



Virtual Production Environment

Version 5.11

Manual



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1 Concept

This user manual explains and describes the module "**Virtual Production Environment**" (VPE). The VPE module is a component of Office and includes the functionalities of a virtual production. It is divided into a scope for **Generating an order**, which is responsible for the automated generation of production orders, and a scope for **Order processing**, which is used to manage the processing of these production orders. Special **production scenarios** can be defined and applied to workplaces for processing the orders.

This is a versatile tool for companies and institutions to simulate and test complex production scenarios. It is therefore useful in research and teaching and can be used as a test environment for application development. The VPE is also suitable for performing stress tests. For example, in order to identify weak points or bottlenecks, a real production operation with a connection to FORCAM FORCE™ can be brought to its performance limits by means of specific predefined production scenarios.

1.1 Prerequisites


Workplaces, personnel and shift schedules must be created before the simulation of a production scenario can be configured. In addition, sample production orders are needed that can serve as templates for the automatic order generation. All this is usually done with a connected ERP system and can be further configured in the Workbench (see also the manual **Master Data and System Configuration**).

The personnel is assigned to the workplaces and can be organized in shifts. The VPE can then use this data as the basis for simulated processing of the generated production orders. These are broken down into operations and automatically processed by simulating the activities of production machines or workers at the workplaces. This allows for simulating long-term or even endless production operations.

1.1.1 Workplace group and capacity group

Grouping workplaces within a workplace hierarchy is referred to as workplace groups. Workplace groups are usually responsible for processing a specific type of production order. A workplace group can represent a sequential arrangement of workplaces, e.g. an assembly line, or a parallel arrangement in which workplaces can also perform the same functions. If workplaces are in a parallel arrangement taking on the same functions, the grouping of these workplaces is referred to as a capacity group.

If the VPE is configured accordingly, it is able to automatically assign operations of a production order to free workplaces within a workplace group in the ERP hierarchy. The use of this function is only appropriate for capacity groups.

 For the workplaces to be used by the VPE, they must be assigned to groups that have the designation "ERP" in the group name.

1.1.2 Production orders and operations

The VPE uses the existing production orders as examples and takes the most important data from them as a template for generating new orders. The following attributes are accessed:

Table 1: Attributes used for a production order

Attribute	Explanation
Material	Product to be produced
Release date	Time of release
Key start and finish time	Maximum order timeframe

Table 2: Attributes used in the operations of the production order

Attribute	Explanation
Material	Product to be produced
Workplace	Workplace at which the operation is to be processed
Workplace group	Workplace group within the workplace hierarchy of the ERP to which the workplace is assigned
Target quantity	Quantity of the product to be produced
Quantity unit	Quantity unit of the material to be produced
Scheduled start and scheduled finish	Start and finish date scheduled with detailed planning of the VPE
ES (de: FAZ) and EF (de: FEZ)	Earliest starting and finishing date, also known as earliest starting time and finishing time
LS (de: SAZ) and LF (de: SEZ)	Latest starting date or finishing date, also known as latest starting time or finishing time
Scheduled starting and finishing time	Starting and finishing time determined by the VPE lead time scheduling
Time per unit	Planned production time of a material's quantity unit
Target processing time	Planned processing time for the target quantity of the material
Target setup time	Planned time for workplace and machine setup
Target Teardown Time	Planned time for workplace and machine teardown
Target wait time	Planned wait time of the produced material, e.g. for cooling, drying or curing
Target move time	Planned time for transporting the processed material to the next workplace

Concept

Attribute	Explanation
Minimum send ahead quantity	Minimum quantity of material produced for transferring (sending ahead) to the next workplace

⚠ For now, the scheduled milestones of a production order to be used as a template should be set to a point in time far in the future. Otherwise, it runs the risk of being scheduled by the VPE. The same applies to the planned start and the scheduled start time in the first operation of this production order. At present, also ensure that the planned start date for the first operation of the order is less than 5 years in the future. This is the only way to later select the production order as a template for generating an order.

The **target processing time** represents the product of the **time per unit** and the **target quantity**. The operation's times for setup, teardown, waiting, queuing, and moving are not included.

ℹ The target quantity, the dates and the workplaces of the orders generated are reset by the VPE as needed. The data of the production orders serving as templates are not changed.

If there is to be a **stroke factor** for production, i.e. a quantity produced per stroke of the production machine, these attributes are included:

Attribute	Explanation
Stroke factor	Produced quantity per stroke
Time per stroke	Time per stroke
Time per unit	Time per stroke divided by the stroke factor

1.2 Generating an order

The VPE automatically generates orders based on the initially created production orders. It is possible to configure the regular intervals at which orders are to be generated, which material is to be produced with which target quantities and at which workplace assignments of the individual operations. This means that the orders can also be assigned to the current production process in terms of time and space.

As part of order generation, **lead time scheduling** (see section 1.2.2) ensures that orders and their operations are scheduled into the production process when they are created.

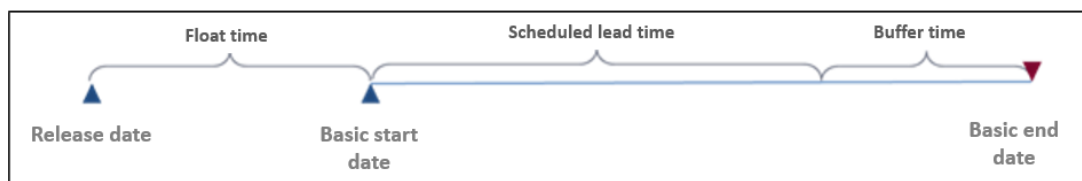


Fig. 1: Time scheduling of an order

Term	Explanation
Release date	The time of release of the order. In the VPE, the release is carried out at the time of order generation.
Basic start date	The basic start date defines the planned earliest start date for processing the order. This can be calculated automatically via the VPE when generating orders.
Float time	The reaction time by which the order start date of the generated orders is moved after the release date.
Buffer time	The time by which an order or operations can be postponed in the production process without affecting the start dates of subsequent orders or operations. The greater the buffer time, the lower the risk of a delay in the planned completion of the order due to unplanned events. The buffer time can be used to set the focus to either adherence to deadlines or optimal utilization of the workplaces.

1.2.1 Execution time and lead time of an operation

The planned **execution time** of an operation is calculated from the sum of the following target times:

- Setup time
- Processing time
- Teardown time

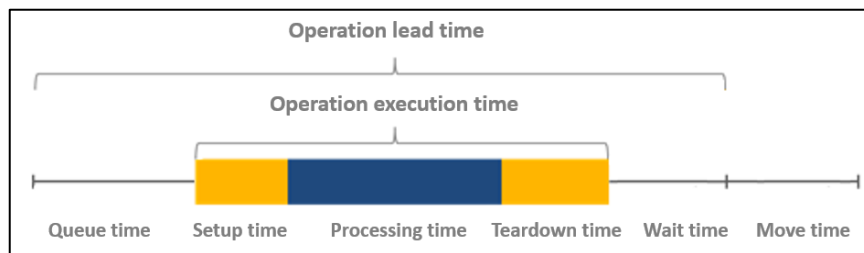


Fig. 2: Lead time and execution time of an operation

Included for calculating the planned **lead time**, are the idle time of the operation and the waiting time between registration and execution of the operation. The latter is first calculated based on the scheduling of the operation in the detailed planning or lead time scheduling of the VPE.

1.2.2 Lead time scheduling

The lead time scheduling in the VPE is done when the order is generated and calculates the earliest and latest start and end times of the operations as well as the key finish date of the order.

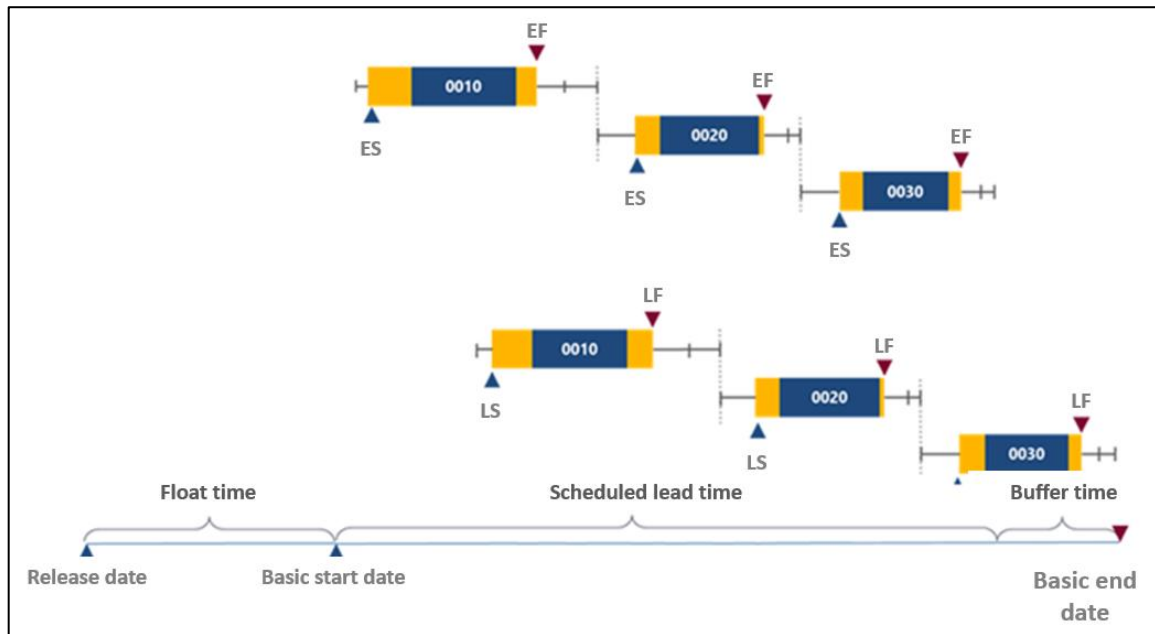


Fig. 3: Lead time scheduling

Based on all specified times, first a forward scheduling and then a backward scheduling is carried out. In forward scheduling, the system starts from the defined key order starting date and determines the earliest start and finish times (ES and EF) of the individual operations consecutively. The operations are arranged sequentially, which means that the planned lead times are added up with the move times of all operations to determine the earliest completion date of the entire order. Given that the **buffer time** is incorporated, the latest finish date of the order (**order finish date**) can then be determined. Subsequently, during backward scheduling, based on the order finish date, the **latest start and finish dates (LS (de: SAZ) and LF (de: SEZ))** of the individual operations are determined.

- ❗ The lead time scheduling of the VPE does not consider parallel operations in progress and ignores shifts. A parallel operation can take place using parallel production scenarios (as described below). Shifts are included in the order processing.

As a result of lead time scheduling, the **terminated lead time** of the order may now be determined. For this purpose, the processing times of the operations are added up, including waiting times.

1.3 Order processing

The VPE can simulate production machines and work steps of the workers through automated processing of the generated production orders or operations at the workplaces. Fictitiously produced materials can be accounted for through generated quantity reports.

Thus, a virtual production site or even several production sites can be simulated via the VPE at distributed locations.

For this purpose, the VPE generates the individual work steps and events using FORCAM FORCE™ native machine messages and booking commands, respectively, and sends them to the rule engine. These automated processes can be freely configured in the order processing of the VPE to ultimately map the desired production scenario.

2 Configuration

Path: Office > System Administration > Virtual Production Environment

2.1 Generating an order

The order generation function can be used to configure simulations for the automatic generation of orders based on the production orders initially created. For example, it is possible to influence the target quantity to be produced or the workplace assignment and scheduling, i.e. the location and timing of the orders and operations in the production operation. The operation sequence with production resources/tools and components is copied from the basic production order.

- ✓ Workplaces and ERP production orders are configured.

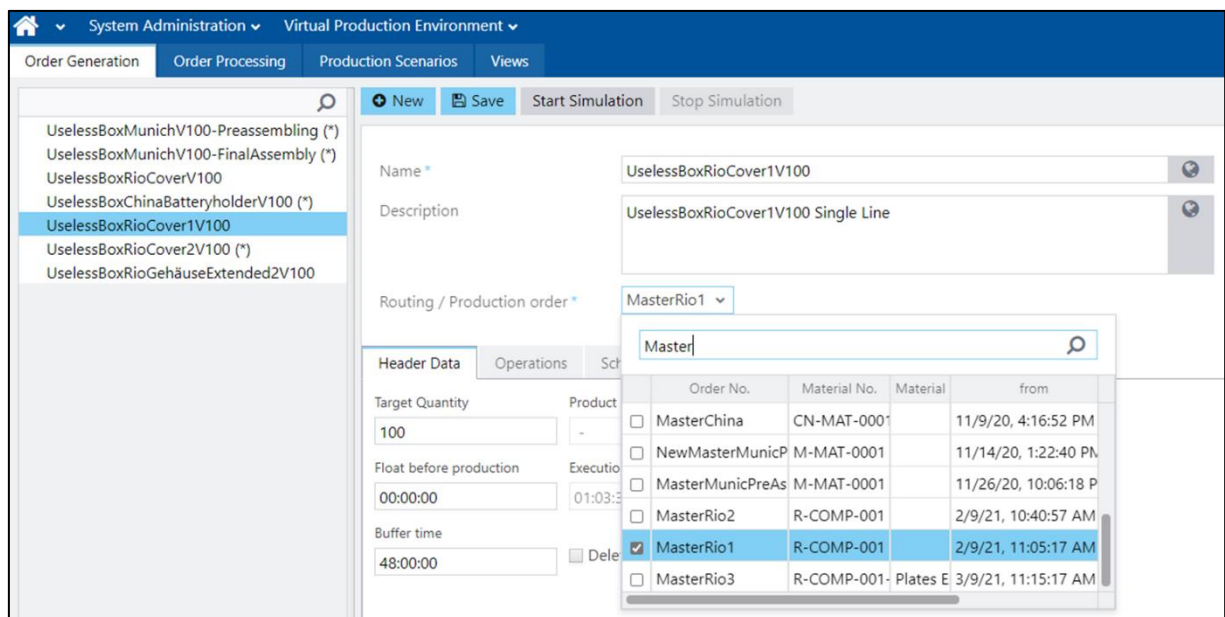


Fig. 4: Creating a new simulation for generating orders

To create a new simulation for generating orders :

1. Click **New** in the top bar.
2. Enter the desired **name** with **description**.
3. **Select the order** to be used as a template for the generated orders

The simulation for generating an order can be activated and deactivated via the buttons **Start simulation** and **Stop simulation**. The following additional settings can be made in the deactivated state.

2.1.1 Configuring the header data

Under the tab **Header data** of the order generation is where the target quantity, float time and buffer time for the lead time scheduling can be adjusted.

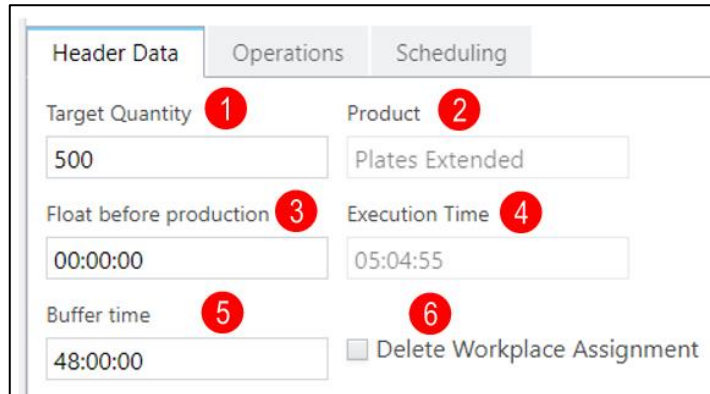


Fig. 5: Configuration of the header data

(1) Target quantity

The number of material to be produced (in this case, the final product). The target quantity is taken from the template by default.

(2) Product (non-editable)

The material to be produced, which is taken from the template.

(3) Float time

Setting the time between the release of a production order and its order start date.

(4) Execution time (non-editable)

The determined execution time of the production order to produce the set target quantity. For this purpose, the setup times and processing times of all operations in the production order are added up. Tear down, wait, and move times are not considered here.

(5) Buffer time

Setting of the buffer time, by which the order or its operations may be shifted in the timing without influencing the start dates of the subsequent orders or operations. The default value for the buffer time is 48 hours.

(6) Delete workplace assignment

The option to ignore the subsequent configuration of the workplace assignment. If checked, the operations of the production order are distributed to a free workplace within the capacity group depending on the mode selected in the order processing.

Configuration

2.1.2 Configuration of operations

Here, the individual operations of the generated production orders can be assigned specific or modified workplaces within the capacity group, where the operation is then processed. By default the workplace is taken from the template.

If the assignment is deleted, the operations of the production order are distributed to a free workplace within the capacity group depending on the selected mode in order processing.

Header Data		Operations			Scheduling	
Operation	Setup time	Processing time	Workplace group	Dispatching		
600	00:02:00	00:00:00	M_ERP_02	M_WPL_16		
Operation	Setup time	Processing time	Workplace group	Dispatching		
100	00:02:00	00:00:00	M_ERP_02	M_WP_11		
Operation	Setup time	Processing time	Workplace group	Dispatching		
200	00:00:30	00:00:00	M_ERP_02	M_WP_12		
Operation	Setup time	Processing time	Workplace group	Dispatching		
400	00:02:00	00:00:00	M_ERP_02	M_WPL_14		
Operation	Setup time	Processing time	Workplace group	Dispatching		
300	00:02:00	00:00:00	M_ERP_02	M_WPL_13		
Operation	Setup time	Processing time	Workplace group	Dispatching		
500	00:02:00	00:00:00	M_ERP_02	M_WPL_15		

Fig. 6: Configuration of the workplace assignment of operations

2.1.3 Configuration of scheduling

This tab is used for defining the number and time classification for generating the orders.

Header Data	Operations	Scheduling
1	Generate	2 order(s),
	in the interval of	1 Day(s)
2	Start date	3/17/21 02:15:15
3	Offset	00:00:00 hh:mm:ss
4	Limit	4 released orders
	5	<input checked="" type="checkbox"/> Set planned dates
	6	Execution Time 0.01 Day(s)
	7	Total time 0.00 Day(s)

Fig. 7: Configuration of scheduling

(1) Generate orders

Specify how many orders should be generated per definable time interval. The generation of the specified number of orders given here is always done at the beginning of each interval.

(2) Start date

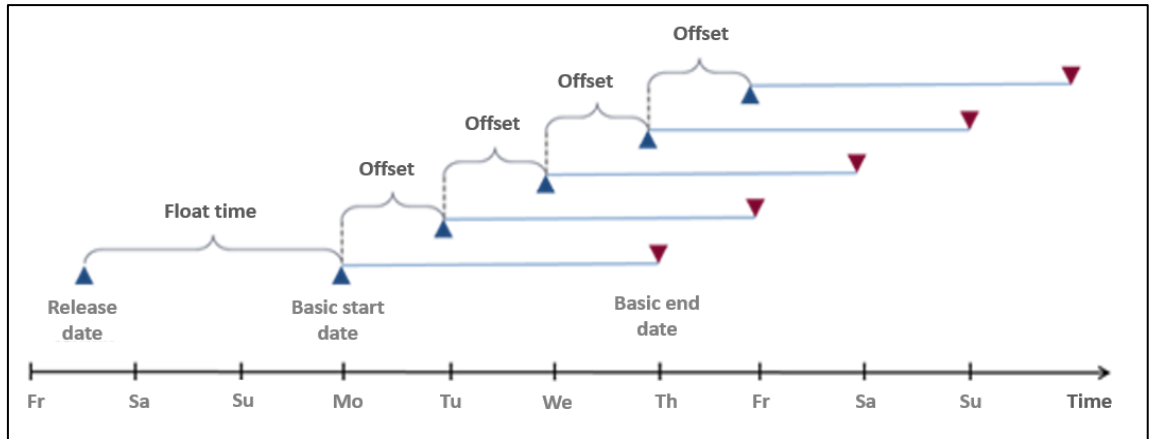
Time at which the first interval of the order generation is to start. If the simulation is not already started at this time, the generation will begin as soon as the simulation is started.

(3) Offset

If more than one order has been specified under **Generate orders**, a time offset can be

Configuration

defined here when specifying the **corresponding start date** of the generated orders. To prevent a backlog of released orders at the assigned workplaces, the offset must be set so that the times of generation are close to the times of the earliest possible start dates for order processing. The offset can be readjusted for this purpose. The simulation must be stopped to do this.



(4) Limit

Allows a limitation of the amount of production orders released at the same time for the produced material. This limitation does not only refer to the production orders of this configuration, but defines an absolute upper limit related to all released and not yet completed production orders of this material. No further orders will be generated after this limit has been reached.

(5) Set planned dates

This option allows you to determine whether the planned start and end times are to be set in the operations of the order. The determination is then made at the time of generation via forward scheduling.

(6) Execution time (non-editable)

Determined execution time of production orders generated per time interval.

For the calculation, the execution time of a single production order (see header data) is multiplied by the number of production orders to be generated. For this calculation, it is assumed that the next order is processed immediately after the completion of one order.

(7) Total time (non-editable)

Calculated total time until the completion of all production orders. In this calculation, the set offset is additionally considered in relation to the execution time, by which the time interval between the production orders can be regulated.

 The production orders generated by the VPE receive the ERP key **INTERNAL_ORDER**.

2.2 Production scenarios

The sequence behavior of the order processing can be controlled via the configuration of the production scenarios. The production scenarios are generically structured which can later be assigned to workplaces as needed.

A production scenario contains command sequences that are based on machine messages. Individual commands represent production-relevant events such as switching to other operating states, messages about produced and qualified quantities or the simulation of machine downtimes with corresponding reasons.

In addition, optional variations can be defined that randomly perform manipulations on produced quantity and time shifts at commands, or randomly intersperse stoppages with selected reasons.

2.2.1 Creating a new product scenario

It is useful to first define a general production scenario that is assigned to all workplaces by default. Further production scenarios can then be defined based on specific materials and assigned to specific workplaces.

In an even more detailed version, the material-specific production scenarios can then be split into further scenarios that are intended to address production-relevant specifics of individual workplaces or individual operations. Thus, almost any number of different production scenarios can be created.

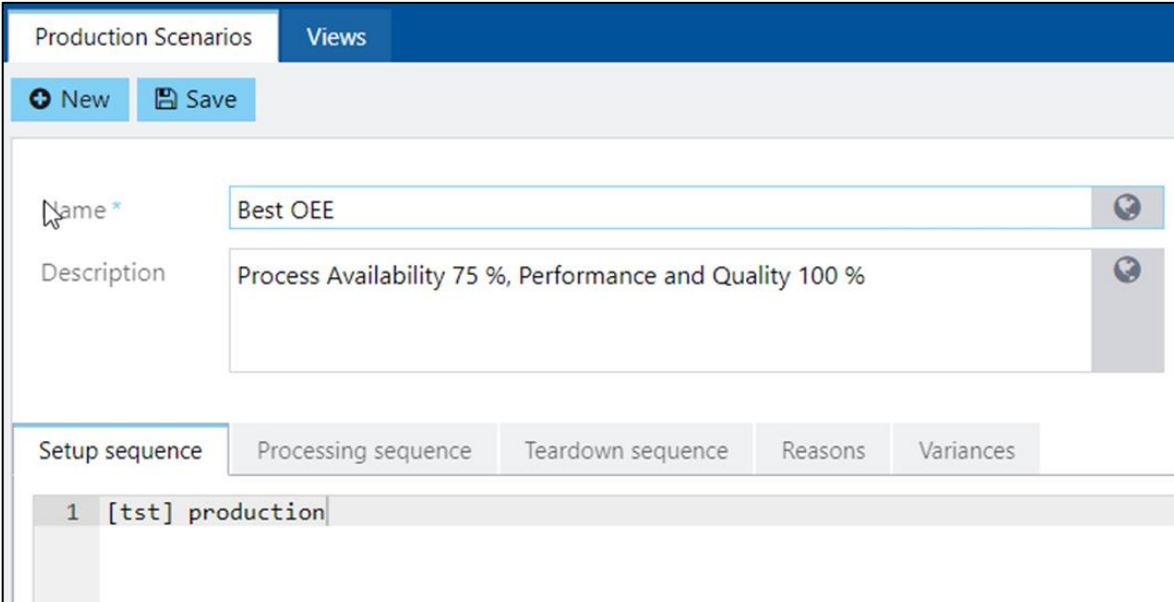



Fig. 8: Creating a production scenario

A new production scenario can be created via the **New** button. It is necessary to designate it with a name. A description can be added optionally.

2.2.2 Command sequences

Command sequences are used in the configuration of setup sequence, processing sequence and teardown sequence of a production scenario. The **setup sequence** is carried out whenever a new operation is pending at the workplace. The **processing sequence** is carried out cyclically until the target quantity is produced or completed via the **completed** command. After that, the **teardown sequence** is started.

-  Defining a setup sequence as well as a teardown sequence is optional, i.e. it can also be left empty. After that, the processing sequence will be started directly.

The commands to be carried out in a sequence are listed one after the other, line by line. For each line, a time, a command, and optionally a quantity specification is defined for the produced quantities. The time specification determines the waiting time until the command is carried out. The three entries must be separated by at least one blank space.

1	25	production
2	25	yield 3
3	25	details
4	25	stoppage

Fig. 9: Example of a command sequence

Table 3: Sequence command of the VPE

Command	Description
Production	Set the workplace to the production operating state.
Stoppage	Set the workplace to the operating state of an unfounded machine stoppage. The explanation is given by the Detail command.
Yield n	Simulate the production of a yield quantity of n parts.
Scrap n	Simulate the production of a scrap quantity of n parts. The qualification of the quantity booking is done via the Detail command.
Rework n	Simulate the production of a rework quantity of n parts. The qualification of the quantity booking is done via the Detail command.
Wait	Pause the order processing for the specified time. This can be used, for example, to simulate adherence to a setup time or teardown time.
Completed	Finish processing the current operation. This is then considered to be completed or finished. No more commands of the production scenarios applicable to the operation will be carried out. The yield (quantity) produced thus far is stored via the rule engine. If there is a pending order, the order processing will be continued immediately with the next operation.
Details	Justify all previously unfounded machine stoppages and qualify previously unqualified scrap and rework quantities. To justify the machine stoppage, an entry is cyclically selected from the corresponding list under the Reasons tab.

Configuration

- i** If a yield factor is defined in the processed operation, the produced quantity data in the **yield**, **scrap** and **rework** commands are first divided by the yield factor before being intermediately stored. If the division is not fully feasible, the quantity is rounded.

The command **Detail** is therefore detached from the other commands because it is supposed to simulate the typical action of a worker who only justifies a machine stoppage at a later time (usually via the SFT), and also detached from production, qualifies the quantities produced.

Formats for the time specification

The time specifications can be explicitly defined as being constant time. It is also possible to define it implicitly (variable) by specifying a target time of the operation to which the command sequence will be assigned later.

Table 4: Formats for explicit and implicit time specifications

Format	Description
HH:MM:SS	Explicit time specification in hours HH , minutes MM and seconds SS . The specification of hours and minutes are optional, i.e. a format MM:SS or SS is also acceptable.
[TIME_PER_UNIT] or [TPU]	Implicit time specification of the time per unit of the operation
[TIME_PER_STROKE] or [TPS]	Implicit time specification of the time per stroke of the operation
[TARGET_SETUP_TIME] or [TST]	Implicit time specification of the target setup time of the operation
[TARGET_PROCESSING_TIME] or [TPT]	Implicit time specification of the target processing time of the operation
[TARGET_TEARDOWN_TIME] or [TTT]	Implicit time specification of the setup and teardown time of the operation

For **explicit time specifications**, only numbers up to 59 are permitted for non-prefixed time values (minutes and seconds). Higher values are permitted for the superordinate time values.

Examples of permissible explicit time specifications:

99999:59
3333:59:59

Examples of non-permissible explicit time specifications:

33:60:60
5:333:222

For **implicit time specifications**, the case is irrelevant, e.g. [tpu] or [tps] are also valid time specifications.


Within the brackets it is possible to insert an operator for the multiplication or division of an implicit time with a constant number.

Examples of implicit time specifications:

[TPU * 100]
[TARGET_SETUP_TIME / 5]

Configuration

Note the enclosure with square brackets and the required empty spaces before and after the operator. Only positive whole integers are allowed as constants. Decimal numbers are not allowed.

 If no target time is defined in the operation, a value of one second is assumed as a substitute.

2.2.3 Setup sequence

The following command is generally used in the setup sequence:

```
[TARGET_SETUP_TIME] production
```

After the setup sequence has been carried out the processing sequence is started.

Without a setup sequence, the processing is also started according to the setup time defined in the operation.

Setup sequence	Processing sequence	Teardown sequence
1 [TARGET_SETUP_TIME / 2] Stoppage		
2 120	Yield 5	
3 [TARGET_SETUP_TIME / 2] Production		

2.2.4 Processing sequence

The processing sequence is carried out cyclically until the defined target quantity is reached or the command **Completed** has been carried out. After that, the teardown sequence is started.

Setup sequence	Processing sequence	Teardown sequence
1 [TIME_PER_STROKE * 10]	YIELD	50
2 10:00	Stoppage	
3 5:00	SCRAP	3
4 7:30	production	
5 45:00	Rework	2
6 5:00	DETAILS	

In order to simulate a plausible order processing, the production scenario must also be able to achieve the target quantity of the operation by producing sufficient yield.

In addition, the induced stoppages must be substantiated, and the quantities produced must also be qualified.

A minimal processing sequence includes the **Yield** command with a value greater than 0 and the **Details** command.

Configuration

2.2.5 Teardown sequence

The teardown sequence can be left empty and will then be ignored. Typically, at the very least, the target setup time is considered:

Setup sequence	Processing sequence	Teardown sequence
1 [TARGET_TEARDOWN_TIME] WAIT		

2.2.6 Reasons

Under this tab, reasons for machine stoppages (command **Stoppage**), scrap reasons (command **Scrap**) and rework reasons (command **Rework**) can each be arranged using the [+] buttons.

Setup sequence	Processing sequence	Teardown sequence	Reasons	Variances
Select Status Detail			+	Select Rework Reason
Post-setup / Clamping			+	Surface
Material damaged completely			+	Geometry
Malfunction electrics				
Missing personnel				
Malfunction hydraulics / pneumatics				
Quality issue (raw material)				
Reparation mechanics				
Machine interrupted during production				
Reparation electrics				
Malfunction mechanics				
Select Scrap Reason			+	
Geometry			+	
Surface			+	

Fig. 10: Reasons for machine stoppages, scrap and rework.

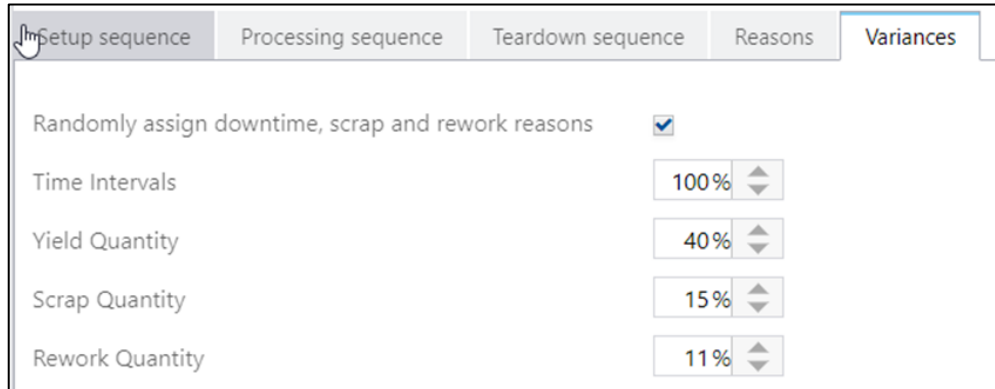
The arranged reasons are then used cyclically by default when the **Detail** command is called up. But the cyclic selection can also be cancelled via the subsequent **Variances** tab and replaced with a random selection.

- ❗ Individual reasons can also be included in the list more than once. This means that they are used more frequently or with greater probability.

2.2.7 Variances

Unplanned random events such as malfunctions or deviations in the qualified quantities can be defined under **Variances**.

For this purpose, a percentage spectrum is defined where the corresponding sequence commands are to deviate randomly at the time of processing. For example, a value of 25% means that during processing of the sequence command, the time interval or quantity specified there varies in the range of 0.75 to 1.25 times. At a value of 50% in the range of 0.5 to 1.5 times.



Tab	Randomly assign downtime, scrap and rework reasons	Time Intervals	Yield Quantity	Scrap Quantity	Rework Quantity
Setup sequence	<input type="checkbox"/>				
Processing sequence	<input type="checkbox"/>				
Teardown sequence	<input type="checkbox"/>				
Reasons	<input type="checkbox"/>				
Variances	<input checked="" type="checkbox"/>	100%	40%	15%	11%

Fig. 11: Configuration of variances

If a check mark is placed in "Randomly assign downtime, scrap and rework reasons", the cyclic selection of these reasons is cancelled and switched to random selection.

2.3 Order processing

Order processing is used to simulate the processing of orders at the existing workplaces. All orders that meet the set start criteria are processed, not just the orders generated by the VPE. The configured production scenarios are now used and can be specifically assigned to the workplaces. A material and machine-specific classification of the former material and machine-independent production scenarios is only possible through this mapping.

Order processing can partially or completely automate the manual interventions that are usually performed by a worker or operator on the SFT. To do so, select from the following three modes:

Term	Explanation
Full-automatic mode	<p>The login and logout of the worker as well as the selection and login for processing the operations at the workplace are carried out automatically here, i.e. no manual intervention is required.</p> <p>⚠ Depending on the configuration or scenario, the processing of an operation may depend on the completion of other operations at other workplaces. To ensure a smooth production process, it is therefore necessary to check that order processing has also been set up there accordingly and that the simulation has been started.</p>
Semi-automatic mode	<p>The login and logout of the worker and the selection, and login for processing the operations must be carried out manually, e.g. via the SFT. Changing the other workplace and operation phases is then handled automatically by the VPE.</p>
Specific scenario	<p>The preset production scenarios can be individually assigned to individual operations or materials via a list of operations or materials. In each case, a specific time is defined from which the production scenario is to start. When the simulation is started, the arranged list is processed automatically without manual intervention.</p> <p>ℹ This option also allows for parallel processing of multiple operations at the workplace.</p> <p>As soon as the simulation is started at a workplace, a search for a random person/worker is performed in the system.</p> <p>ℹ For a worker to be selected, at least one person must be defined in the FORCE system. However, order processing also works when no worker is available.</p> <p>ℹ There is no plausibility check for the randomly selected worker. The selected worker could already be logged into another workplace or not be on a work shift at the time.</p>

2.3.1 Shifts and breaks

By default, the VPE observes the shifts and breaks during order processing. At the beginning of a shift, the simulation automatically reports the startup of the workplace or the machine to the rule engine. At the end of a shift the workplace or the machine is brought to a standstill by a corresponding message to the rule engine. The same procedure is used for pauses. The job processing simulation remains inactive during these stoppages. This mechanism can optionally be turned off by ignoring free shifts and breaks.

2.3.2 General configuration

After selecting the order processing tab, all available workplace groups with the associated workplaces are listed on the left.

- ❗ It may take some time until new workplaces created in the ERP hierarchy are displayed in this list.

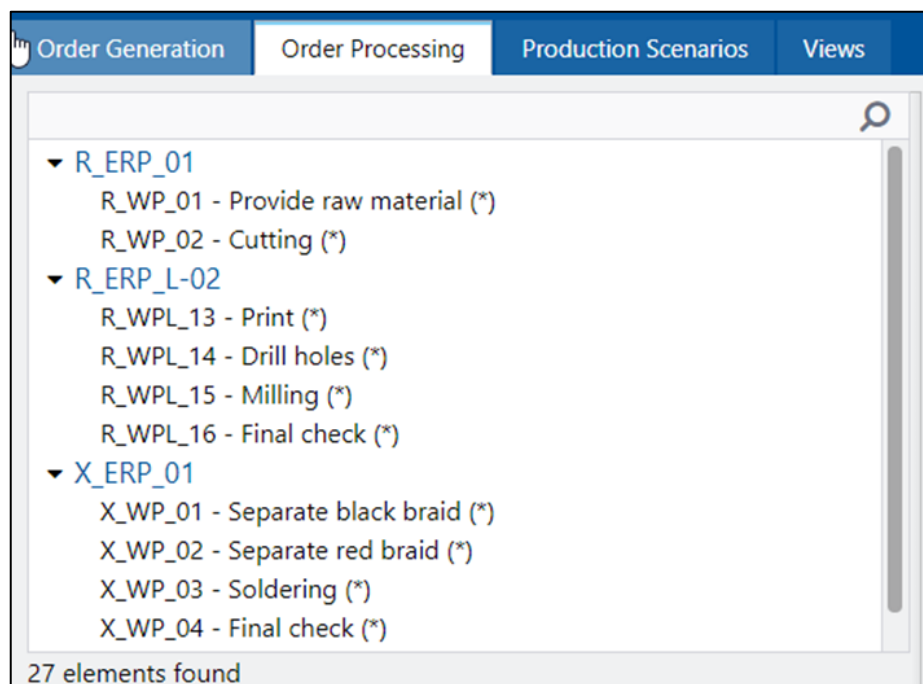
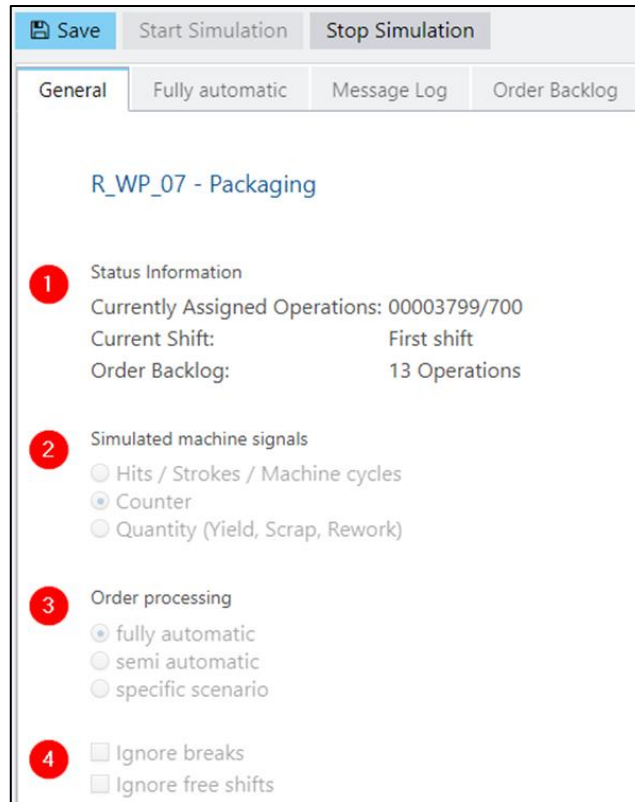


Fig. 12: Workplace groups of the ERP hierarchy

- ❗ The mark (*) indicates that the simulation is currently running at this workplace.

The Order processing can be configured for a workplace after it has been selected.



Save Start Simulation Stop Simulation

General Fully automatic Message Log Order Backlog

R_WP_07 - Packaging

1 Status Information
 Currently Assigned Operations: 00003799/700
 Current Shift: First shift
 Order Backlog: 13 Operations

2 Simulated machine signals
☐ Hits / Strokes / Machine cycles
☒ Counter
☐ Quantity (Yield, Scrap, Rework)

3 Order processing
☒ fully automatic
☐ semi automatic
☐ specific scenario

4 ☐ Ignore breaks
☐ Ignore free shifts

Fig. 13: General configuration for order processing

(1) Status information

Information about the operations currently logged into the workplace (specifying the operation/order number) and the current shift, as well as the number of operations in the workplace's order backlog.

(2) Simulated machine signals

Here it is possible to specify the type of production and the generation of a corresponding machine signal. Normally, production is done based on counters, i.e. the simple reporting of a produced unit or a counter increment (+1). If production is to be based on strokes, the stroke factor defined in the operation, i.e. the quantity produced per stroke, is factored into the message. The Quantities option is available for the simulation of machines that can independently (i.e. without a worker) detect and report the quantity and qualification (yield, scrap, rework).

(3) Order processing

This is where the order processing mode can be selected (see introduction of this chapter).

(4) Ignore breaks and free shifts

Regardless of the mode of order processing, it is possible to ignore breaks or free shifts. If a check mark is set, the production scenarios are not stopped during shift breaks or within free shifts but continue to be simulated.

Depending on the mode selected in **Order processing**, one of the following three tabs will be activated next to the **General** tab.

2.3.3 Configuration of fully automatic order processing

If the fully automatic mode for order processing was selected in the general configuration, the following settings are available:

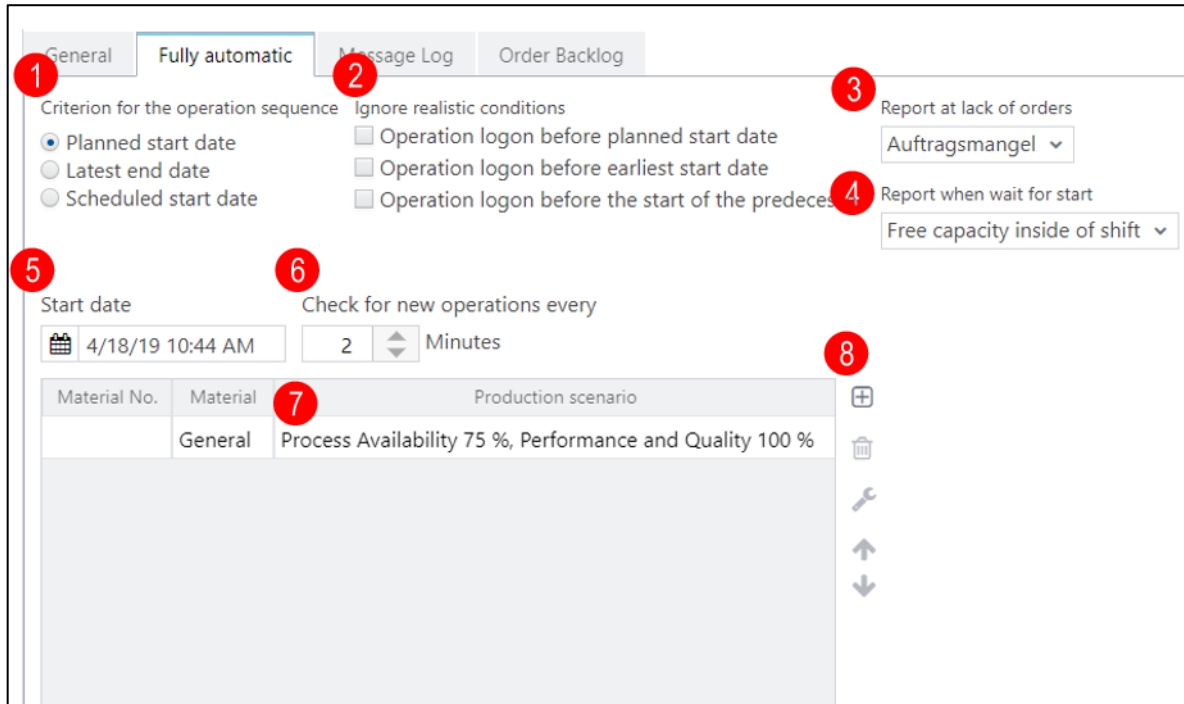


Fig. 14: Settings for fully automatic order processing

(1) Criteria for the sequence of operations

This is used to specify which criteria is to be used for selecting the next operation for processing.

For this, the pending operations can be sequenced using the times determined in lead time scheduling, based on one of the following criteria:

- Planned start, i.e. earliest planned start date
- Latest finish time, i.e. latest finish date
- Scheduled start, i.e. start date determined by lead time scheduling.

In this case, the scheduled start dates come from the order generation (see option **Set schedule start/schedule end** in the configuration of the scheduling).

(2) Ignore realistic conditions

Under realistic conditions, an operation is rarely assigned before its planned start date because the necessary components and production resources are usually not yet available before that time. However, If the **operation is to be allowed to start before the scheduled start date**, a check mark can be placed here as required.

If the operation registration is also supposed to be allowed **before the earliest start date** or even **before the start of the preceding** operation, the additional checkmarks can be set as required.

(3) Report at lack of orders

This is where it is possible to select which reports are to be generated when the order backlog at the workplace is empty. The workplace then goes through this report in the respective operating state until an operation from the order backlog can be registered again.

Configuration

(4) Report when waiting for start

If the order backlog is not empty, but the start date of the pending operation has not yet been reached, one or more reports can also be selected for this purpose, which are then generated. The workplace then goes into the respective operating state until another operation can be logged in from the order backlog..

(5) Start time

This is where a time can be set from which order processing is to be started at the workplace. This is the point at which a check is carried out for the first time to determine whether a new operation can be assigned from the order backlog. If according to the criteria set above, no operations are yet ready to start, then the reports set in **Report when waiting for start date** are generated.

The default start time is the current browser time.

(6) Check for new operation

Definition of a time interval in which the check is carried out whether a new operation from the order backlog can be logged in and, if necessary, registered and processed. Only one operation per workplace is logged in or processed at any one time.

The time interval configured here is also used for checking and carrying out the operation phase change when a production phase has been completed.

(7) Processed production scenarios

The table shows which production scenario is assigned to which materials.

At least one production scenario is required. This is represented as a **general production scenario** and is carried out if no material-specific production scenario has been defined.

(8) Edit completed production scenarios

Using the buttons, a new assignment can be added, deleted or edited.

To add a new table entry:

1. Select the start date.
2. Select the material.
3. Select the production scenario to be assigned.

Select material-specific Production Scenario

Material

Production Scenario

	Material No.	Material
<input checked="" type="checkbox"/>	R-MAT-0001	
<input type="checkbox"/>	R-COMP-001	

Production scenario

Process Availability 75 %, Performance and Quality 100 %

Add

Cancel

Fig. 15: Adding a new table entry for the fully automatic order processing add

2.3.4 Configuration of semi-automatic order processing

The following settings are available if the semi-automatic mode for job processing was selected in the general configuration.

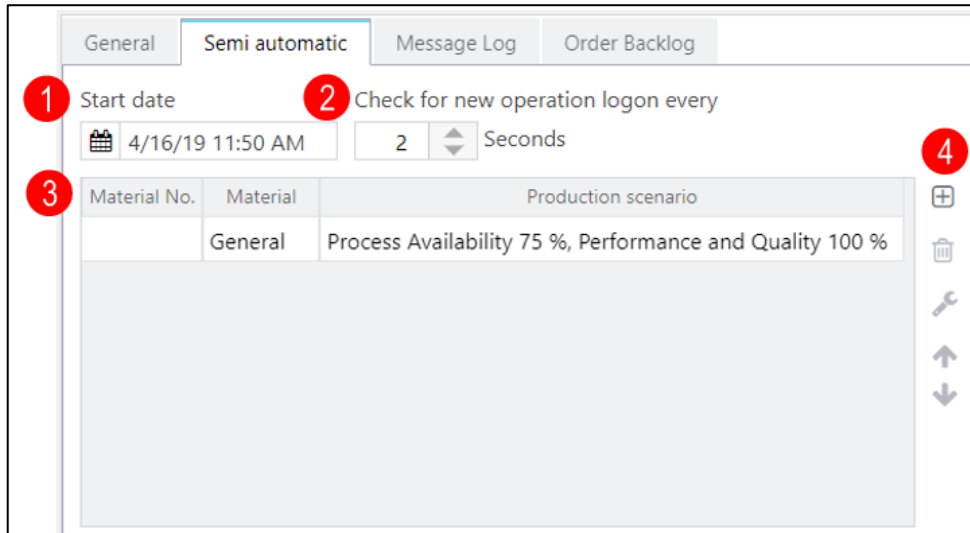


Fig. 16: Settings for semi-automatic order processing

(1) Start time

This is where a time can be set from which order processing is to start at the workplace, and a check for new operations is to occur for the first time.
The default start time is the current browser time.

(2) Check for new operation

Definition of a time interval to check if new operations were assigned from the order backlog (e.g. by a worker) and, if necessary, to process them.
This configured time interval is also used for checking and carrying out the operation phase change when a production phase has been completed.

(3) Processed production scenarios

The table shows which production scenario is assigned to which materials.
At least one production scenario is required. This is represented as a general production scenario and is carried out if no material-specific production scenario has been defined.

(4) Edit completed production scenarios

Using the buttons, a new assignment can be added, deleted or edited. See also section 0.

2.3.5 Configuration of order processing via specific scenario

The following settings are available if order processing was selected in the general configuration via **specific production scenario**:

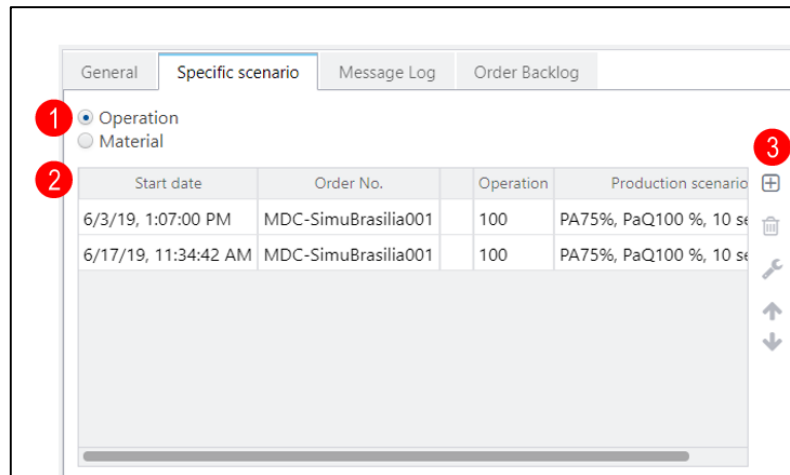


Fig. 17: Setting order processing via specific scenario

(1) Operation/Material

Specifies whether production scenarios are to be assigned based on a list of operations or materials.

If a list based on materials is selected, the VPE determines which specific operations are used to produce the materials.

Use caution when changing this setting if a list has already been created, as the list will then be deleted. The user is reminded of this before the change is made by means of appropriate security prompts.

(2) Processed production scenarios

The table shows which production scenario is assigned to which operations or materials.

(3) Edit completed production scenarios

Using the buttons, a new assignment can be added, deleted or edited.


Configuration

To add a new table entry:

1. Select the start date.
2. Select the operation or material.
3. Select the production scenario to be assigned.

Select Production Scenario

Start date

 12/14/20 06:03:22 PM

Operation


	Order	Operation	Material	Workplace	from
<input checked="" type="checkbox"/>	00000607	700	R-COMP-001	R_WP_07	12/1/20, 10:13:

Production Scenario

Production scenario
Process Availability 75 %, Performance and Quality 100 %

Add
Cancel

Fig. 18: Adding a new table entry for specific scenario

-  The set start date or start time determines when the new entry is activated and therefore determines the start of the processing of the operation with the assigned production scenario. This type of order processing also allows parallel processing of operations.

3 Monitoring functions

The Office module offers a wide variety of methods for monitoring and analyzing the performance of production processes. This means that relevant reports and visualizations are also available for the configured processes in the VPE. A detailed explanation of all available functionalities for this is provided in the **Performance Analysis** manual.

In addition, further monitoring functions are available in the scope of order processing.

3.1.1 Messages

This tab provides access to the messages accumulated at the workplaces regarding operating states, quantities and reasons.



General Fully automatic Message Log Order Backlog										
Workplace: R_WP_07 Time: 3/14/2021 - 3/17/2021 Message Type: Machine Counter, Machine Hits, Machine Quantity, ...  										
Timestamp	Message	Workplace	Order	Operation	Details (Status)	Number	Yield Qty.	Scrap Qty.	Rework Qty.	
Mar 17, 2021, 12:16:55 PM	Machine State	R_WP_07	0	0	Quality issue (raw material)	0	0	0	0	
Mar 17, 2021, 12:16:55 PM	Machine State	R_WP_07	0	0	Undefined stoppage	0	0	0	0	
Mar 17, 2021, 12:15:15 PM	Machine Counter	R_WP_07	0	0	Cnt. No.: 0	8	0	0	0	
Mar 17, 2021, 12:14:25 PM	Machine State	R_WP_07	0	0	Production	0	0	0	0	
Mar 17, 2021, 12:13:35 PM	Machine State	R_WP_07	0	0	Malfunction hydraulics / pneumatics	0	0	0	0	
Mar 17, 2021, 12:13:35 PM	Machine State	R_WP_07	0	0	Undefined stoppage	0	0	0	0	
Mar 17, 2021, 12:11:55 PM	Machine Counter	R_WP_07	0	0	Cnt. No.: 0	9	0	0	0	
Mar 17, 2021, 12:11:05 PM	Machine State	R_WP_07	0	0	Production	0	0	0	0	

Fig. 19: Listing of messages at selected workplaces

The following filters are available:

- Workplace (multiple)
- Time (time, shift, day)
- Message type

Messages are signals that represent a change in the Shopfloor Terminal. These are booked and interpreted centrally via the rule engine and prepared for reporting or the ERP. The following message types are available:

- o Machine counter
Counter for produced pieces of a machine
- o Machine strokes
Number of strokes that a machine makes
- o Machine quantity
Any quantities produced by a machine (e.g. kg)
- o Machine status
- o Operation phase
- o Operation quantity
Yield as opposed to scrap- and rework quantity
- o Personnel status change
Person logged on to the operation

Monitoring functions

- o Personnel workplace status change
Person logged on to the workplace
- o Shift status
Created by the shift generator status of the shift whenever it starts/ends.

3.1.2 Order backlog

This tab lists the pending orders with the most important attributes.



General Fully automatic Message Log Order Backlog									
Workplace: M_WPL_13 More... 									
Order	Operation	Material	Operation Phase	Operation Status	Status since	Priority	Workplace Group	Workplace	Planned Starting Date
00002782	300	M-MAT-0002	Production Ready	Not assigned	1/16/21, 7:36 AM		M_ERP_02	M_WPL_13	12/10/20, 5:05 PM
00002800	300	M-MAT-0002	Production Ready	Not assigned	1/17/21, 7:36 AM		M_ERP_02	M_WPL_13	12/10/20, 5:05 PM
00002751	300	M-MAT-0002	Interrupted	Not assigned	2/8/21, 3:40 PM		M_ERP_02	M_WPL_13	12/10/20, 6:05 PM
00002786	300	M-MAT-0002	Production Ready	Not assigned	1/16/21, 7:36 AM		M_ERP_02	M_WPL_13	12/10/20, 6:05 PM
00002803	300	M-MAT-0002	Production Ready	Not assigned	1/17/21, 7:36 AM		M_ERP_02	M_WPL_13	12/10/20, 6:05 PM
00002754	300	M-MAT-0002	Production Ready	Not assigned	1/15/21, 7:36 AM		M_ERP_02	M_WPL_13	12/10/20, 7:05 PM
00002806	300	M-MAT-0002	Production Ready	Not assigned	1/17/21, 7:37 AM		M_ERP_02	M_WPL_13	12/10/20, 7:05 PM

Fig. 20: Listing of the order backlog at selected workplaces

The following filters are available:

- Workplace (multiple)
- Material (multiple)
- Operation (multiple)

-  After selecting an attribute in the table header, the entries are sorted primarily by the selected attribute.

3.1.3 Visualizations

Visualizations provide a clear realtime representation of the current situation in production.

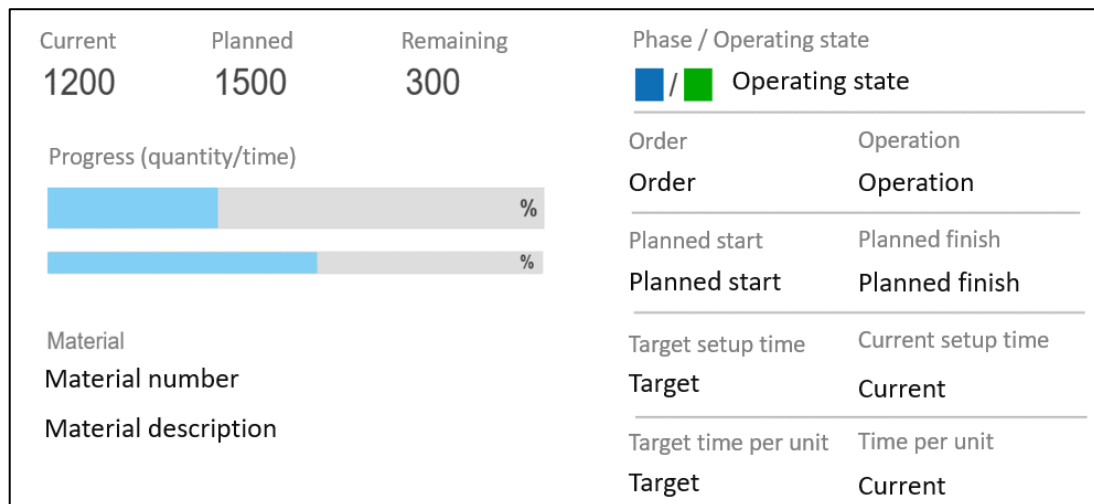


Fig. 21: Example of a simple visualization

For more information on creating and editing visualizations, see the manual **Performance Analysis**.

4 Annex

4.1 Abbreviations

Abbreviation	Explanation
AVO (German)	Operation
ES	Earliest date the operation can start
EF	Earliest date the operation can finish
LS	Latest date that the operation can start
LF	Latest date that the operation can end
VPE	Virtual production environment

4.2 Document history

Version	Date	Name	Change
1	2021-02-01	Matthias Koranda	Created
	2021-05-10	Sigrid Ternes	Translated into English