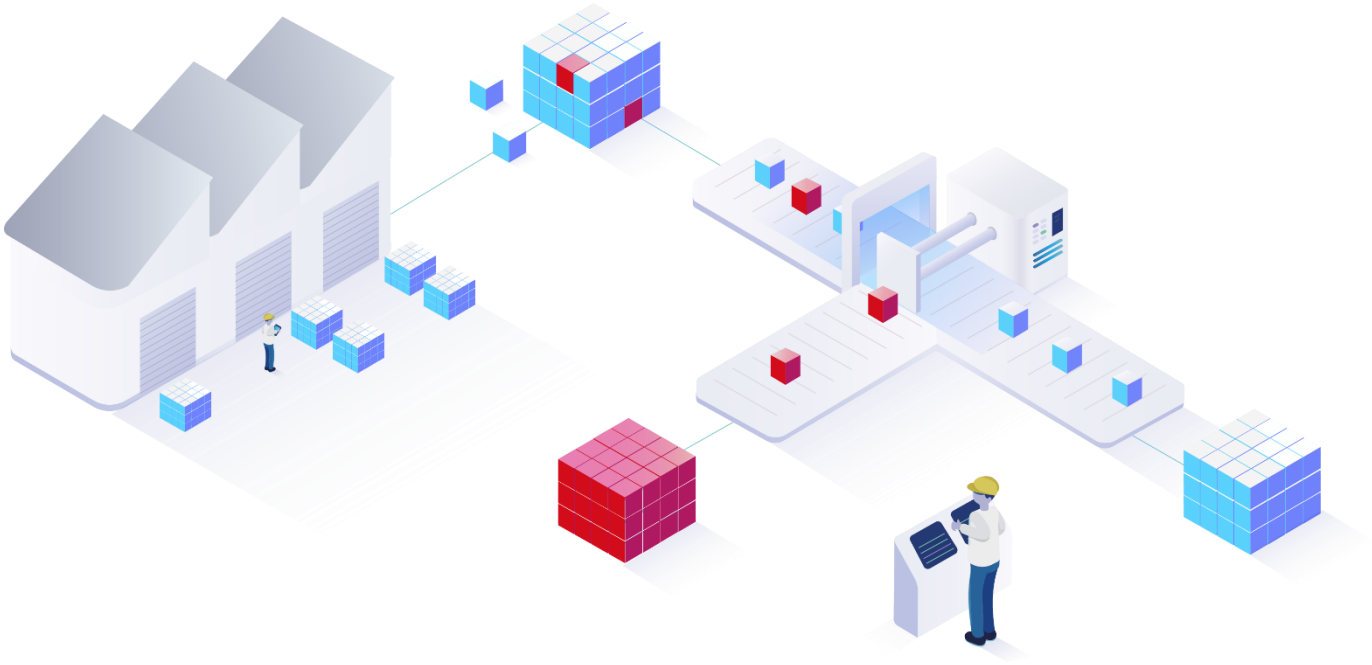

Track & Trace Use Cases

Version 5.11

Manual

Document:	Manual - Track & Trace Use Cases.docx
Release date:	2021-03-01
Document version:	1
Author:	S. Ternes

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FB_8-41 CREATED: 01.03.21 LAST CHANGES: 10.03.21 VERSION: V1
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1 Introduction

1.1 Goal of this document

This documentation describes the use of FORCAM FORCE™ Track & Trace in the form of example use cases. The contents of these use cases were selected based on typical customer requirements.

This documentation and the corresponding reference configuration, which can be provided as an initial configuration upon customer request, will help to accelerate a rollout and the understanding of FORCAM FORCE™ Track & Trace. The templates of this module are designed as single templates.

It is meant to serve as a bridge between the flexibly configurable Track & Trace module and a specific customer project rollout. The document adheres to the structure of FORCAM's general use cases, but specifically addresses the needs and challenges of traceability.

The configuration of Track & Trace is not described in this document, but can be found in the **configuration documentation**.

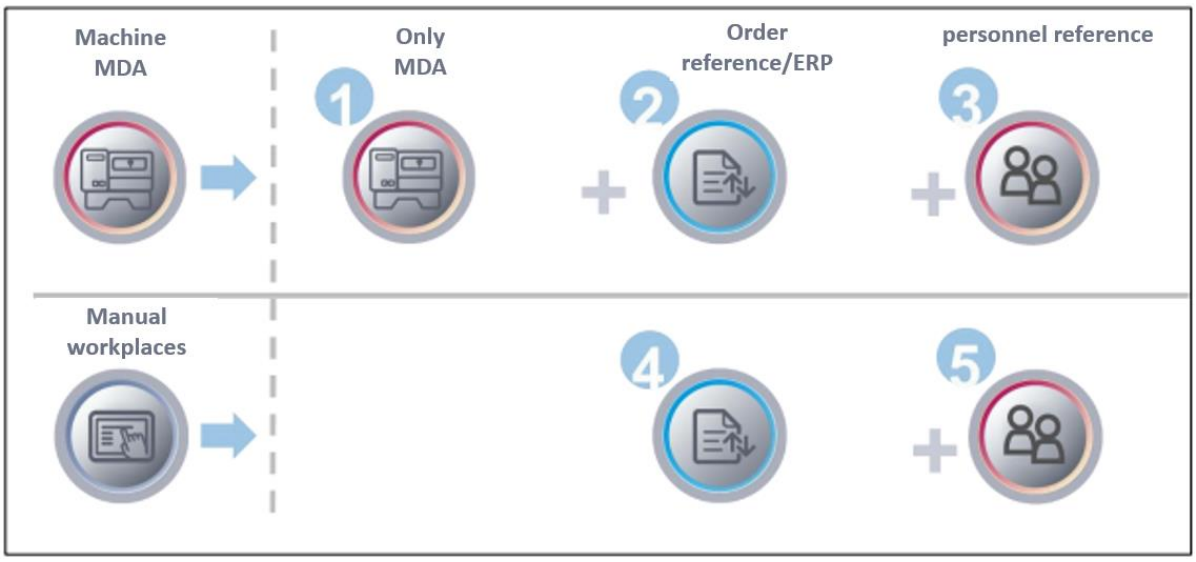


Fig. 1: FORCAM FORCE™ use cases

1.2 Track & Trace general information

The main function of Track & Trace is to record and trace production data. In addition, processes can be interlocked and secured.

Traceability:

Recording production data ensures complete traceability of the manufacturing process, which means that every product can be traced back to the conditions under which it was manufactured.

This helps to reduce the liability risk in the event of a complaint in terms of product liability. Furthermore, the recall quantity can be clearly defined in the event of a recall.

The recorded data provides the basis for more in-depth analyses which help to sustainably improve process and product quality.

Interlocking and securing processes

The recorded data can be used as a basis for ensuring that the prerequisites for further processing or treatment are met for a successor process.

The following checks are available as an example:

- Previous process was completed
- Result of previous process is in good quality
- All components are available

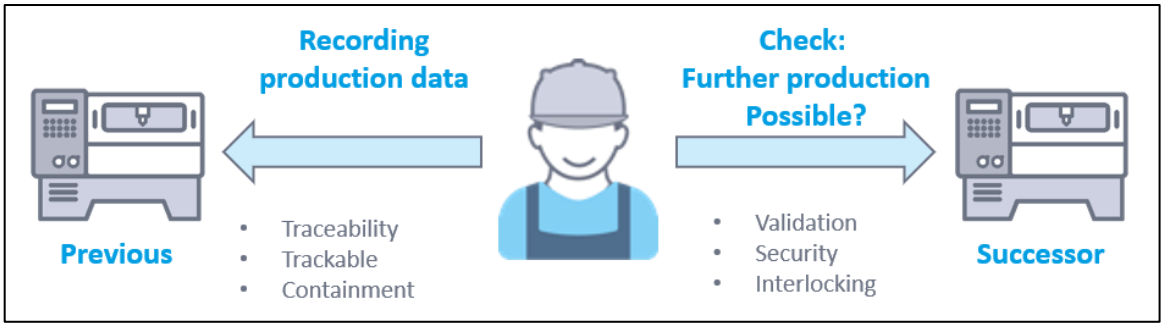


Fig. 2: Track & Trace basic concept

1.3 Track & Trace use cases

The Track & Trace use cases are organized in four submodules. Each submodule has its own template, which is geared towards the functional scope.
The four use cases are described in detail in the following chapters:

- Process data
- Batch
- Individual part
- Assembly

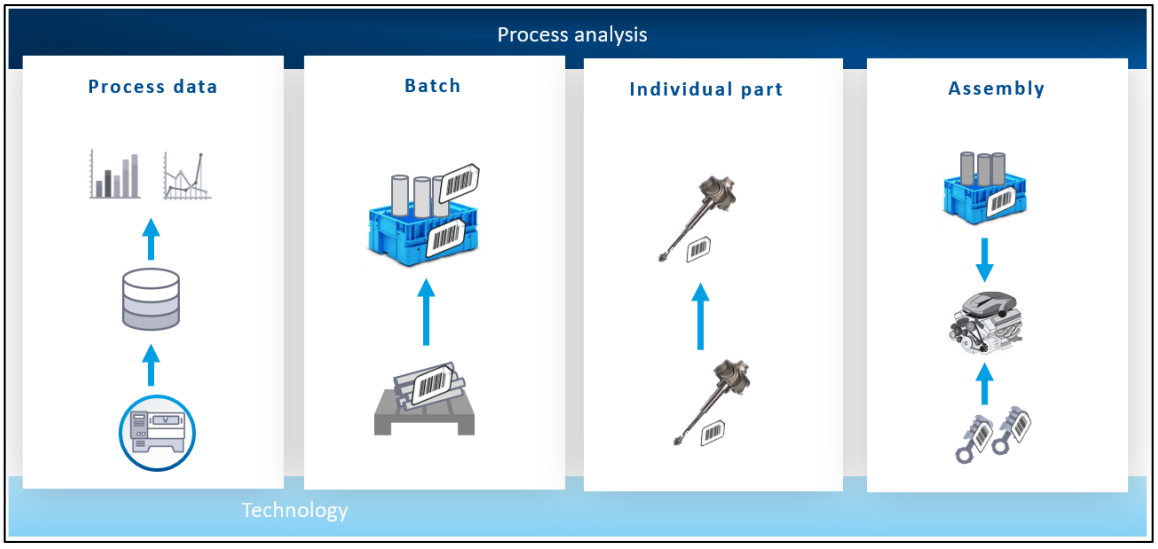


Fig. 3: Track & Trace use cases

1.4 Overall value chain

In a real manufacturing environment, it is rare to find single-stage production processes. Therefore, the use case templates were designed in such a way that a multilevel production process can be mapped with no need for additional configuration.

In this case, the batch and individual part traces function as modules which are installed in the assembly (i.e. final assembly).

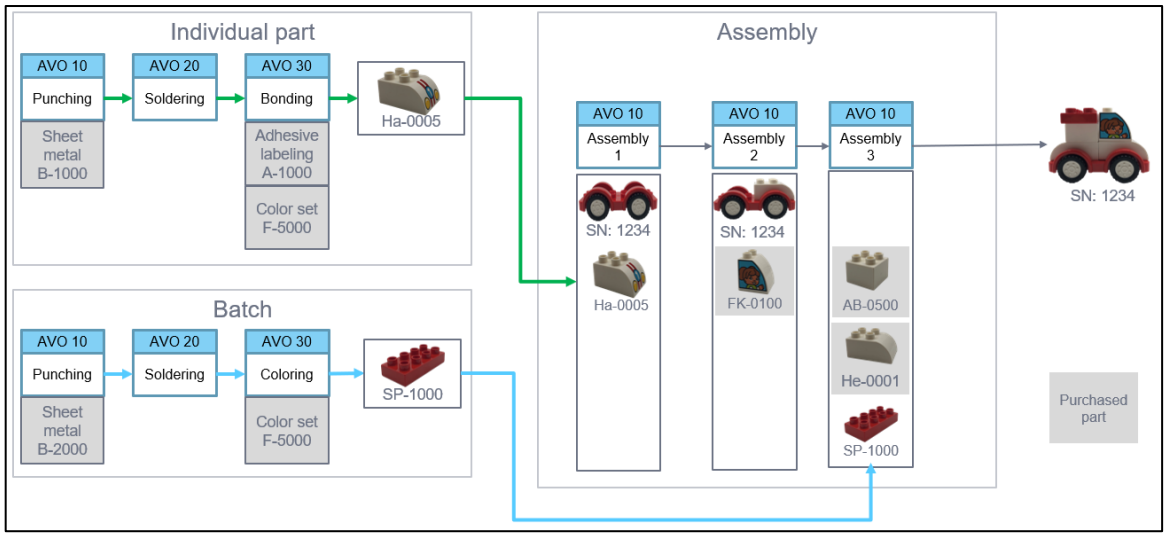


Fig. 4: Multilevel value chain with Track & Trace

2 Use Case: Process Data

In the process data use case, data on the production process for a workplace (machine) is recorded continuously.

Process data is used for recording and monitoring processes. This is then used to measure energy consumption and to monitor limit values.
Contrary to the other use case templates, the process data acquisition has no direct reference to a manufactured object. The mapping can only be done via a time limitation.

There are two ways process data is reported. One way is via the reporting integrated in Track & Trace, and the other is by visualizing data configured as energy consumption in the performance analysis in the energy data section.

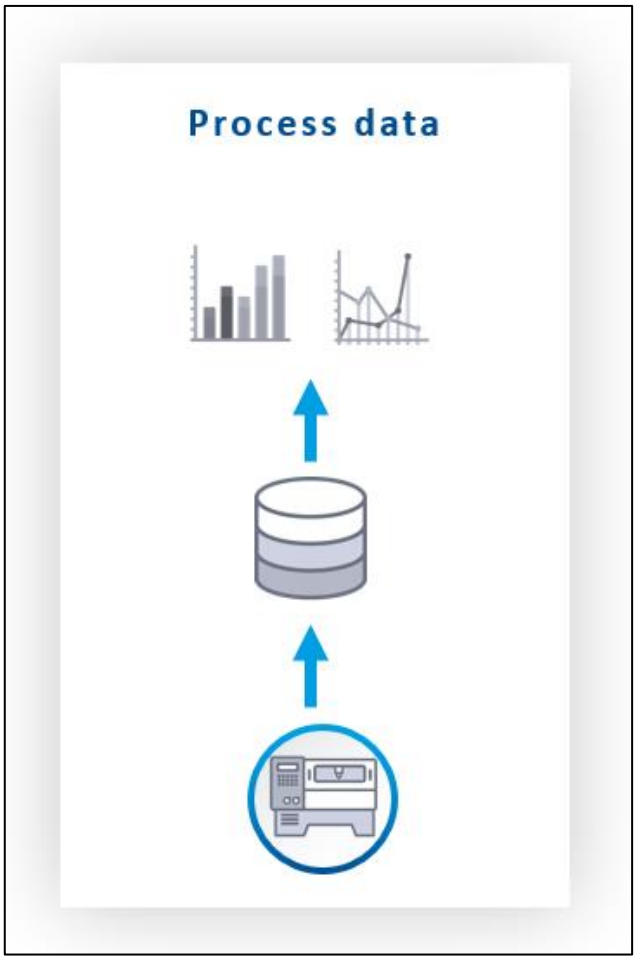
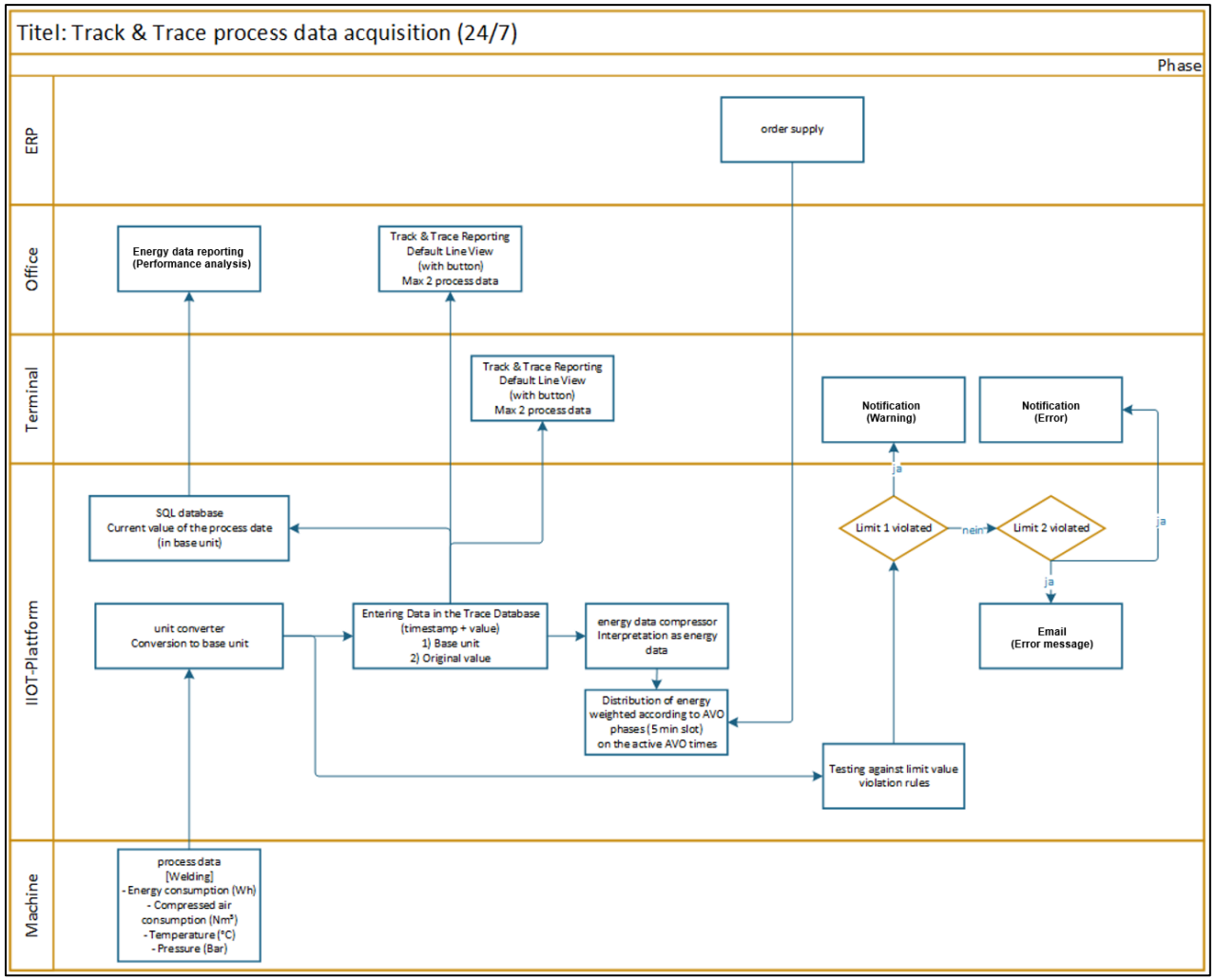


Fig. 5: The procedure for process data acquisition

2.1 Workflow


Titel: Track & Trace process data acquisition (24/7)
Phase
ERP
Office
Terminal
IIOT-Plattform
Machine
order supply
Energy data reporting (Performance analysis)
Track & Trace Reporting Default Line View (with button) Max 2 process data
Track & Trace Reporting Default Line View (with button) Max 2 process data
Notification (Warning)
Notification (Error)
SQL database Current value of the process date (in base unit)
Limit 1 violated
nein
Limit 2 violated
ja
ja
ja
unit converter Conversion to base unit
Entering Data in the Trace Database (timestamp + value) 1) Base unit 2) Original value
energy data compressor Interpretation as energy data
Email (Error message)
Distribution of energy weighted according to AVO phases (5 min slot) on the active AVO times
Testing against limit value violation rules
process data [Welding] - Energy consumption (Wh) - Compressed air consumption (Nm³) - Temperature (°C) - Pressure (Bar)

2.2 Functional description

2.2.1 Order supply

The order supply via ERP is required for the assignment of the energy requirements to operation phases. This allows energy consumption to be mapped to the phases based on the causor.

2.2.2 Process data acquisition for "Welding" production process

Process data acquisition involves the continuous acquisition of process data reported by a plant or plant control system.

For this use case, the following process data are preconfigured for the *welding* process:

Process date	Input type	Usage in reporting
Energy consumption [Wh]	Absolute value	Consumption history
Energy consumption [Wh]	Incremental value	Total consumption
Compressed air consumption [Nm^3]	Incremental value	Total consumption
Temperature [°C]	Absolute value	Temperature history
Pressure [Bar]	Absolute value	Pressure history

In the use case templates, the process data is recorded via a CSV file. In the productive system, the process data acquisition must be configured individually.

The following prerequisites and preparations must be met:

What	Where (module)	How
Plant with a control system supported by FORCAM		Advance clarification by customer
Create workplace	Workbench	Configuration
Add DCU to workplace	Workbench	Configuration
Create DCP in VPIE	Office	Configuration

2.2.3 Unit converter

The unit converter converts the acquired units into their respective base units. For this, a unit system must be created in the configuration.

The conversion into the base unit makes it possible to also convert the collected process data into other units or to view process data with various collection units in a standardized way. This also allows switching between the configured physical units in reporting.

The following unit system is predefined in the use case template:

Process value	Input unit	Base unit	Defined unit
Energy consumption	[Wh]	Joule [J]	kWh/Wh/J/KJ
Compressed air consumption	[Nm^3]	[Nm^3]	
Temperature	[°C]	Kelvin [K]	C/K
Pressure	[Bar]	Torr	Pascal/Bar/mBar/PSI/ATM/Torr

2.2.4 Storing process data in the trace database

The captured process data is stored in the Track & Trace database (MongoDB) in the value of the recorded unit and the value of the converted base unit. This enables the visualization of the original recorded value in the reporting without possible rounding differences from the conversion to the base unit.

2.2.5 Reporting of process data in Track & Trace

Path: Track & Trace > Reporting > Common reporting > Process data chart

Process data can be displayed graphically in the process data visualization. Generally, process data can be visualized in two different axes with different process data units. Several process data curves can be displayed per axis.

Process data can be exported from the visualization: The export as PDF document will load the visualization with the corresponding legend and the option *Export all* exports the process data as .CSV files. These can be used as input for further evaluations.

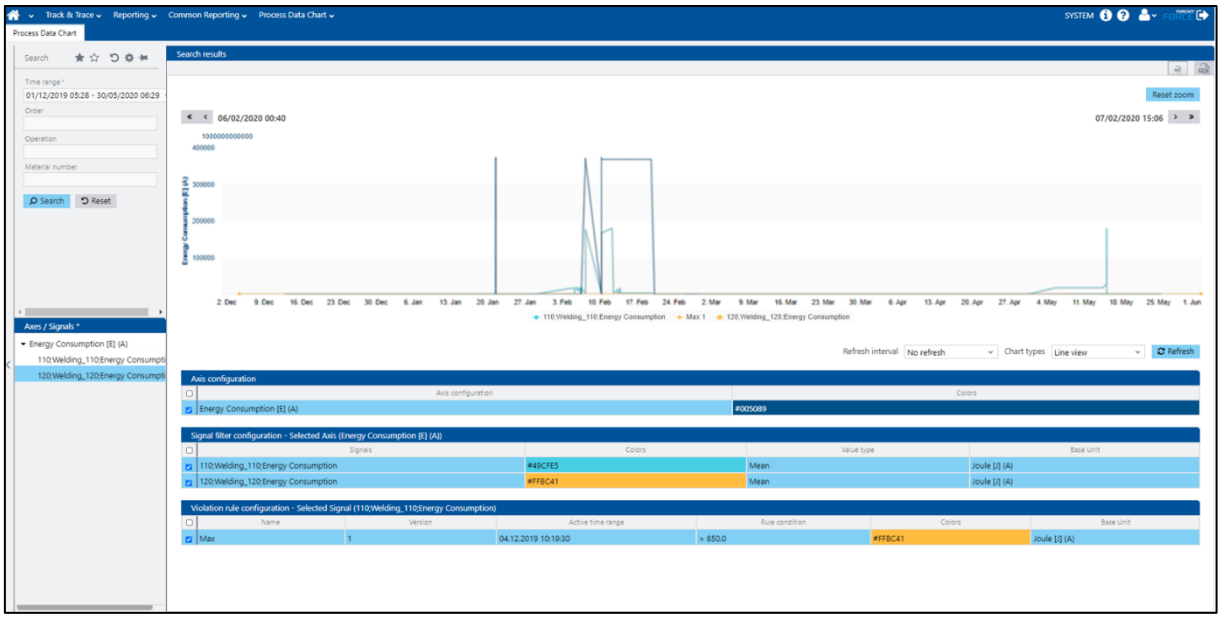


Fig. 6: Visualization of process data in trace reporting

2.2.6 Energy data compression

The energy data compression distributes the energy consumption evenly to the active operation phases. This means the total energy consumption is distributed to the active operation phases similar to a calculation of overhead costs.

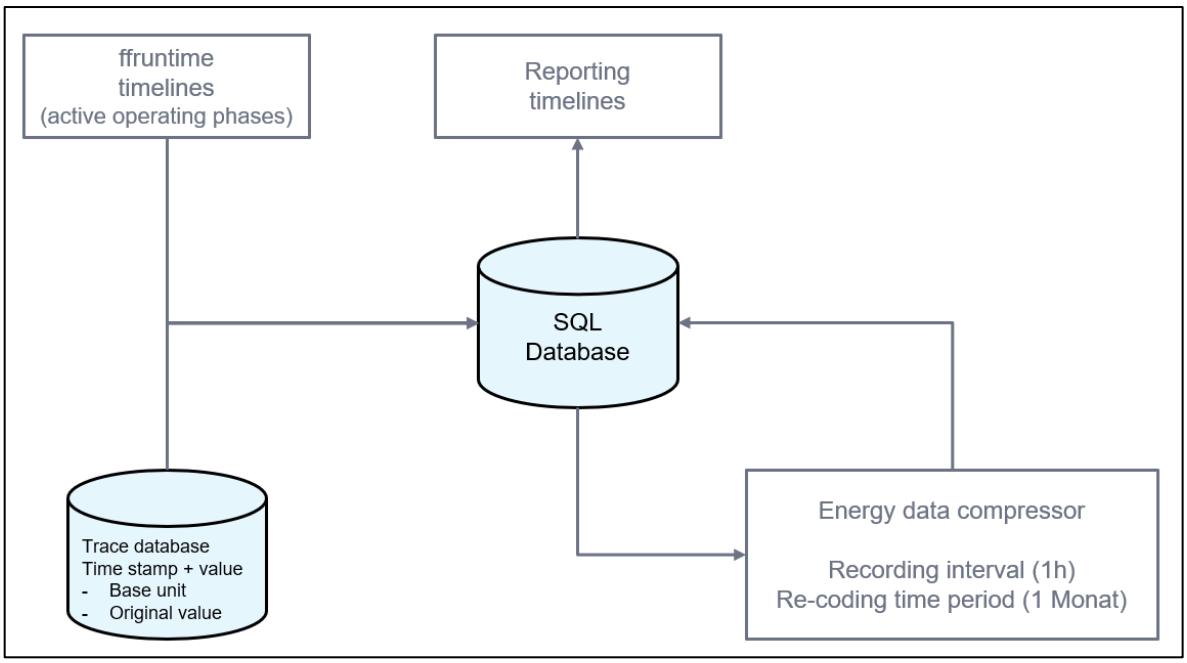


Fig. 7: Basic procedure energy data compression

The following configuration parameters influence the functional scope of energy data compression:

Parameter	Effect
Re-code every X hours	Interval at which the captured data is recoded (default = 1h)
Re-coding time period	Backwards going time period at which re-coding is to be done during an interval
Compression interval for workplace	Time period for an interval

No energy data is lost if there was a re-coding of operation phases. There is only a redistribution to the respective operation phases. The time frame for re-coding to take place depends on the time set in the "Period for re-coding" configuration parameter. The longer the re-coding period is set, the longer the time it will take to update the timelines.

2.2.7 SQL database

Process data that represent energy consumption are saved in the SQL database, which can be accessed by the reporting in the performance analysis.

2.2.8 Check against violation rules

Violation rule limits can be defined in the Office module for recorded process data, which lead to an alarm depending on the configuration. It is possible to reach or exceed upper and lower limits. If a rule value is violated, an alert can be sent to a SFT in the form of a message. Another option for notification is the automatic sending of an email. Several recipients can be specified, and the display text can be edited.

2.2.9 Reporting of energy data in the Performance Analysis

Path: Performance Analysis > Reporting > Energy data acquisition

The acquired energy data is available in the Performance Analysis, which can be found in the Office module of FORCAM FORCE™ (see also Manual - Energy Analysis).

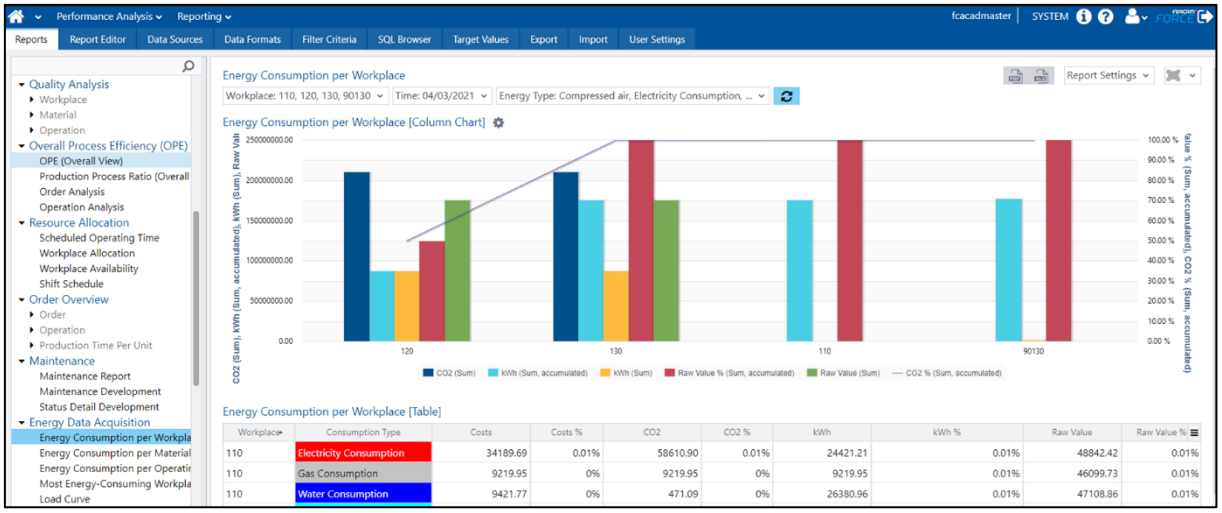


Fig. 8: Reporting of energy data in the Performance Analysis

3 Use Case: Batch

In this use case, data generated during the production process is recorded for a batch (batch trace). Here, the trace object to be tracked is a uniquely identifiable container. All data that is generated during the production process is recorded for the container.

A batch can consist of one or more containers.

For clear identification, the trace object must be marked with a serial number. Ideally, this is done in a machine-readable manner for scanning.

ⓘ Process data that is collected for trace objects is called trace data.

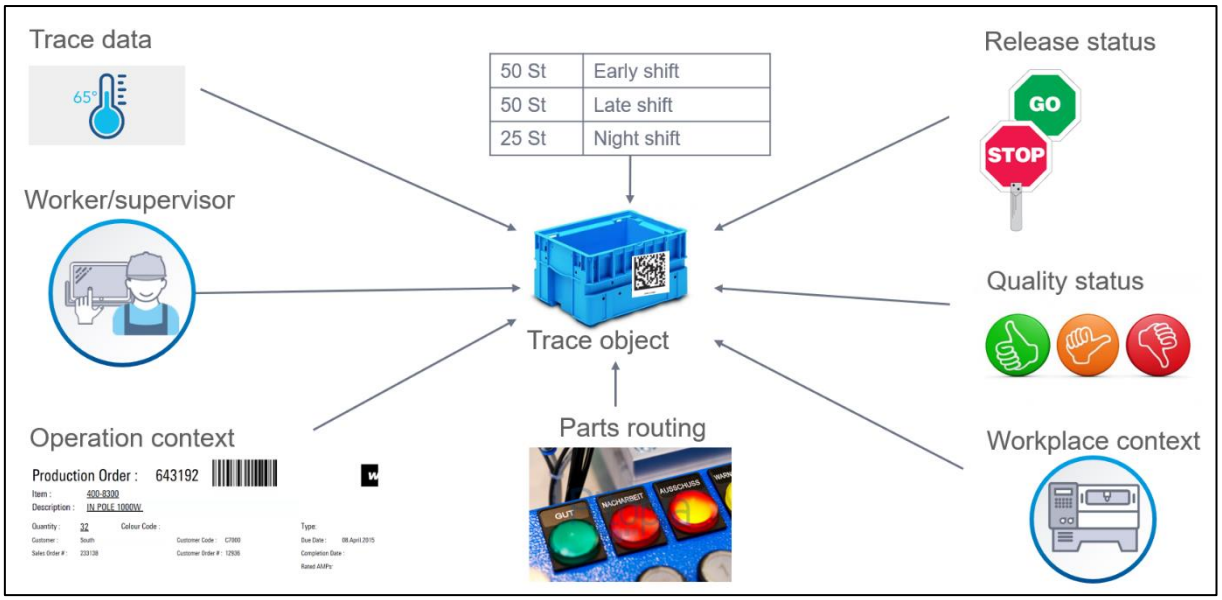
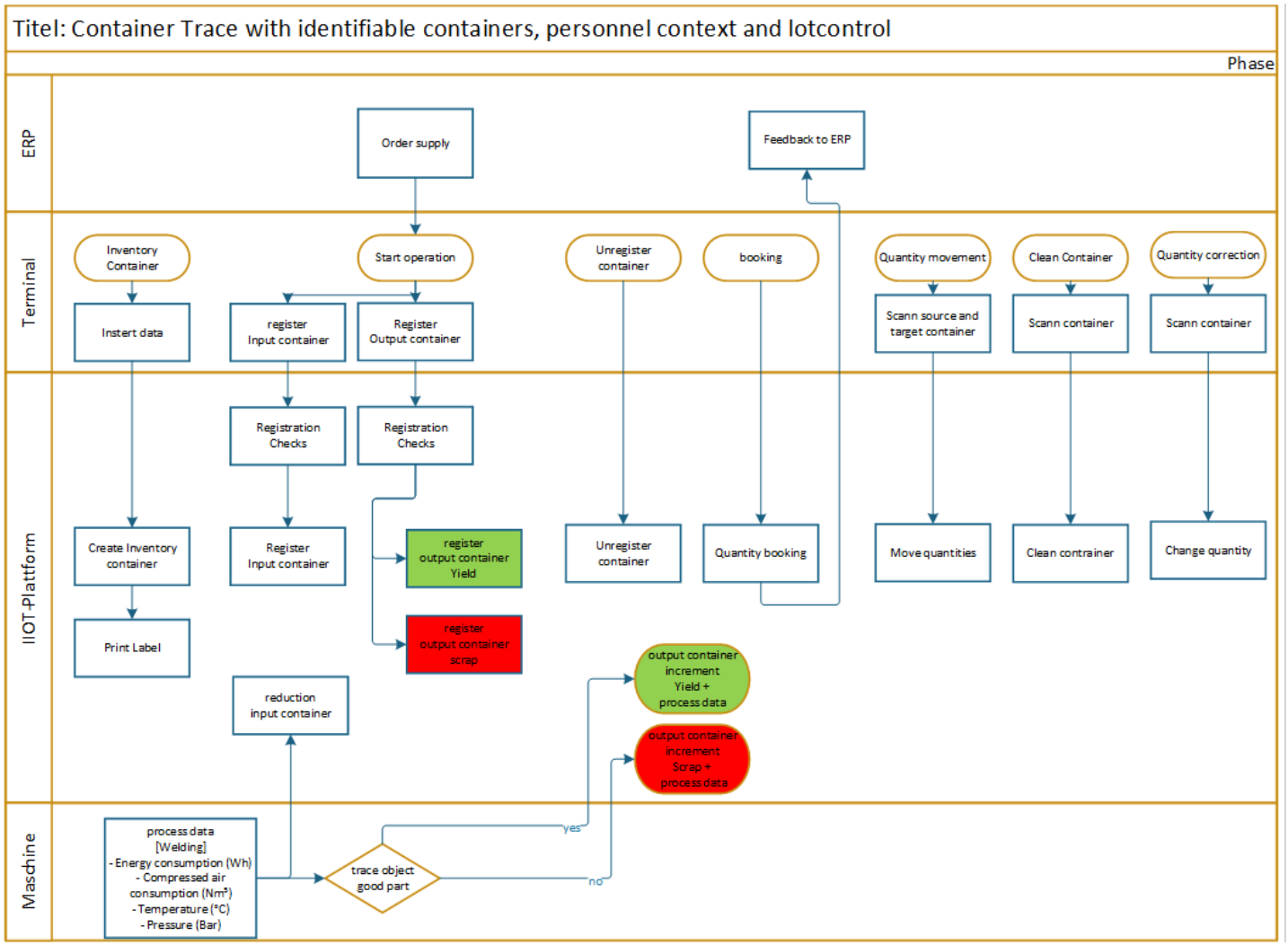


Fig. 9: Procedure for data acquisition for batch containers

3.1 Workflow


Titel: Container Trace with identifiable containers, personnel context and lotcontrol
Phase
ERP
Terminal
IIOT-Plattform
Maschine
Order supply
Feedback to ERP
Inventory Container
Start operation
Unregister container
booking
Quantity movement
Clean Container
Quantity correction
Instert data
register Input container
Register Output container
Scann source and target container
Scann container
Scann container
Registration Checks
Registration Checks
Create Inventory container
Register Input container
register output container Yield
Unregister container
Quantity booking
Move quantities
Clean contrainer
Change quantity
Print Label
register output container scrap
reduction input container
output container increment Yield + process data
output container increment Scrap + process data
process data [Welding] - Energy consumption (Wh) - Compressed air consumption (Nm³) - Temperature (°C) - Pressure (Bar)
trace object good part
yes
no

3.2 Function description

3.2.1 Basic functions

3.2.1.1 Order supply

An order supply is required to be able to use the container function. Orders were created manually in the office module within the scope of the use case templates.

3.2.1.2 Container configuration

The container configuration is used to define containers in Track & Trace. Later on in the process, it can be used to ensure that only certain container types can be used (registered) at a workplace.

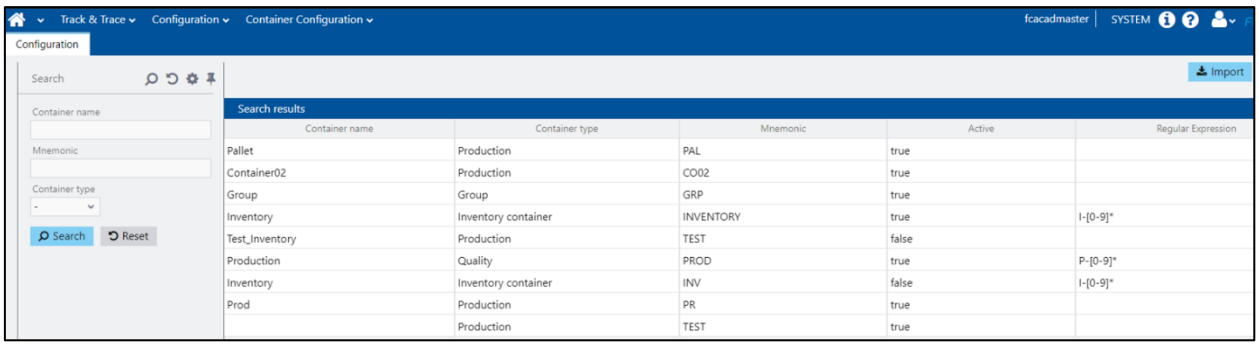


Fig. 10: Overview of container types for container configuration

Container description	Regular expression	Meaning
Inventory	I-[0-9]*	Container type for material that is withdrawn from storage and fed into the production process. The container identification starts with *I-*. Additionally, a numerical identification is configured.
Production	P-[0-9]*	Container type for use in the production. The container identification starts with *P-*. Additionally, a numerical identification is configured.

Depending on the specific application, any other container types can be configured.

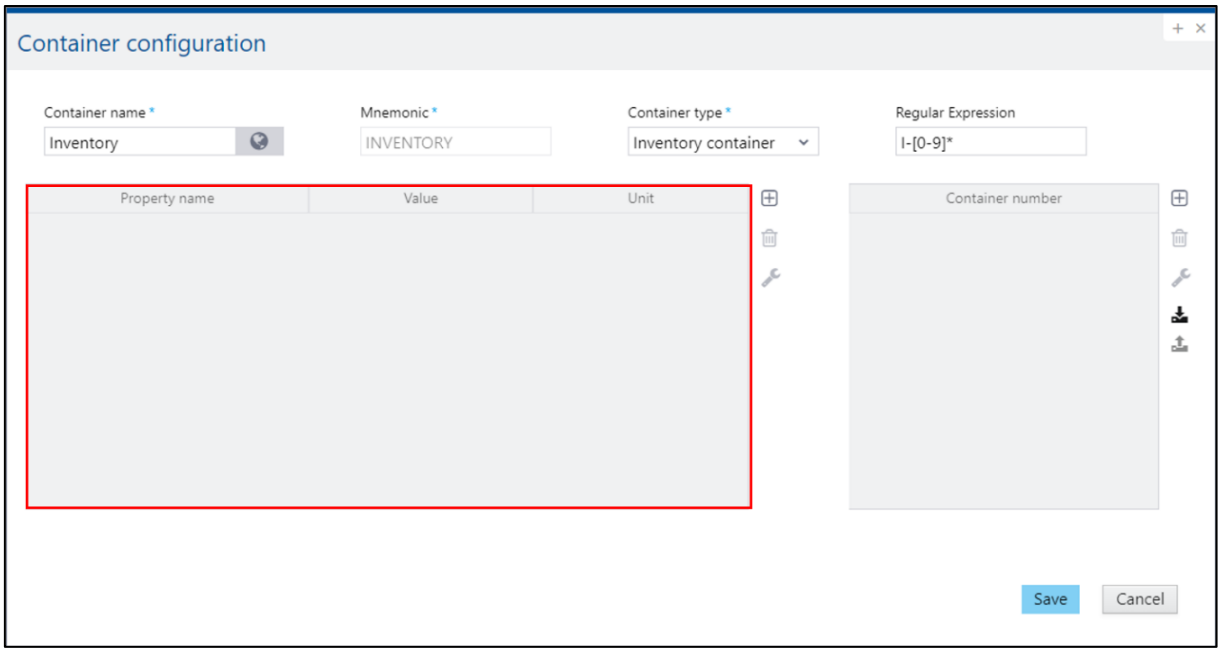


Fig. 11: Detail view in the container configuration

No further details of properties need to be defined in the configuration of container types in order to be able to use Track & Trace. However, depending on the application, further properties may be necessary.

Additional physical container properties can be configured (e.g. length, width, height). Furthermore, it is possible to enter all the containers that are in circulation here. Moreover, containers can be created with unique container IDs. This has been omitted in this use case.

3.2.2 Creating storage containers

A storage container is created when material is removed from the warehouse. This serves as an information and goods carrier. The information is then transferred to the yield material when the materials are processed.
A storage container is registered in the production process at an operation as an input material.

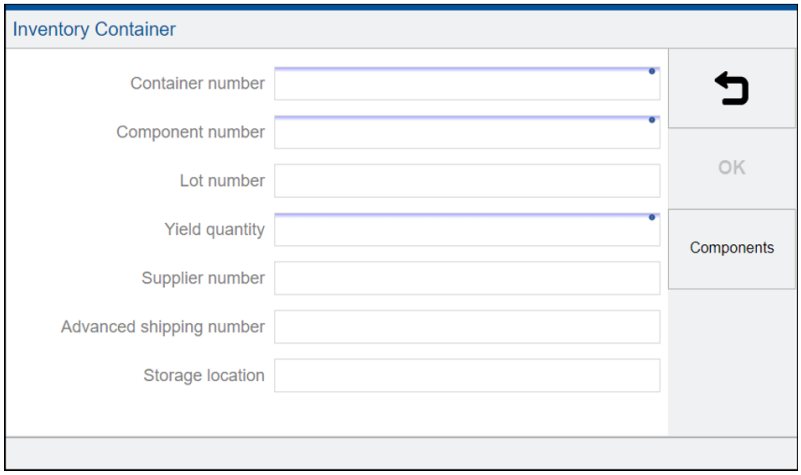


Fig. 12: Creating a storage container in the SFT

Field	Description	Input
Container number	Unique identifier of the container	Required
Component number	Number of the component	Required
Batch	Number of the component batch	Required
Yield	Number of containers	Required
Supplier number		Optional
Advanced shipping number		Optional
Storage location		Optional

After the storage container is created, a label with the relevant information is printed for it.

ⓘ To print a label, the client-side connector must be installed.

Storage containers can also be created directly via the Bridge API. Manually creating storage containers serves to complete the workflow within the framework of the use case.

3.2.3 Start operation

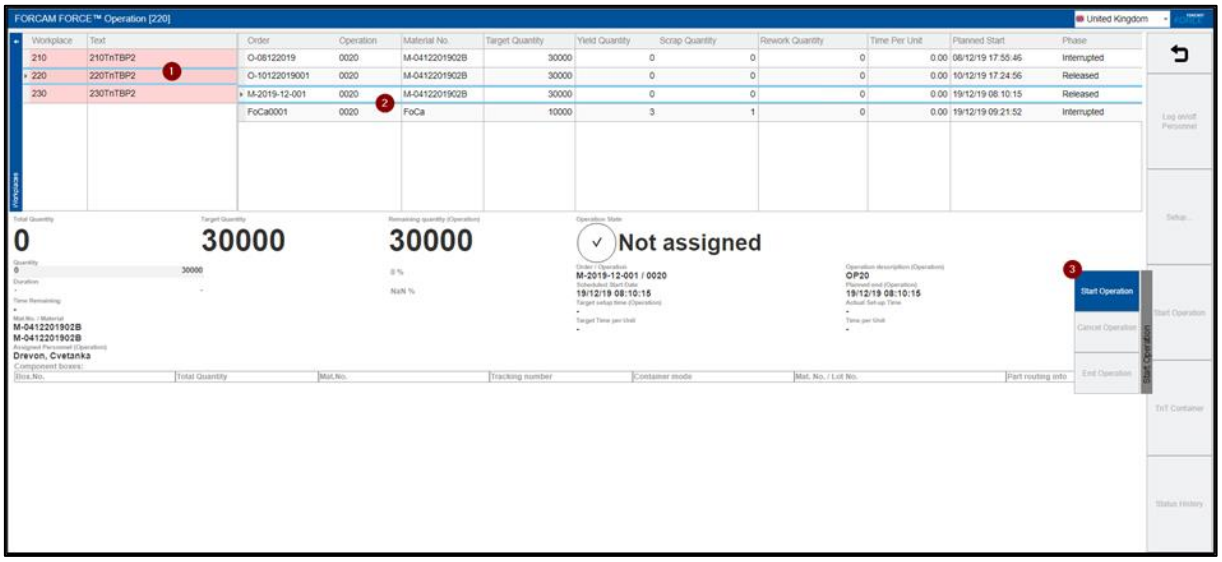


Fig. 13: Basic page of the SFT with configured *operation start* button

To start an operation

1. Select workplace (1).
2. Select operation (2).
3. Klick on **start operation** (3).

4. Enter a personnel number in the follow-up dialog.

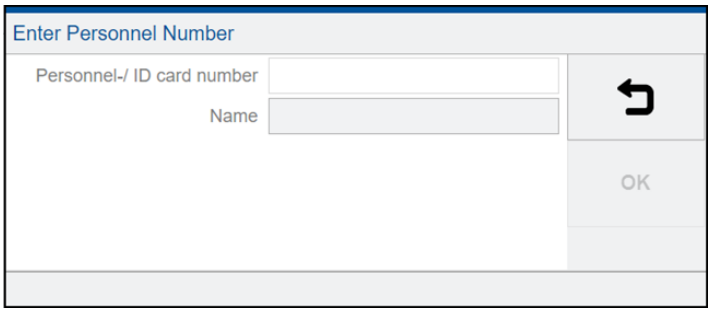


Fig. 14: Dialog for entering a personnel number for plant identification

3.2.3.1 Registering storage containers as input containers

For traceability, it is necessary to register the storage containers as input containers at an operation.

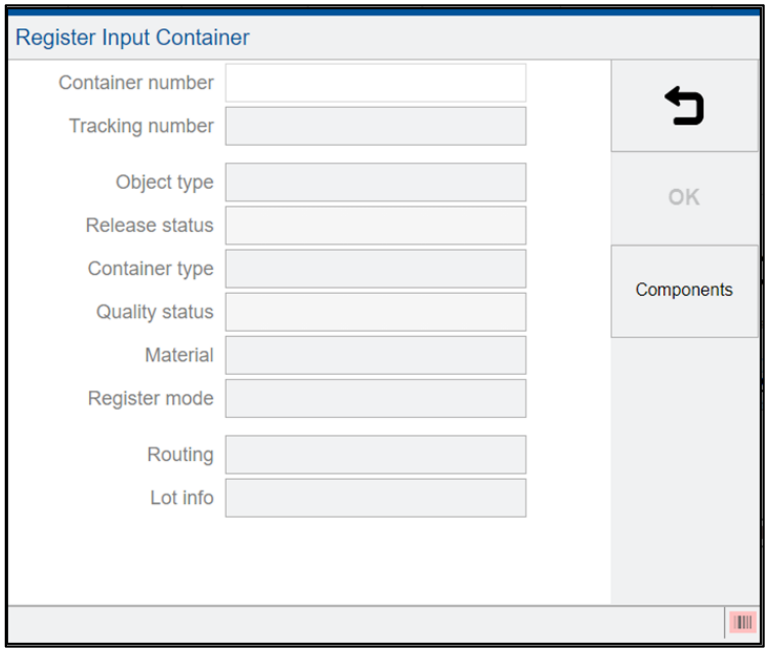


Fig. 15: Dialog for registering an input container for an operation

Registration	Description
Storage container	Register storage container as input container
Production container	Registering the output container (yield) of a preceding operation as an input container.

3.2.3.2 Registering production containers as input containers

The configuration in the use case specifies that production containers from the previous operation are to be registered as input containers for the following operation.
The process stipulates that only production containers which contain yields can be registered.

3.2.3.3 Registration check of the input containers

Registration check	Description
Material check	Checks if the scanned container contains material that corresponds to a material number of the production operation.
Quality status	Checks if the quality status is as expected.
Release status	Checks the release status of the container. – Released (target) – Locked – Initial
Registration status	Checks if the container has already been registered on another operation. – Exclusive mode (can only be logged on to one operation) – In-line mode (container serves as input and output container) – Standard mode (no check during registration)

3.2.3.4 Registering output containers

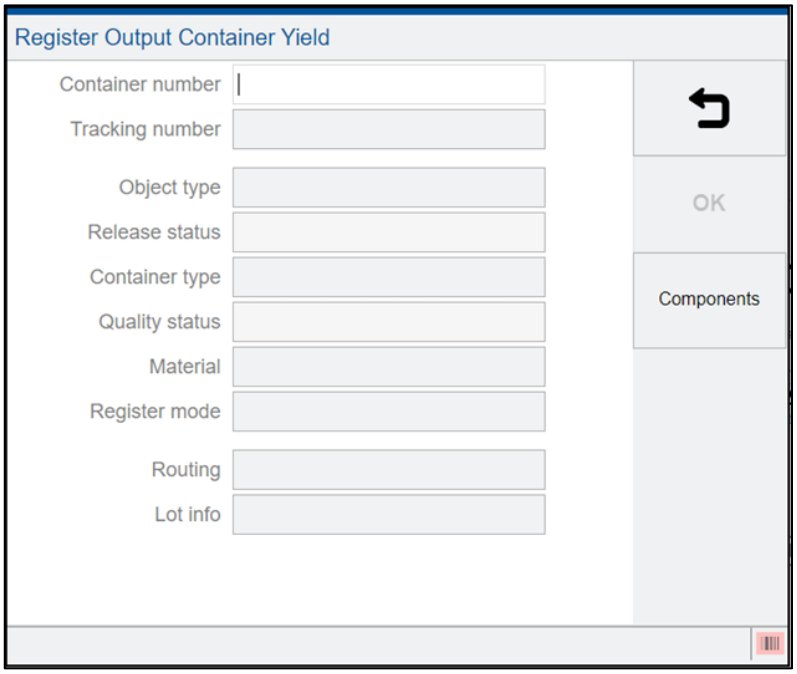


Fig. 16: Dialog for registering an output container on a workplace

Container	Description
Output yield	Container in which the yield of the operation is produced
Output yield quantity	Containers in which scrap parts are processed

3.2.3.5 Registration check of the output containers

Registration check	Description
Container type	Checks if the expected container type matches the scanned container.
Material check	Checks if the scanned container contains material that corresponds to the material of the production operation.

Parts routing	Ensures that material is routed to the correct container (e.g., a scrap container).
Quality status	Checks if the quality status is as expected.
Release status	Checks the release status of the container. – Released (target) – Locked – Initial
Registration status	Checks if the container has already been registered on another operation. – Exclusive mode (can only be logged on to one operation) – In-line mode (container serves as input and output container) – Standard mode (no check during registration)

3.2.4 Process control via machine signals

Type	Description
Process data	Preconfigured process data: – Energy consumption [KWh] – Compressed air consumption [Nm³] – Temperature [°C] – Pressure [Bar] – Quality code [1 = good; 2 = scrap]
Quantities	– Quantity impulse (triggered by process data) – Incrementing the output containers (depending on the quality classification!) – Decrementing the input containers

In the use case templates, the machine signals are recorded via a CSV file. In the productive system, the process data acquisition must be configured individually.

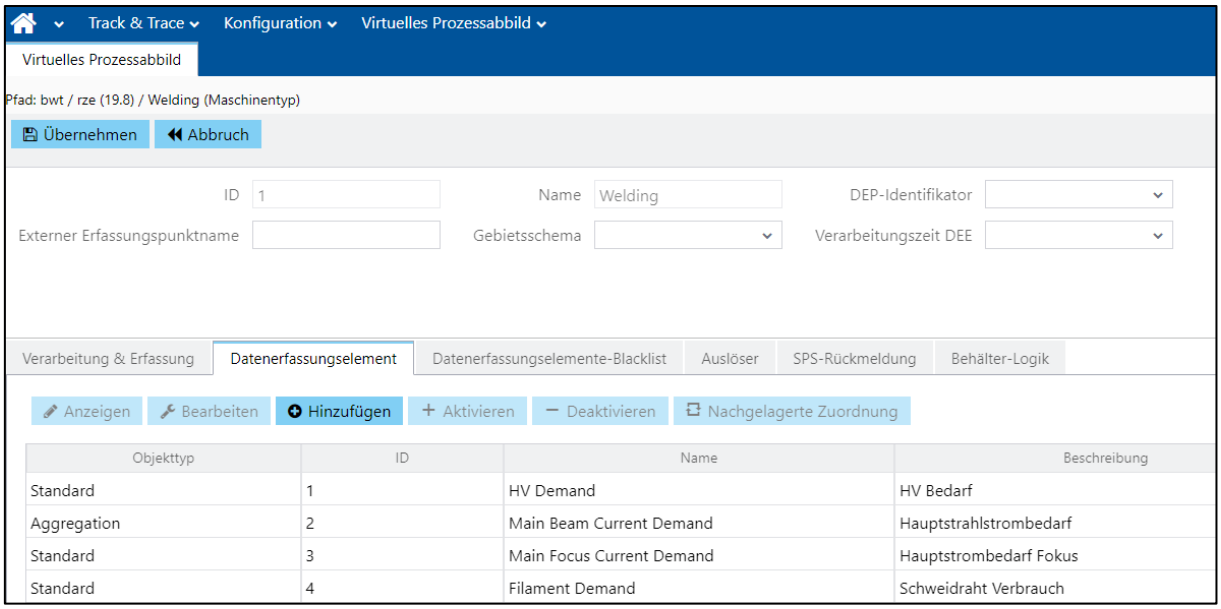


Fig. 17: Configuration of trace data

3.2.5 Trace data acquisition via machine signals

In the use case templates, trace data is recorded via a CSV file. In the productive system, process data collection must be configured individually.

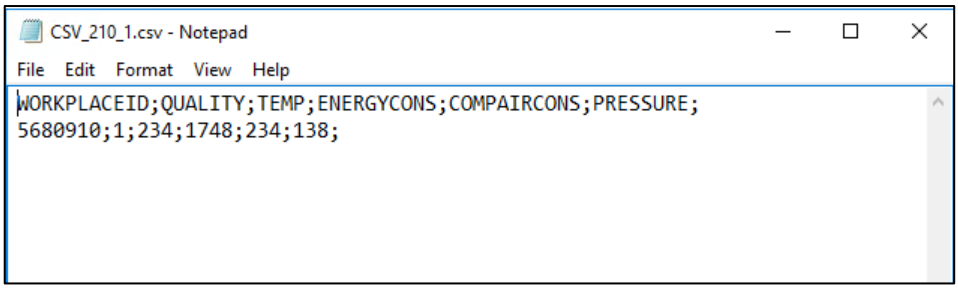


Fig. 18: Example of a CSV file for trace data acquisition

3.2.6 Quality data acquisition via machine signals

The data acquisition in this use case has been configured in such a way that quality reporting is done by the machine. A quality status for the produced part is transmitted with each data packet (see Fig. 18).

Quality status	Description
1	Yield quantity
2	Scrap quantity

3.2.7 Unregister a container

In the use case configuration, a container can only be active at a single workplace.
To be able to register a container again at one of the subsequent operations, it must be unregistered at the previous operation.

Entering the container number to unregister a container from the operation.

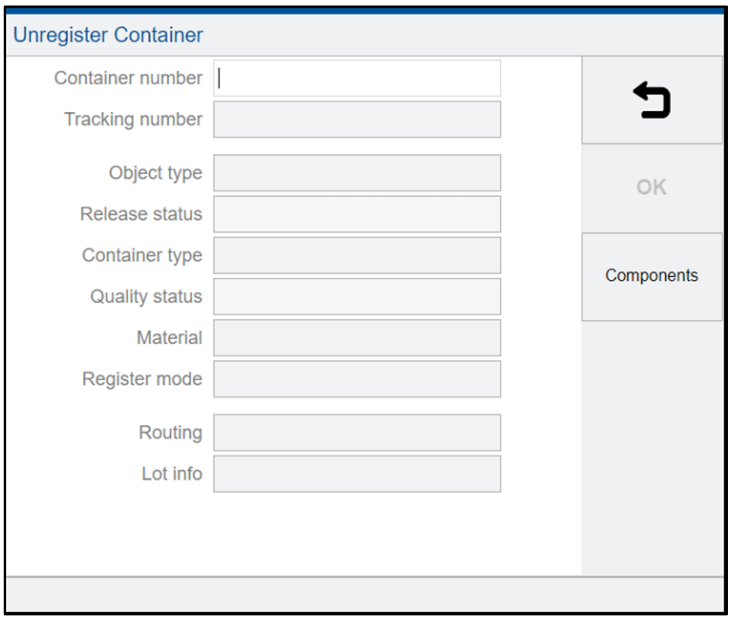


Fig. 19: Dialog for unregistering a container from a workplace

3.2.8 Booking

A quantity booking must be carried out for each container for the ERP. In the use case, yield and scrap quantities are booked for the corresponding containers.

A container can contain both booked and not booked quantities.
This can be restricted using the *only booked* filter setting.

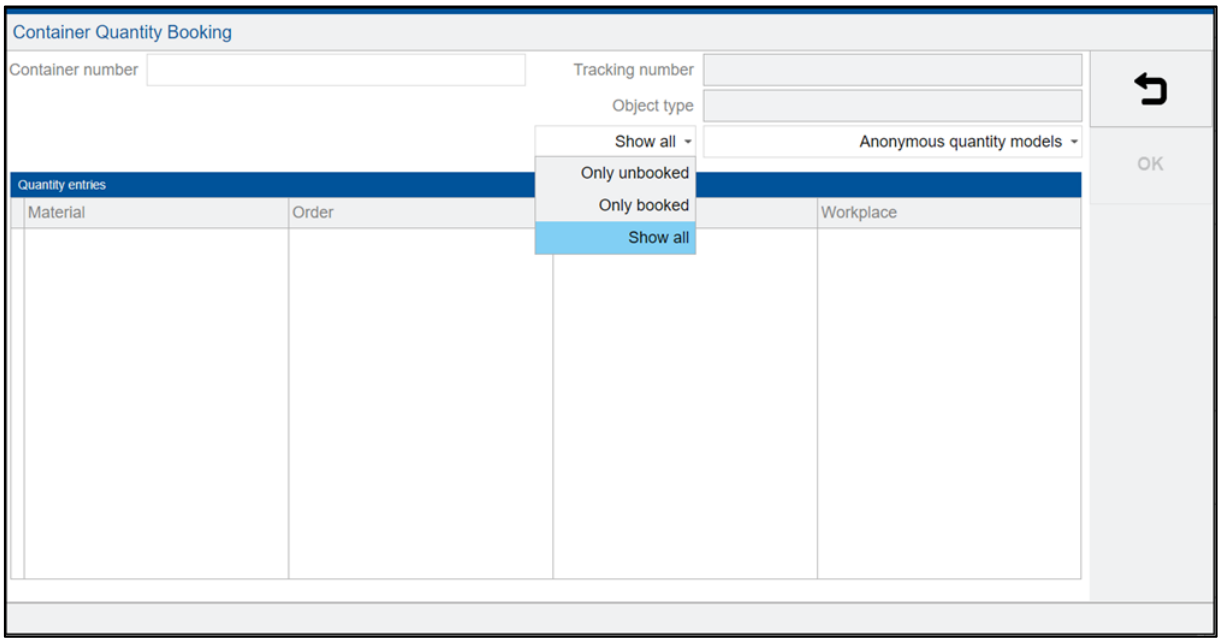


Fig. 20: Dialog for quantity booking

ⓘ In batch tracing, several quantity models can be managed in one container. This function is not described in detail in the use case.

3.2.9 Moving quantities

Moving quantities from a source container to another container is a function that can be performed without an active operation.

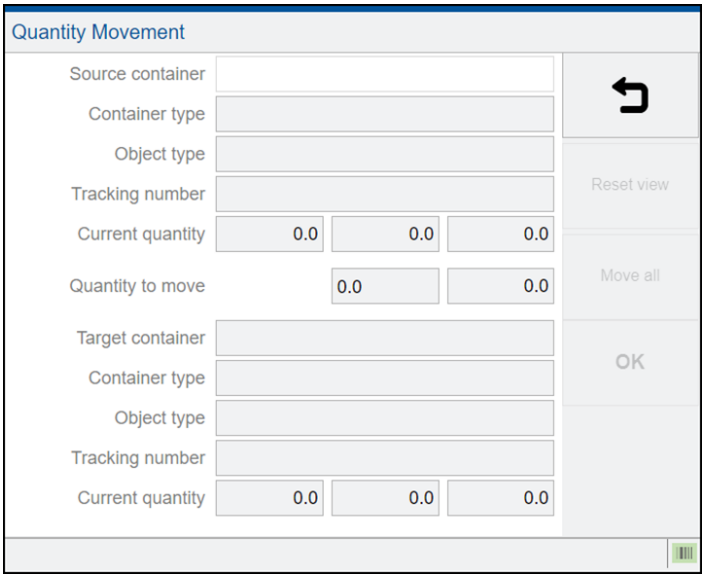


Fig. 21: Dialog for moving material between containers

3.2.9.1 Required inputs

Type	Description
Source container	Container from which parts are to be removed.
Target container	Container into which parts are to be placed. If a previously unknown container ID is used, a *production* container type is automatically created.
Quantity to move	Quantity that is to be moved from the source container to the target container.

3.2.9.2 Checks during quantity movement

Check	Description
Material	Checks if the material of the source and target containers match.
Quality status	Checks if the quality status of the material matches the expected one.
Registration status	Checks if the target container is already registered to another operation.
Release status	Checks if the release status is *released*.

3.2.10 Clearing the container

A container is emptied in order to use it again for another process.
This function ensures that the physical quantity in a container (0 pieces) matches the reported quantity.

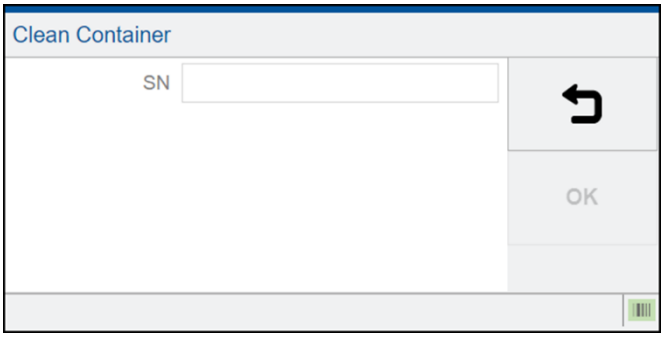


Fig. 22: Dialog for clearing a container

3.2.11 Quantity correction

Manual correction of a quantity in a container.

⚠ The quantity correction has no effect on other quantity models of the same container, unless corresponding quantity adjustment rules are defined. No quantity adjustment rules are configured in the use cases.

⚠ The quantity correction has no effect on quantities of other containers.

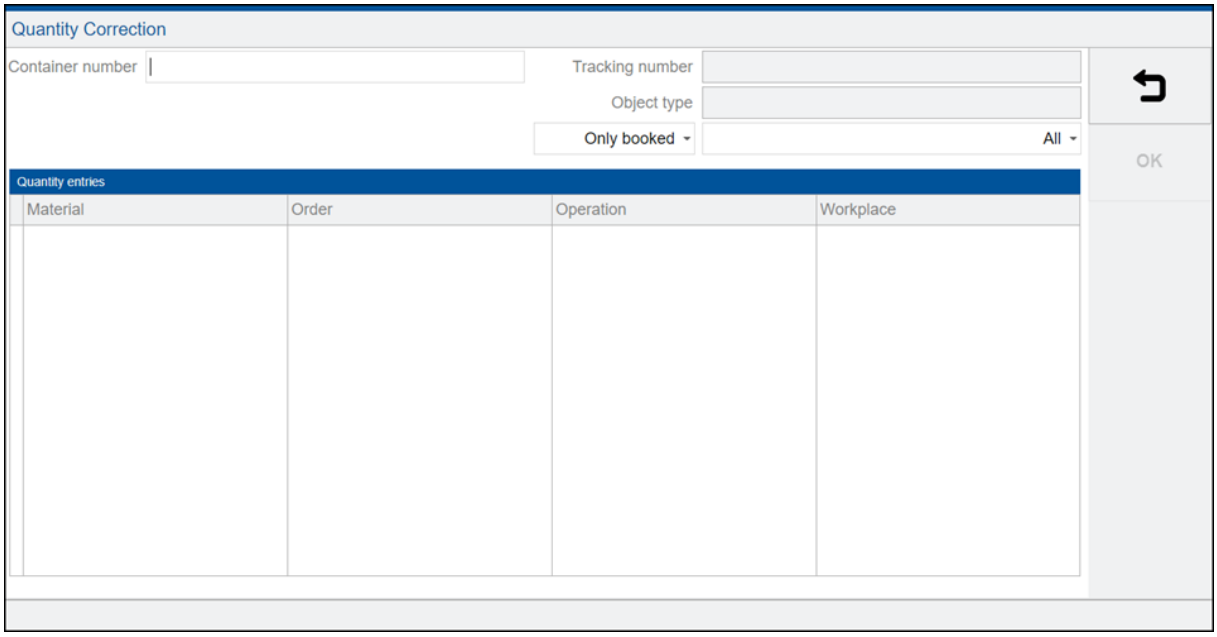


Fig. 23: Dialog for quantity correction of a container

Example:
E A part in the scrap container is subsequently declared as a good part and shall be moved to the container for good parts:

Step1:
Correct the quantity in the scrap part container.

Type	Description
Yield	+1
Scrap	-1

Step2:
Move the good part from the scrap container to the container for good parts (movement dialog).

What	Description
Source container	Container for scrap parts
Target container	Container for yield (good) parts
Quantity to be moved	Yield (1 St)

3.2.12 Track & Trace admin functions

The Track & Trace Admin functions require foreman authorization.

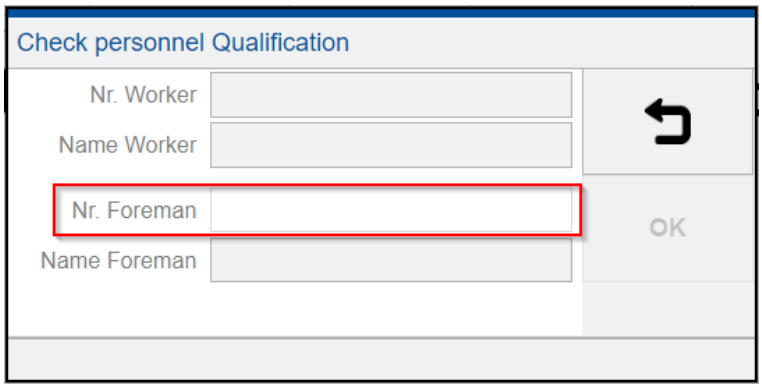


Fig. 24: Dialog for checking/assigning foreman authorization

3.2.12.1 Changing the parts routing of a container

The parts routing of a container determines which quality status is accepted for the parts placed there.

For the use case, the configuration was selected so that the production containers for good parts may only contain parts with the quality characteristic *Good* or *Unknown*. Production containers for scrap parts may only contain parts with the quality characteristic *Scrap*.
This can be edited in the *Change part routing* dialog box.

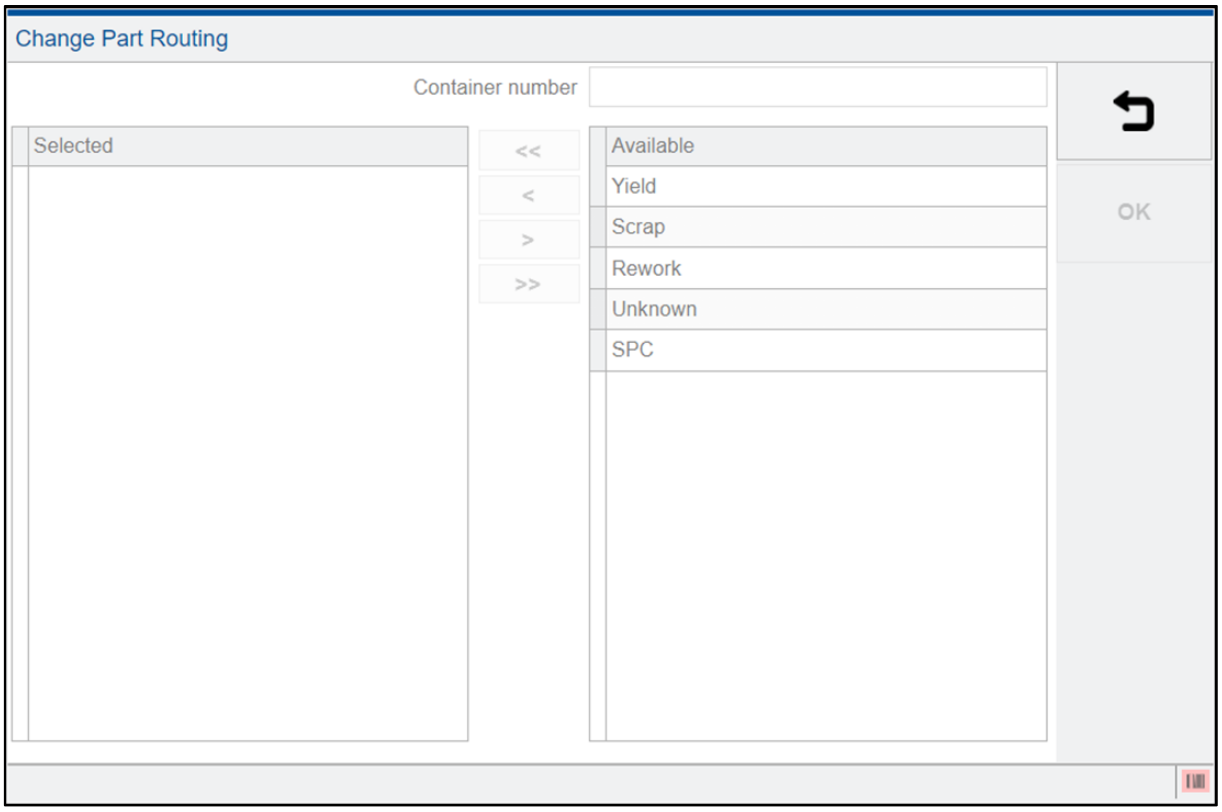


Fig. 25: Dialog for changing the parts routing of a container

3.2.12.2 Changing the release status of a container

Changing the release status of a container affects whether or not a container can be logged on to a workplace.

In this use case, the configuration is designed to only accept containers with the status *Released* when logging on to a workplace.

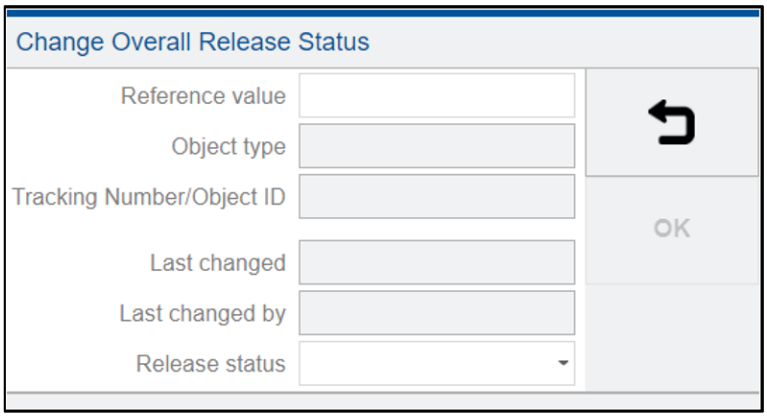


Fig. 26: Dialog for changing the release status of a container

3.2.12.3 Changing the quality status of a container

The containers have an overall quality status that is independent of the quality of the parts they contain.

This use case configuration is designed so that only containers with the *Yield* quality status are accepted when logging on to a workplace.
Accordingly, changing the quality status of a container has an effect on the container's logon capability.

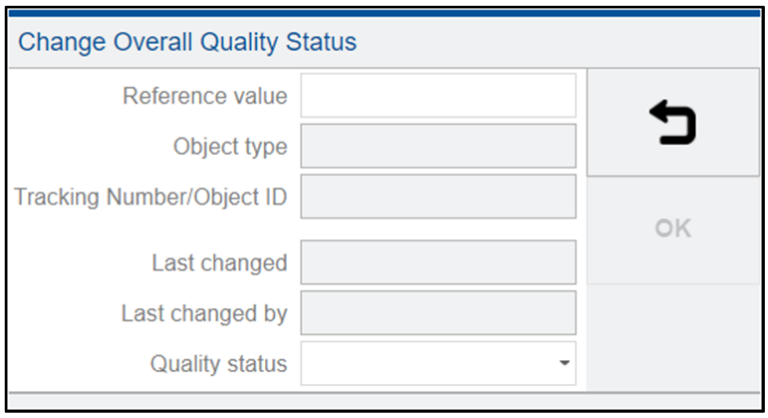


Fig. 27: Dialog for changing the quality status of a container

3.2.13 Container reporting

3.2.13.1 Container upstream search

The container upstream search is used to filter the containers according to various criteria and display them in tables. In addition to predefined filter criteria, it is also possible to set further dynamic filter criteria. This enables refining searches, e.g. by specifying limit values for continuous filtering.
It is also possible to jump from the upstream search to the downstream search and the material movement search.

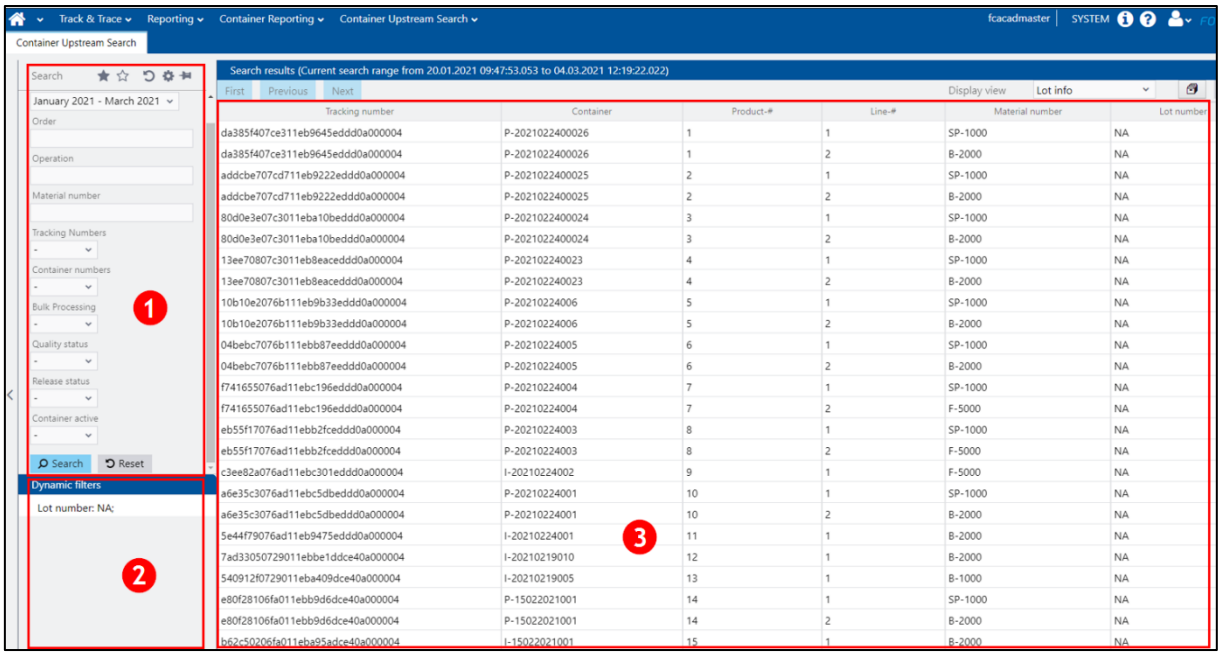


Fig. 28: Page for container upstream search

(1) Setting predefined criteria
(2) Setting dynamic filter criteria
(3) Displaying the search results

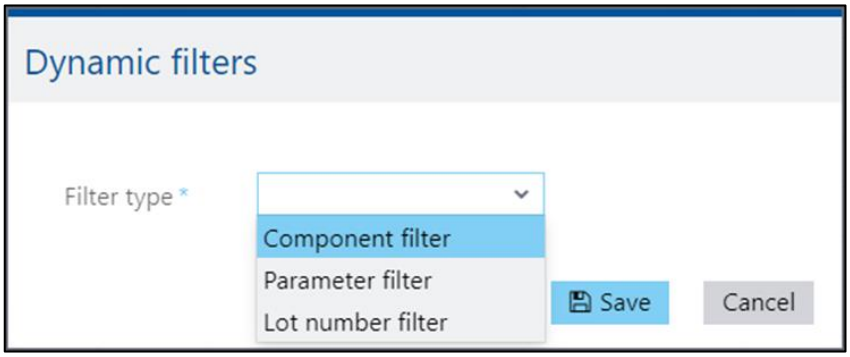


Fig. 29: Setting dynamic filter criteria

3.2.13.2 Container downstream search

The container downstream search is used to display all data for a specific container. The data can be displayed by topic via sub-tabs.

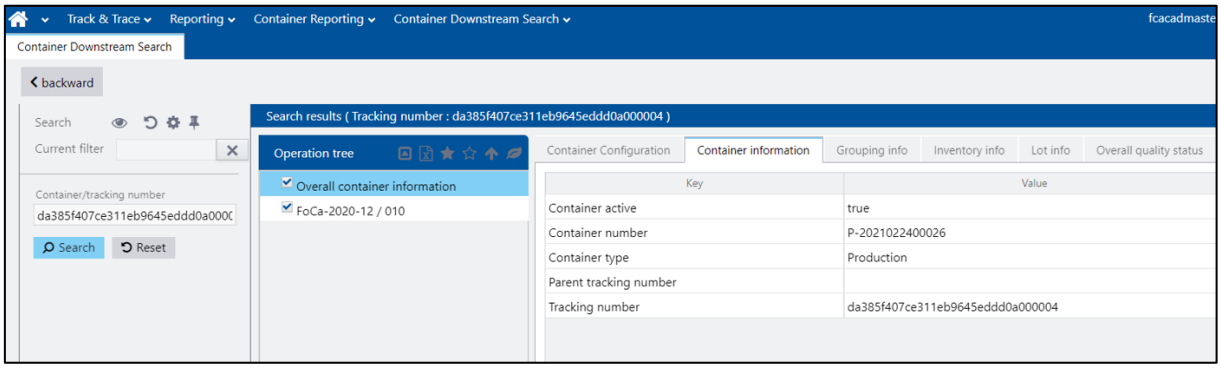


Fig. 30: Container downstream search

3.2.13.3 Movement search

In the movement search, the material flow can be displayed for all containers involved.

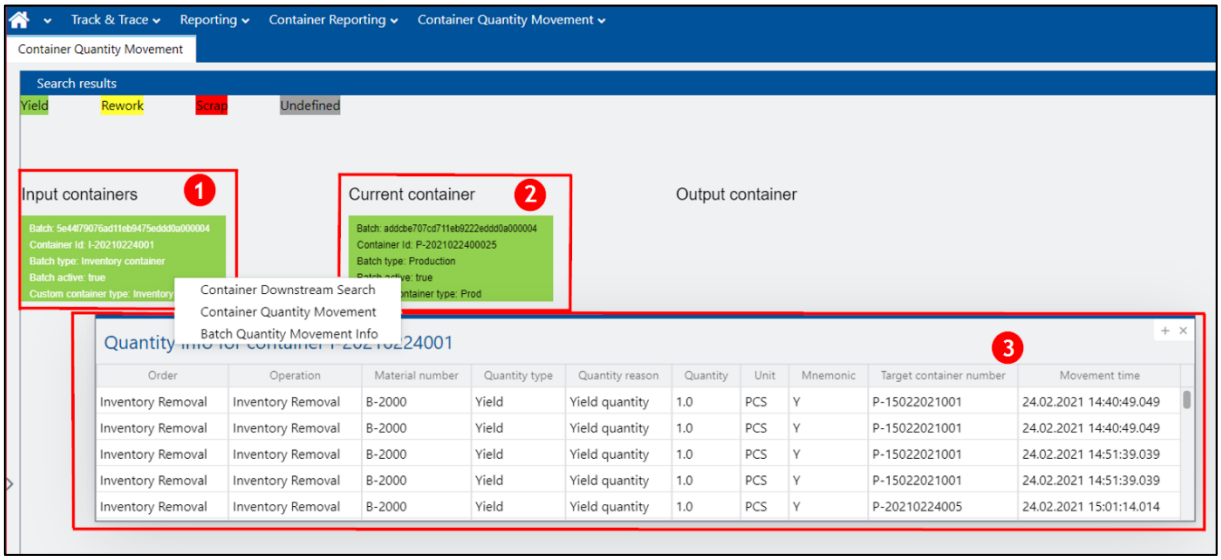


Fig. 31: Movement search

Starting from the current container (1), the input containers (2) and the output containers (here empty) are displayed. For every container displayed, it is possible to jump to the downstream search, movement search and quantity information (3).
The quantity information clearly shows which quantities are in which receiving container.

3.3 Batch handling

For this use case, the simplest type of batch handling was chosen: the recording of batch numbers. This makes it possible to clearly identify which materials with which batch went into a container.

Name	Description
Recording	Recording the batch number from the input container to the output container without separating batches. A container can contain several batches of the same component.
Global batch control	Recording the batch number from the input container to the output container with separation of batches. A container can contain only one batch per component. When the batch of the input component is changed, it forces a container change at the output. Global setting for all components.
ERP batch control	Recording of the batch number from the input container to the Output container. Information about components with batch control is provided by the ERP system. This procedure is the same as the "global batch control" for components subject to batch control. Batch numbering is mandatory for components subject to batch control. Incoming materials with batch requirement and missing batch number are not accepted.

4 Use case: Individual Part

The individual part is the trace object to be tracked and is a uniquely identifiable individual (single) part. In this use case, data that has accumulated during the production process is recorded for each individual part. The individual part becomes the trace object here.

To ensure that the individual part can be clearly identified, the trace object must be marked with a serial number. Ideally, this is machine-readable.
Process data that is recorded for trace objects is also referred to as trace data.

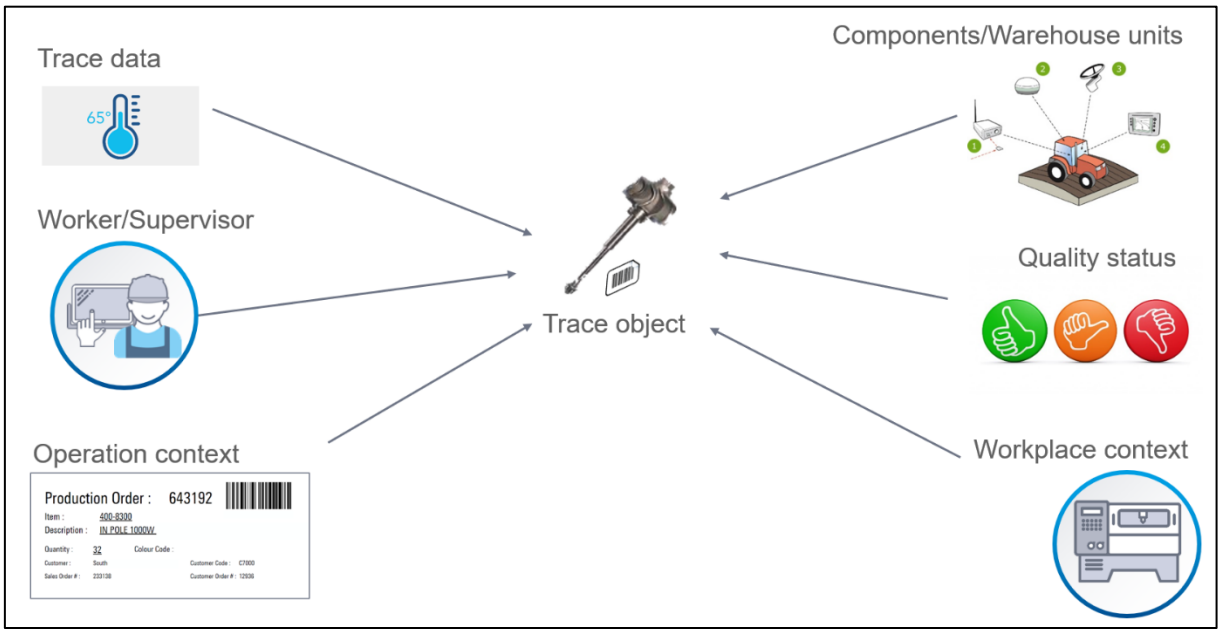
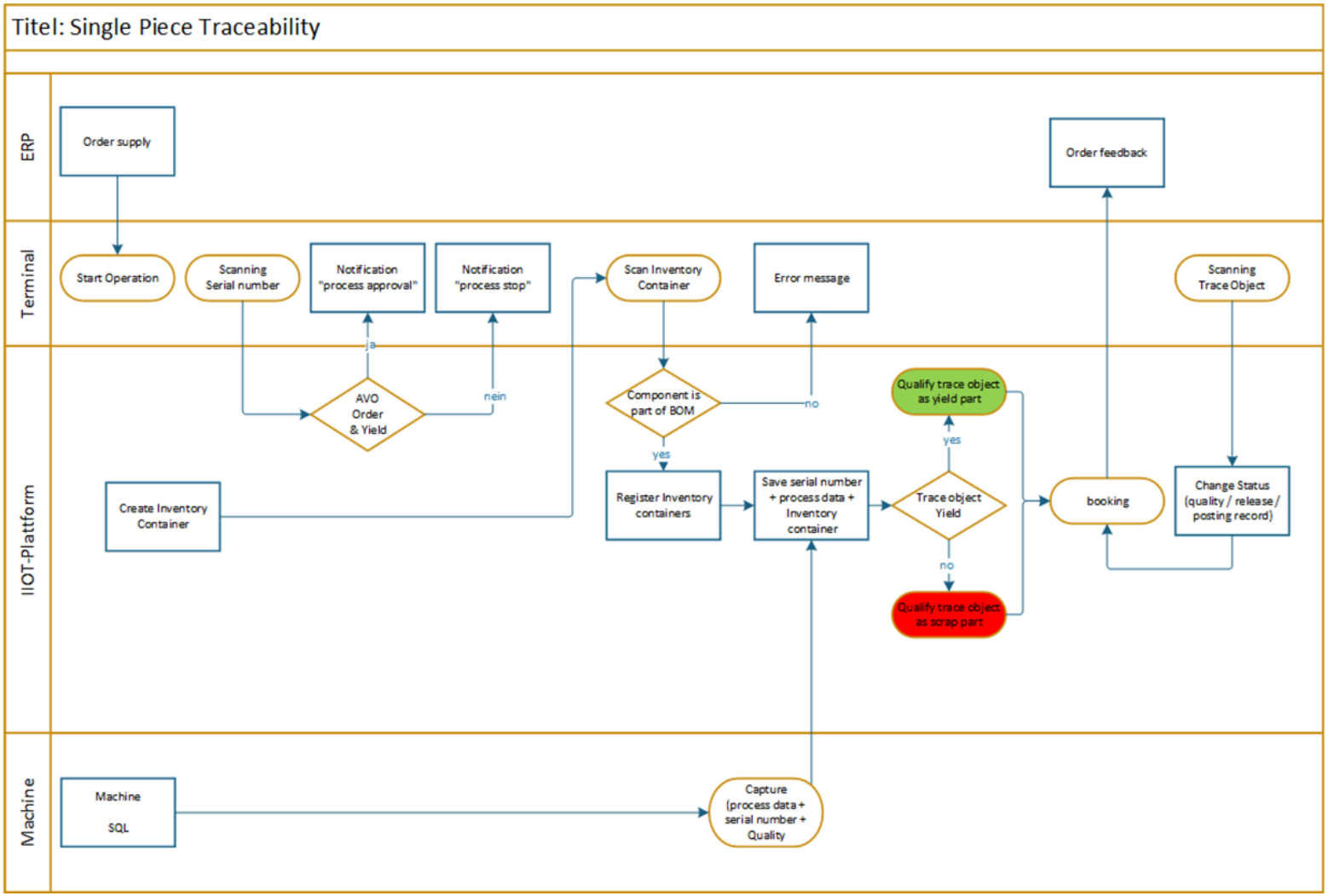


Fig. 32: Procedure for data acquisition for individual parts

4.1 Workflow


Titel: Single Piece Traceability
ERP
Terminal
IIOT-Plattform
Machine
Order supply
Order feedback
Start Operation
Scanning Serial number
Notification "process approval"
Notification "process stop"
Scan Inventory Container
Error message
Scanning Trace Object
ja
nein
AVO Order & Yield
Component is part of BOM
no
yes
Qualify trace object as yield part
Create Inventory Container
Register Inventory containers
Save serial number + process data + Inventory container
Trace object Yield
booking
Change Status (quality / release / posting record)
no
Qualify trace object as scrap part
Machine
SQL
Capture (process data + serial number + Quality

4.2 Functional description

4.2.1 Create storage container

Creating the storage containers is done in the same way as for the batch use case (see section 3.2.2).

4.2.1.1 Registering the storage container as input container

Component containers are registered at the SFT by manually scanning or entering the container number. See the batch use case (section **Fehler! Verweisquelle konnte nicht gefunden werden.**) for a description.

4.2.2 Start operation

The start of an operation is the same as for the use case batch (see section 3.2.3).

4.2.2.1 Manual serial number check

In the use case template, it is specified that the worker carries out a manual check of the individual part before it is inserted into the machine. The aim is to receive feedback from Track & Trace via the SFT as to whether the individual part may be processed at that particular workplace.

Check	Description	Feedback at SFT
Operation sequence	Checks whether the serial number was processed at the previous operation.	– at process release – at process stop
Yield check	Checks whether the serial number is registered as a yield part in the last operation.	– at process release – at process stop

This check can also be configured as an automated sequence. In this case, it is performed via machine signals. In this use case, however, the manual check was selected for ease of understanding.

4.2.2.2 Registering storage containers and production containers as input containers

Registering storage containers and production containers is the same procedure as the batch use case (see section **Fehler! Verweisquelle konnte nicht gefunden werden.** and **Fehler! Verweisquelle konnte nicht gefunden werden.**).

4.2.2.3 Registration check of input containers

Similar to the registration of serial numbers, registration checks, and a system reaction can also be configured for the registration of components, e.g. in the form of feedback at the SFT.

Check	Description	Feedback at SFT
Against the component list	Checks to see if the component is a part of the component list.	– at registration – at error message

4.2.3 Process control via machine signals

Type	Description
Process data	Preconfigured process data: – Energy consumption [KWh] – Compressed air consumption [Nm³] – Temperature [°C] – Pressure [Bar] – Quality code [1 = good; 2 = scrap]
Registration check	– Feedback when serial number was successfully scanned – Process lock/release

In the use case templates, the machine signals are acquired via a CSV file. In the productive system, the process data acquisition must be configured individually.

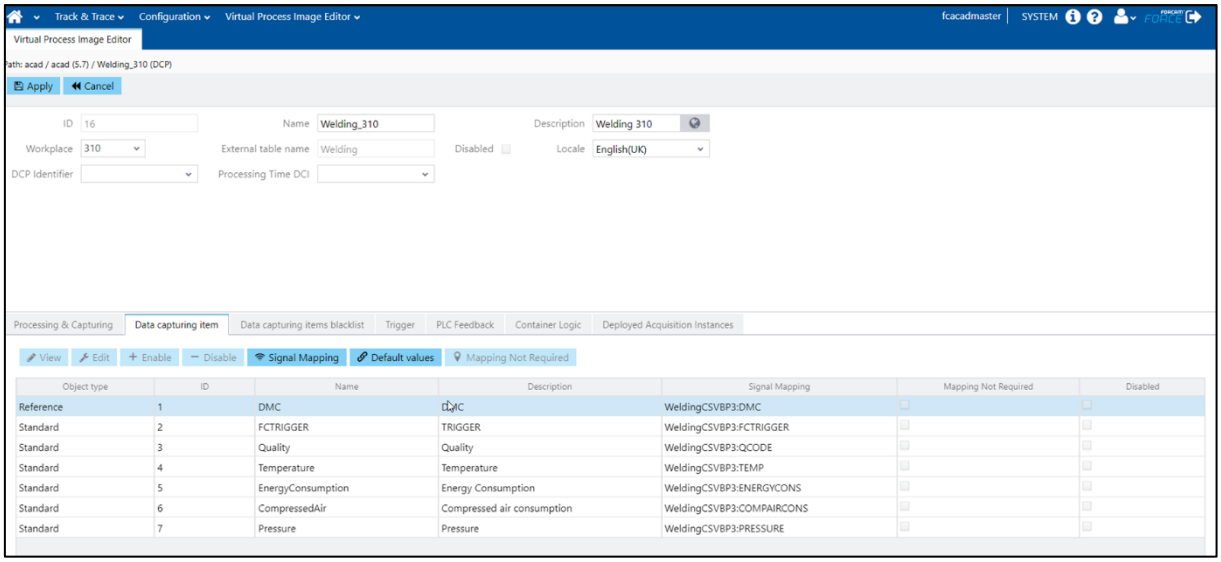


Fig. 33: Configuration of trace data

4.2.4 Trace data acquisition via machine signals

In the use case templates, trace data is acquired via a CSV file. In the productive system, process data acquisition must be configured individually.

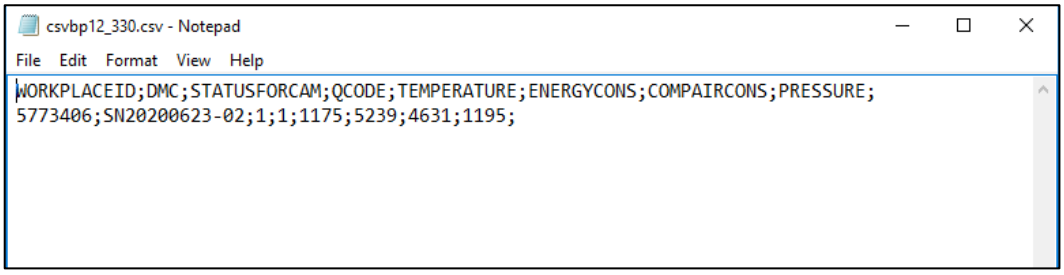


Fig. 34: Example of a CSV file for trace data acquisition

4.2.4.1 Quality recording via machine signals

For this use case, the data acquisition has been configured to ensure that the quality message is sent by the machine. A quality status for the produced part is transmitted with each data packet (see Fig. 34).

4.2.5 Correcting the quality status

The quality status of an individual part can be adjusted manually later on.

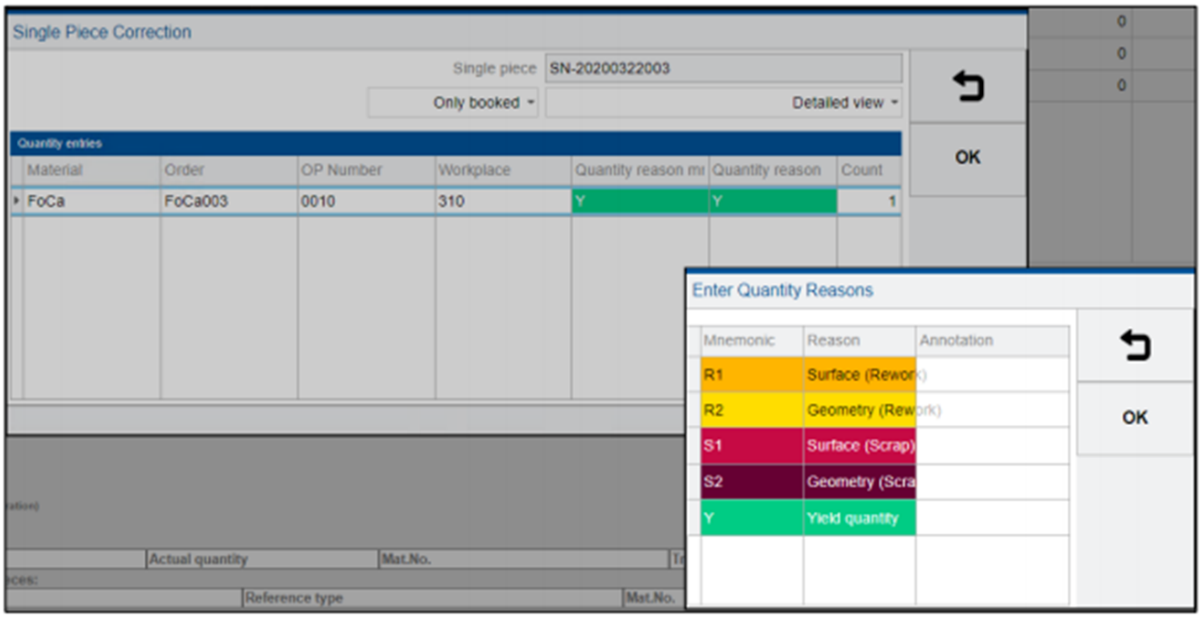


Fig. 35: Correcting the quality status of an individual part

4.2.6 Booking

This use case is configured so that after all data has been recorded by the machine, a trigger is triggered that performs an automatic booking.
A good or a scrap part is posted depending on the quality message from the machine.

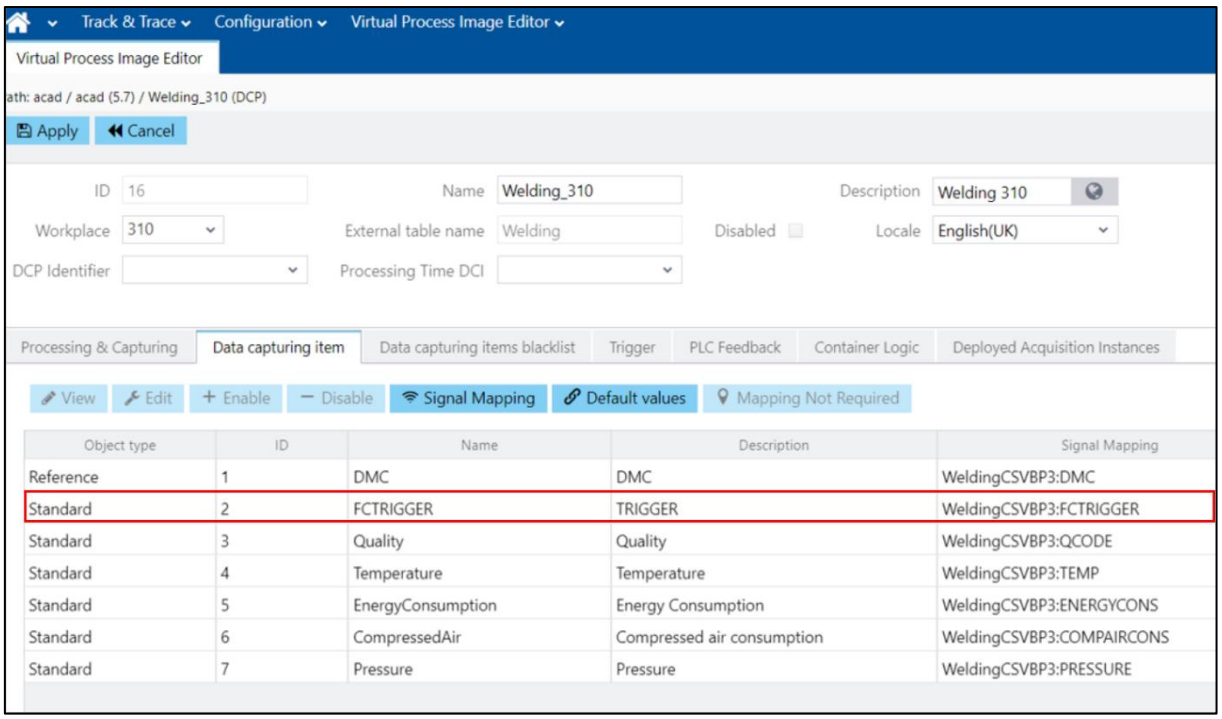


Fig. 36: Configuring the booking trigger

4.2.7 Reporting

4.2.7.1 Upstream search

The upstream search is used to filter the individual parts according to various criteria and to display them in a table. In addition to the predefined filter criteria, dynamic filter criteria can also be set.
It is possible to jump from the upstream search to the downstream search and the movement search.

4.2.7.2 Downstream search

The downstream search is used to display all data for a specific individual part. The data can be displayed by topic via sub-tabs.

4.2.7.3 Correlation analysis

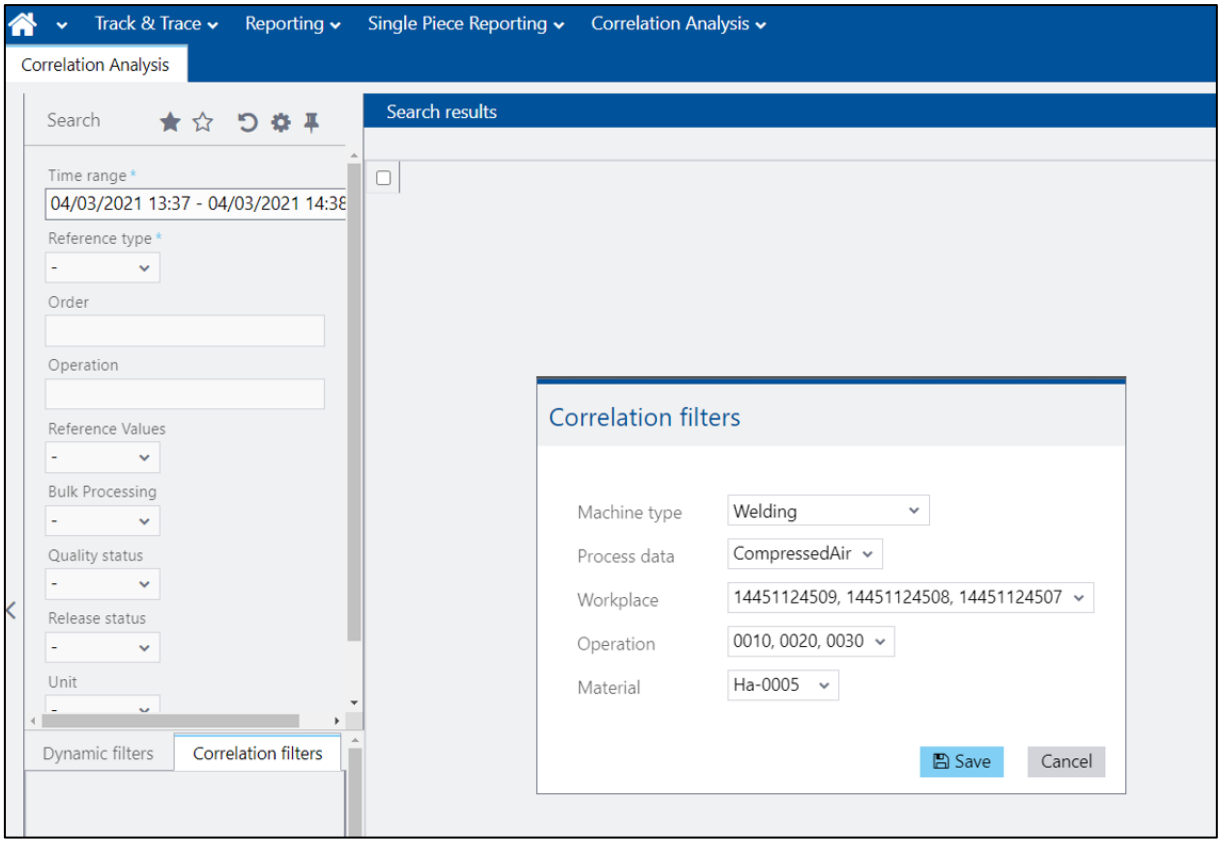


Fig. 37: Correlation analysis via correlation filter

Using filters in the correlation analysis makes it possible for the individual parts concerned to be displayed in a table. Furthermore, the search can be restricted to two process data values.
The analysis can be exported and sent to an evaluation tool for correlation calculation.

⚠ No calculation of the correlation is done within Track & Trace.

5 Use Case: Assembly

In the assembly use case, additional trace data is recorded that is generated during the manual assembly of a main component. In addition to the individual part trace, this use case foresees the use of document links and inspection characteristics.

Assembly is components-based, which means that documents and inspection characteristics are assigned to the components being assembled.

Definable mandatory entries are tracked, and the assembly process cannot be completed until all relevant steps are successfully performed.

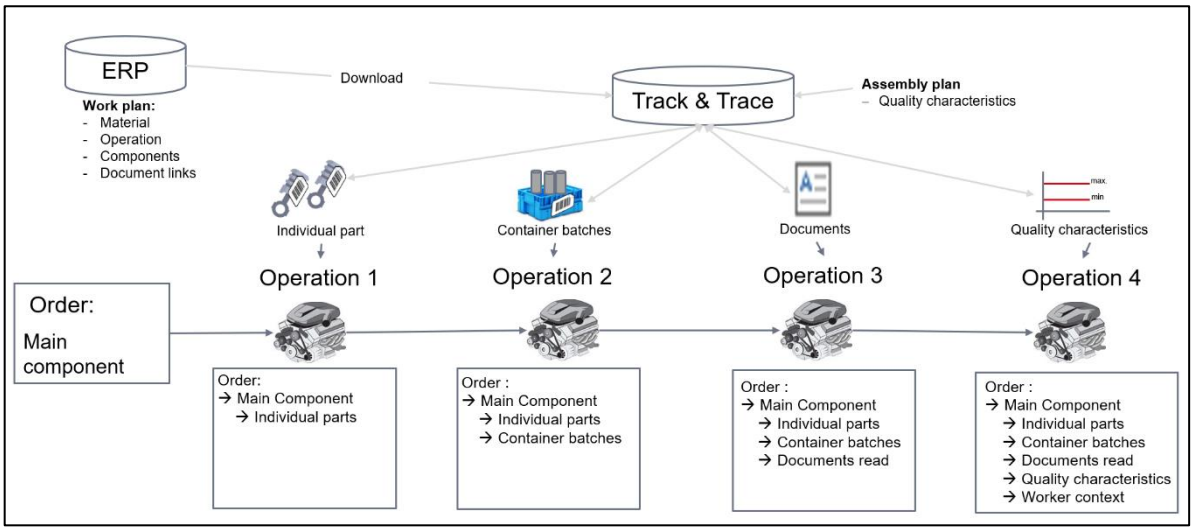
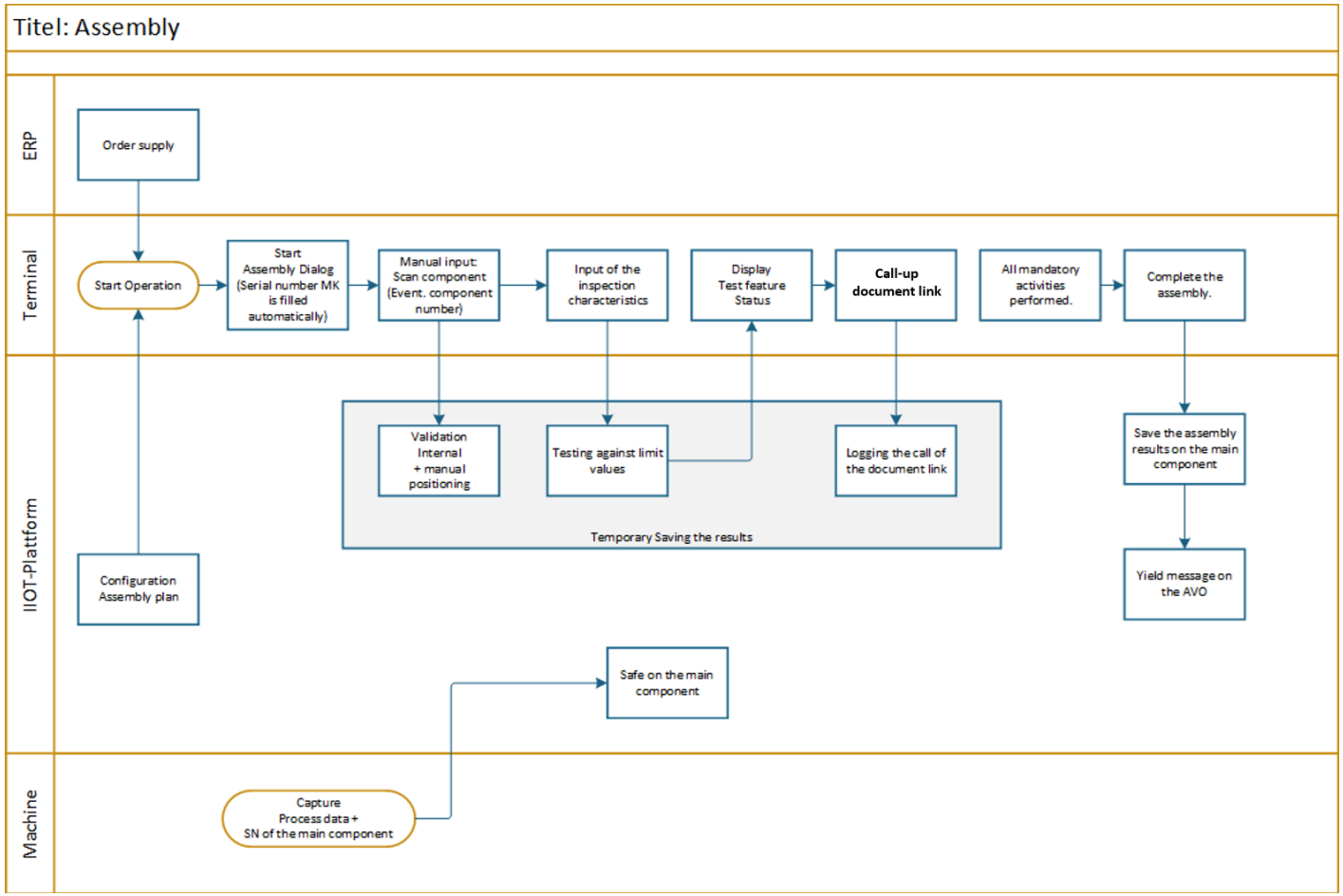


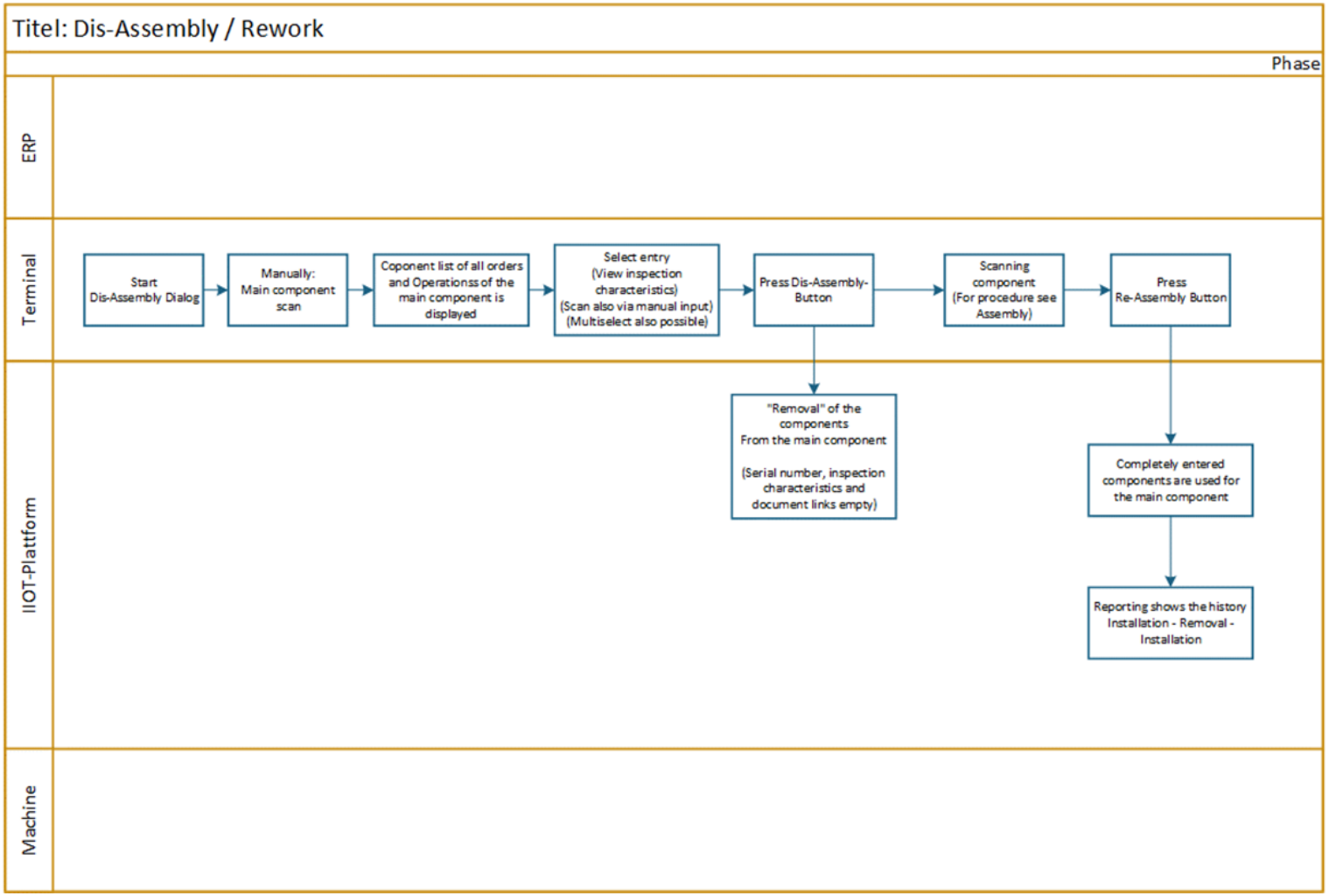
Fig. 38: Procedure for assembly of a main component

5.1 Workflow

5.1.1 Workflow for assembly of a main component



5.1.2 Workflow for disassembly or reassembly of a main component



5.2 Functional description

5.2.1 Order supply

For trace data collection in assembly to occur, it is necessary that the relevant components be assigned the *Trace needed* property in the order supply from the ERP system. Specifically, all components with the *Trace needed* property are considered mandatory components for recording.

Also, document links can be added to the order supply to the components, if required.

5.2.2 Configuration of the assembly plan

The configuration of an assembly plan for material or for components can be carried out in the Workbench.
Here, the orders or operations specified by the ERP are extended by characteristics that are additionally recorded for each component during the assembly process.

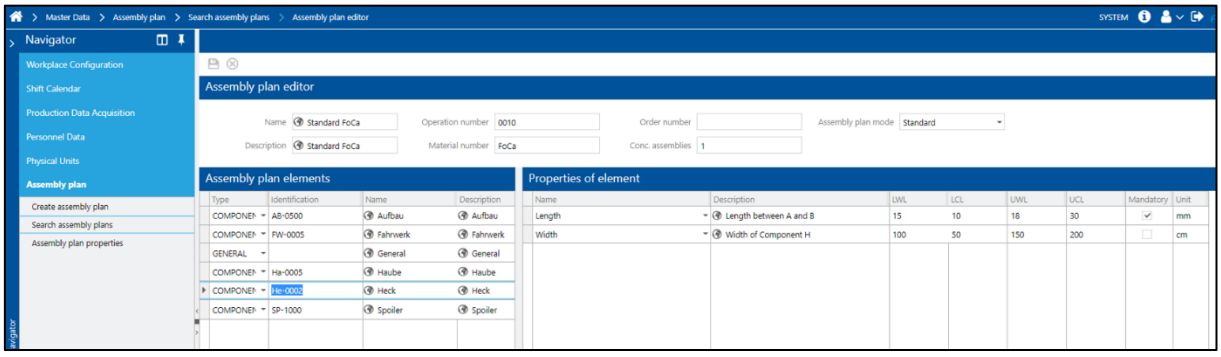


Fig. 39: Overview for extending characteristics in the assembly plan

5.2.3 Start operation

The start of an operation is the same as for the batch use case (see section 3.2.3).

5.2.4 Start assembly dialog

The assembly takes place in a separate dialog that maps according to the assembly plan.
The assembly dialog contains all assembly-relevant specifications for the current operation.

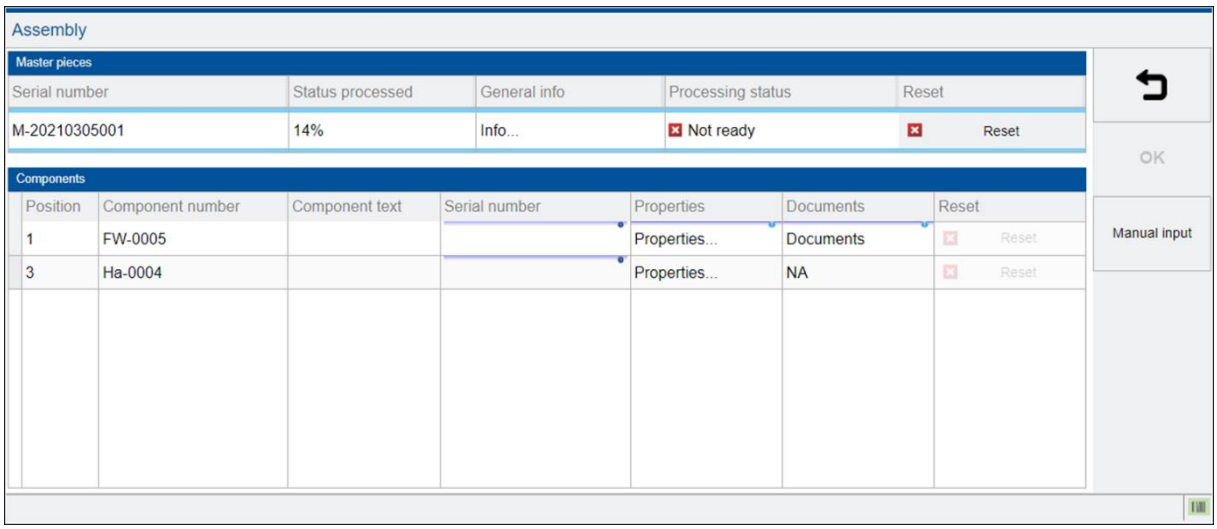


Fig. 40 Assembly dialog

5.2.5 Registering a main component

The main component must be registered in the assembly dialog. This is done by scanning, whereby the serial number is then displayed in the assembly dialog.

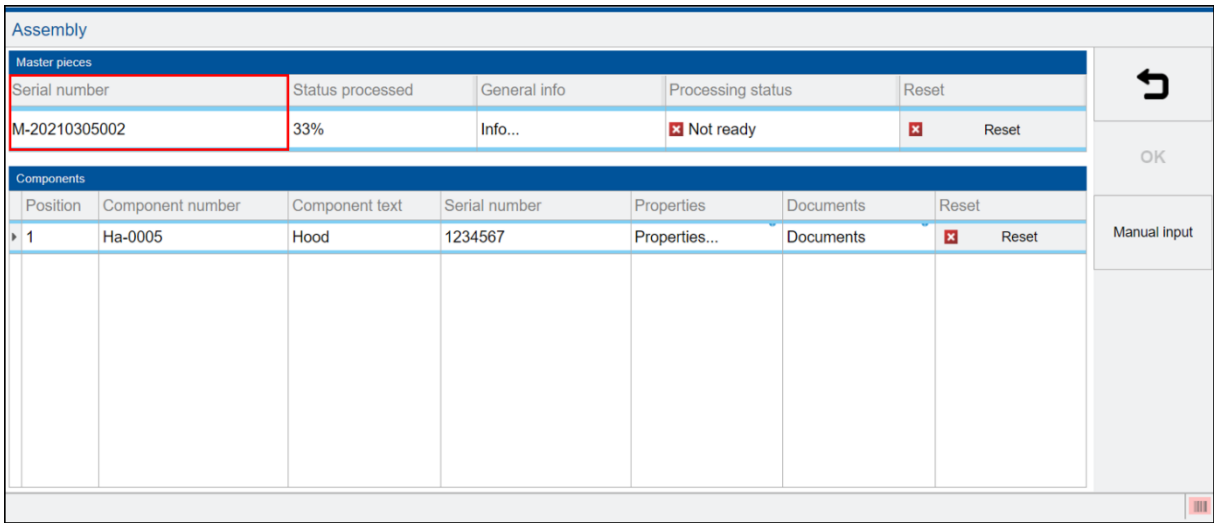


Fig. 41: Registering a main component in the assembly dialog

5.2.6 Manually registering components

To register components, it is necessary to enter or scan the component numbers.
The following component types are possible:

Name	Source	Effect
Individual part	For example, from an upstream processing stage	An individual part can be used once in a main component (ratio 1:1)
Production component	From an upstream processing stage	One container can supply components for several main components (ratio 1:n)
Storage container	Input material from warehouse	

5.2.7 Internal validation and positioning

The internal validation checks if the scanned component number is known in the system (database).

For example, if a container number is scanned, the following checks are performed:

Check	Contents
ID exists in the system	Is the ID already known in the system?
ID to component	Which component number corresponds to the scanned ID?
Components to assembly plan	Is the component part of the assembly plan?

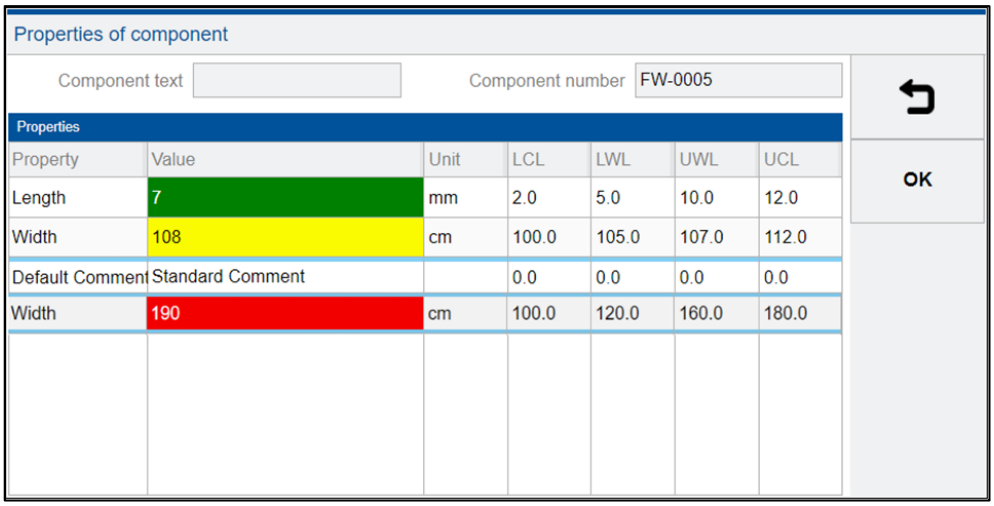
If the validation is successful, the scanned number is entered in the component line of the assembly plan.

If the validation fails, the worker can opt to enter a manual classification.

5.2.8 Entering characteristics and limit values

It is possible to record checking characteristics in the assembly plan, such as torques for each component and checking compliance with limit values. Warning and action limits can be defined for these checking characteristics. Violations of warning limits are displayed in yellow, and control limits are in red.
Also, it is possible to globally set whether the violation of warning limits is permitted, thus still allowing a representation of a positive work result.

This use case was configured so that a violation of warning limits is permissible.



Property	Value	Unit	LCL	LWL	UWL	UCL
Length	7	mm	2.0	5.0	10.0	12.0
Width	108	cm	100.0	105.0	107.0	112.0
Default Comment	Standard Comment		0.0	0.0	0.0	0.0
Width	190	cm	100.0	120.0	160.0	180.0

Fig. 42: Page for entering checking characteristics

5.2.9 Calling up and logging the document link

Document links can be specified for each component in the assembly plan. With components that require a trace, the opening of the documents is mandatory and is logged.

Two possible versions are available for the notification requirement:

Parameter	Effect
Always	The document must be opened/read before processing of every new main component begins.
Once	The document only needs to be read once. A timeout time is also set here. The document must be opened before this time has elapsed. For example, this is applied in cases where a work instruction only needs to be read once per shift.

In this use case, the notification requirement was predefined with the value *once* and a timeout of 5 minutes.

5.2.10 Display, locking, and feedback

In the assembly plan, the mandatory entries are marked in blue. Feedback for a main component can only take place if all mandatory entries have been successfully executed.

The assembly process can be canceled at any time. The entries made thus far are temporarily saved.

When feedback is given for a main component, a yield quantity is reported to the ERP system.

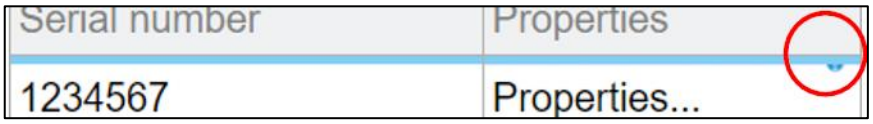


Fig. 43: Identification and mandatory entries

5.2.11 Disassembly and reassembly

5.2.11.1 Reset before feedback

Resetting a component enables reworking while the work is in progress.

Before feedback is given for a main component, it is possible to reset each component or the entire main component. Resetting a component will delete all data previously recorded in the assembly step. For example, the correlation between a main component and an assembled individual part is terminated. The individual part can then be reassembled in another main component.

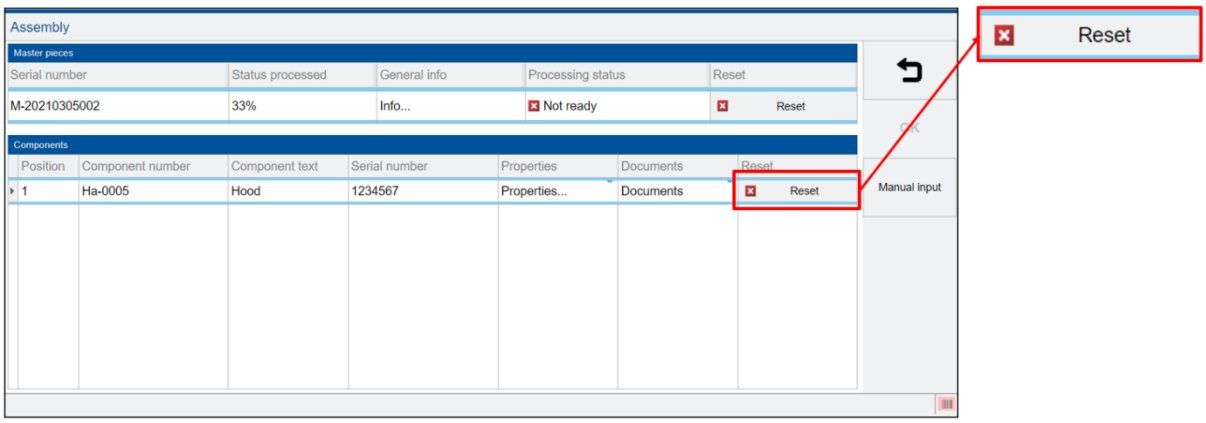


Fig. 44: Dialog for resetting assembly steps

5.2.11.2 Disassembly after feedback

Disassembling enables components to be reworked outside of a work process.

After the main component has received feedback, the components must be removed again using the disassembly dialog. Here, the data connection between the components and the main component is released. In contrast to resetting during the work process, the removal of the components from the main component is documented in the trace tree. This ensures traceability.
The reassembly of a component also takes place in the rework dialog.

Disassembly enables components to be reworked outside of a work operation.

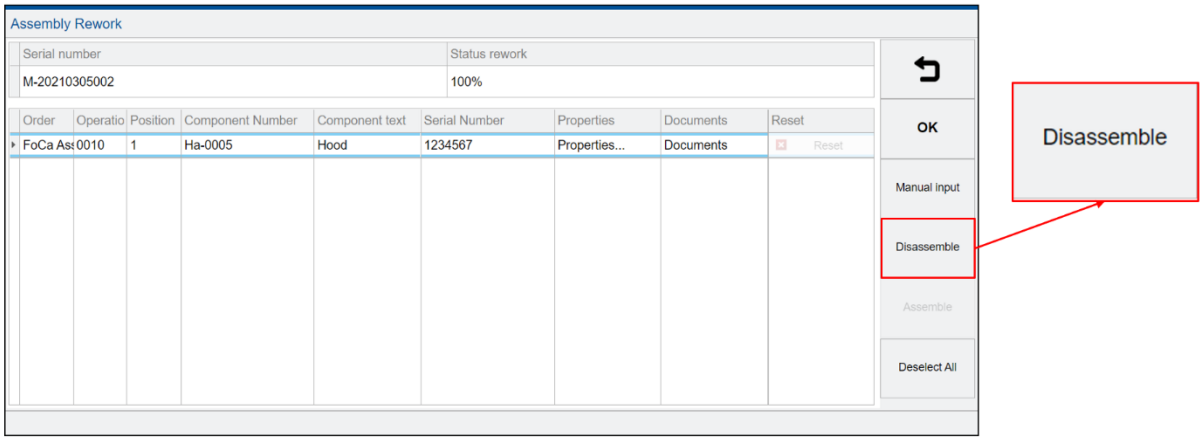


Fig. 45: Disassembly of components in the rework dialog

The disassembly of components is logged for the main component. This process can then be displayed in the reporting module.

6 Scope of Functions

The use cases only cover a small part of the Track & Trace functionality. They represent a logical overview of common implementation options. The scope of functions and functional exclusions are described below.

6.1 Process data

⚠ The process data acquisition does not offer any assignment of process data to a production object.

⚠ In addition to mapping the workplace, process data acquisition offers the line function for line-organized productions. This function is not supported from release version 5.11.

6.2 Batch

Functions that are part of Track & Trace, but not part of this use case configuration:

- Creating storage containers via FORCAM FORCE™ Bridge API
- Quantity movements of individual parts to containers
- Automatic quantity movements
- Registering and deregistering of containers via machine signals
- Grouping containers
- CAQ process
- Process data acquisition via FORCAM FORCE™ Bridge API
- Quantity control at manual quantity changes
- Recording of processing times
- Ensuring batch purity

6.3 Individual part trace

Functions that are part of Track & Trace, but not part of this use case configuration:

- CAQ process for individual parts
- Recording of processing times
- Dynamic process data acquisition
- BI connector
- Process data acquisition via FORCAM FORCE™ Bridge API

6.4 Assembly

Functions that are part of Track & Trace, but not part of this use case configuration:

6.4.1 Extended functions

- Assembly plan mode without *main component* and *commissioning*
- Parallel assembly of several main components on one workplace
- Manual selection of the components to be assembled before scanning the serial number

6.4.2 Custom functions

- Installing components at a defined (displayed) position on the main component
- External validation service for scanned serial numbers
- Assembly of machine signals (DACQ script)

7 Appendix

7.1 Abbreviations

Abbreviations	Explanation
°C	Degrees in Celsius
ATM	Standard atmosphere (unit for measuring pressure)
AVO	Operation
DACQ	Data acquisition
DCU	Data collection unit
DCP (DEP)	Data collection point (German: Datenerfassungspunkt)
ERP	Enterprise resource planning (A software solution for resource planning in a company)
FAUF	Production order
J	Joule
K	Kelvin
KJ	Kilojoule
MDE (MDA)	Maschinendatenerfassung (English: machine data acquisition)
Nm	Newton meter
PSI	Pound force per square inch
SFT	Shopfloor Terminal
VPIE	Virtual process image editor
Wh	Watt hour

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