set the width of the columns and the alignment within the columns here.

 The first column, **Workplace**, cannot be changed. It is required to be able to assign the key figures to a workplace.

The capacity view offers the same sorting and filtering functions as the operation table. Up to four columns can be sorted one by one in descending or ascending order. Each table column offers filter options with various operators.

## Configuring the capacity view

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar. On the left in the dialog field, click **Columns Capacity View** (1).



**Fig. 22: Configuration of the capacity view**

### To configure the capacity view:

1. Select the appropriate columns in the **Available** area (5).
2. Use the arrow buttons (4) to move columns to the **Selected** area (3).
  - Single arrows: Adopt only selected columns.
  - Double arrows: Adopt all existing columns.

OR:

Double-click on the appropriate columns.

3. Click **Save** or **Apply** (6).

### To change the sequence of columns:

1. Select a column in the **Selected** area (3).
2. Use the arrow buttons (2) to move the column.
3. Click **Save** or **Apply** (6).

The available columns of the capacity view are described in Table 3.

**Table 3: Columns available in the capacity view**

Column name	Description	Calculation type
Workplace	-	None
Workplace Description	-	None
Workplace Group	-	None
Number of Operations	-	Sum
Number of Setups	-	Sum
Number of blocks	-	Sum
Number of block groups	-	Sum
Production Time	Sums of planned production times, target quantity x piece times	Sum
Setup Time	Sums of planned setup times	Sum
Processing Time	Sum of production time and setup time	Sum
Avail Capacity	Sums of available work time of workplace - available shift time minus shift breaks and maintenance	Sum
Free Capacity	Difference between available capacity and processing time	Sum
Capacity Rate	Ratio between processing time and available capacity as a percentage Note: May be >100%, e.g. in case of production during breaks	Weighted average <sup>1</sup>
Idle Time [dd:hh:mm]	Difference between target start and earliest target start Note: Can only be calculated if "earliest target start" exists for operations; operations without "earliest target start" are not considered.	Sum
Ø Idle Time [dd:hh:mm]	Average idle time of all operations Note: Can only be calculated if "earliest target start" exists for operations; operations without "earliest target start" are not considered. Additionally: The workplace with the longest average idle time is identified as a "bottleneck" and the corresponding cell is highlighted in color.	Mean (arithmetic mean)
Max Idle Time [dd:hh:mm]	Longest waiting time of an operation Note: Can only be calculated if "earliest target start" exists for operations; operations without "earliest target start" are not considered.	Mean (arithmetic mean)

<sup>1</sup> Determined as follows:

$$Sum = \Sigma Values$$

$$Weighted\ average = \frac{\Sigma\ numeratur}{\Sigma\ denominator}$$

$$Average = \frac{1}{n} \times \Sigma Values$$

- ⚠ All calculations are based on the selected and loaded period. Parts beyond this period are not considered.
- ⚠ As a result of the particular characteristics of operation blocks and operation block groups (see section 5.5), especially for parallel operations, special rules apply.
- Only one operation is considered for calculating the production, setup and processing time figures as well as free capacity and capacity rate.
  - If these operations have different processing times, the operation with the longest duration will be considered.
  - For parallel operation blocks, only the operation with the earliest target start time is considered.

### 3.9 Color models

Color models are useful to obtain a clear arrangement and see different states, aspects and operating conditions at a glance. This is particularly helpful in case of large data volumes. Color models are used to color operations in the operation bar and (if active) in the operation table rows according to different criteria.

A color model is selected in the Gantt chart (see Fig. 23). Direct color model selection permits changing it quickly. This makes it possible to quickly focus on different aspects in the display.

You can choose the color models to be available also for direct selection in the Gantt chart in the configuration menu with the color model option.

The color is always applied to the background of an operation bar or a row in the operation table. Text and numbers are displayed in either black or white, as appropriate, to ensure optimum legibility.



**Fig. 23: Selection area for color models and color legend in the Gantt chart**

Two categories of color models are available for selection:

- Select color model** to color operation bars completely. The color is defined on the basis of attributes or criteria such as phase, state, etc. in the configuration menu.
- Color ratio** to color operation bars based on a percentage, e.g. ratio of target quantity to yield quantity.

The color legend of the color model selected is shown below the Gantt chart in a horizontal bar (see Fig. 23). You can enable or disable it in the function bar of the Gantt chart with the color models option.

Color models can also be displayed in the operation table. You can enable this function in the **More** menu of the operation table by **Use color model in table**.

All color models are configured in the configuration menu of the Digital Planning Board.

The choice of color models directly available in the Gantt chart is determined from the complete set of all predefined color models available and the user-defined color models.



### 3.9.1 Default color models

Identifier	Value
▼ Color Models	
▼ Default color models	(12) List Elements
1 ▼ Default	Default
Color for Match	#4472C4
2 ▼ Block groups/blocks	Block group:
Color for no match	#4472C4
3 Operating State	Operating St
4 Operation Phase	Operation Pl
5 ▼ Past Operation	Past Operati
Color for Match	#525252
Color for no match	#4472C4
6 ▼ Short-Term Start Operations	Short-Term :
Timeframe to [dd:hh:mm]	01:00:00
Color for Match	#ed7d31
Color for no match	#4472C4
7 ▼ Medium-term Operations	Medium-ten
Timeframe from [dd:hh:mm]	01:00:00
Timeframe to [dd:hh:mm]	05:00:00
Color for Match	#bf9000
Color for no match	#4472C4
8 ▼ Operation Planning Status	Operation Pl
Color for Match	#008000
Color for no match	#4472C4
9 Ratio of Target/Yield Quantity	Ratio of Targ
10 Ratio of Target/Real Setup Time	Ratio of Targ
11 Ratio of Target Quantity/Unqualified Quantity	Ratio of Targ
12 ▼ Operation on Schedule	Operation oi
Difference to ERP Target end ± [dd:hh:mm]	00:00:00
Color for Match	#008000
Color for no match	#FF0000
Custom Color Models	(0) List Elements

Save Apply Cancel

**Fig. 24: Configuration of default color models**

- (1) **Default:** Uniform representation in a configurable standard color
- (2) **Block groups/blocks:** Operation block groups and operation blocks are automatically shown in a certain color.
- (3) **Operating State:** Colors operations according to the current operation status (*Not assigned, Production, Waiting for Processing, Setup, Completed, Closed, Maintenance interrupted, Waiting for maintenance, Maintenance, Planned break, Stoppage*). The colors correspond to the definitions in the master data.

- (4) **Operation Phase:** Colors operations according to the current operation phase (*Released, Setup, Processing, Closed, Interrupted, Completed*). The colors correspond to the definitions in the master data.
- (5) **Past Operation:** Colors operations, the target start date of which is in the past. You can customize the colors for matches (i.e. past ones) and mismatches.
- (6) **Short-Term Start Operations:** Colors operations within a period ranging from now to a certain point of time in the future. All operations with a target start date within this period are colored accordingly. You can customize the period and colors for matches and mismatches.
- (7) **Medium-Term Operations:** Colors operations within a specified period (from – to) in the future. You can customize the period and colors for matches and mismatches.
- (8) **Operation Planning Status:** Colors operations according to their planning status. New operations planned will be colored accordingly. You can customize the colors for matches (here: planned) and mismatches (here: unplanned).
- (9) **Ratio of Target/Yield Quantity:** Colors operations according to the ratio of target quantity to qualified yield quantity.
- (10) **Ratio of Target/Real Setup Time:** Colors operations according to the ratio of target setup time to actually booked setup time.
- (11) **Ratio of Target Quantity/Unqualified Quantity:** Colors operations according to the ratio of target quantity to unqualified actual quantity.
- (12) **Operation on Schedule:** Colors operations closed in due time. The comparison is based on the planned end / ERP target end (target completion date & time) of the operation. In addition, it is possible to configure a time buffer and specify a positive value to provide an additional time reserve (before ERP target end) or a negative value to specify an admissible delay (after ERP target end). You can customize the colors for matches and mismatches.

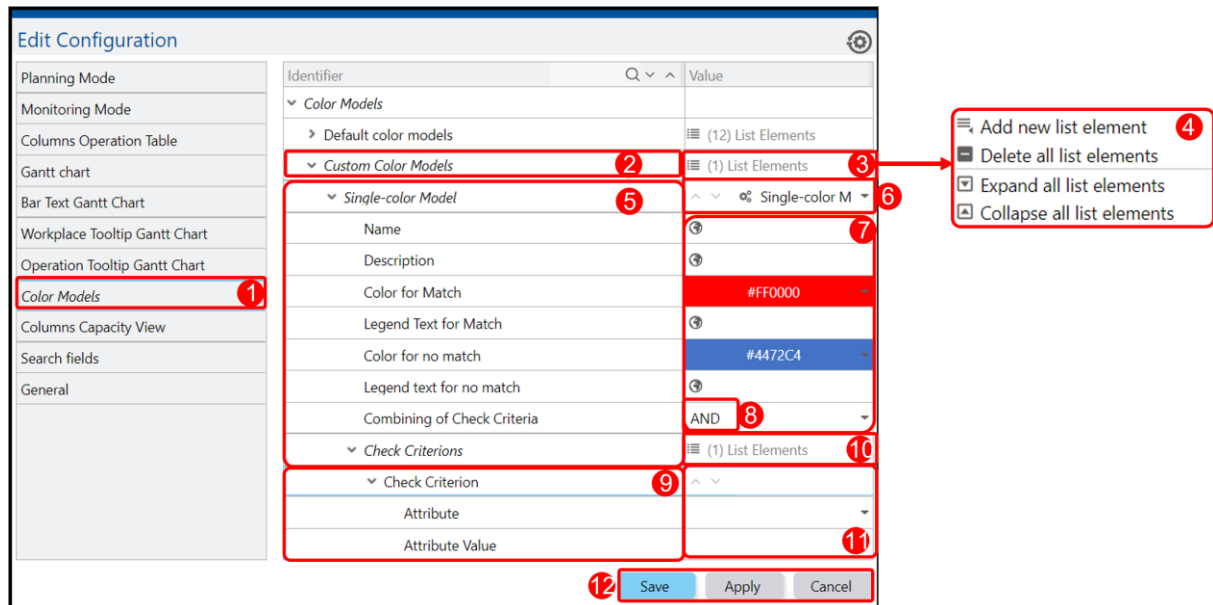
### 3.9.2 Custom color models

You can also create your individual color models.

For this purpose, operation attributes with an expected attribute value are assigned to a color model. You can then use a search function to identify those operations that include the attribute value; these are then colored accordingly.

- **Single-color Model:** To color all matching operations in a certain color. The operation attributes defined are subject to an AND or OR operation.  
AND operation: All attributes defined must match the expected attribute value.  
OR operation: At least one attribute must match.
- **Multi-color Model:** Each attribute is assigned an individual color. If an operation includes several of the attributes found, the color of the first match is used (OR operation). This makes it possible to show matches with different colors by a single-color model.

## Create a single-color model



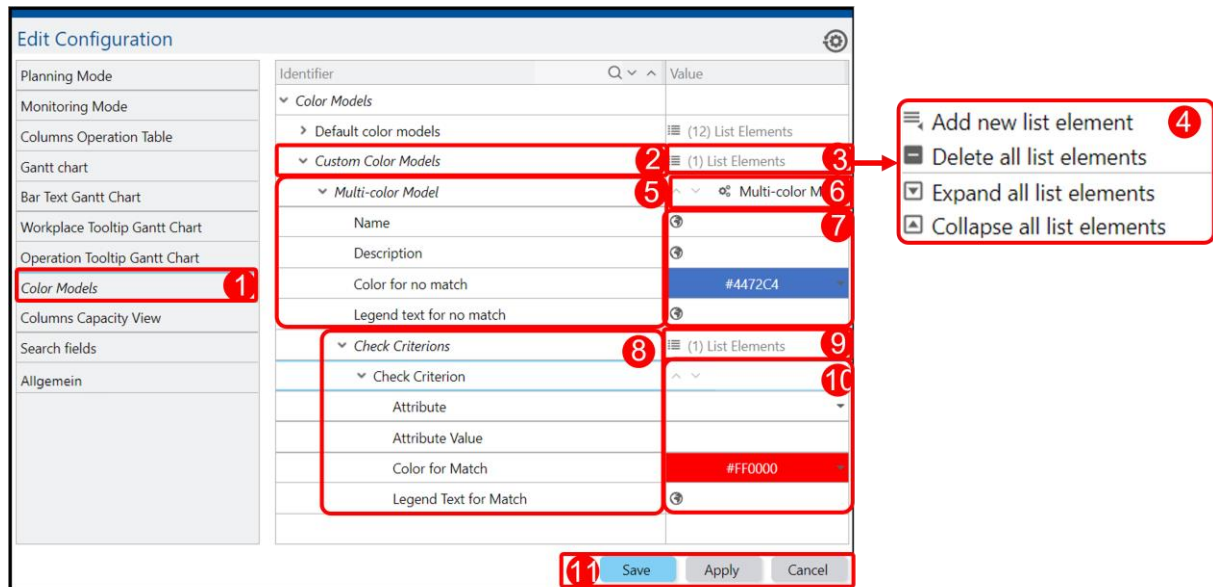
**Fig. 25: Creating a single-color model**

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar. On the left in the dialog field, click **Color Models** (1).

### To create a new single-color model:

1. Hold the mouse pointer on the **List Elements** area (3) and click the right-hand mouse key.
  - ➔ A new dialog window opens.
2. Click **Add new list element** in the dialog window (4).
3. Open the list below **Custom Color Models** (2).
4. Select **Single-color Model** in the display area (6).
5. Open the list below **Single-color Model** (5).
6. Enter the name, a description and legend entries and select the colors.
  - ❗ Double-click on the globe icon to open a menu in which you can enter the designations in the corresponding line for all system languages.
7. Select an **operation for the check criteria** (8).
  - AND: All attributes defined must match the expected attribute value.
  - OR: At least one attribute must match.
8. To add check criteria, hold the mouse pointer on the **List Elements** area (10) and click the right-hand mouse key. Select **Add new list element** in the dialog window.
9. Open the **Check Criterion** list (9).
10. Select an **Attribute** from the drop-down menu (11) and enter an attribute value.
11. Click **Save** or **Apply** (12).

## Create a multi-color model



**Fig. 26: Creating a multi-color model**

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar. On the left in the dialog field, click **Color Models** (1).

### To create a new multi-color model:

1. Hold the mouse pointer on the **List Elements** area (3) and click the right-hand mouse key.
  - ➔ A new dialog window opens.
2. Click **Add new list element** in the dialog window (4).
3. Open the list below **Custom Color Models** (2).
4. Select **Multi-color Model** in the display area (6).
5. Open the list below **Multi-color Model** (5).
6. In the display area (7), enter the name, a description and a legend entry and select a color.
  - ❗ Double-click on the globe icon to open a menu in which you can enter the designations in the corresponding line for all system languages.
7. Open the **Check Criterion** list (8).
  - ❗ One check criterion is already defined.
    - a. To add check criteria, hold the mouse pointer on the **List Elements** area (9) and click the right-hand mouse key. Select **Add new list element** in the dialog window.
8. Select an **Attribute** from the drop-down menu (10), enter an attribute value and a legend entry and select a color.
9. Click **Save** or **Apply** (11).

## 3.10 Other basic functions

### 3.10.1 Export functions

#### — PDF export in the function bar

This button appears only if either operation table, Gantt chart or capacity view are active. For the operation table and the Gantt chart, the information displayed in the operation table and Gantt chart are exported together. For the capacity view, only this will be exported.

- **CSV export in the function bar**

This button appears only if either operation table or capacity view are active. For the operation table, the complete operation table will be exported. For the capacity view, only this will be exported.

- **PDF export in the operation table**


**Path:** **More** menu of operation table > Export table as PDF


This will only export the operation table.

- **PDF export in the Gantt chart**

**Path:** **More** menu of Gantt chart > Export Gantt as PDF

This will only export the part of the Gantt chart that is currently visible to the user.

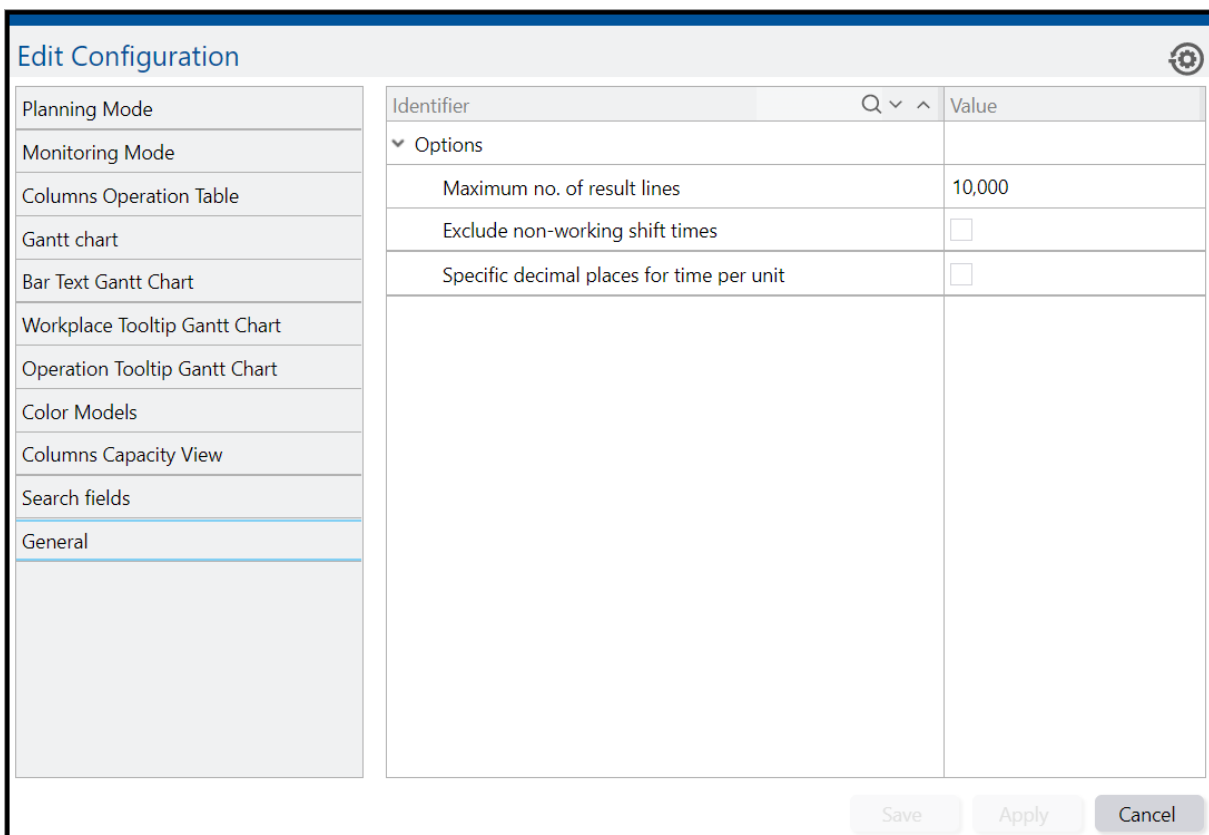
 Every operation table export process considers the currently active filters, i.e. both the standard filters and the technical filters.

 When exporting from the operation table, you can **Export only selected rows**.

To do this, the function **Export only selected rows** must be active in the **More** menu and one or more rows must be selected.

### 3.10.2 General settings

You can use the **General** option in the configuration menu of the Digital Planning Board to make general settings for the Digital Planning Board.



The screenshot shows the 'Edit Configuration' dialog box with the 'General' tab selected. The left sidebar lists various configuration categories, and the main area displays a table of settings.

Identifier	Value
Options	
Maximum no. of result lines	10,000
Exclude non-working shift times	<input type="checkbox"/>
Specific decimal places for time per unit	<input type="checkbox"/>

At the bottom of the dialog are buttons for 'Save', 'Apply', and 'Cancel'.

**Fig. 27: General configuration**


**Maximum no. of result lines** defines how many matches are displayed as a maximum in an operation search. This is useful to avoid long loading times by stopping the search after reaching the maximum number of matches.

You should select **Specific decimal places for time per unit** if you want to display no more than two decimal places for the piece time in the operation table, tooltips, etc. regardless of the overall system configuration.

### 3.10.3 User-specific configuration

Most configurations and settings of the Digital Planning Board view are saved on a user-specific basis.

- **Configuration menu:** All values and settings
- **Operation search:** All search fields  
(except target start and end as well as ERP target start and end)
- **Operation table**
  - Setting for **Use color model in table**
  - Setting for **Export only selected rows**
- **Gantt chart**
  - Setting for **Scale**
  - Setting for **Rows**
  - Setting for **Join / Separate operation in table and Gantt chart**
  - Setting for **Align start time of the operation to the left / Do not align according to start time**
  - Flag for **Expand rows / Merge rows**
  - All color model settings
  - Setting for **Show operation relations**

 The **Reset to Default Configuration** button in the configuration menu can be used to cancel all user-specific settings irrevocably.

## 4 Monitoring functions

### 4.1 Monitoring mode

Data and information are normally updated when executing the operation search.  
However, in monitoring mode you can also run a cyclic update of the order and status data.


Data are reloaded at regular intervals as long as monitoring mode is active.

#### To activate monitoring mode:

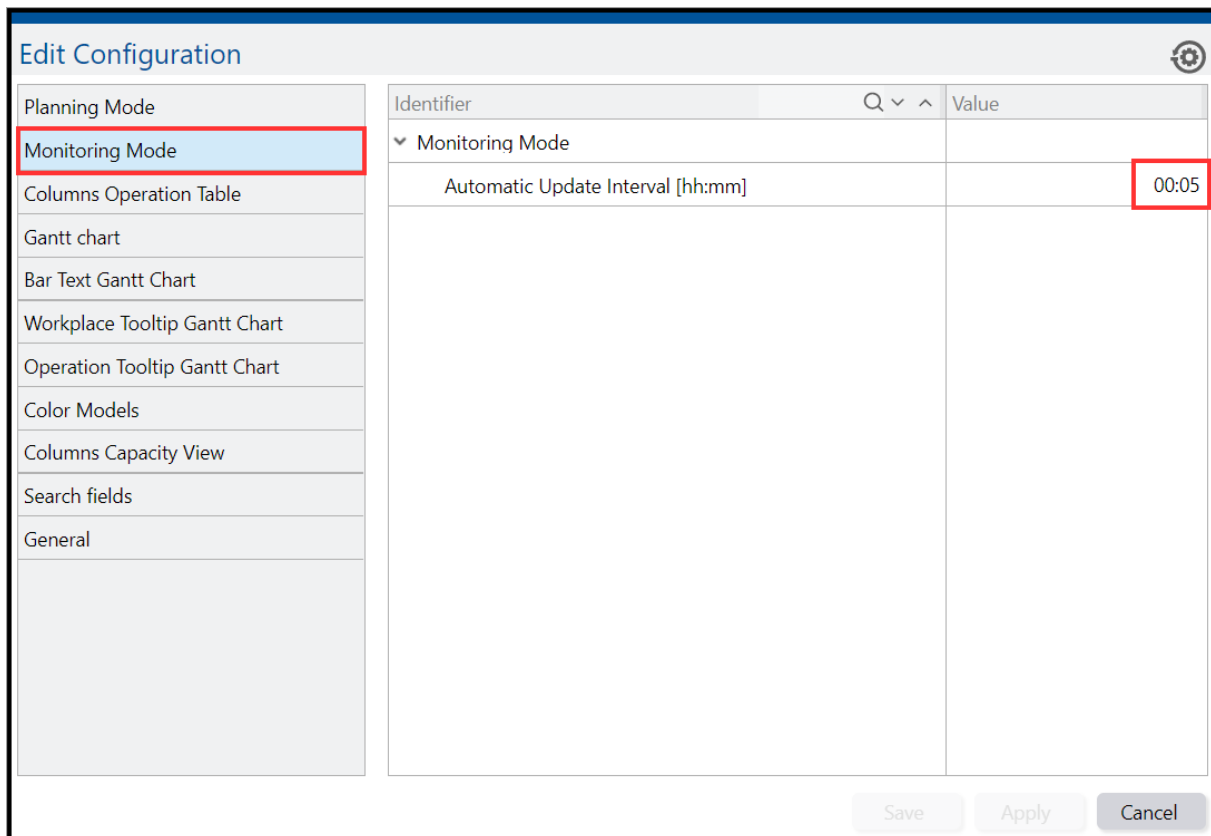
- ✓ You have successfully loaded data using the operation search function.
- 1. In the function menu, click the **Activate Monitoring Mode** icon.
- The icon has a blue background.

#### To change the update interval in monitoring mode:

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar.  
On the left in the dialog field, click **Monitoring Mode** (1). Now you can set an update interval on the right. Click **Save** or **Apply**:

 The update interval may be from 2 minutes to 168 hours.






Identifier	Value
Monitoring Mode	
Automatic Update Interval [hh:mm]	00:05

**Fig. 28: Configuration of the update interval for monitoring mode**

In monitoring mode, information about the workplaces and orders/operations are shown in a Gantt chart, in tabular format or as key figures.

 You cannot use monitoring mode and planning mode at the same time, since manual planning requires a constant image without data changing dynamically.

## 4.2 Actual data mode

In order to support users in monitoring, it is important that they are continuously informed about any current changes and see a chronological structure which reflects the reality of operations in production. For this reason, operations can be represented in one of two ways:

- **Show operations according to their plan data**  
Operations are shown in the operation table and Gantt chart based on their target start and target end. An operation is shown on the basis of its plan data even if it has already been closed or started.
- **Show operations according to their actual data**  
With actual data mode active, the start and end times are calculated and shown on the basis of the values actually registered in production. Interrupted operations are shown with their corresponding parts.

The start and end times displayed for operations with actual data mode active depend primarily on the operation status.



- i** Interrupted operations are shown in the Digital Planning Board with their real time sections / parts. This means that every part is visualized with its first and last reporting time and appears with a separate entry in the operation table and a separate bar in the Gantt chart.

The following rules apply to the table below:

- Now = Current time
- Remaining time = *Remaining setup time* + (*Remaining quantity* × *Planned time per unit*)
- Remaining setup time = *Target setup time* – *Actual setup time*  
Special case: If Actual setup time > Target setup time, 0 is assumed (unpredictable).
- Remaining quantity = *Target quantity* – *Actual quantity*  
You can define the quantities to be used for calculation in the configuration menu, see section 5.4.3.  
Special case: If Actual quantity > Target quantity, 0 is assumed (overproduction).

**Table 4: Calculating start and end times for planning in actual data mode**

Phase (code)	Start time	End time
<b>Closed (7) &amp; Completed (90)</b>	First reporting time (setup or production)	Last reporting time
<b>Released (45)</b>	Planned start	Planned end
<b>Setup (48)</b>	First reporting time (setup or production) If operation was interrupted, the reporting time of its last part.	If operation was already in production: <i>Now</i> + ( <i>Remaining quantity</i> × <i>Planned time per unit</i> )  Otherwise: <i>Now</i> + <i>Remaining time</i>
<b>Production (50) &amp; Training</b>	First reporting time (setup or production) If operation was interrupted, the reporting time of its last part.	<i>Now</i> + ( <i>Remaining quantity</i> × <i>Planned time per unit</i> )
<b>Interrupted (89)</b>	As described above. The following applies to the last part:  If replanned: New planned start  Otherwise: First reporting time of last part.	As described above. The following applies to the last part:  If Start time > Now: New planned end  Otherwise: Same as in setup phase

In order to be able to place the actual data into the focus in actual data mode, an extension of the fields is activated in the operation table. Target start and target end become **Actual/Target Start** and **Actual/Target End** and contain the following data under these circumstances:

- Operation (part) not started: Target data
- Operation (part) started: Actual start and calculated actual end
- Operation (part) closed: Actual data

**Original Target Start** and **Original Target End** with information on target start and end are additional fields in actual data mode.

**To activate actual data mode:**

- ✓ You have successfully loaded data using the operation search function.
- 1. In the function menu, click the **Activate actual data mode** icon.
- The icon has a blue background.



**Fig. 29: Icon for actual data mode in the function bar**


## 5 Planning mode


### 5.1 Basics

The Digital Planning Board has been designed to carry out manual planning tasks. The result of manual planning activities are modified planned data, target start data as well as changes to the workplaces of operations. This can be achieved by various interventions in the Gantt chart and operation table. Other functions support planners in implementing more realistic planning.

As a prerequisite for any manual planning activity, planning mode must be activated. Only in planning mode you can perform planning activities, i.e. move operations with respect to time and resources and recalculate their durations.


Planning is only possible for currently loaded operations, and these are available for most of the planning support functions.

 Manual planning on operations loaded may have an impact on subsequent operations that are not loaded. In planning mode, the user can extend the initially loaded time range selected for the operation search both towards the future and the past, if necessary. Extending the period loaded is achieved by scrolling in the Gantt chart.

 Manual replanning is only possible for operations in the future. Planning activities are not possible for operations in the past.

An operation displayed in the Digital Planning Board is usually configured in an ERP system and contains all the necessary data to be able to display it in the Digital Planning Board and use it for planning. In order to display an operation in the Digital Planning Board, it needs a planned/target start and a planned/target end as well as a workplace or a workplace group. These data provide the basis for incorporating the operation into the operation table and Gantt chart.

The Digital Planning Board does not perform any logical testing or automated planning with the data input. They are displayed as they are. An operation is only validated and recalculated by manual planning performed by the user; among other things, the duration of the operation is calculated on the basis of its setup and processing time.

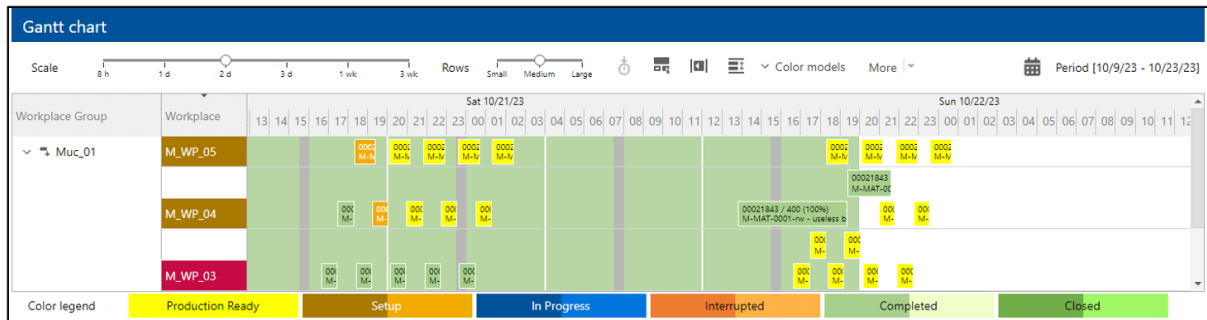
 This document distinguishes between the time planning of an operation and rescheduling among workplaces used for processing an operation. For this reason, we use the following semantic convention:

- Planning:  
Move an operation on the same workplace to a different start time.
- Rescheduling:  
Move an operation to a different workplace or workplace group.

Unplanned operations are those, the target start/end dates and workplace assignments have been adopted from the ERP system and have not yet been modified.

### 5.1.1 Overlaps

An operation is initially assigned to a specific workplace or workplace group. The user can reschedule this operation in the Gantt chart or operation table to a different workplace or workplace group. It is possible that existing operation data involve that operations overlap within the same workplace group or on the same workplace, i.e. that they are planned to be executed simultaneously in full or in part on the same workplace or in the same workplace group.

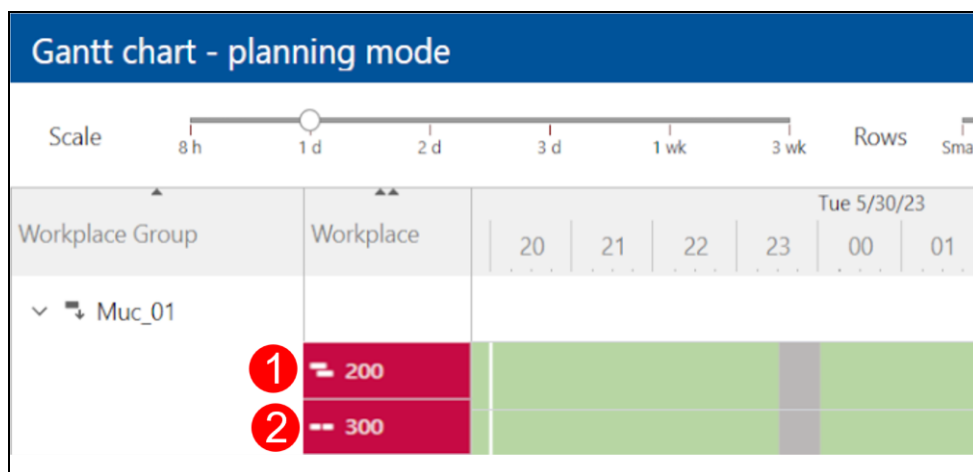


**Fig. 30: Example of overlapping operations**

Workplaces may allow overlaps or not. Usually workplaces do not allow overlaps. The Digital Planning Board can cover both cases with different planning rules. For this purpose, every workplace must be assigned the *Operation Overlap* as either *Allowed* (parallel workplace) or *Not allowed* (sequential workplace) beforehand in the workplace master data and there in the ORG hierarchy tree.

For more details, refer to the **Manual – Master Data and System Configuration**.


In planning mode, it is visually indicated whether the workplace is parallel or sequential.



**Fig. 31: Icons for parallel (1) and sequential (2) workplaces in the Gantt chart**

Planning mode must be active to display this workplace characteristic. In addition, the check mark must be set at **Planning mode > Display overlap status** in the configuration menu.

When manually planning an operation with the 50% rule on a sequential workplace, an overlap is not allowed. There are exceptions for active and closed operations. Within workplace groups, such rules do not apply, i.e. an overlap of two or more operations is admissible. The group is merely used as a container.

 The Digital Planning Board is used for planning workplaces but not workplace groups. This is true even if operations can be moved from and to workplace groups. From a practical viewpoint,

workplace groups should be considered in the Digital Planning Board as buffers and operations in workplace groups as work backlog.

### 5.1.2 Utilization rate

In practice it may happen that a workplace cannot be utilized 100%. Therefore a workplace can be assigned a utilization rate in MES FLEX to take this circumstance into account in planning.

For example, if a workplace is only available at a utilization rate of 50%, this will be considered in addition when recalculating the duration of the operation in planning or rescheduling.

For this purpose, the workplace must be assigned a value for the utilization rate beforehand in the workplace master data and there in the ORG hierarchy tree in the attributes area.

The value entered corresponds to the utilization rate as a percentage (%). The default value automatically used is a utilization rate of 100%. The utilization rate must always be greater than 0%. For more details, refer to the **Manual – Master Data and System Configuration**.

You can also activate or deactivate the utilization rate in the Digital Planning Board in the configuration menu with the menu option **Planning mode > Consider utilization rate (workplace)**. If a utilization rate is not considered, a utilization rate of 100% is assumed.

- ❗ The utilization rate is only applicable to the production time. This does not relate to the setup time.
- ❗ The utilization rate of a workplace is also considered when creating an operation split, if applicable (see section 5.4.8).

### 5.1.3 Processing lock for operations

It is not possible to replan active and closed operations in planning mode. This applies to all operations with status *Closed*, *Setup*, *Processing* or *Completed*. These operations are identified visually by a “No entry” sign.



**Fig. 32: Operation locked for processing**


A processing lock has the following effects:


- Planning and editing a locked operation is not possible (Gantt chart and operation table).
- If an operation is moved to a locked operation, an overlap will occur on this workplace, and the 50% rule is not applied; this is also true for a sequential workplace.
- Users can fix operations and thereby exclude them from manual planning. This causes a manual processing lock.

Once active, operations can only be replanned if they are interrupted. In this case, the remaining quantity (target quantity less actual quantity) has a decisive role. If the remaining quantity should be  $\leq 0$ , replanning the operation manually is not possible any more. The target/planned quantity has been produced completely and therefore there is no number of pieces available for planning any more. If the remaining quantity is  $> 0$ , the operation can be replanned.

### 5.1.4 Effects of saving the manual planning

When saving the manual planning result in the Digital Planning Board, all operations directly or indirectly modified will be adopted into MES FLEX with the new values for planned/target start and end, workplace, workplace group and changes by operation splits. These new values are then applied all across the MES FLEX system world and may also be adopted into third systems if necessary, e.g. into the ERP system.

 Values changed are locked in case of a new ERP update and not overwritten. The values currently saved in the ERP system are contained in the ERP target start and end data fields.

 Any changes made during the manual planning process are not automatically saved in temporary storage. This means that users have to save any changes explicitly and intentionally. Any planning changes will be lost when exiting the Digital Planning Board, performing a new operation search, making changes to the configuration and other actions. The user will always be prompted to confirm such an action before it is executed.

## 5.2 Planning in the Gantt chart

Planning in the Gantt chart is performed by drag-and-drop.

To plan an operation, drag it to the desired chronological position on a workplace. In the Gantt chart, a vertical line and the potential new start time appear at the beginning of the operation bar for chronological orientation. For precise manual planning, use the manual planning function in the operation table (see section 5.3).

The operation moved is assigned the time of the point where it was placed as its new target start. Its target end is recalculated according to its setup time, piece time and remaining quantity. Shift-free times, breaks and maintenance planned may cause an extension of the operation duration.

When rescheduling an operation to a different workplace or workplace group, the new workplace / workplace group is adopted unless the **Check group capacity** function is active and such rescheduling is not permitted. In this process, allowed overlaps of operations may occur in workplace groups and for parallel workplaces. With regard to sequential workplaces, a potential overlap causes the 50% rule to be applied and any possible conflicts are dissolved.

### 50% rule

When performing manual planning on sequential workplaces, operation overlaps are excluded. If an operation should be moved in such a way that an overlap with a subsequent operation would occur, one of the operations affected will be moved according to the 50% rule and any conflicts with other subsequent operations affected by the move will be eliminated automatically (as far as to the first gap in time occurring). If **Close gap automatically** is active, all chronological successors are concatenated without any gap in addition.

The move depends on where the operations overlap.

If an operation is moved to the last 50% of an existing operation, the operation moved is planned directly after the existing operation, i.e. its new planned/target start is the planned/target end of the existing operation. This means that the planned operation is arranged immediately behind it.


If an operation is moved to the first 50% of an existing operation, the operation moved is assigned the planned/target start of the existing operation. The existing operation is moved in such a way that it follows immediately.

If an operation is placed into a free section without causing an overlap with another operation due to its duration, the place defined is adopted as the new planned/target start without any change.

## 5.3 Planning in the operation table

Manual planning can also be performed in the operation table.


### Prerequisites

-  As a fundamental prerequisite, planning mode must be active and only one workplace is allowed to be selected. Only then is it possible to use manual planning by drag-and-drop or direct target time entries in the operation table.

When activating planning mode, the Digital Planning Board performs the following checks and actions:



- Checking whether only operations of one workplace are selected and displayed.  
If this is not the case, the planning functions can only be used in the Gantt chart but not in the operation table.
- Checking whether the planned/target start and planned/target end columns of the operation table are shown in the display.  
If this is not the case, they are displayed.
- Checking whether the planned/target start and workplace columns of the table can be edited.
- Sorting the operation table according to planned/target start in ascending order. The sort order of the operation table cannot be changed in planning mode.

### 5.3.1 Rescheduling operations to another workplace

-  The workplace of an operation can only be changed if the operation start time is not in the past. If you want to reschedule an operation with planned/target start in the past to another workplace, you have to assign a future planned/target start to this operation first. Only then can you change the workplace.

When rescheduling operations to another workplace or workplace group, it may be necessary to reload the new workplace or workplace group. Only then can the user see the allocation of the new workplace or workplace group and may be able to detect any potential conflicts beforehand.

#### To reschedule an operation in the operation table:

- ✓ A workplace is selected in the operation search.
- 1. Select the operation to be rescheduled to a different workplace in the operation table.
- 2. Select the new workplace in the workplace column in the drop-down menu.
-  Dialog windows may appear to make you aware of any potential conflicts or automatic rescheduling actions.
- ➔ The operation is rescheduled to another workplace or workplace group.
-  Further chronological planning in the operation table is not possible since more than one workplace are loaded after rescheduling. To be able to do this, you would have to explicitly select only one workplace once again in the operation search.

For operations on sequential workplaces that overlap chronologically with the rescheduled operation after rescheduling as well as for all subsequent operations, the following adjustments are made:

- **Close gap automatically** is active:  
All subsequent operations are arranged chronologically directly following each other. Any gaps occurring between the subsequent operations are closed.
- **Close gap automatically** is inactive:  
The subsequent operations are arranged chronologically directly following each other until reaching the first gap occurring. The gap is maintained. Operations after the gap are not replanned chronologically.

### 5.3.2 Planning operations chronologically

#### Planning by direct editing

The user can plan the planned/target start of an operation in the operation table directly by entering it manually.

Entering the planned/target start directly is particularly useful to be able to specify a precise start date & time. This precision is not possible when using drag-and-drop in the Gantt chart, regardless of the scale set.






Operation table				
 A+ A- More ▾				
Order no.	Operation no.	Target Start	Target End	
 abc ▾	 abc ▾	 ▾	 ▾	
▶ 00020241	101	05/25/23 01:37	05/25/23 02:38	
00020241	202	<div> <div>May</div> <div> <div>Mo</div><div>Tu</div><div>We</div><div>Th</div><div>Fr</div><div>Sa</div><div>Su</div> </div> <div> <div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div> </div> <div> <div>8</div><div>9</div><div>10</div><div>11</div><div>12</div><div>13</div><div>14</div> </div> <div> <div>15</div><div>16</div><div>17</div><div>18</div><div>19</div><div>20</div><div>21</div> </div> <div> <div>22</div><div>23</div><div>24</div><div>25</div><div>26</div><div>27</div><div>28</div> </div> <div> <div>29</div><div>30</div><div>31</div> </div> <div>Today</div> </div>	5/23 02:57	
00020241	302		5/23 03:06	
00020242	101		5/23 03:58	
00020241	302		5/23 03:15	
00020241	402		5/23 03:31	
00020241	402		5/23 03:47	
00020247	100		5/23 05:17	
00020250	101	<div> <div>2023</div> <div> <div>1</div><div>37</div> </div> <div>OK</div> </div>	5/23 04:44	
00020241	502		5/23 04:48	
00020242	202	05/25/23 03:58	05/25/23 04:17	

Fig. 33: Planning by entering a new target start in the operation table



## Planning by drag-and-drop

Planning by drag-and-drop is also possible in the operation table.

To do this, grab a row and drag it to the desired position in the operation table. A red frame indicates the probable new position within the operation table.

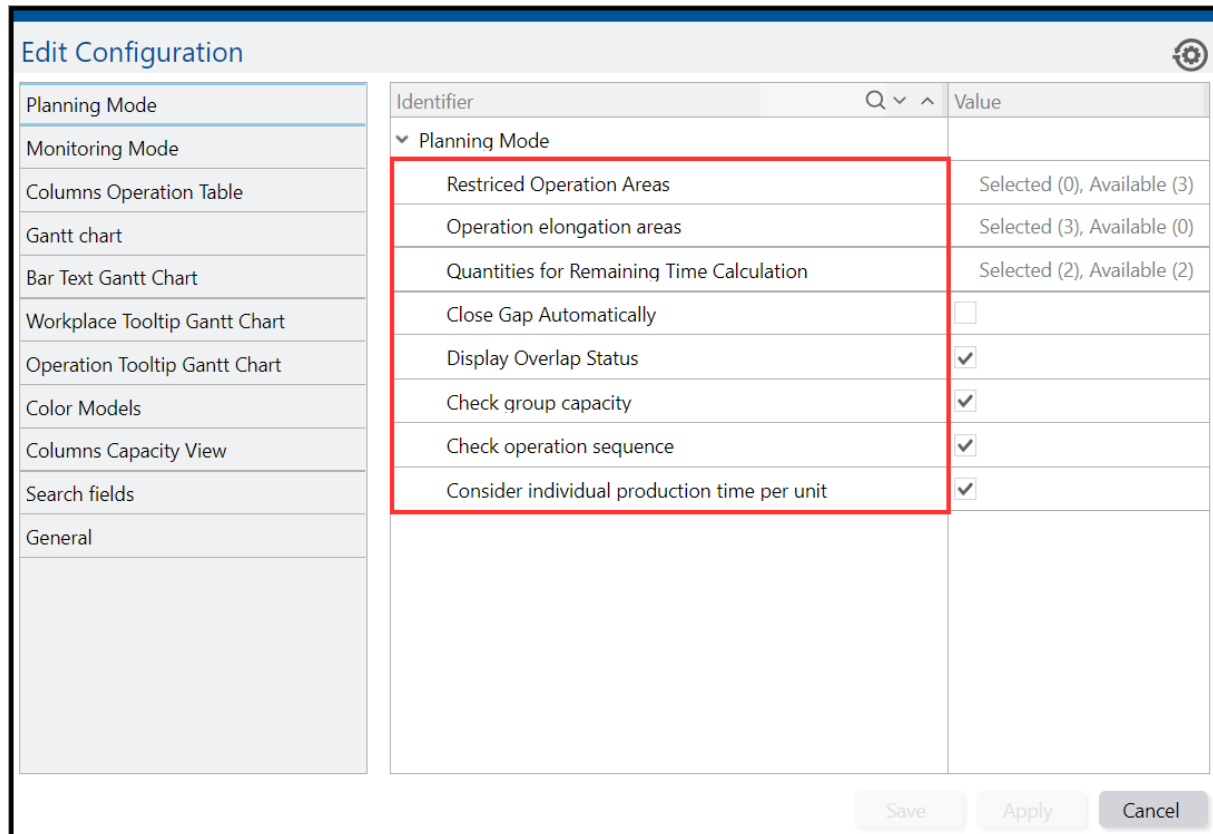
If the red frame is in the top half of an operation row, the planned operation is placed before the existing operation.

Moving operations is only possible if the new start time is in the future. The moved operation is placed before the operation of the row below. The following rules apply:

- The new target start of the moved operation will be the target end of its immediate predecessor in the table.
- Exception: If an operation is moved to the very first existing operation in the table, the planned/target start of the very first operation is adopted.
- The calculation of the planned/target end of the moved operation is performed in the same basic way as described in Table 4: Calculating start and end times for planning in actual data mode. This is done using basically the following simplified equation:  
$$\text{Target end} = \text{Target start} + \text{Remaining setup time} + \text{Remaining quantity} \times \text{Target processing time}$$
- If an overlap with other subsequent operations should occur:
  - without **closing gaps automatically**: Subsequent operations move chronologically without gap as far as to the first gap occurring. The calculation of their duration is performed in the same way as described above.
  - with **closing gaps automatically**: All subsequent operations move chronologically without gap. Any existing gaps are closed automatically. The calculation of their duration is performed in the same way as described above.
- If multiple operations are selected, all of them are moved as a block. First, the planned/target times of these operations are rearranged chronologically according to their sequence within the block. Subsequently the operations now following this block are arranged behind chronologically with the new planned/target times, similarly taking into account the **automatic gap closing** setting.

## 5.4 Planning support functions

The Digital Planning Board offers numerous assistant functions to the users. Users can activate, deactivate or configure many of these via the configuration menu.



Identifier	Value
▼ Planning Mode	
Restricted Operation Areas	Selected (0), Available (3)
Operation elongation areas	Selected (3), Available (0)
Quantities for Remaining Time Calculation	Selected (2), Available (2)
Close Gap Automatically	<input type="checkbox"/>
Display Overlap Status	<input checked="" type="checkbox"/>
Check group capacity	<input checked="" type="checkbox"/>
Check operation sequence	<input checked="" type="checkbox"/>
Consider individual production time per unit	<input checked="" type="checkbox"/>

Fig. 34: Planning support functions in the configuration menu

### 5.4.1 Restricted operation areas

Restricted operation areas are those areas where a start time of an operation is not allowed. The following restricted operation areas can be defined:

- Shift-free times
- Shift breaks
- Maintenance

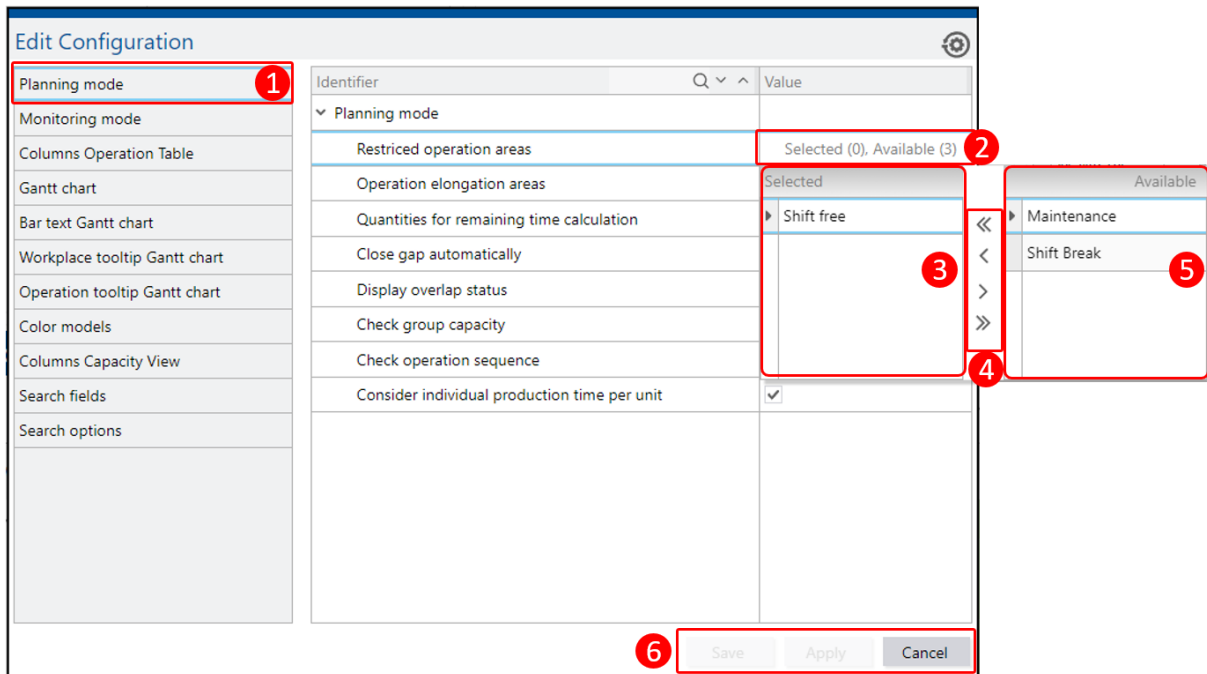
When planning operations, a check is made to see whether the planned/target start is within a restricted operation area. If this is the case, manual planning is not executed and the operation remains at its originally planned target start.

#### To define a restricted operation area:

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar. On the left in the dialog field, click **Planning Mode** (1).

1. In the **Restricted Operation Areas** line, click into the area on the right (2).
  - ➔ A new dialog window opens.
2. Use the arrow buttons (4) to move the desired restricted areas (5) into the **Selected** area (3).

- Single arrows: Adopt only selected line.
  - Double arrows: Adopt all existing lines.
- OR:  
Double-click on the appropriate line.
3. Click **Save** or **Apply** (6).



**Fig. 35: Configuration of restricted operation areas**

A restricted operation area can be deactivated for individual workplaces and operations together with the operation elongation.

**To deactivate/reactivate restricted operation areas for individual workplaces or operations:**

- ✓ Planning mode is active.
1. Hold the mouse pointer on the row of the appropriate operation (in the operation table) or on the appropriate workplace (in the Gantt chart).
  2. Click with the right-hand mouse key.
  3. Select **Ignore operation restricted & elongation areas (for this workplace)**.

**i** You can deactivate restricted and elongation areas for operations or workplaces in the operation table.

In the Gantt chart, you can deactivate restricted and elongation areas only for workplaces.

Ignoring of restricted areas is active until you finish it actively or exit planning mode.

## 5.4.2 Operation elongation

The operation elongation function calculates the target end of a newly planned operation. Target times (setup and processing times) and non-productive periods are taken into account.

The following non-productive periods can be considered in the calculation:


- Shift-free times
- Shift breaks
- Maintenance

**To configure the operation elongation:**

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar. On the left in the dialog field, click **Planning Mode**.

1. In the **Operation elongation areas** line, click into the area on the right.  
→ A new dialog window opens.
2. Use the arrow buttons to move the desired non-productive period into the **Selected** area.
  - Single arrows: Adopt only selected line.
  - Double arrows: Adopt all existing lines.

OR:  
Double-click on the appropriate line.
3. Click **Save** or **Apply**.

 Recalculation of the duration with elongation is only performed for the replanned (moved) operations as well as in actual data mode for all active operations (phases: *Setup*, *Production* or *Training*).

For all other operations, recalculation is not performed.

No recalculation is performed for the following operations and conditions, either:

- Operations loaded initially into the Digital Planning Board
- Operations not yet planned in the Digital Planning Board
- Operations set to their original ERP values
- After changes to the planning input data, e.g. shift and maintenance times

It is possible that there is no shift information available for the recalculation of the target end of an operation.


This may be due to one of the following reasons:

- The shift service does not supply any shifts any more (time limit).
- There are no more shifts planned.
- The time range loaded into the planning board was limited by the user.

If an operation is moved directly or by interactions to a time which is partly or entirely in a non-productive period, the following happens:


- The duration of the operation is elongated to subsequent productive periods until its remaining time can be processed completely.

Even if operation restriction and elongation is active, a user may make an exception from applying these functions to individual operations or workplaces when planning.

 As a result, there is neither an elongation for the corresponding operations nor a check whether they start in a restricted area.

**To deactivate/reactivate operation elongation for individual workplaces or operations:**

- ✓ Planning mode is active.
1. Hold the mouse pointer on the row of the appropriate operation (in the operation table) or on the appropriate workplace (in the Gantt chart).
  2. Click with the right-hand mouse key.
  3. Select **Ignore operation restricted & elongation areas (for this workplace)**.

-  You can deactivate restricted and elongation areas for operations or workplaces in the operation table.

In the Gantt chart, you can deactivate restricted and elongation areas only for workplaces.

Ignoring of elongation is active until you finish it actively or exit planning mode.

### 5.4.3 Quantity for remaining time calculation

This function calculates the duration of an operation based on remaining quantities. This makes it possible for the Digital Planning Board to provide more precise information about the remaining time of the corresponding operation based on the actual quantities reported. As a result, manual planning becomes more precise.

The user determines the quantities notified to be deducted from the target quantity and thereby defining the remaining quantity. The selection of quantity types determines the piece number to be used for the remaining time calculation.

The following quantity types are available for selection:

- Actual Yield Quantity
- Actual Rework Quantity
- Actual Scrap Quantity
- Unqualified Machine Quantity

#### To configure the quantities for remaining time calculation:

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar. On the left in the dialog field, click **Planning Mode**.

1. In the **Quantities for Remaining Time Calculation** line, click into the area on the right.
  - ➔ A new dialog window opens.
2. Use the arrow buttons to adopt the desired quantity types (from the **Available** area) into the **Selected** area.
  - Single arrows: Adopt only selected quantity types.
  - Double arrows: Adopt all existing quantity types.

OR:

Double-click on the appropriate quantity type.
3. Click **Save** or **Apply**.

If the user does not select a quantity in the configuration, the planned/target quantity of the operation is used for remaining time calculation.

The remaining time calculation and thus the end date depends on the operation phase and is done according to Table 4 (End time column).

Calculation of the remaining time and thus the new end date of an operation is performed in manual planning.


The end date calculated (according to the remaining time) is used in the Gantt chart and in the operation table.

Non-working times are only considered if operation elongation is active.

#### 5.4.4 Close gap automatically

The **Close Gap Automatically** function and automatic sequence planning is very helpful for manual planning on sequential workplaces.


When an operation is planned (moved), all subsequent operations of this workplace are automatically planned, or arranged, one after the other without gaps.

-  The **automatic gap closing** function only applies to the data loaded (the period selected) of the workplace. For this reason, you should take into account any filters set in the operation search.

**To activate / deactivate automatic gap closing permanently:**

Open the configuration menu by clicking the gear button (Change Configuration) in the function bar. On the left in the dialog field, click **Planning Mode**.

1. Set/remove the check mark on the right of the **Close gap automatically** row, as appropriate.

-  You can activate the **Close gap automatically** function momentarily once for the current drag-and-drop action by pressing the CTRL key (hotkey).

#### 5.4.5 Check group capacity

The concept of group capacity refers to the rules that are applied when importing operation data into MES FLEX and their characteristics that are considered in the Digital Planning Board.

Three options are available:

- Pull
- Auto-Split
- Serial Auto-Split

The setting is made in the FORCE MES FLEX master data for each workplace group. For more details, refer to the **Manual – ERP Interface – Data & Events via XML**.

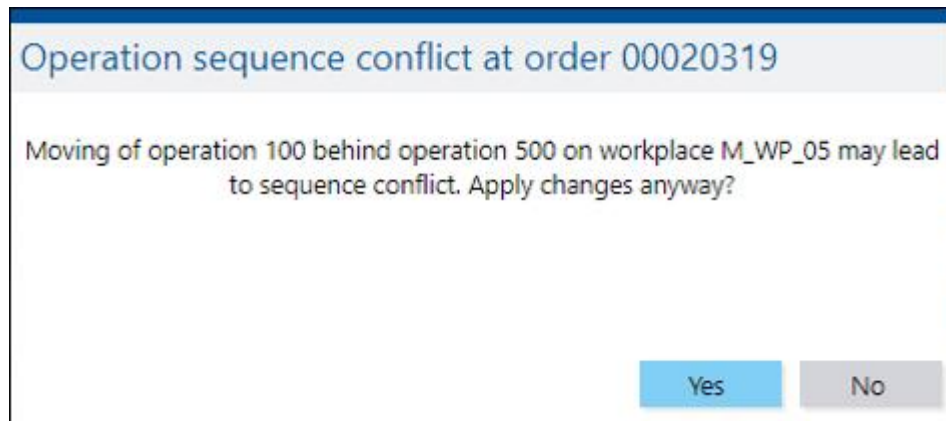
The following rules apply when rescheduling with the associated basic capacities:

- **Pull:** Operations can only be rescheduled to a different workplace within the same workplace group.
- **Auto-Split:** Operations cannot be rescheduled to another workplace. Operations can be replanned on the same workplace.
- **Serial Auto-Split:** Operations cannot be rescheduled to another workplace. Operations can only be replanned on the same workplace.

If the function is inactive, there are no restrictions for rescheduling to other workplaces or workplace groups.

#### 5.4.6 Check operation sequence

This function checks the logical sequence of the operations and outputs a warning in case of any violation of rules.



**Fig. 36: Warning in case of a conflict of operation sequence**

The user receives a warning when trying to move an operation predecessor (operation 10) behind an operation successor (operation 20) of the same order or to advance a successor. The operation processing sequence to be adhered to within an order is defined by the numerically incrementing sequence of operations. It is usually defined in steps of ten, e.g.: 10, 20, 30, 40, 50, 60.

When an operation is moved with sequence checking activated in planning mode, a background sequence check is performed across all workplaces, i.e. also for those which may currently not be loaded. If a conflict is not found, manual planning is performed.

If the move causes a conflict, the user is made aware of this in a dialog window and can decide whether to perform the move anyway.

- i If the function is inactive, the user can move operations without an operation sequence check being performed. In this case, an operation predecessor (operation 10) may be planned after an operation successor (operation 20) of the same order without a warning being displayed.

In summary, the operation sequence is not checked by the Digital Planning Board in the following cases:

- If the function is inactive.
- Only those operations are checked for correct sequence that pertain to the same order as the operation moved. Operations of other orders that are moved automatically because of a new manual planning action (e.g. by closing gaps automatically) are not checked for correct sequence.
- The sequence check may also be performed on the basis of the split number (e.g. Serial Auto-Split).

#### 5.4.7 Consider individual production time per unit

For manual planning, the Digital Planning Board uses the piece time per unit for the calculation of the operation duration. For this purpose, a check is made in the **Production time per unit** table to see whether production times are defined for the workplace/material number combination for the planned period. If values are available in the table, these may be used.

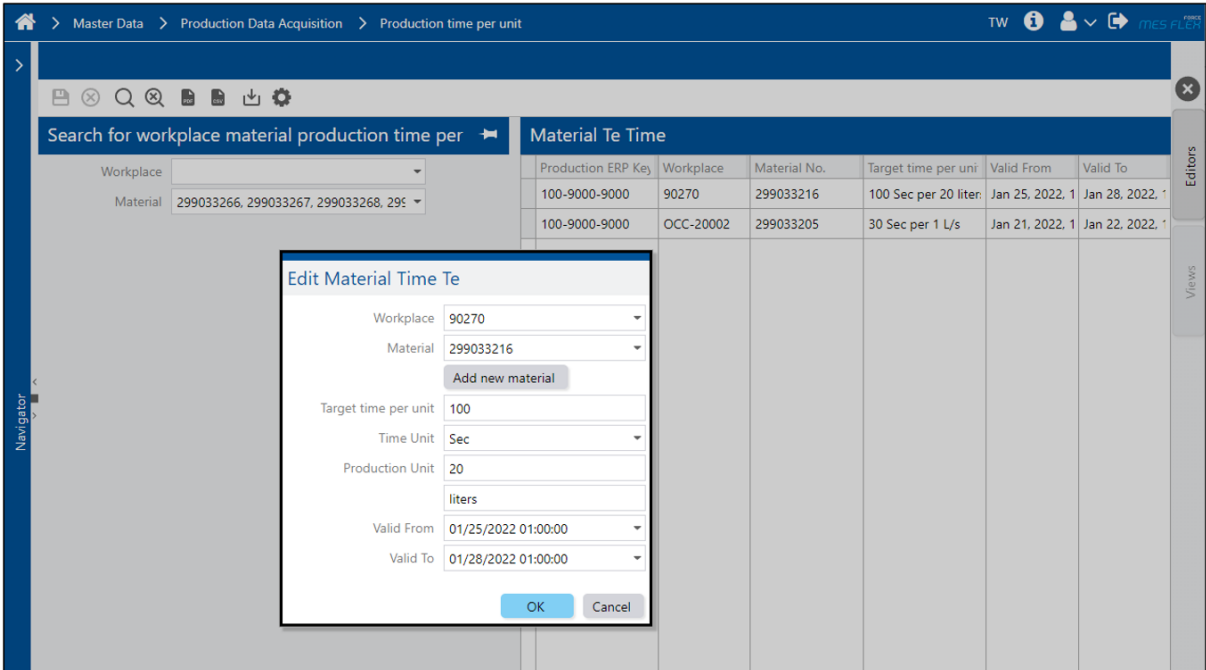


Fig. 37: Master data maintenance relating to production time per unit

When calculating the processing time (in operation table, Gantt chart, capacity view, etc.), the user must check whether the **Production time per unit** table contains a dataset with the corresponding workplace/material number combination. If this is the case, another check must be made to see whether the planned start time of the operation is within the valid period of this dataset. If this is true, the time specified in the table is used for calculating the duration. Otherwise the times stored in the ERP are used for calculation.

### 5.4.8 Operation split

This function makes it possible to split an operation into two parts. Operations can be distributed manually to different workplaces or planned in several parts with interruptions. This function is not available in monitoring mode.

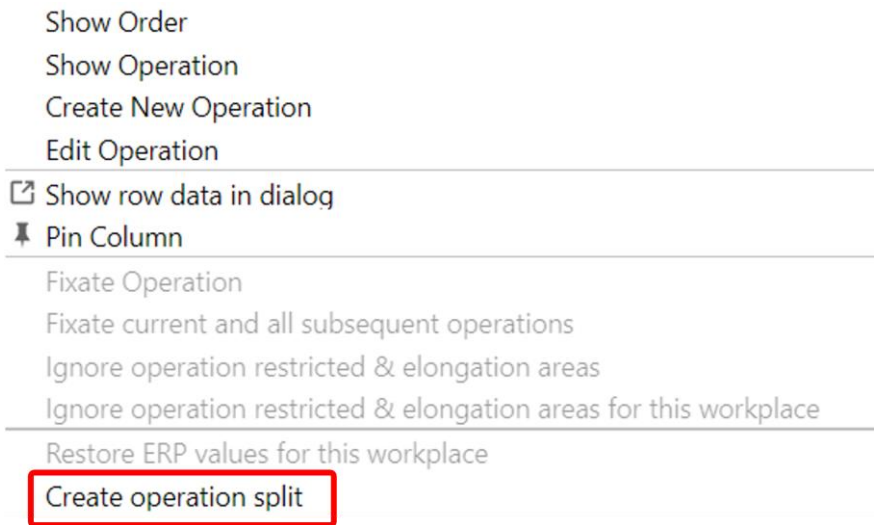
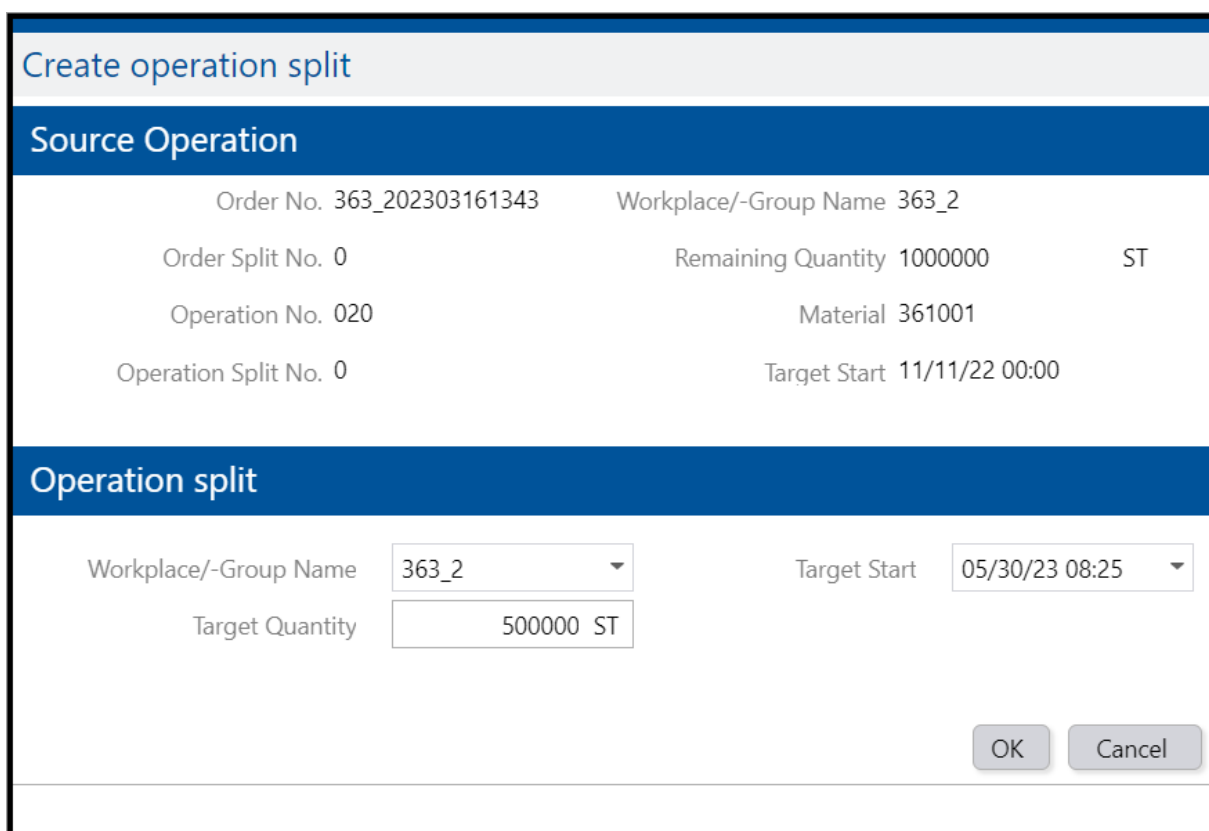


Fig. 38: Operation split



**To split an operation:**

1. Click with the right-hand mouse key on an operation in the operation table or in the Gantt chart.
2. Click **Create operation split**.
  - ➔ A dialog window opens (see Fig. 39).
3. Set the parameters as necessary.
  - **Target workplace** of the new operation (operation split). The default value suggested is the workplace of the source operation.
  - **Target start** for the new operation (operation split). The default value suggested is the start date & time of the source operation.
  - **Target quantity** for the new operation (operation split). The default value suggested is half the source operation, rounded if necessary.
4. Click **OK** or **Cancel**.




Create operation split		
<b>Source Operation</b>		
Order No. 363_202303161343	Workplace/-Group Name 363_2	
Order Split No. 0	Remaining Quantity 1000000	ST
Operation No. 020	Material 361001	
Operation Split No. 0	Target Start 11/11/22 00:00	
<b>Operation split</b>		
Workplace/-Group Name	363_2	Target Start 05/30/23 08:25
Target Quantity	500000 ST	
		OK Cancel

**Fig. 39: Operation split dialog**

The source operation keeps its workplace and target start. The target quantity is reduced by the quantity to be processed in the new operation (operation split). The duration of the source operation is reduced accordingly.

The new operation split is assigned a new serial split number to distinguish the operation split unambiguously. Every new operation split can be split again until there are no more target quantities available. For integer numbers, this is 1; for decimal numbers, quantities less than 1 are also possible.

 An operation split is saved directly by clicking **OK** in the operation split dialog and cannot be undone thereafter. Resetting to ERP values cannot reset an operation split, either.

- ❗ An operation split does not initiate (partially) automated planning actions or checks, such as **Check operation sequence**. Planning actions must be performed manually afterwards by the user. This implies that invalid situations may occur at first, e.g. an overlap on a sequential workplace.

An operation split is not possible for the following types of operations:

- All operations that do not have operation status *Released* or *Interrupted*
- All operations, the start of which is in the past
- All operations that are part of an operation block

- ❗ If any changes are not saved yet in planning mode, an operation split can only be created if the changes are saved or discarded first.

If the **Check group capacity** function is active, the following rules apply:

- **Pull:** Operations can only be split within the workplace group
- **Auto-Split:** No operation splits allowed
- **Serial Auto-Split:** No operation splits allowed

#### 5.4.9 Fixed operation

A fixed operation is locked for the current planning session. A fixed operation stays in its position (workplace and time) regardless of the planning action carried out by the user. The operation cannot be moved neither in the Gantt chart nor in the operation table. Adjusting the start date or workplace manually in the operation table is not possible, either.

This fixing applies only temporarily until new data are loaded.

##### To fix an operation:

1. Click with the right-hand mouse key on an operation in the operation table or in the Gantt chart.
2. Click **Fix operation**.  
OR:  
Click **Fix current and all subsequent operations**.

To undo the fixing, perform the same steps accordingly.

- ⚠ Overlaps may occur due to planning of other operations, since fixing does not prevent users from planning other operations. With a fixed operation, overlaps would have to be eliminated manually, since the 50% rule and planning support functions (e.g. Close gap automatically) are not applied.

#### 5.4.10 Restore ERP values

You can reset saved planning activities in full or in part. This function sets the target start and target end as well as the workplace for the operations loaded to the values predefined in the ERP. The values set by manual planning with FORCE MES FLEX are cleared.

The user can choose whether to restore the planning data for all operations loaded in the Digital Planning Board or only those loaded for a workplace.

- ❗ This function is only available in planning mode.

There are several options to restore the ERP values:

- In the function bar > **Restore ERP values**  
(All operations loaded are reset to the ERP values.)



**Fig. 40: Restoring ERP values in the function bar**

- In the operation table > Right-click > **Restore ERP values for this workplace:**  
(All operations loaded for the selected workplace are reset to the ERP values.)
- In the Gantt chart > Right-click on workplace > **Restore ERP values for this workplace:**  
(All operations loaded for the selected workplace are reset to the ERP values.)
- In the Gantt chart > Right-click on operations > **Restore ERP values for this workplace:**  
(All operations loaded for the selected workplace are reset to the ERP values.)

## 5.5 Planning elements

### 5.5.1 Introduction

In FORCE MES FLEX, operations form the basis for all workflows and therefore for production planning in the Digital Planning Board. As a rule, operations are planned on workplaces and therefore the operation is the planning element. Depending on the nature of production or planning, it may happen that it is not useful to plan on the basis of individual operations. Other planning elements may also be operation groups, i.e. groups of operations that require planning together.

A distinction is made between one- and two-stage operation groups:

- A one-stage operation group is an **operation block**.  
An operation block consists of several operations starting sequentially or in parallel.
- A two-stage operation group is an **operation block group**.  
An operation block group consists of several sequentially linked operation blocks.

Such operation groups can be found in joint production, block production, cutting processes and other production types.

Planning with operation blocks or block groups is not possible in the Digital Planning Board under the following circumstances:

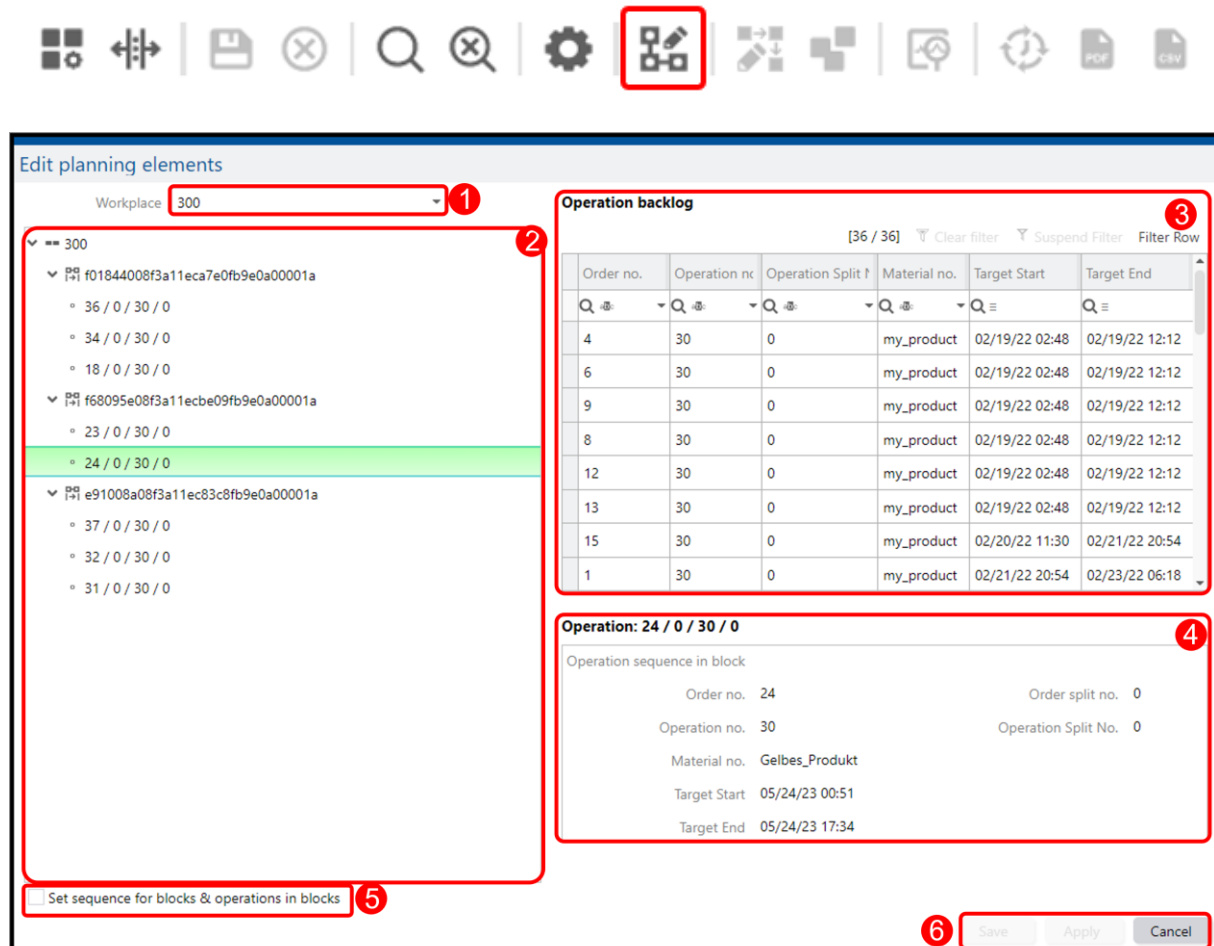
- Groups are not planned across several workplaces.
- Inconsistent data are not corrected, e.g. a group with different workplaces.

Blocks are checked for consistency when entering planning mode in order to ensure valid manual planning. If an invalid operation block or an invalid operation block group is identified in the input data, they are locked. They are excluded from any manual or semi-automatic planning action and therefore not available for planning.

Users may repair a defective operation block (group) using the planning element editor. It is not possible in this editor to correct an invalid block assigned to several workplaces.

## 5.5.2 Planning element editor

Operation blocks and operation block groups can be created and edited in the planning element editor. You can open the planning element editor via the function bar of the Digital Planning Board.



**Fig. 41: Planning element editor**

- (1) Select the workplace for which you want to create or edit operation blocks or block groups here.
- (2) **Operation block (group) overview:** All operation blocks and block groups existing on the workplace are displayed and can be edited here. Each operation block is shown with the associated operations and this information: order number / order split number / operation number / operation split number.  
Operation blocks (or block groups) are greyed out and cannot be edited if at least one operation is not in the "Released" operation phase any more.
- (3) **Operation backlog:** This field shows all operations that are not assigned to an operation block and are in operation phase "Released" or "Interrupted" along with the corresponding information of the selected workplace.
- (4) **Detail view:** Displays information about elements (operation block, operation block group or operation) selected in the operation block (group) overview. You can edit the block description for operation blocks and block groups. The arrangement of operation blocks (parallel or sequential) is also specified.
- (5) **Set sequence:** For sequential operation blocks and block groups, you can define the sequence of operations or operation blocks within blocks and block groups, respectively. A check mark set here is required to adopt the order defined in the tree structure of the

operation block (group) overview as a default setting for the sequence. Otherwise the Digital Planning Board assumes an arbitrary sequence.

(6) Button to exit the dialog window.

#### To create operation blocks and block groups:

- ✓ Planning mode is deactivated.
- 1. Click the **Open planning element editor** icon in the function bar.
- The **Edit planning elements** dialog window opens.
- 2. Click the arrow for the drop-down menu in the workplace field (1).
- ❗ Although it is possible to make an input in this field, this will not have any result.
- The **Workplace Selection** dialog window opens.
- 3. Select the workplace for which you want to create an operation block or an operation block group.
- 4. Click on the desired workplace with the right-hand mouse key.
- 5. Choose whether you want to **add a block group** or **add a block**.
- The detail view (4) shows details of the operation block or block group.
  - a. You can edit the block (group) description in the detail view (4) at will.
  - b. Double-click on the globe icon in the description to add the name in other languages.
  - c. For an operation block, select parallel or sequential planning for the block.
- 6. Use drag-and-drop to drag the operation from the operation backlog field (3) or from other operation blocks or groups in the overview (2) to the desired operation block or group.
- Optional:  
Set the check mark in field (5) to adopt the order from the tree structure as the setting for the sequence.
- 7. Click **Save** or **Apply**.

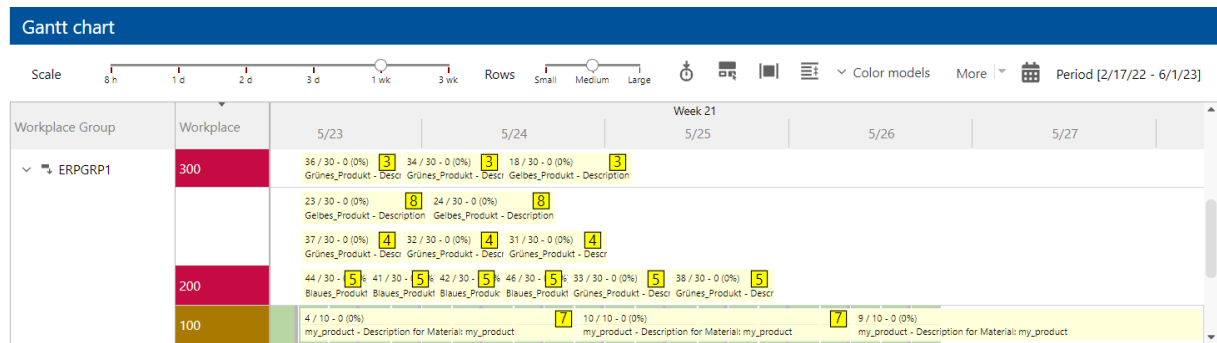
Every new operation block or block group is assigned a unique identification number (ID) which cannot be changed.

- ❗ Operation blocks and operation block groups must not be empty. Operation block groups must not be filled with empty operation blocks only.

### 5.5.3 Visualization of operation blocks and operation block groups

Operations joined (in operation blocks and operation block groups) are visually indicated in the Gantt chart by the following characteristics:

- Symbols for operation blocks and operation block groups
- Block numbers: All operations of a block and all operations and blocks of a block group are marked with the same number. This number is assigned at random.
- Extension to the standard color model: All operations pertaining to the same operation block or to the same operation block group have the same color. This color is set automatically and cannot be modified. The color legend shows the different colors used. The label is adopted from the operation block or operation block group, respectively. If a description does not exist, the operation block (group) number is used.



**Fig. 42: Operations in the same block or block group indicated by block numbers**

A selected operation which is in the focus on the display and its associated operations in block relations are framed by a selection frame in the Gantt chart. For more detailed information for the configuration, refer to section 3.7.2 “Configuration of the Gantt chart”.

Various data fields relating to the block can be displayed in the operation table. This requires that these fields are selected in the configuration menu (see section 3.6.1). Sorting and filtering functions are available to the user to arrange operation blocks and block groups in a visually coherent way.

### 5.5.4 Differing planning logic

Planning activities with planning elements of operation blocks and block groups may sometimes require a planning logic that is different from planning activities with individual operations.

#### To plan operation blocks and block groups in the Gantt chart:

- ✓ Planning mode is active.
- 1. Drag any individual operation of an operation block or an operation block group to the intended start time.
- ➔ The complete operation block or block group is displayed at the new start time in the Gantt chart.

It is possible that the input data of the Digital Planning Board do not provide operation blocks/block groups with proper time adjustment. Automatic checking of the operation blocks and block groups is performed as soon as planning mode is activated. This means that all operations are rearranged according to the block rules in the loaded and/or reloaded area. The result of this automatic planning function is saved directly. The following rules apply:

- **For parallel operation blocks:**
  - All operations have the same start time.
  - Operations may differ in duration and therefore have different end times.
  - The next operation, operation block or operation block group begins after the end of the last operation of the block in case of a time overlap of blocks.
- **For sequential operation blocks:**
  - The sequence is based on the operation start times if an explicit sequence is not defined.
  - Operations may differ in duration.
  - An operation must end before the next operation can start.
- **Additional rule for operation block groups:**
  - Operation blocks within an operation block group are always arranged sequentially.
  - If there is no explicit sequence defined, the earliest start time of an operation within an operation block governs the arrangement of the sequence.

The following logic checks are carried out during planning:

- If a parallel operation block is rescheduled to a workplace which does not allow parallel processing, it is planned sequentially.  
It is not possible to reschedule a parallel operation to a serial workplace which does not allow parallel processing.
- If one or more operations within an operation block or block group have an active status (*Processing, Setup*), it is not possible to replan the operation block or block group.
- Fixing of an operation, operation block or operation block group takes effect for all operations of the block or group.
- A fixed operation block or operation block group cannot be planned.

## 6 Operation management

Users can also perform actions in the Digital Planning Board which do not relate specifically to manual planning but to maintenance of orders and operations. These include the following functions:

- Show Order
- Show Operation
- Create New Operation
- Change Operation

These can be selected by the user with a right-click on an operation in the operation table or Gantt chart. The corresponding dialog window opens.

To exit the dialog window and return to the operation table or Gantt chart view, click on **Operation table** or **Gantt chart** in the header line.

The **Show Order** and **Show Operation** fields display the details of an order or operation, respectively.

The **Create New Operation** can be used to create a new operation for an existing order.

1. Enter the appropriate values.
2. In the header line, click on **Operation table** or **Gantt chart**.
  - ➔ A dialog window opens.
3. Select whether you want to save your changes or not.
  - ❗ If the data entered are not yet complete, a warning appears at the bottom of the screen, indicating the information still missing.

The **Change Operation** option can be used to edit an operation and modify most of its attributes.



## 7 Annex

### 7.1 Abbreviations and terms used

**Table 5: Abbreviations and terms used**

Abbreviation/term	Explanation
px	Pixel
Tooltip	This refers to a small pop-up window appearing in application programs or on webpages. It shows a description of an element of the graphical user interface.