Functional Release Notes

Version 5.12

Release Information

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Content

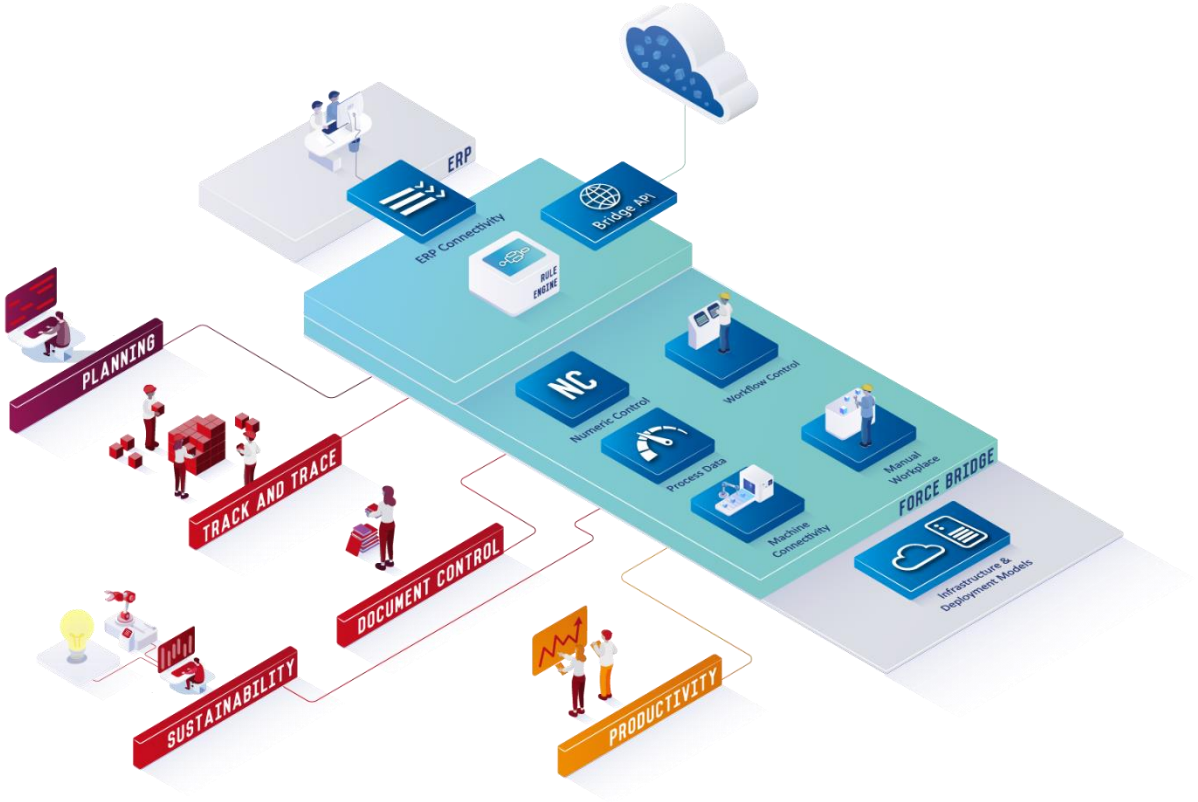
1 General

FORCAM provides companies with all the information they need to control and optimize their production. The modular IIoT solution FORCAM FORCE IIOT is as flexible as the needs of customers. With a variety of production apps, FORCAM helps companies to make their processes more transparent and improve their workflows. In this way, companies create the basis for optimization measures and sustainable success, thereby ensuring their competitiveness.

FORCAM is always endeavored to optimize the solution FORCAM FORCE IIOT further, to enrich it with functions, offering customers consistent growth and greatest possible use. For this purpose, several releases are published throughout the year.

This document lists functions that have been added or changed during the **5.12** release. It serves as an overview of the most important features so FORCAM FORCE IIOT can be used in the best possible way.

Detailed descriptions of the individual functions can be found in the respective product documentation.



2 FORCAM FORCE™ COMMON

2.1 New number of characters for order number and order split

Affected module	Affected area	Status
Workbench	Master Data	Changed

An operation always required an order number to have at max. 32 characters and an order split to have 8 characters. The corresponding database fields for FR_MD_ORDER would indicate larger values. However, as orders come with operations, the limit for FR_MD_OPERATION would have been valid for orders as well. To make this clearer on the database level, character limits have been transferred to the order as well.
The column FR_MD_ORDER.ORDER_NUMBER has changed from 255 characters to 32 characters. The column FR_MD_ORDER.ORDER_SPLIT has changed from 255 characters to 8 characters.

2.2 FFSetup now handles the installation process

Affected module	Affected area	Status
FFSetup	5.12 Artifactory	New

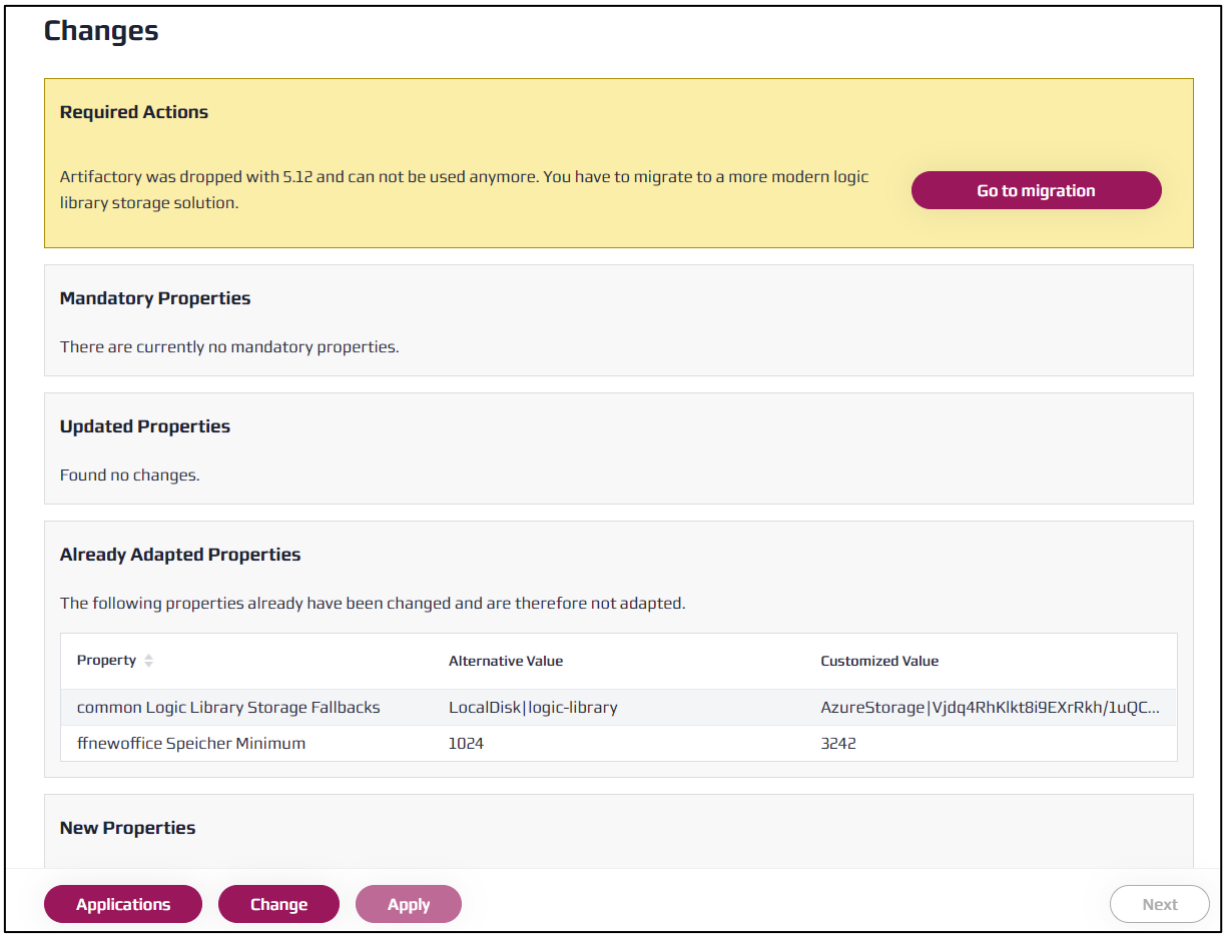
FFSetup now handles the installation process for FORCAM FORCE IIOT. An execution of FINSTER apps and base is not required anymore.

FFSetup

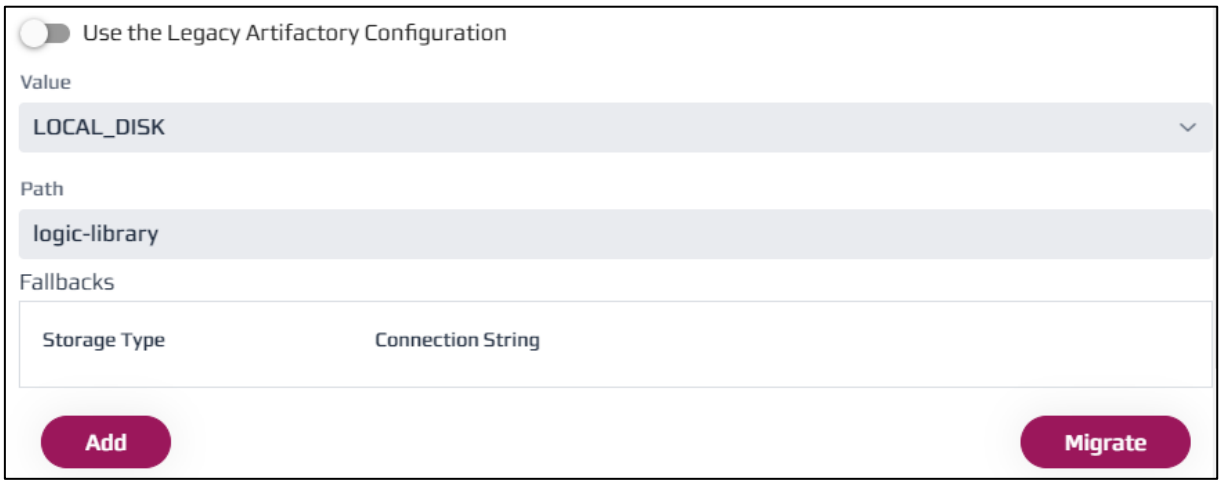
Artifactory migration

With 5.12, Artifactory is deprecated and must no longer be used. Therefore, FFSetup will force you to migrate to a local storage.

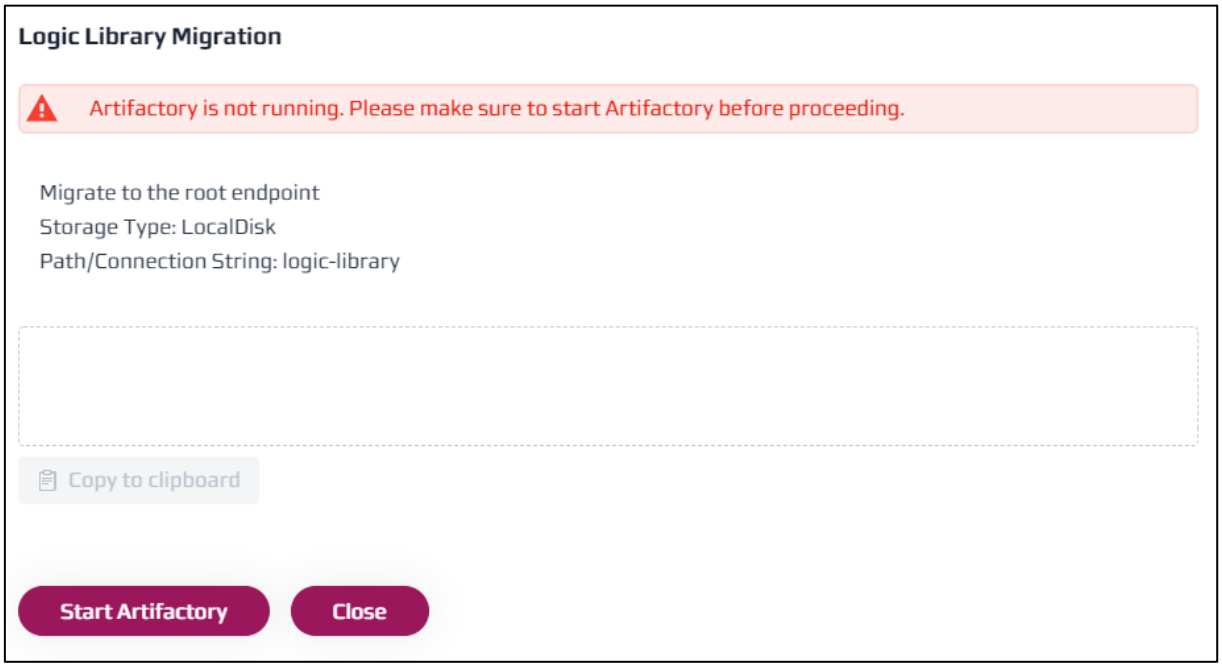
Changes



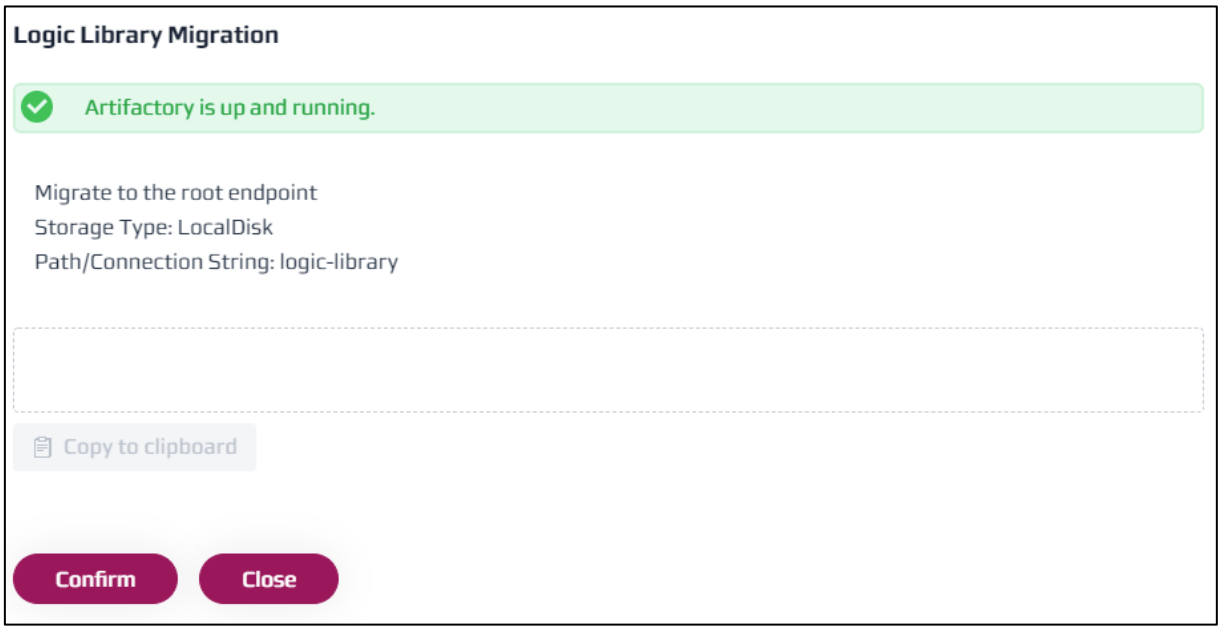
Make sure to not use the legacy Artifactory configuration anymore and click on the migrate button to follow the migration process.



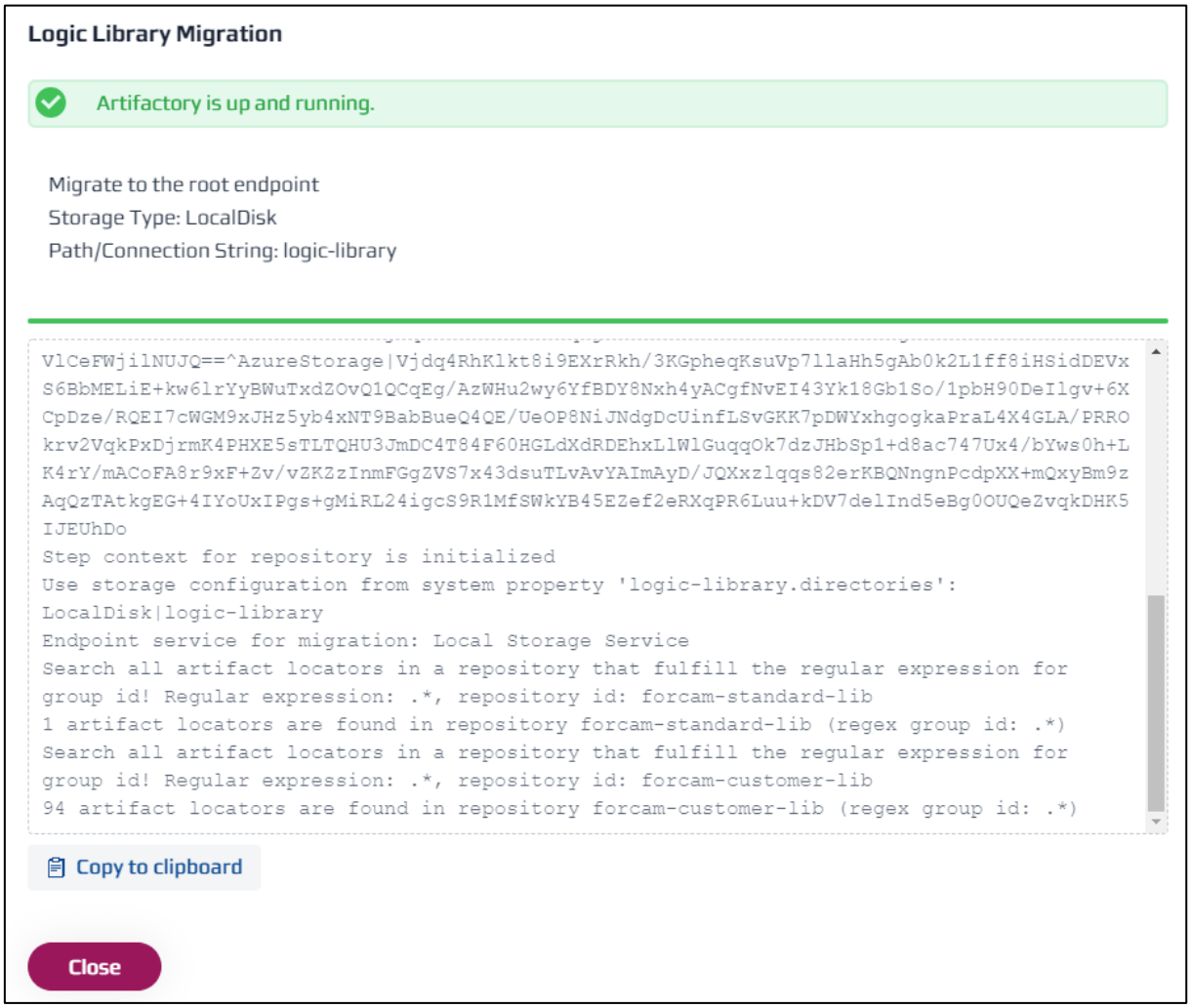
If your Artifactory is not started yet. you will be provided with an option to start it. Click on the “Start Artifactory” button.



Once Artifactory is available, there will be a screen like the one below where you can click on “Confirm” to start the actual migration process.

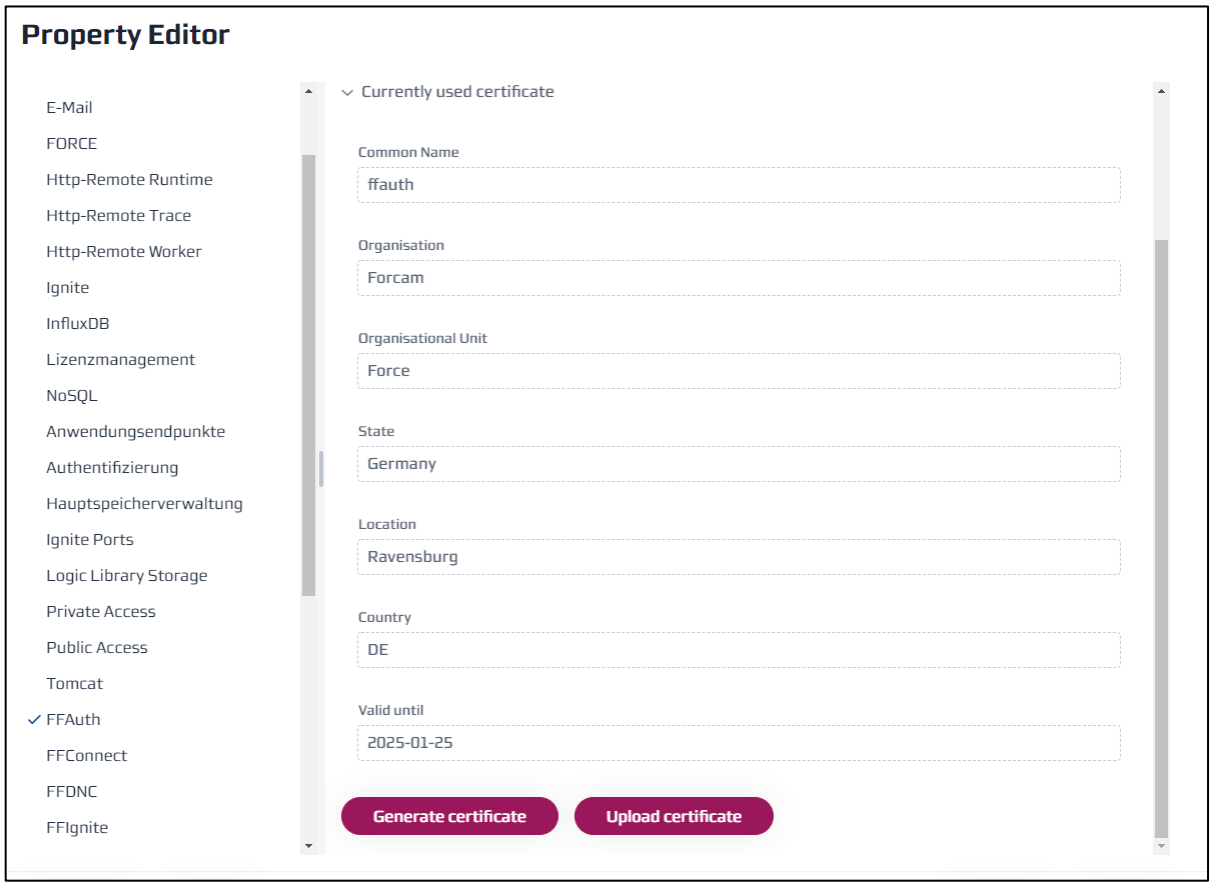


When the migration was successful, close the dialog. The business logic packages should now be available in the app/logic-library directory.



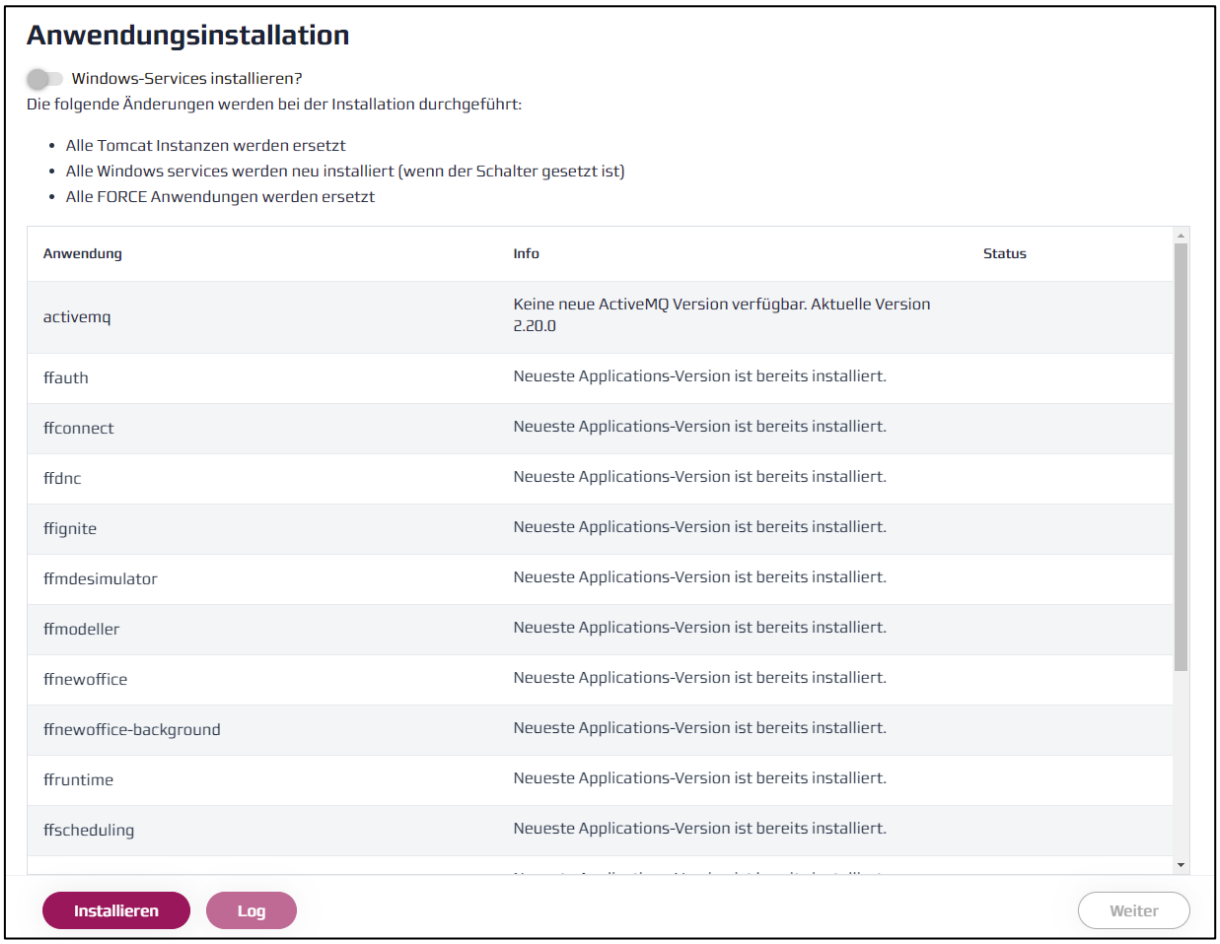
Certificate creation

FFSetup allows you to either create a self-signed certificate for an installation to be used by FFAuth or provides an option for uploading a certificate that should be used.



Application installation

FFSetup now handles the installation of tomcats and applications. There is an option to choose whether the services should be installed or not. In general, it will remove the respective tomcat installations and move the applications to the webapps directory.



2.3 Artifactory support has been removed from FINSTER

Affected module	Affected area	Status
FFSetup	5.12 Artifactory	New

We have been removing Artifactory support from FINSTER. Going forward Artifactory will no longer be supported. There is an option to migrate the logic project from Artifactory to either an Azure storage or a local one, which will replace Artifactory. The logic project migration can be found in the "FFSetup property editor" under the "Logic library storage" section (see "Migration steps" in the Technical Release Notes 5.12).

2.4 Installer now uses the G1 garbage collector

Affected module	Affected area	Status
FFSetup	CMS garbage collector	New

The installer now uses the G1 garbage collector instead of the deprecated and lower performance CMS garbage collector in the installed startup scripts for all Java-based FORCAM FORCE IIOT components.

ⓘ This is no change in functionality, only a low-level technical change. There are no customer-side settings changes required.

2.5 New icons for all FORCAM FORCE IIOT clients

Affected module	Affected area	Status
Global	FFWorkbench/FFNewOffice/ FFSimulation/FFUiComponents	Changed

FFWorkbench, FFNewOffice, FFSimulation and FFUiComponents icons were changed to newer ones. None of them significantly changed form-wise.

3 Cross-platform

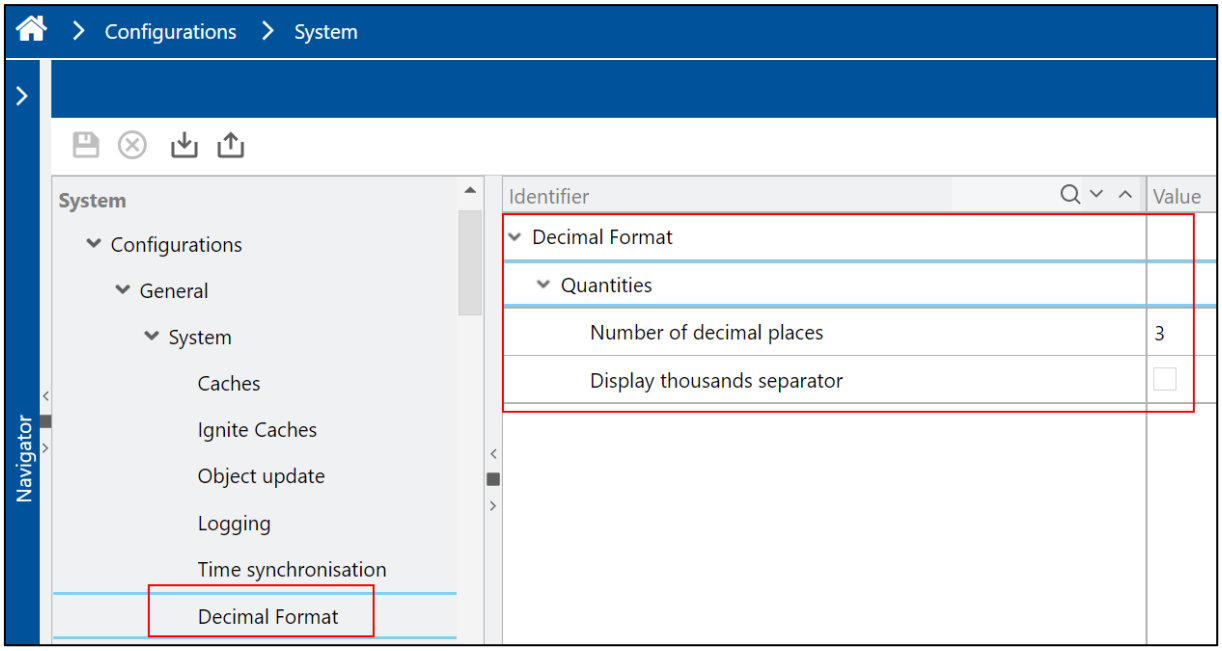
3.1 New configuration “Decimal format”

Affected module	Affected area	Status
Global	All	New

Workbench

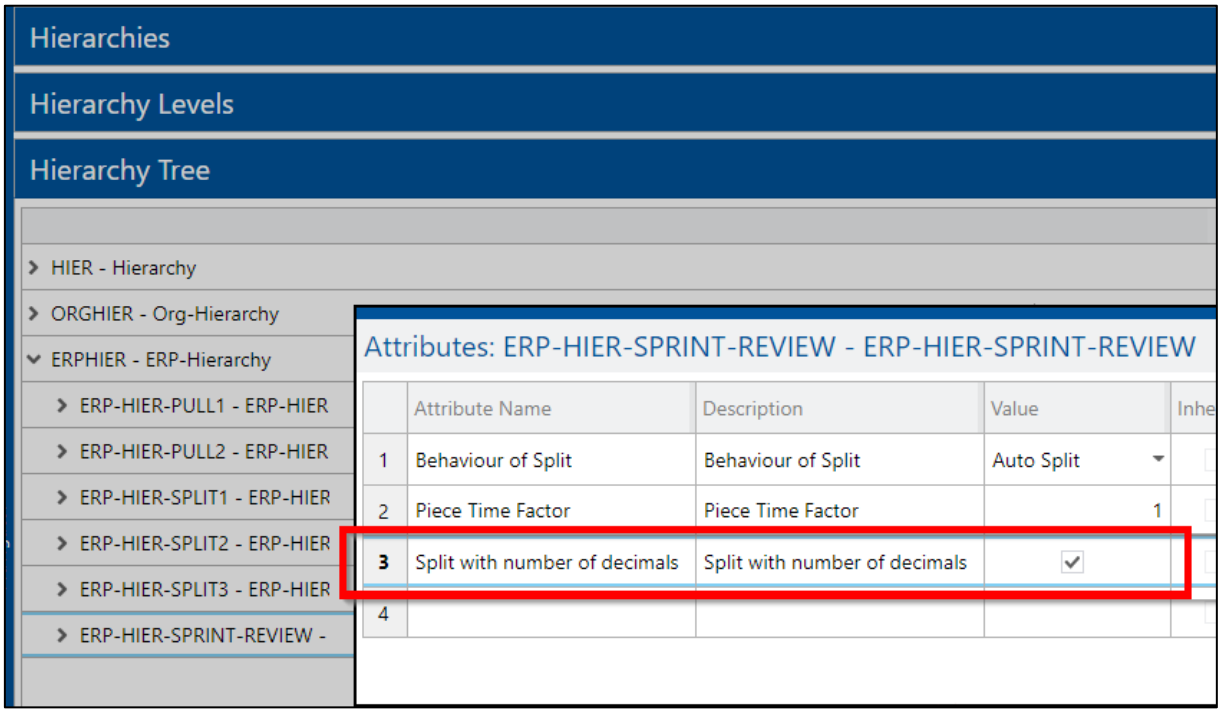
Path: Configuration > System

A new configuration under system configuration called “Decimal format” is introduced. There are now two new configuration options. The first is the “Number of decimal places” which enables configuring the number of decimal places for the quantity. The valid range for this is 0 to 6 (both inclusive). The second configuration option “Display thousands separator” defines whether the thousands separator (comma (,) or dot (.)) is to be used in the quantity. Comma or dot is decided based on current locale of the system.



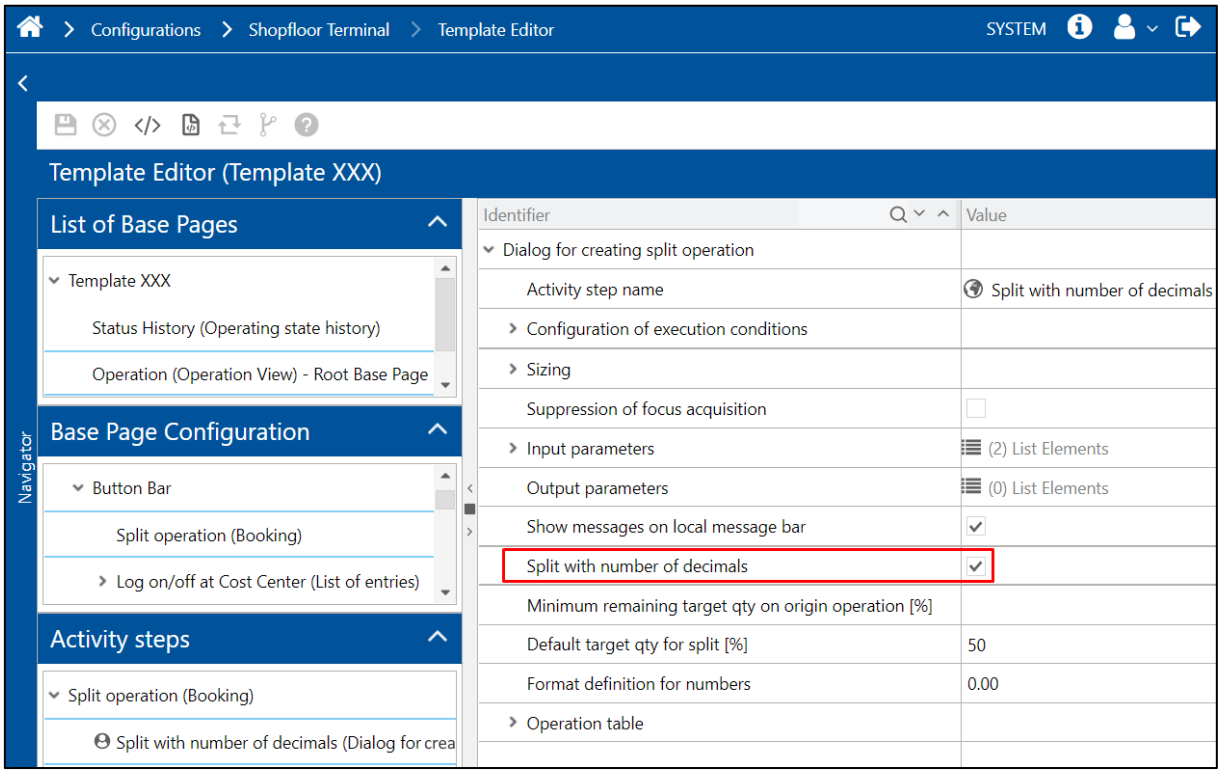
Path: Workplace Hierarchy > ERP Hierarchy

A new attribute “Split with number of decimals” for capacity group type: Auto split is introduced. This attribute configuration determines whether the split is done with decimal numbers (if applicable). When this attribute configuration is enabled (checked), the split will not force natural numbers only (if applicable). For example, if there are two workplaces and a quantity of 101, the split would be 50.50 for each split.



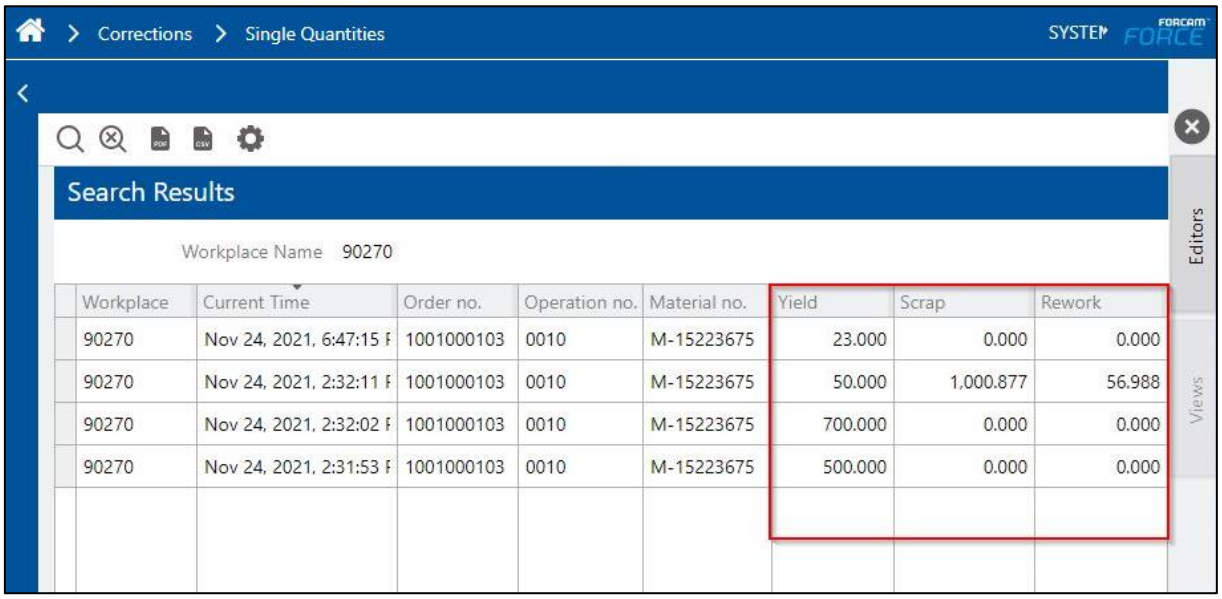
Path: Configurations > Shopfloor Terminal > Template Editor

A new attribute “Split with number of decimals” for “Dialog for creating split operation” is introduced. This attribute configuration is used to decide whether the split is done with decimal numbers (if applicable). When this attribute configuration is enabled (checked), the split will not force natural numbers only (if applicable). For example, with a quantity of 101, the split would be 50.50 for each split.



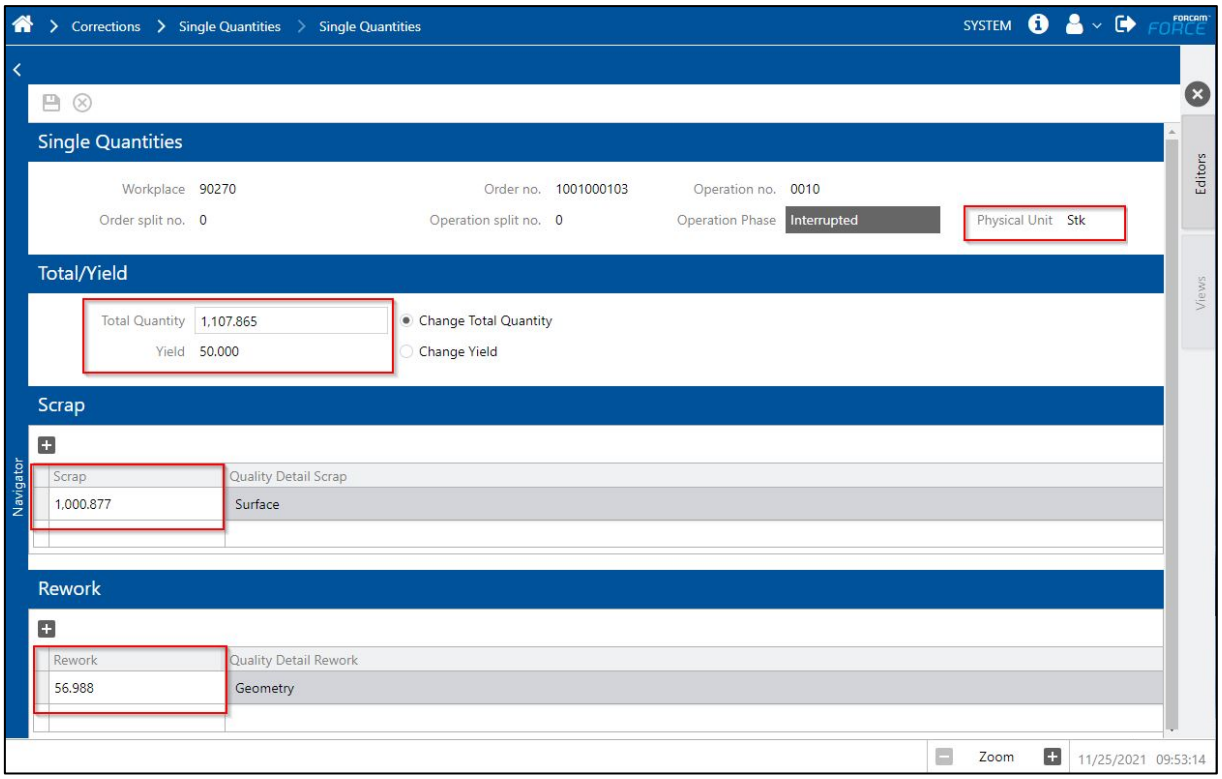
Path: Corrections > Single Quantities

The UI for single quantity correction uses the global configuration of “decimal format”. All quantities will be formatted according to the configuration.



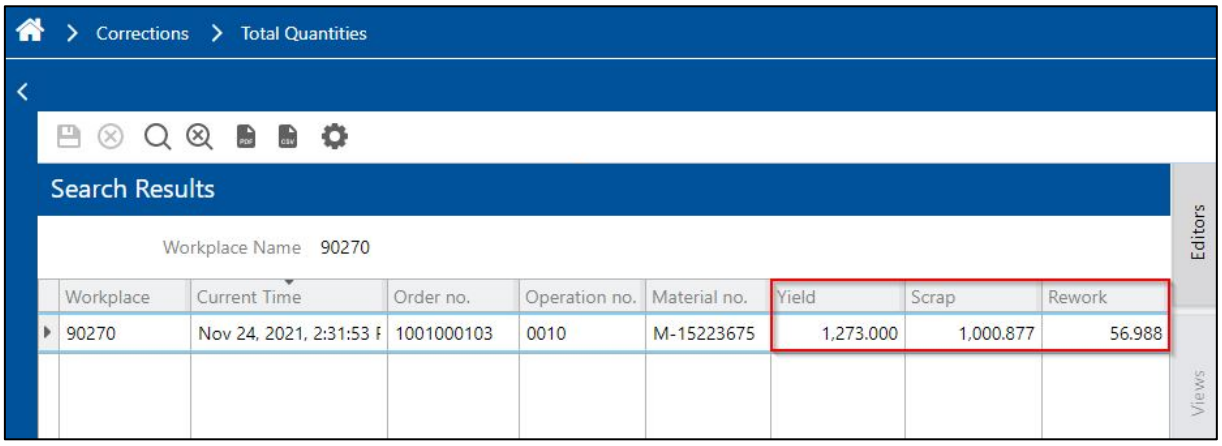
Workplace	Current Time	Order no.	Operation no.	Material no.	Yield	Scrap	Rework
90270	Nov 24, 2021, 6:47:15 F	1001000103	0010	M-15223675	23.000	0.000	0.000
90270	Nov 24, 2021, 2:32:11 F	1001000103	0010	M-15223675	50.000	1,000.877	56.988
90270	Nov 24, 2021, 2:32:02 F	1001000103	0010	M-15223675	700.000	0.000	0.000
90270	Nov 24, 2021, 2:31:53 F	1001000103	0010	M-15223675	500.000	0.000	0.000

The booking page UI for single quantity correction also uses the global decimal format configuration. In addition, the “physical unit” field has been added as a read-only mode.

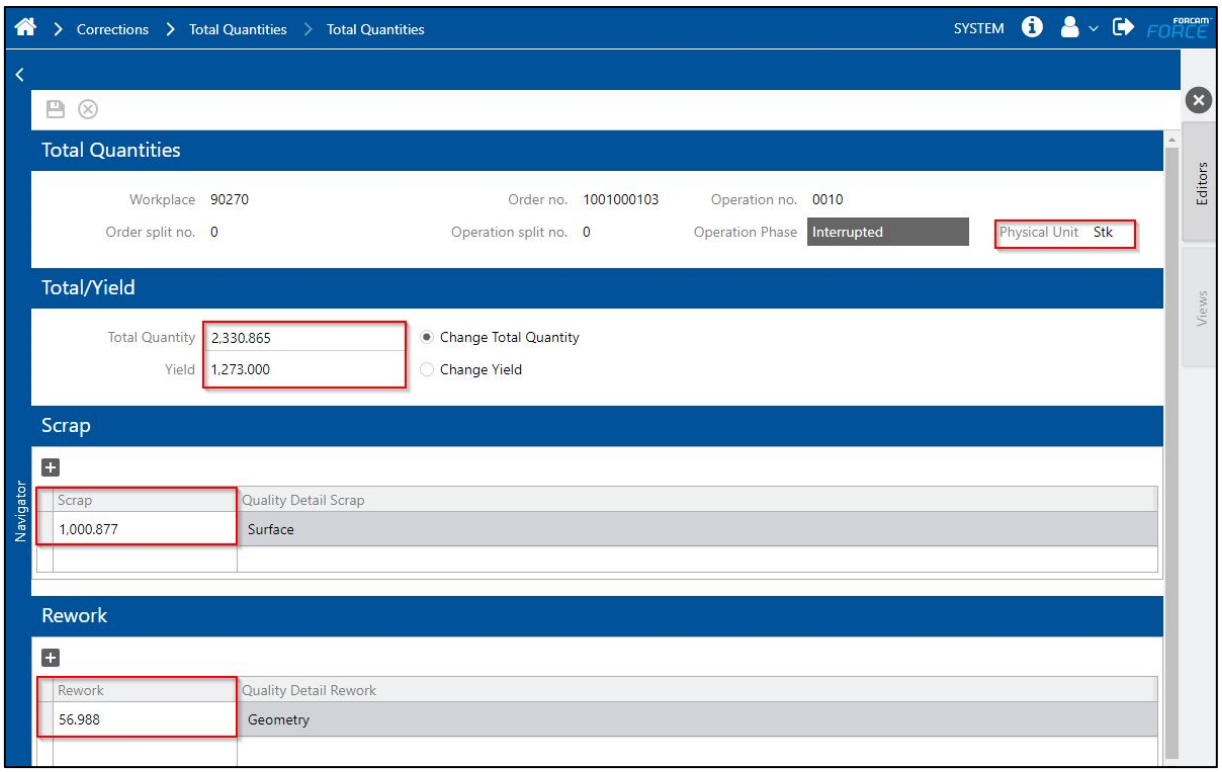


Path: Corrections > Total Quantities

The UI for total quantity correction uses the global configuration of “decimal format”. All quantities will be formatted according to the configuration.

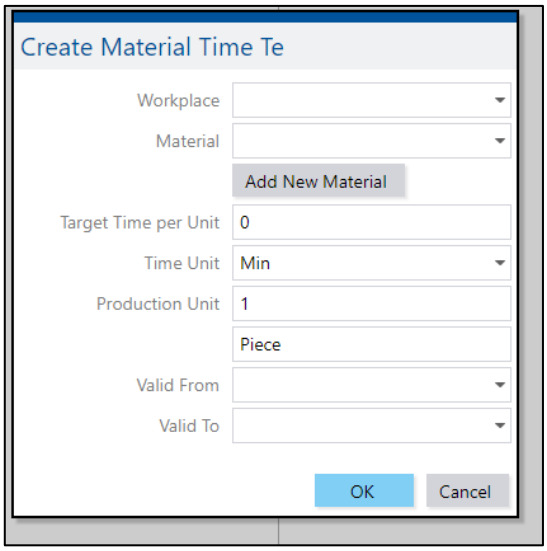


The booking page UI for total quantity correction also uses the global decimal format configuration. In addition, the “physical unit” field has been added as a read-only mode.



Path: Master Data > Production time per unit

In the master data configuration, the physical unit field for “Production time per unit” is now a plain input text and editable. It is possible to enter any physical unit in this field. The tooltip information for the “Target time per unit” is also updated. “Piece” is the default physical unit, however, it is also possible to enter any other physical unit.



Digital Planning Board

All quantities in the Digital Planning Board are modified to display the decimal formats according to what is specified in the global configuration, including considering the rules for different languages:

- All quantity fields of the operation table, operation bar (Gantt chart) and operation tooltip (Gantt chart) use the global configuration for displaying quantities.
- Also, the sub-masks showing orders, operations, editing and changing operations use the global configuration settings. Most fields only display quantities. In the editor sub-masks “create new operation” and “edit operation” it is possible to change the quantity. The quantity unit is now also visualized (not editable) in the sub-masks.
- The operation split functionality also uses the global configuration settings.
- The search field “target quantity” must also use the global configuration settings. Additionally, the search for target quantity now has a search range with “from” and “to”.

The “Time per unit” data field needs to be handled separately. Generally, it uses the global configuration by default. However, it is possible to override the global configuration by customizing the configuration in the Digital Planning Board (in configuration section “Other”). This means, there are always two decimal numbers shown if applicable (i.e., if decimal numbers are available, there are no trailing zeros). This is useful when no decimal numbers are of interest globally, and thus configured not to be shown; but as the “time per unit” is likely a decimal number, it is of vital interest in the Digital Planning Board and can be seen here independent of the global settings.

Detailed Order Scheduling (DOS)

Starting situation:

The physical units in DOS serve only for visualization purposes and are displayed in a sub-mask where single operations are displayed. DOS interprets and uses the following units:

- Piece: “St”, “HU”, “PC”
- Weight: “KG”, “GR”, “T”, “Tone”, “LB”
- Volume: “ML”
- Length: “M”

Lower case or upper case is irrelevant. Piece is accepted for all other unit information, e.g. DOS would display the unit “mg” as “piece”.

DOS can also handle comma values.

From 5.12.0: DOS will continue to use the above logic. There are no changes, only that the global transport quantity was not using the above logic and was adapted to it.

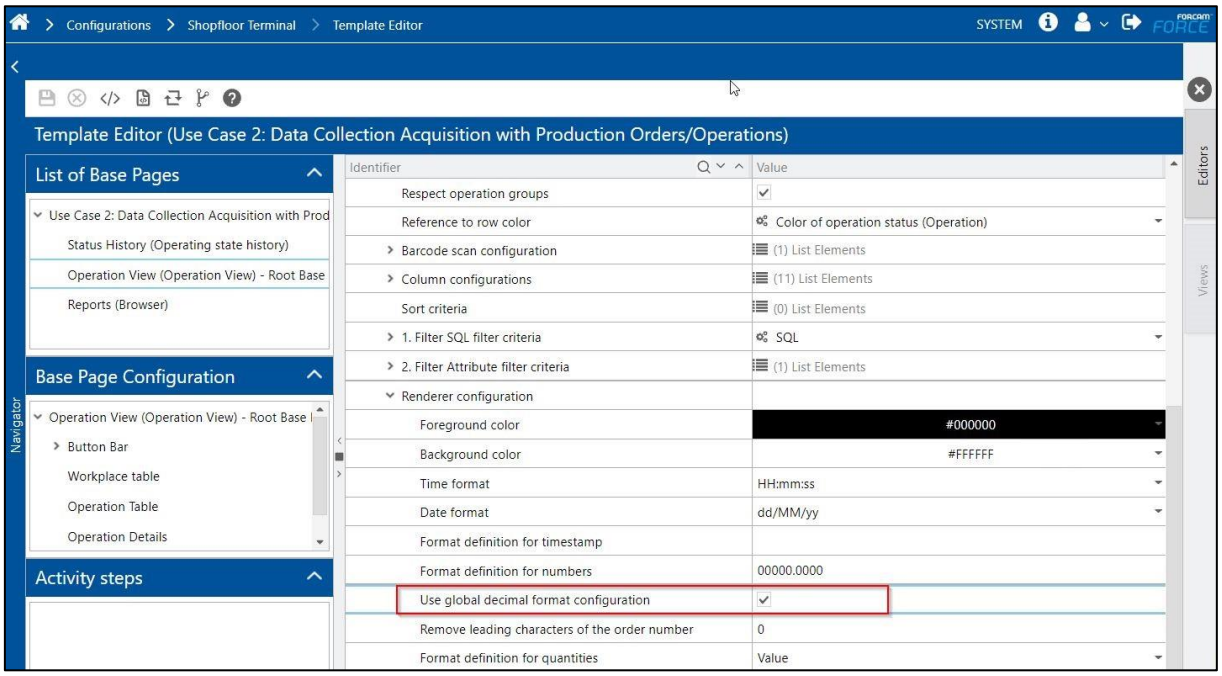
Common modules

Runtime access

A new service called GlobalDecimalUnitRoundingService is introduced which rounds up and formats the given quantity as per the provided global configuration of the decimal numbers.
In FFRuntime (realtime), all the events which carry quantity information into the Rule Engine has been updated to round the quantity information as per the global configuration for “decimal format”.

FFWorker

A new configuration under renderer configuration called “Use global decimal format configuration” is introduced for Shopfloor Terminal templates. This configuration is available for each renderer configuration of Shopfloor Terminal templates.



When “Use global decimal format configuration” is selected, the quantities-related information will be shown according to the configuration of Workbench > Configuration > System > “Decimal Format” and padding digits(0s) will be added according to the configuration of “Format definition for numbers”.

Some example cases are given below:

Use global decimal format configuration:

- Checked (true)

Format definition of numbers:

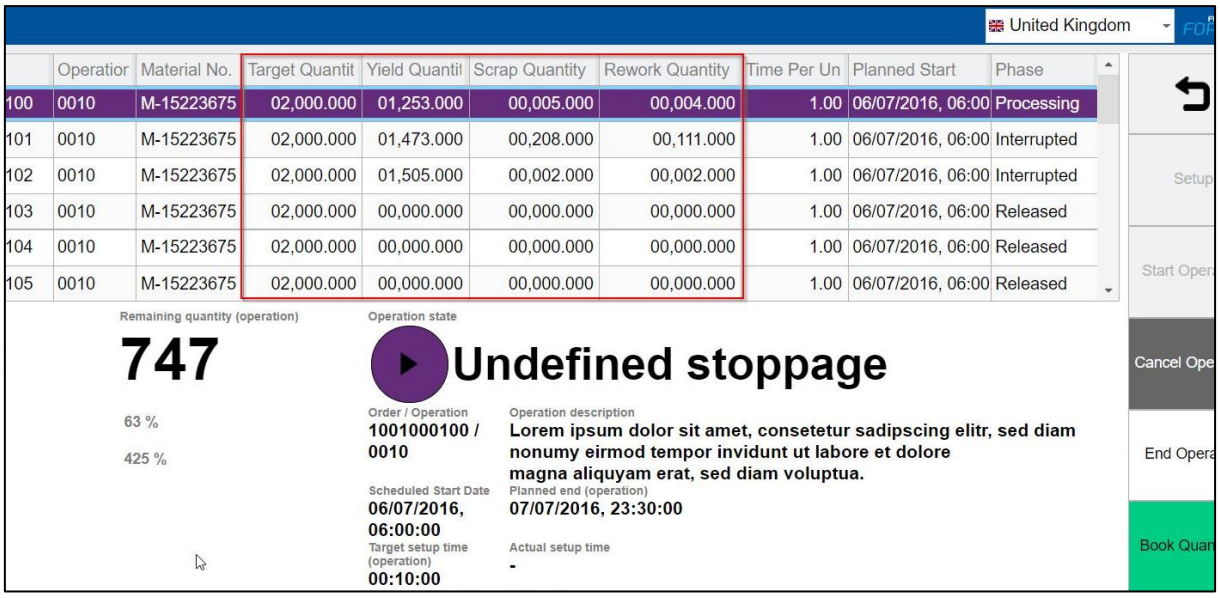
- 00000.0000

Decimal format (Workbench configuration [System > Decimal]):

- Checked (true); number of decimal Places = 3 and thousands separator = true

The resulting quantity related information inside grids/tables inside SFT:

- The quantity related information shown is based on the global configuration (3 digits after decimal point and with thousands separator) and padding 0s are added based on the configuration of format definition of numbers (which is 00000 [always showing 5 digits before decimal point]).



Use global decimal format configuration:

- Unchecked (false)

Format definition of numbers:

- 00000.0000

Decimal format (Workbench configuration [System > Decimal]):

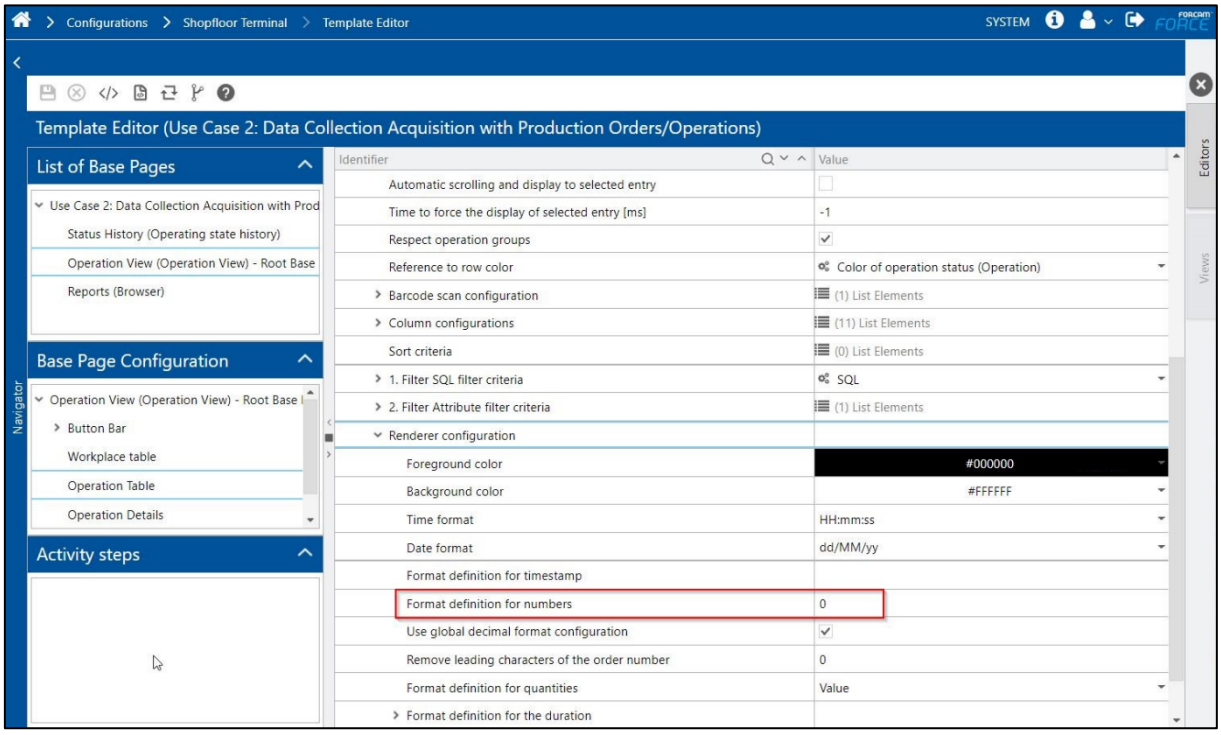
- Checked (false)

The resulting quantity related information inside grids/tables inside SFT:

- The quantity related information shown is based on the configuration of format definition of numbers (which is 00000.0000 [always showing 5 digits before decimal point and 4 digits after decimal point]).

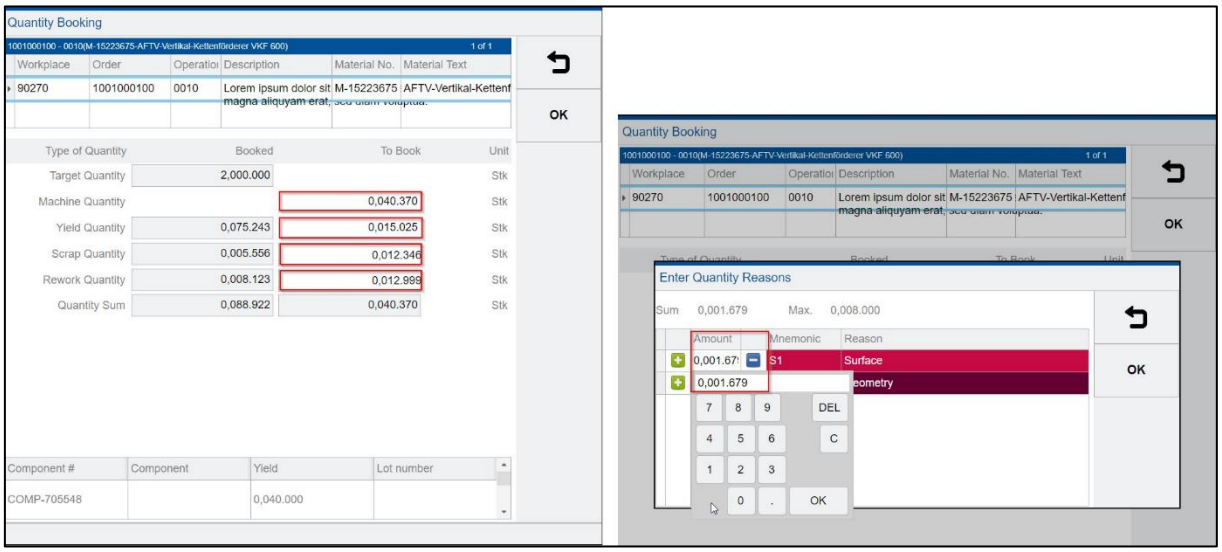
	Operatior	Material No.	Target Quantit	Yield Quantil	Scrap Quantity	Rework Quantity	Time Per Un	Planned Start
100	0010	M-15223675	02000.0000	01253.0000	00005.0000	00004.0000	1.00	06/07/2016, 06
101	0010	M-15223675	02000.0000	01473.0000	00208.0000	00111.0000	1.00	06/07/2016, 06
102	0010	M-15223675	02000.0000	01505.0000	00002.0000	00002.0000	1.00	06/07/2016, 06
103	0010	M-15223675	02000.0000	00000.0000	00000.0000	00000.0000	1.00	06/07/2016, 06
104	0010	M-15223675	02000.0000	00000.0000	00000.0000	00000.0000	1.00	06/07/2016, 06
105	0010	M-15223675	02000.0000	00000.0000	00000.0000	00000.0000	1.00	06/07/2016, 06

In addition, the default configuration value for “Format definition for numbers” under renderer configuration is set to 0 instead of 0.00.



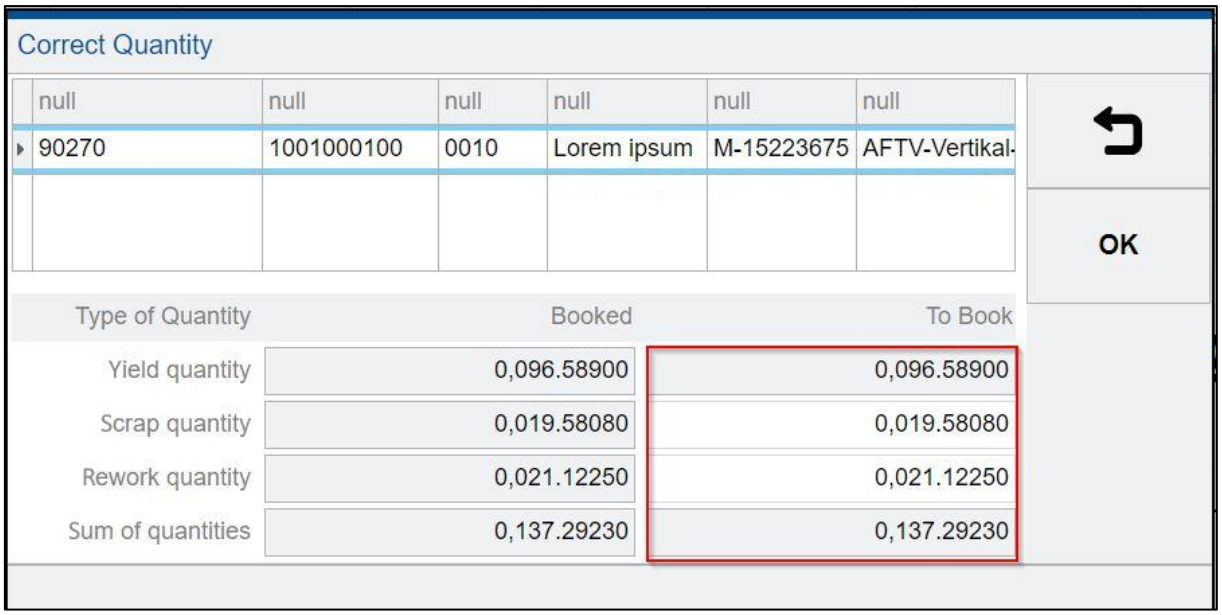
Quantity booking activity step

The “Quantity booking activity step” uses the number of decimal places and thousands separator which is defined in the global configuration.



Quantity correction activity step

The “Quantity correction activity step” also uses the number of decimal places and thousands separator that is defined in the global configuration.

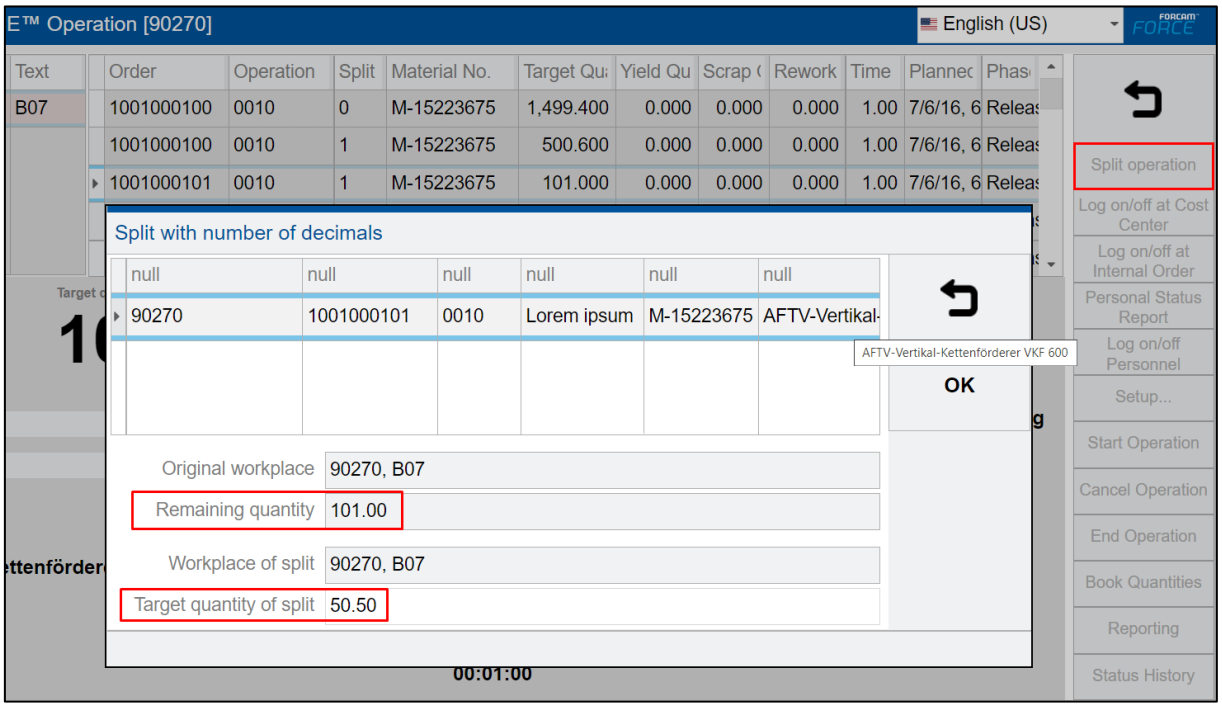


Operation details view

The operation detail view, which contains quantity information (e.g. “target quantity”, “booked quantity”, “remaining quantity”, etc.) uses the number of decimal places and thousands separator according to the global configuration. A new Javascript function (function name: “formatNumberUsingGlobalConfig(numberToFormat”) has been introduced in the use case templates (use cases 2-9).

Split operation activity step

When “Split with number of decimals” for “Dialog for creating split operation” is checked, then split is done with decimal numbers.



Office client

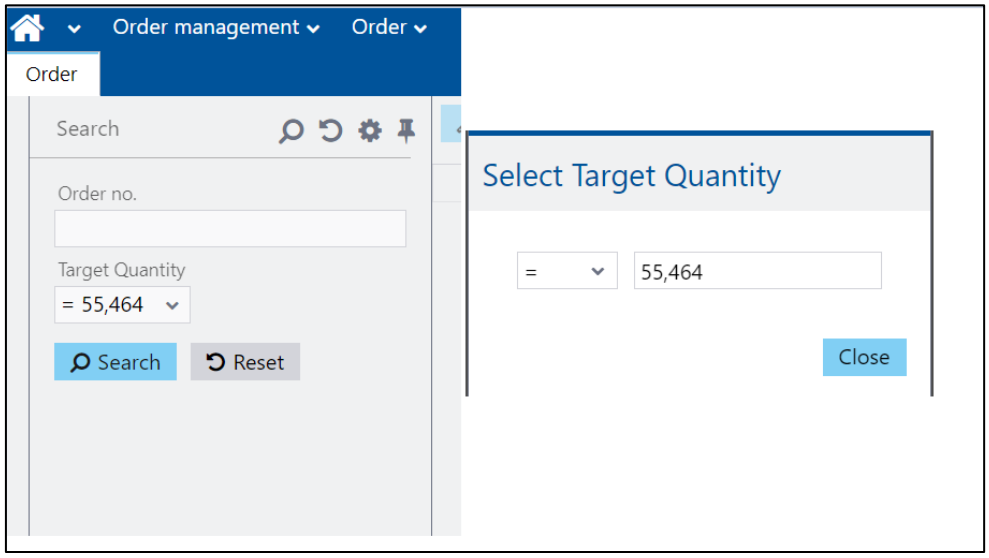
All quantities in the “Order Management” of Office, are modified to display according to the decimal formats specified in the global configuration.

The input and the display of the quantity fields are modified to enter/change all quantities with the maximum number of decimal places. This applies to all UIs and pop-ups of the order management configured in the global configuration.

The quantities in search fields are entered without the decimal places. However, the thousands separator is applied according to the global configuration selection. The thousands separator format is based on the selected language.
For US and UK format, a comma (,) is used, and a dot (.) is used for the German format.

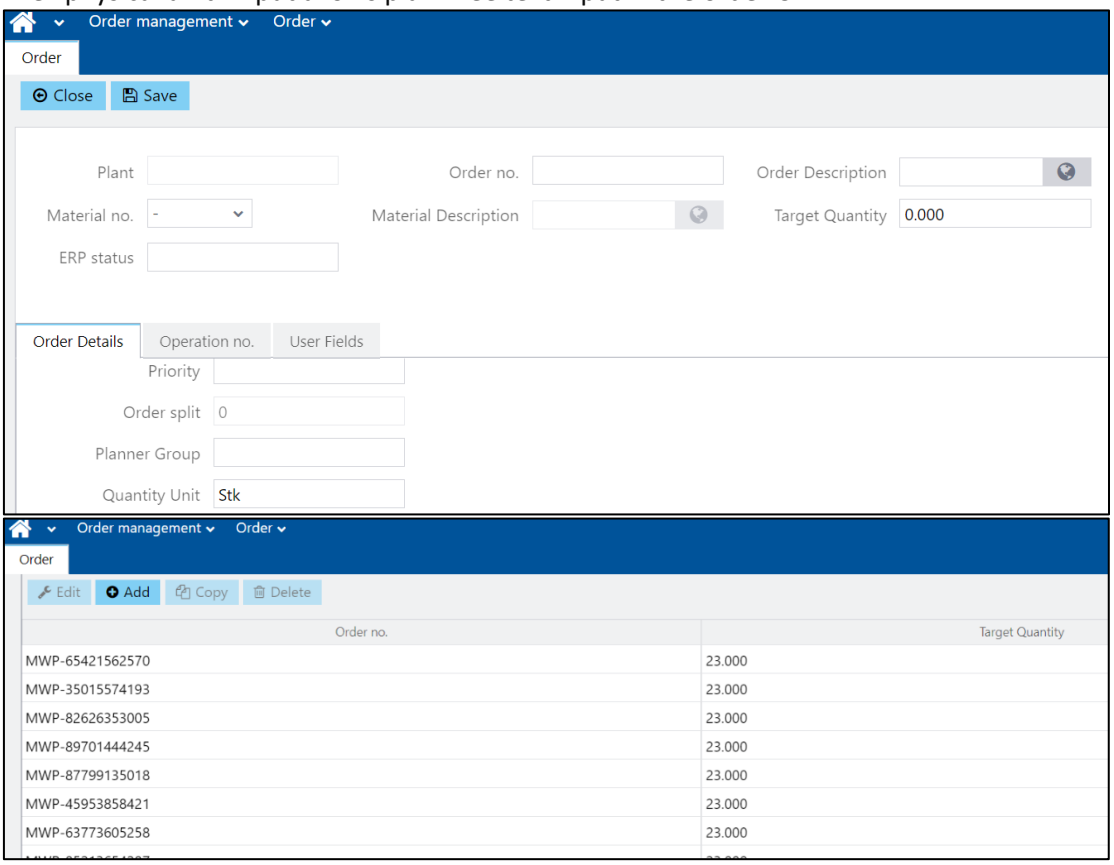
Order management

- The “target quantity” filter in the order UI allows the input without reference to the number of decimal places defined in the global configuration, but based on the expected language-based number format and the global configuration for the thousands separator
- “Physical unit” filter in the order UI allows plain free text input



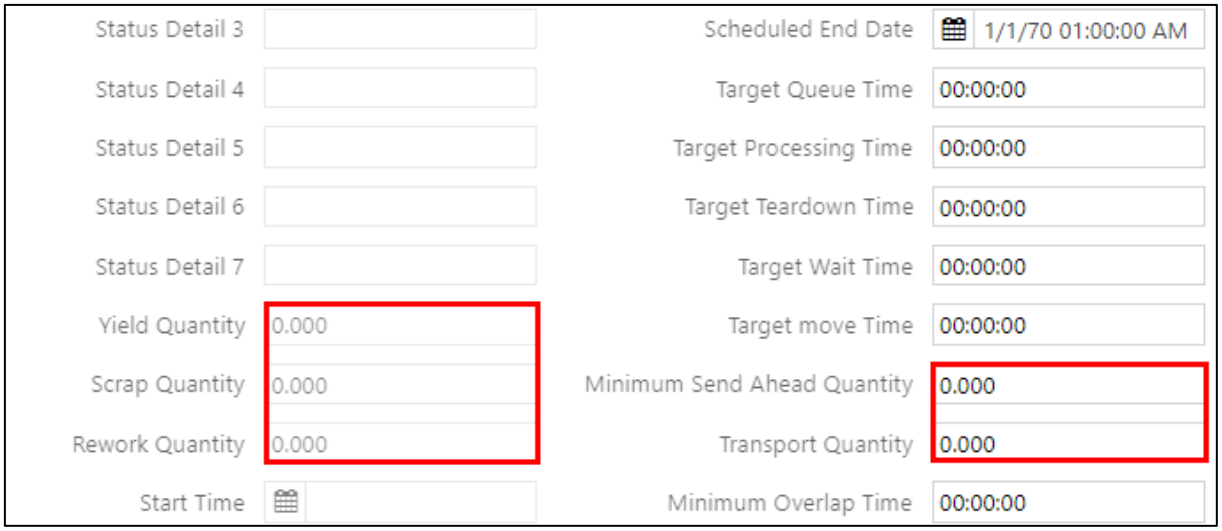
- Quantities in the order UI and display table are displayed according to the defined precision of the configuration and based on the expected language-based number format, also according to the configuration of the thousands separator.
- The “quantities Input” in the order UI allows the maximal number of decimal places according to the defined precision of the configuration and based on the expected language-based number format.

- The “physical unit” input allows plain free text input in the order UI.



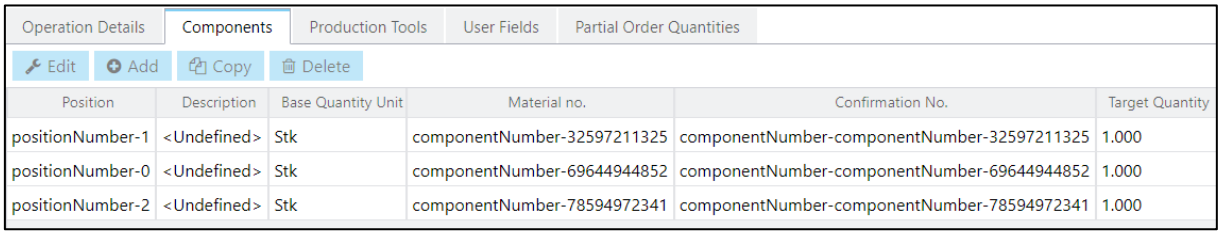
Operation management

- Quantity filters in the operation UI allow the input without referencing the number of decimal places defined in the global configuration, but is based on the expected language-based number format and the global configuration for the thousands separator.
- “Physical unit” filter in the operation UI allows plain free text input.
- Quantities in the operation UI and display table are displayed according to the defined precision of the configuration, the expected language-based number format, and according to the configuration of the thousands separator.
- Quantities input in the operation UI allow the maximum number of decimal places according to the defined precision of the configuration, the expected language-based number format, and the configuration of the thousands separator.
- “Physical unit” input allows plain free text input in the operation UI.



Components

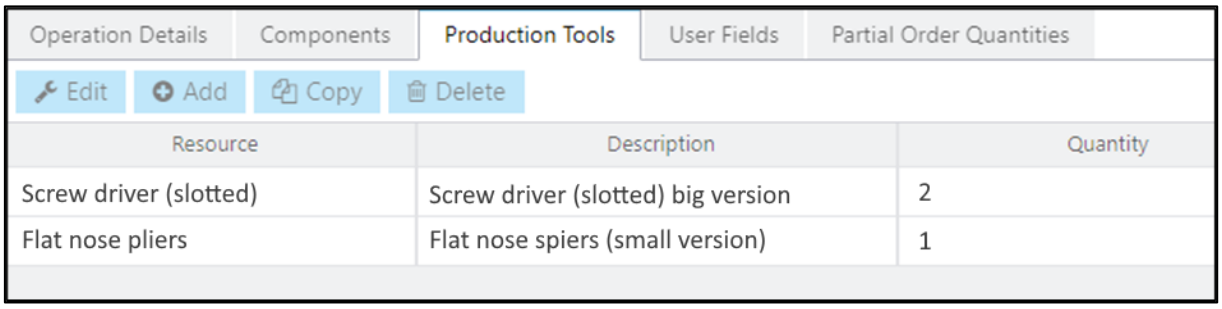
- Quantities in the components UI and display table are displayed according to the defined precision of the configuration, the expected language-based number format, and the configuration of the thousands separator.
- “Quantities input” in the components UI allow the maximum number of decimal places according to the defined precision of the configuration, the expected language-based number format, and the configuration of the thousands separator.
- “Physical unit” input allows plain free text input in the components UI.



Position	Description	Base Quantity Unit	Material no.	Confirmation No.	Target Quantity
positionNumber-1	<Undefined>	Stk	componentNumber-32597211325	componentNumber-componentNumber-32597211325	1.000
positionNumber-0	<Undefined>	Stk	componentNumber-69644944852	componentNumber-componentNumber-69644944852	1.000
positionNumber-2	<Undefined>	Stk	componentNumber-78594972341	componentNumber-componentNumber-78594972341	1.000

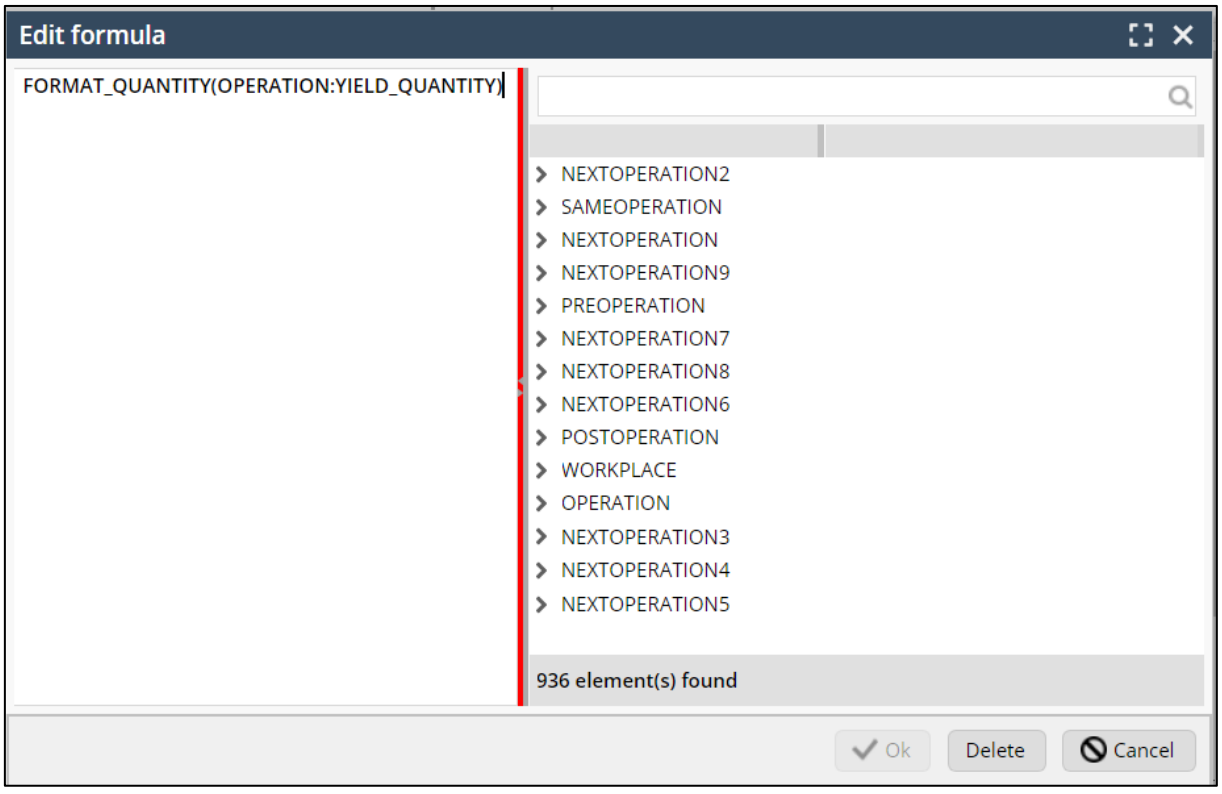
Production tools

- Quantities in the production tools UI and display table are displayed according to the defined precision of the configuration, the expected language-based number format, and the configuration of the thousands separator.
- “Quantities input” in the production tools UI allows the maximum number of decimal places according to the defined precision of the configuration, the expected language-based number format, and the configuration of the thousands separator.
- “Physical unit” input allows plain free text input in the components UI.



Visualization – formula editor

In the Visualization, the formula editor quantities are provided as raw values with the full precision. To apply to global format configuration, the FORMAT_QUANTITY function can be used.



Quantities that are formatted with this function are displayed according to the defined precision of the configuration, the expected language number format, and the configuration of the thousands separator.

Example: FORMAT_QUANTITY(3.141592)

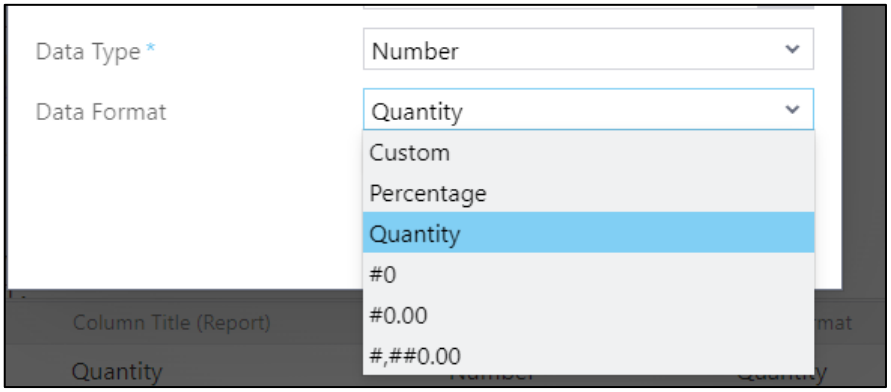
Global formatting configuration:
Number of decimal places: 2
Display thousands separator: True
Locale: English (US)

The function returns the value 3.14.

Reporting - data source editor

In the data source editor of FFNewOffice, a new “Quantity” data format was introduced for data source columns of type “Number”. When a number is formatted in the data format “Quantity”, the number format defined in the “decimal format” configuration of FFWorkbench will be used to format the number.

ⓘ The data format does not only affect the values, but it also affects the different chart properties like the y-axis/x-axis format, the format of the tooltip, etc.

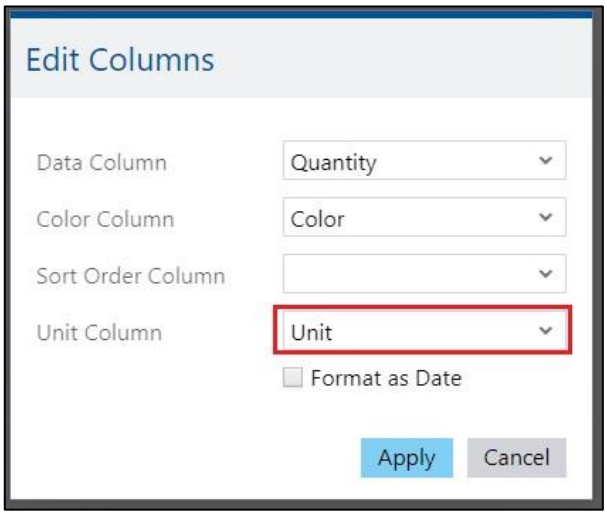


Reporting - report editor

In the report editor, a unit can be defined for several types of reports. Only columns of data type “String” can be used as unit columns. The following chapters describe for which report types a unit can be defined and how the unit will affect the report.

Table

A unit can be defined for each column in a table report. The unit column can be selected in a drop-down menu, similar to the color column or sort order column:



If a unit column is defined for a table report column, the unit value will be appended to the column value. This also affects the sum row (if the unit is unique for all values of the sum) and transposed tables.

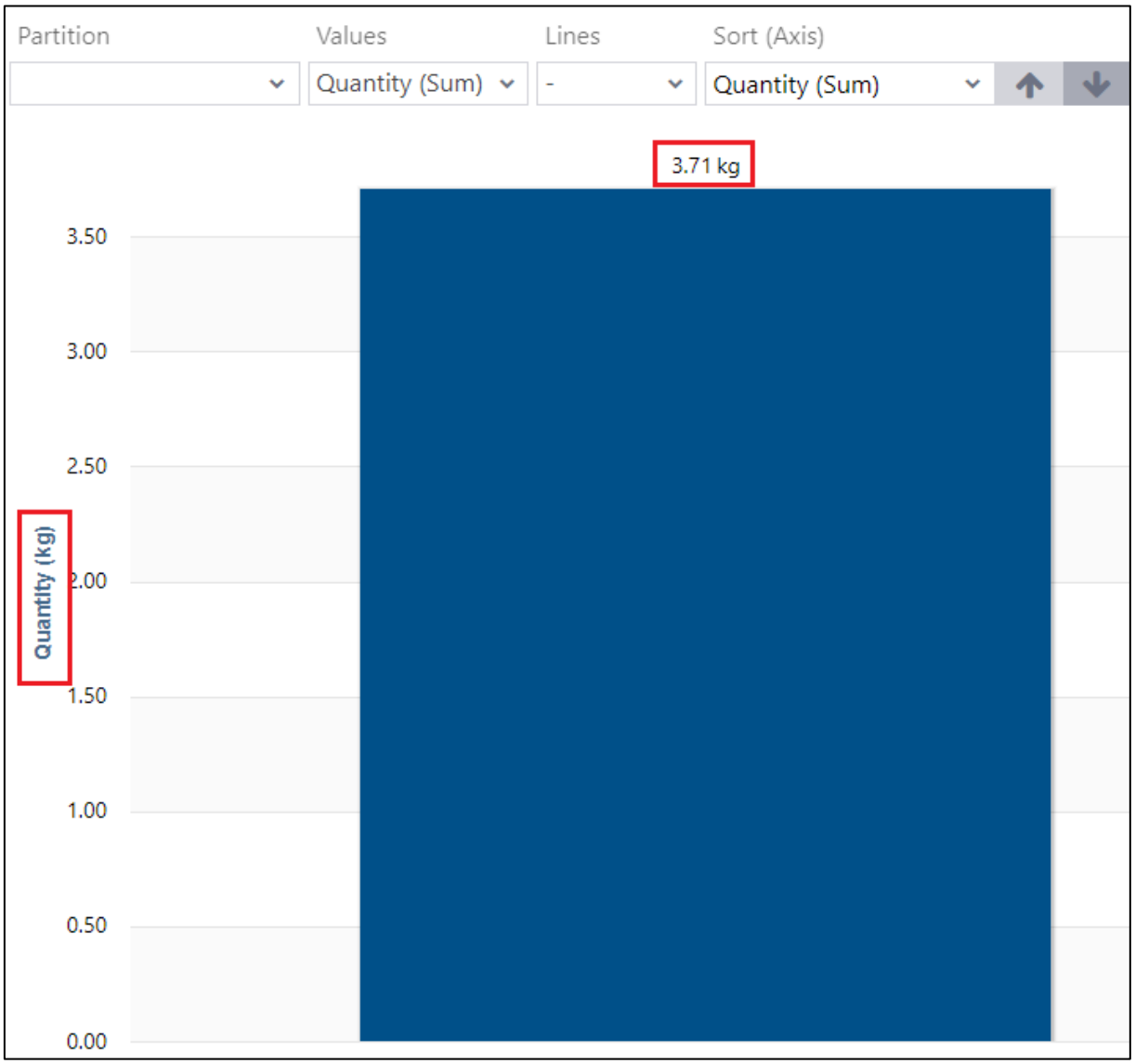
Pivot table

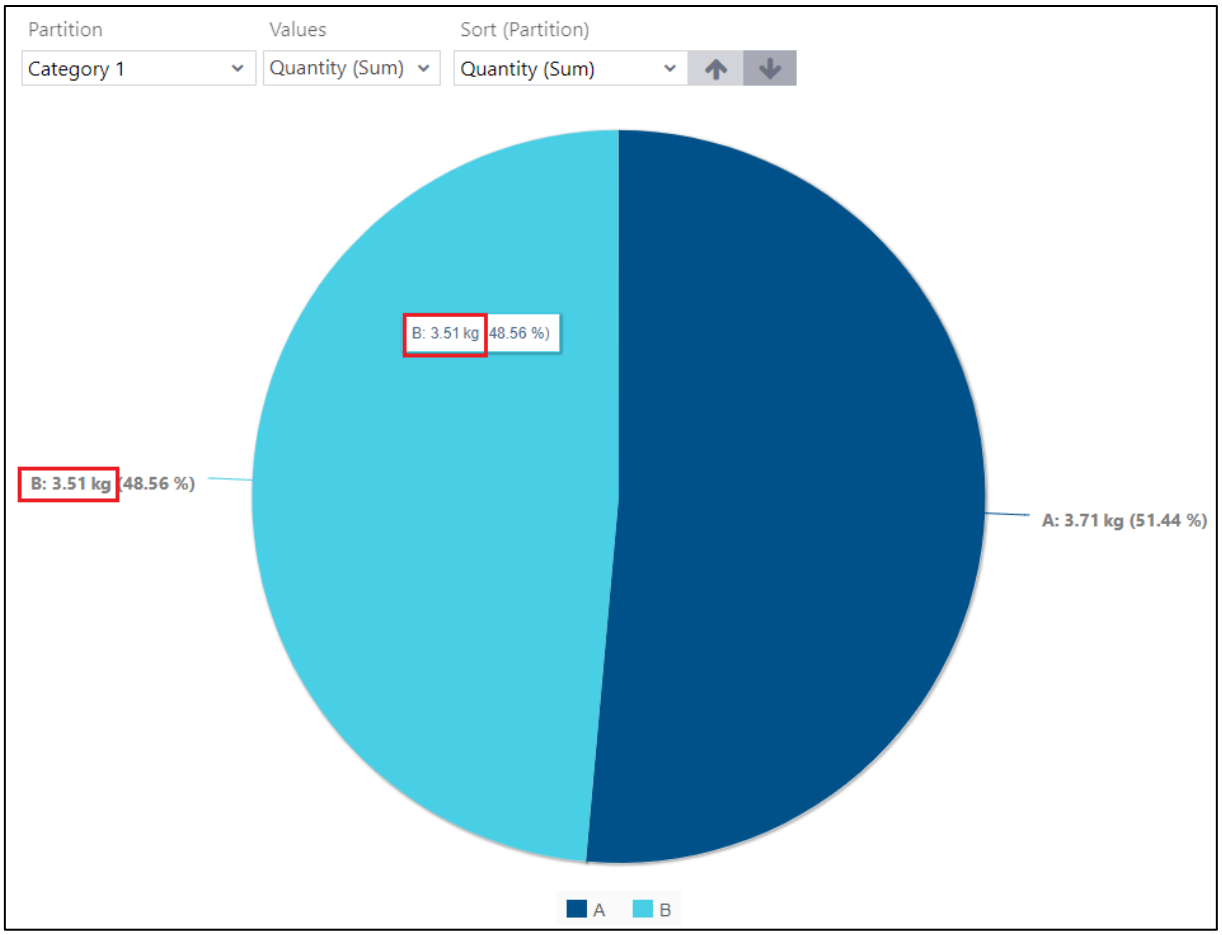
In “pivot table” reports, a unit column can be defined for value fields and row totals. The unit is appended to the column value, like it is done for regular table reports.

ⓘ The row total values are aggregated. The unit can only be displayed if it is unique for all aggregants.

Bar/column/pie charts

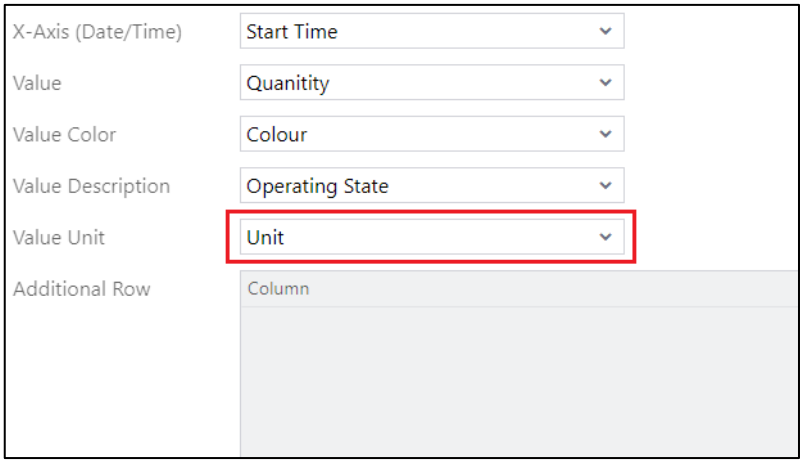
For bar/column/pie charts, the unit can be set in the value column of the chart. The unit will be displayed in the y-axis title, the data labels, and the tooltip of the chart:



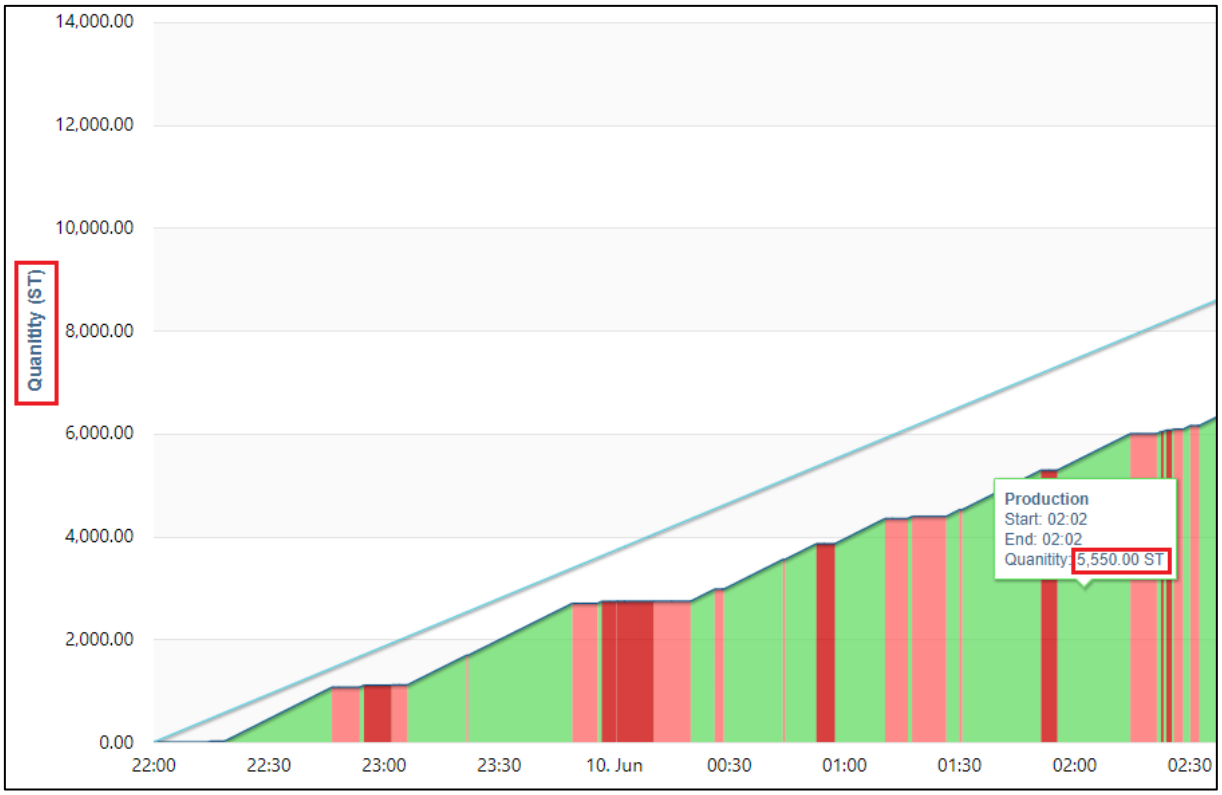


Ramp diagram

The unit for “ramp diagram” reports can be defined in the “Value unit” drop down menu:

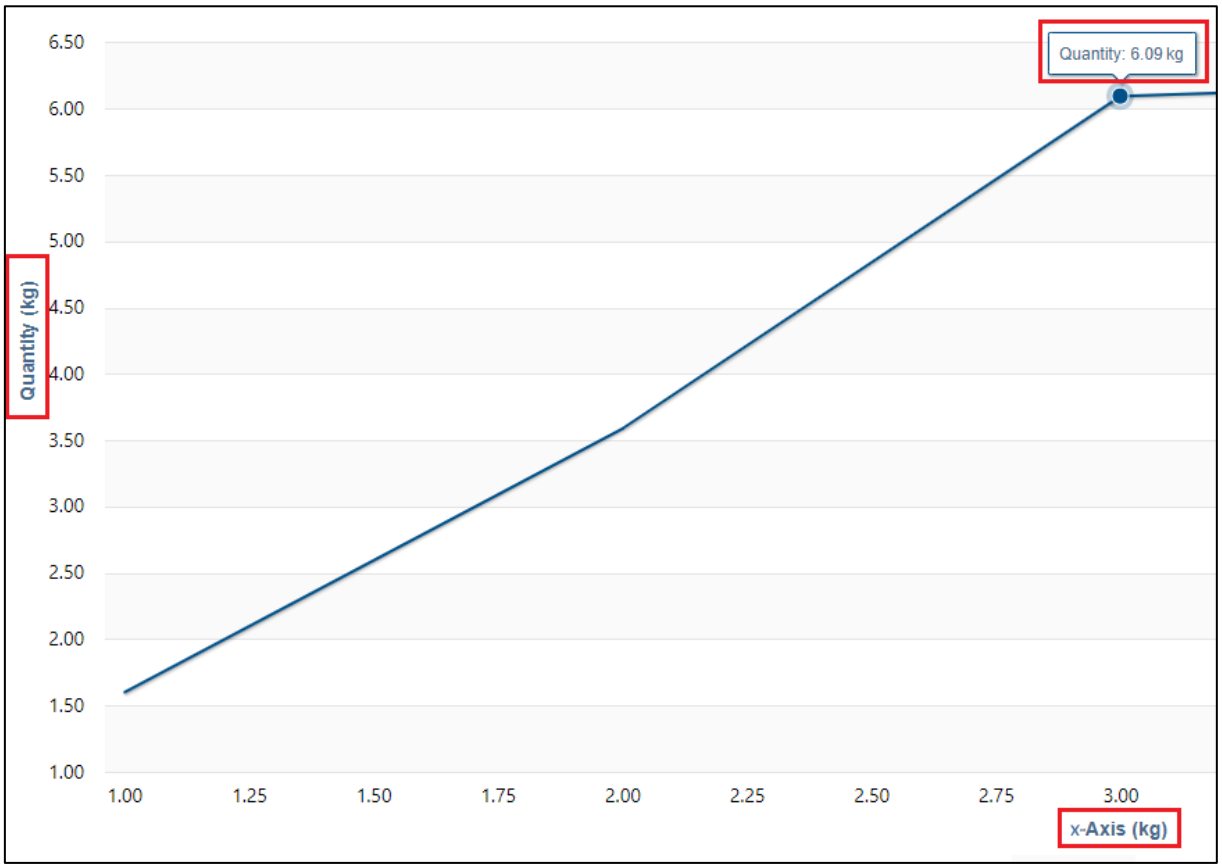


The unit will be visible in the y-axis title and the tooltip of the chart:



Line diagram

In “line diagram” reports, the unit can be defined for the x-axis and the y-axis value. If a unit is configured for the x-axis, it will be part of the x-axis title. Units which are defined for the y-axis values, are shown in the y-axis title and in the tooltip:



Excel export

To enable further processing of the Excel files, the unit is not appended to the value in the Excel export, but is displayed in a separate column next to the value:

6		
7	Quanti	Unit
8	1,6	kg
9	2,0	kg
10	2,5	kg
11	0,1	kg
12	1,0	kg
13		

ⓘ For reports that show aggregated values (such as bar/column/pie charts or the sum row of a table report), the unit can only be displayed if it is unique. If the unit is not unique, it will be empty. The unit will be not appended to percentage values.

Standard reports

The following standard reports contain quantity information and have therefore been updated. The “Quantity” data format is used for the columns that represent quantities, and the unit is defined for these columns:

- Quantity status diagram (workplace)
- Quantity status diagram (workplace) (online)
- Quantity status diagram (operation)
- Quantity status diagram (operation) (online)
- Quantity log
- Shift book
- Shift book (strokes calculated from quantities)
- Message log
- Quality report (workplace)
- Quality details (workplace)
- Quality development (workplace)
- Quality details (development per workplace)
- Hitlist quality details (workplace)
- Quality detail class report (workplace)
- Quality detail class development (workplace)
- Quality report (material)
- Quality details (material)
- Quality development (material)
- Quality details (development per material)
- Hitlist quality details (material)
- Quality detail class report (material)
- Quality detail class development (material)
- Quality report (operation)
- Quality details (operation)
- Hitlist quality details (operation)
- Quality detail class report (operation)
- Order analysis
- Operation analysis
- Personnel activity log
- Personnel development (cost unit/personnel grouping) (online)

ⓘ Only standard reports visible in the “Reports” view are listed. The sub reports and data sources of the reports above were also changed to support the new quantity and unit functionality.

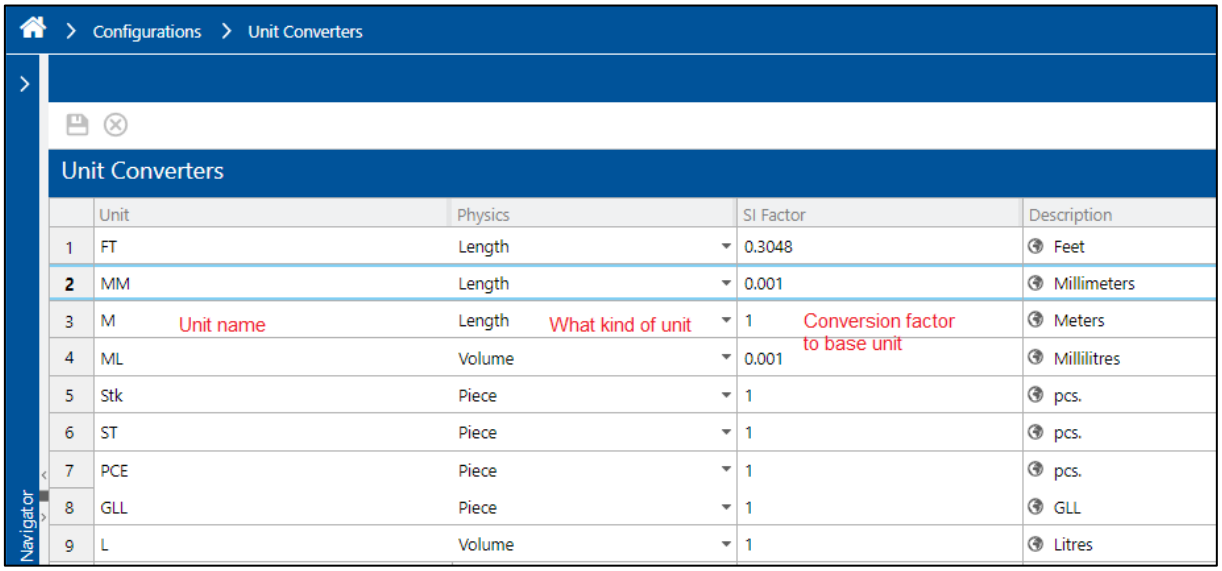
MDC - Connectivity

The sendQuantityWorkplace and sendQuantityOperation DACQ script functions can now have an extra parameter indicating the unit in which the machine delivers the quantities.

Examples:

- send a good length quantity, the unit delivered by the machine is “mm”
  - sendQuantityOperation(“@|WPL|@”, counter, “Y”, “mm”);
- send a good weight quantity, the unit delivered by the machine is “g”
  - sendQuantityWorkplace(“@|WPL|@”, counter, “Y”, “g”);

Before sending, the quantity will be converted into the unit specified in the operation. Provided it is compatible – for instance, it would not be possible to convert millimeters to kilograms.
Instead of specifying a fixed unit, the unit could also be in a variable - for example if the unit can be changed on the machine.
The conversion of the units can be done in the Workbench of FORCAM FORCE IIOT under:
Configuration > Unit converters



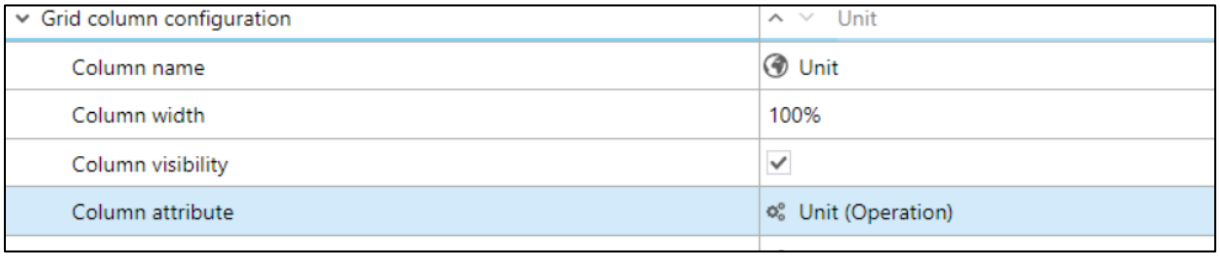
	Unit	Physics	SI Factor	Description
1	FT	Length	0.3048	Feet
2	MM	Length	0.001	Millimeters
3	M	Length	1	Meters
4	ML	Volume	0.001	Millilitres
5	Stk	Piece	1	pcs.
6	ST	Piece	1	pcs.
7	PCE	Piece	1	pcs.
8	GLL	Piece	1	GLL
9	L	Volume	1	Litres

To function correctly, the required unit must be included in the unit converters table.

Track & Trace

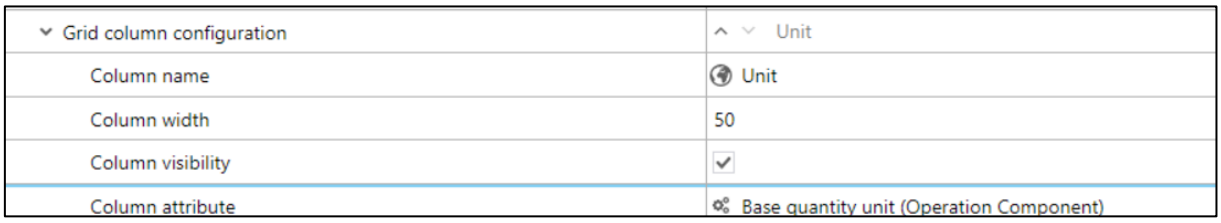
Changes were made in the BridgeAPI call for creating an inventory container (upsertInventoryContainer). Now, it is no longer required to create the quantities for different quantity units. This means, when creating an inventory container, the quantity unit should be the same, but the quantity unit type can be different.
Now, it is possible to also configure the unit column in the following SFT activity steps related to Track & Trace. There, the user can select a column value for the unit from the operations.

- Qualified quantity correction of anonymous pieces (TraceContainerQualifiedQtyCorrectionActivityStepUI)
- Trace material movement (TracingContainerMovementActivityStepUI)

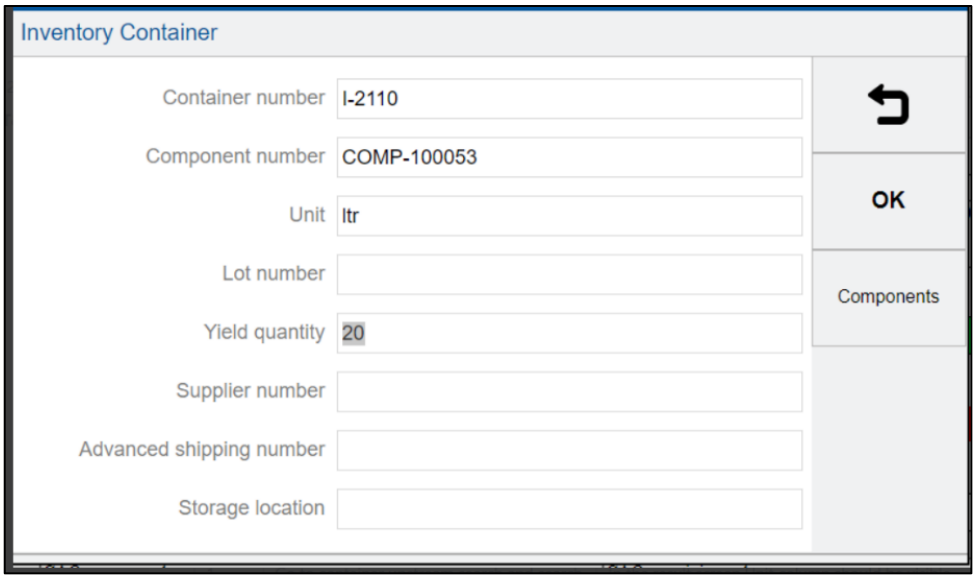


Now it is also possible to configure the unit column in the following activity steps related to Track & Trace from the operating component.

- Digital bill of material (TracingDigitalBillOfMaterialsActivityStepUI)
- Dialog to capture assembly plan (TracingInspectionPlanActivityStepUI)
- Assembly plan for rework (TracingEditAssemblyActivityStepUI)



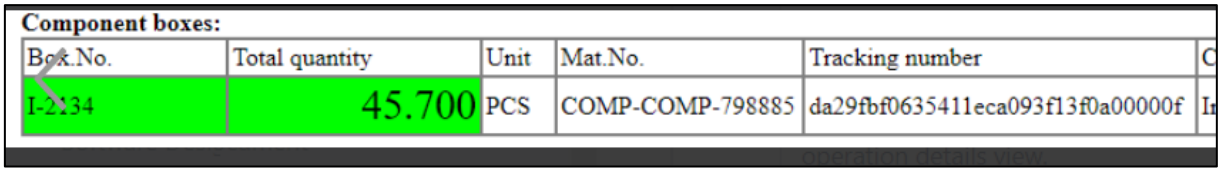
Now it is also possible to create inventory containers with the unit from the SFT activity step. Here it is possible to enter the unit via a text field, which is an optional field.



Now the unit will also be displayed in the following Track & Trace reports:

- "Container upstream search"
- "Container movement search"

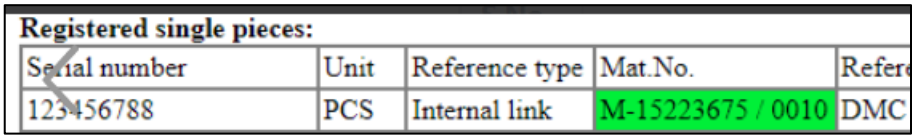
The units with quantities will also be visible in the operation details view of SFT. It will only be shown on "Component box info" and "Single piece info".



Component boxes:

Box.No.	Total quantity	Unit	Mat.No.	Tracking number	C
I-2134	45.700	PCS	COMP-COMP-798885	da29fbf0635411eca093f13f0a00000f	In

operation details view



Registered single pieces:

Serial number	Unit	Reference type	Mat.No.	Refere
123456788	PCS	Internal link	M-15223675 / 0010	DMC

Virtual Production Environment (VPE)

Starting situation: VPE cannot use decimal values and units other than piece.

5.12.0-5.12.5: It is no longer ensured that VPE will function. Decimal values in the data transferred to VPE may cause an error. This means for the time being, all users of VPE should not update to a version 5.12.xx.

From 5.12.6: It will be ensured that VPE can also function when importing decimal values. However, VPE is unable to process decimal values or units.

3.2 Dynamic number of columns in the multi-level tree hierarchy

Affected module	Affected area	Status
Global	Planning/Productivity	Changed

FFWorkbench

With 5.11.x the Gantt component offers only a maximum of two columns on the left side, which are usually used to display a hierarchy - manually sortable. More hierarchy levels were needed for a correction functionality.

Thus, the generic Gantt component was changed as follows:

- A dynamic number of columns is now possible
- Columns are not sortable via headers on the client side. They must be sorted on the server side accordingly. Generally, this is not practical for such a visual representation, where the displayed hierarchy is essential. The Gantt displays the rows in the order in which they are specified during creation, i.e. the sorting must be done via the specified data.

4 Platform & Connectivity

4.1 External extensibility of the user fields for order, operation and workplace

Affected module	Affected area	Status
FFWebservices	BridgeAPI/CommandAPI	New

We now offer the possibility to retrieve and update user fields via the FORCAM BridgeAPI. New APIs have been added to retrieve and update user fields for the following API resources:

- ProductionOrder
- Operation
- StaffMember
- Material

4.2 New APIs to create, update or delete orders and operations

Affected module	Affected area	Status
FFWebservices	General Improvements/ BridgeAPI	New/Changed

FFWebservices

API version v4 has been introduced. Breaking changes in this API are mentioned explicitly in the following notes.

Breaking changes

- Removal of a JSON property
- Renaming of a JSON property
- General restructuring in the design of existing representations
- Removal of old API versions

API version latest has been introduced which provides the same functionality as the most recent version of the API.

⚠ It is not recommended to use the latest version in production. If the latest version is used in production, it is the customer's responsibility to handle potential changes after an update.

If an outdated version is requested, a redirect with HTTP status code 308 and location header leading to the latest version and the same API path will be returned, e. g. /api/v1/workplaces will be redirected to /api/latest/workplaces.

⚠ Version v1 and v2 have been removed. The current supported versions are v3, v4 and latest. All API requests from external systems must be updated if necessary.

FORCAM BridgeAPI

Operation component:
A new GET API to get an operation component has been introduced:

- GET /operations/{operationId}/components/{componentId}

ⓘ The operation component model has been migrated to a real resource and the JSON model has been changed accordingly. This affects the following APIs (a UUID has been introduced):

- GET /operations/{operationId}/components.

Callbacks

It is now also possible to register a callback for a certain EventType (like ERP) to receive all messages of that type.
It is now possible to register a callback with maxUnconfirmedMessages = 0 to make sure that no messages are lost. Internally, messages will be sent to a dynamic MQTT queue which will persist all messages before they are sent out to the destination.

⚠ It must be ensured that callbacks with maxUnconfirmedMessages = 0 are delivered at some point, otherwise messages will pile up in the persistent queue and bring the message broker down at some point. Deletion of a callback will also delete all queues related to it.

Retries

If maxUnconfirmedMessages = 0 the following rules apply for retries:

- The retry mechanism is started per default 10 seconds after a delivery failure or if the delivery takes longer than 10 seconds
- Retries are triggered with an exponential backoff. Starting from 200ms to 10 seconds per default.
- Keep in mind that messages are still removed from the queue after maxRedeliveryAttempts are reached.
- Currently there are only two ways to cancel the retry mechanism:
  - Deletion of the callback
  - Restart of the FFWebservice application

If a callback is registered with maxUnconfirmedMessages = 0 and maxRedeliveryAttempts = 0 the delivery of messages will be retried forever. If this configuration is used, the message order is also maintained in case of delivery failures.

ERP integration

New APIs have been introduced to create/update/delete orders:

- POST /productionOrders
- PUT /productionOrders/{productionOrdersId}
- DELETE /productionOrders/{productionOrderId}
- PUT /productionOrders/{productionOrdersId}/customFields/{customFieldId}

New APIs have been introduced to create/update/delete operations:

- POST /productionOrders/{productionOrderId}/operations/{operationId}
- PUT /operations/{operationId}
- DELETE /operations/{operationId}
- PUT /operations/{operationId}/customFields/{customFieldId}

New APIs have been introduced to create/update/delete materials:

- POST /materials
- PUT /materials/{materialId}
- DELETE /materials/{materialId}
- PUT /materials/{materialId}/customFields/{customFieldId}

New APIs have been introduced to create/update/delete operation components:

- POST /operations/{operationId}/components
- PUT /operations/{operationId}/components/{componentId}
- DELETE /operations/{operationId}/components/{componentId}
- PUT /operations/{operationId}/components/{componentId}/customFields/{customFieldId}

ERP Callbacks

New callbacks for ERP upload messages have been introduced:

- EventType: ERP
- EventObjectType: OPERATION
- EventName: OPERATION_COMPONENT

- EventType: ERP_VERBOSE
- EventObjectType: OPERATION
- EventName: OPERATION_COMPONENT

- EventType: ERP
- EventObjectType: OPERATION
- EventName: OPERATION_DURATION
-
- EventType: ERP_VERBOSE
- EventObjectType: OPERATION
- EventName: OPERATION_DURATION

- EventType: ERP
- EventObjectType: OPERATION
- EventName: OPERATION_DURATION_CORRECTION

- EventType: ERP_VERBOSE
- EventObjectType: OPERATION
- EventName: OPERATION_DURATION_CORRECTION

- EventType: ERP
- EventObjectType: OPERATION
- EventName: OPERATION_QUANTITY

- EventType: ERP_VERBOSE
- EventObjectType: OPERATION
- EventName: OPERATION_QUANTITY

- EventType: ERP
- EventObjectType: OPERATION
- EventName: OPERATION_QUANTITY_CORRECTION

- EventType: ERP_VERBOSE
- EventObjectType: OPERATION
- EventName: OPERATION_QUANTITY__CORRECTION

- EventType: ERP
- EventObjectType: OPERATION
- EventName: OPERATION_PHASE

- EventType: ERP_VERBOSE
- EventObjectType: OPERATION
- EventName: OPERATION_PHASE

ⓘ For details of the corresponding JSON format for each message, consult the online documentation for the callbacks via the Swagger UI. It is possible to register for an “EventType” like ERP to receive all messages with that type.

4.3 Separation of ERP functionality from FFRuntime

Affected module	Affected area	Status
FFRuntime	ERP functionality	Changed

ERP functionality was highly embedded within the FFRuntime which had several drawbacks:

- When ERP functions stop working, the complete system needs to be restarted.
- Runtime performance is affected by the ERP integration.
- Future scaling and development of FFRuntime and ERP integration is not possible independently.

In the scope of this change, the ERP functionality is extracted from FFRuntime into a separate FFERP service.

4.4 New ERP adapter for Infor ION

Affected module	Affected area	Status
ERP connectivity	BrigdeAPI	New

Affected versions:

The ERP adapter for Infor ION is a separate function and works with FORCAM FORCE IIOT, version 5.11 and above. This adapter will be released together with 5.12.0.

This ERP adapter needs to be implemented in Infor ION and allows, for example, the communication between an Infor ERP system (like LN 10.6 and above) to exchange information between the ERP system and the FORCAM FORCE IIOT solution.

The following items are available with the ERP adapter for Infor ION:

- “Download” - Transmission from ERP to FORCAM FORCE IIOT:
  - Orders/Operations
  - Personnel
  - Shifts
- “Upload”
  - Status messages
  - Quantity messages
  - Durations
  - Corrections

4.5 Easier integration between Node-RED and FORCAM BridgeAPI

Affected module	Affected area	Status
BridgeAPI	Configuration/requests/ callbacks/logs	New

FORCAM BridgeAPI Node-RED nodes have been developed to make integrations between Node-RED and the FORCAM BridgeAPI easier.

FORCAM BridgeAPI palette

The following Node-RED nodes have been developed and can be installed as FORCAM BridgeAPI palette in Node-RED:

- **configuration**
  Global configuration which is used in the other nodes of the palette like URLs, credentials, logging configuration.
- **request**
  Can be used to send a request to the FORCAM BridgeAPI. The node will implicitly request the necessary request token.
- **token request**
  Can be used to request an access token by providing “clientId” and “clientSecret”. The access token can be used for requests to the FORCAM BridgeAPI.
- **activity**
  Can be used to call the activity endpoint of the FORCAM BridgeAPI. The node will implicitly request the necessary request token.
- **http callback**
  Can be used to register a HTTP callback and receive the corresponding notifications from the FORCAM BridgeAPI. Additionally, uses the new external identifier “name” to make sure that the callback already exists.
- **mqtt callback**
  Can be used to register a MQTT callback and receive the corresponding notifications from the FORCAM BridgeAPI. Additionally, uses the new external identifier “name” to make sure that the callback already exists.
- **logging**
  Can be used to log messages. Provides the possibility to define a log level with which the message will be logged.

4.6 CVE-2021-45046 in Log4j-Core dependency

Affected module	Affected area	Status
FFAuth	Framework	Changed

The framework used in FFAuth has been updated to the latest version. This solves CVE-2021-45046 in log4j-core dependency.

5 Productivity

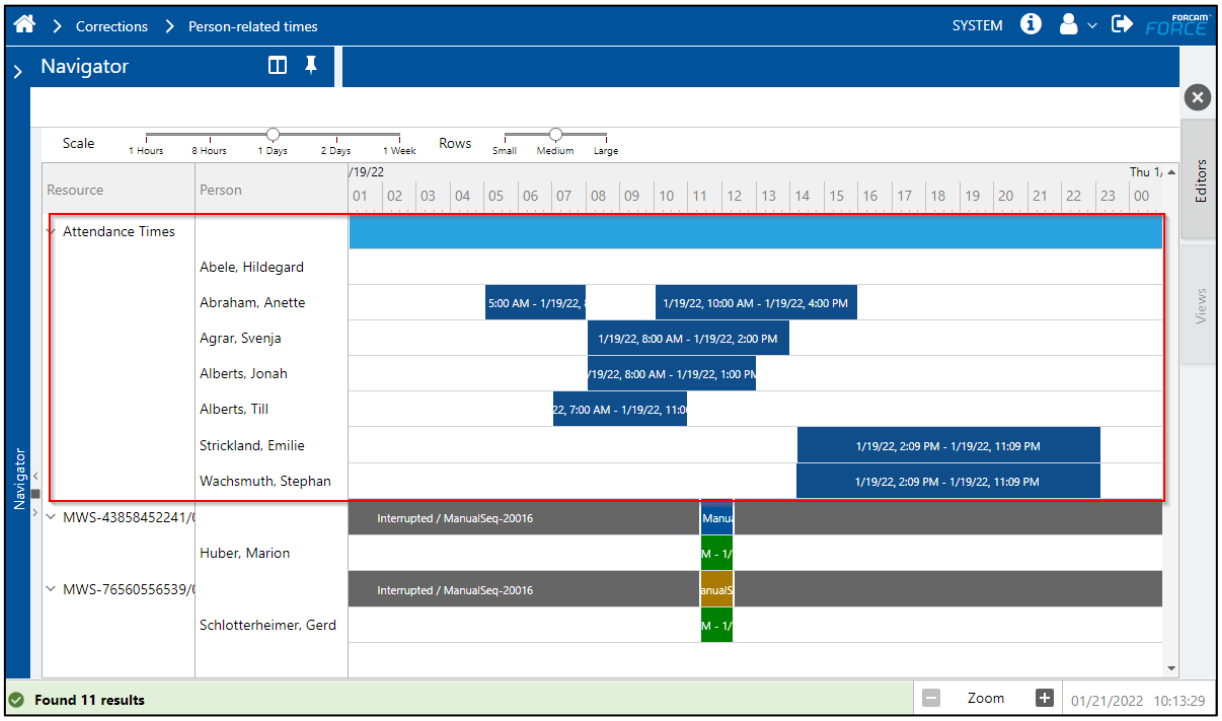
5.1 Consolidation of table-based correction processes

Affected module	Affected area	Status
Corrections	Person-related times	Changed

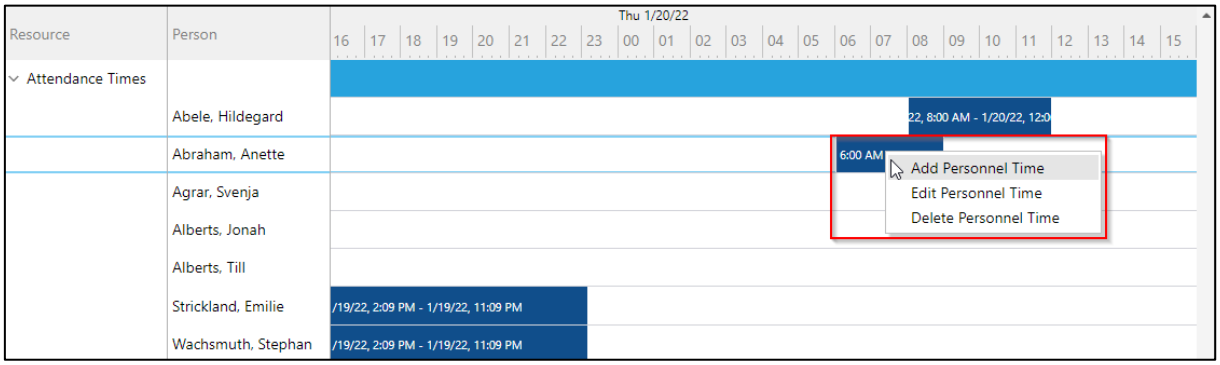
FFWorkbench

Path: Corrections > Person-related times

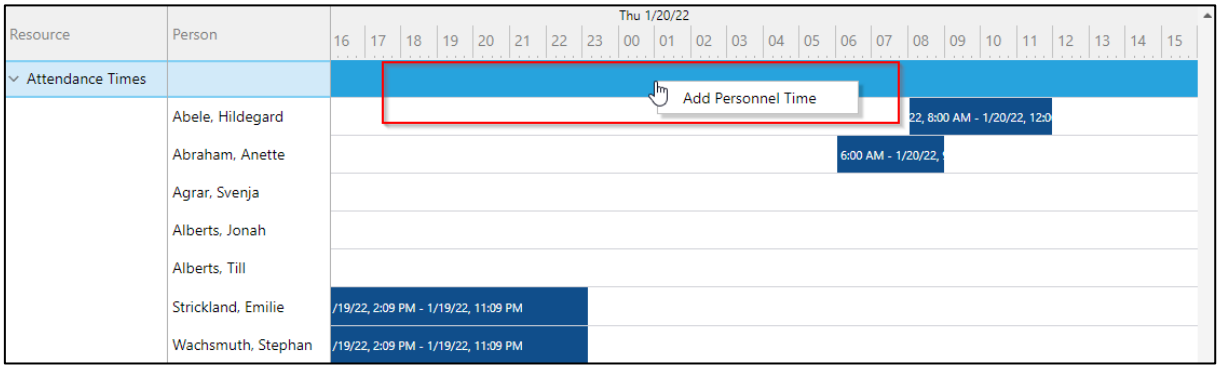
Operation-related times correction is renamed to “person-related times” and “attendance times correction” has been included inside the graphical correction UI [Gantt Chart]. All the attendance time intervals are shown under the group “Attendance times”.

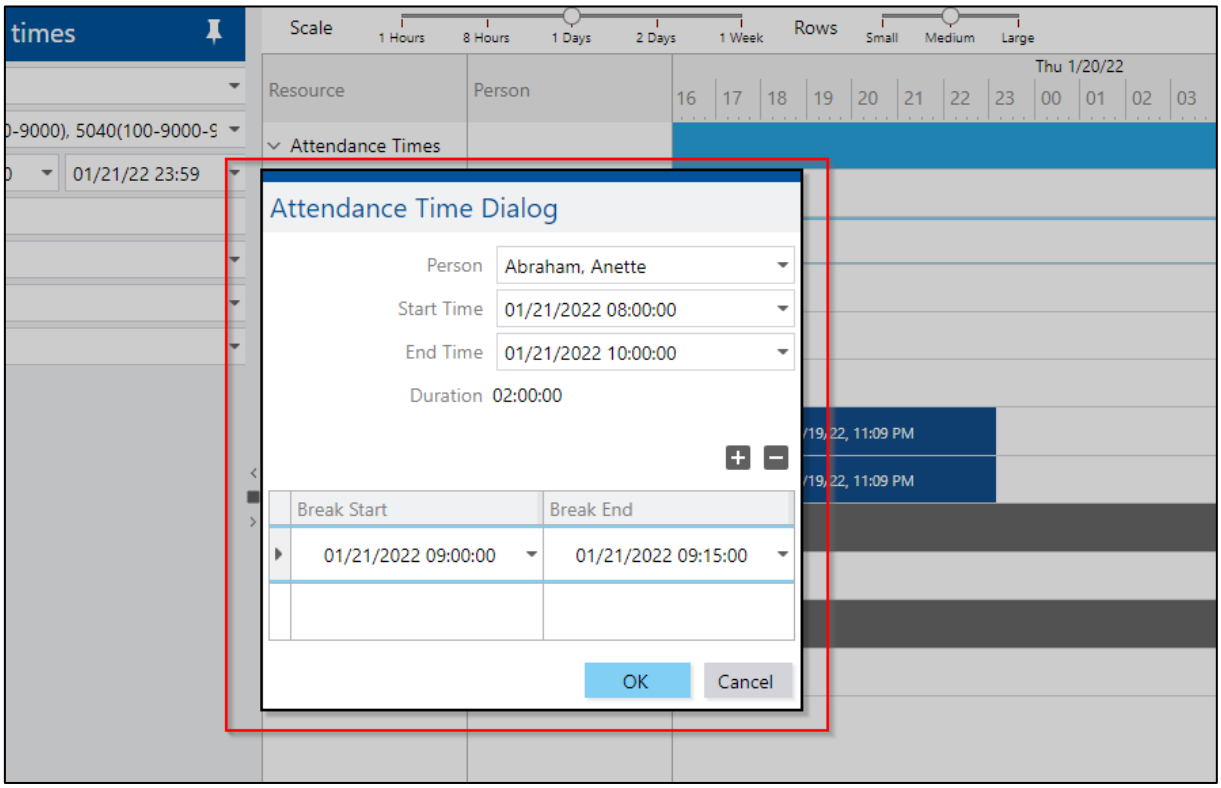


Data can be corrected via the context menu which consists of 3 actions: “add”, “edit” and “delete personnel time”.

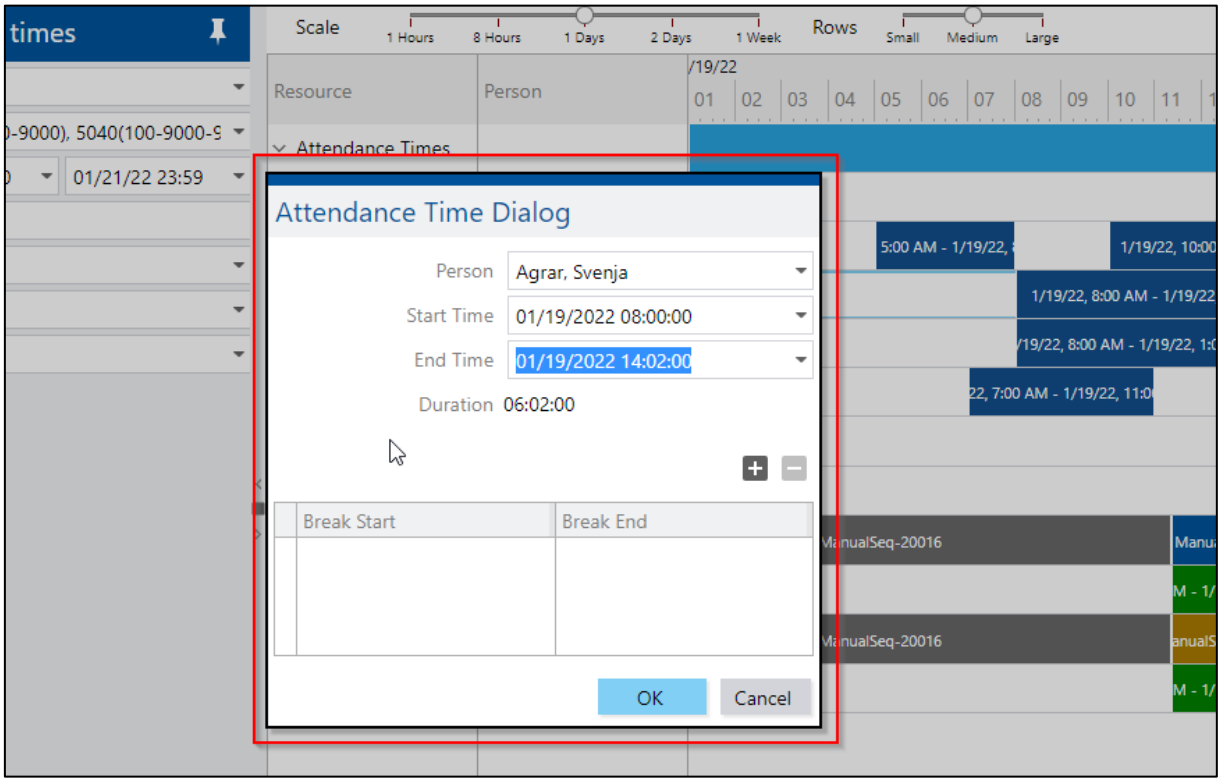


If the first blue row is selected, which has a time range from the selected from and to date of the filter, then only the adding of the personnel time action is available.

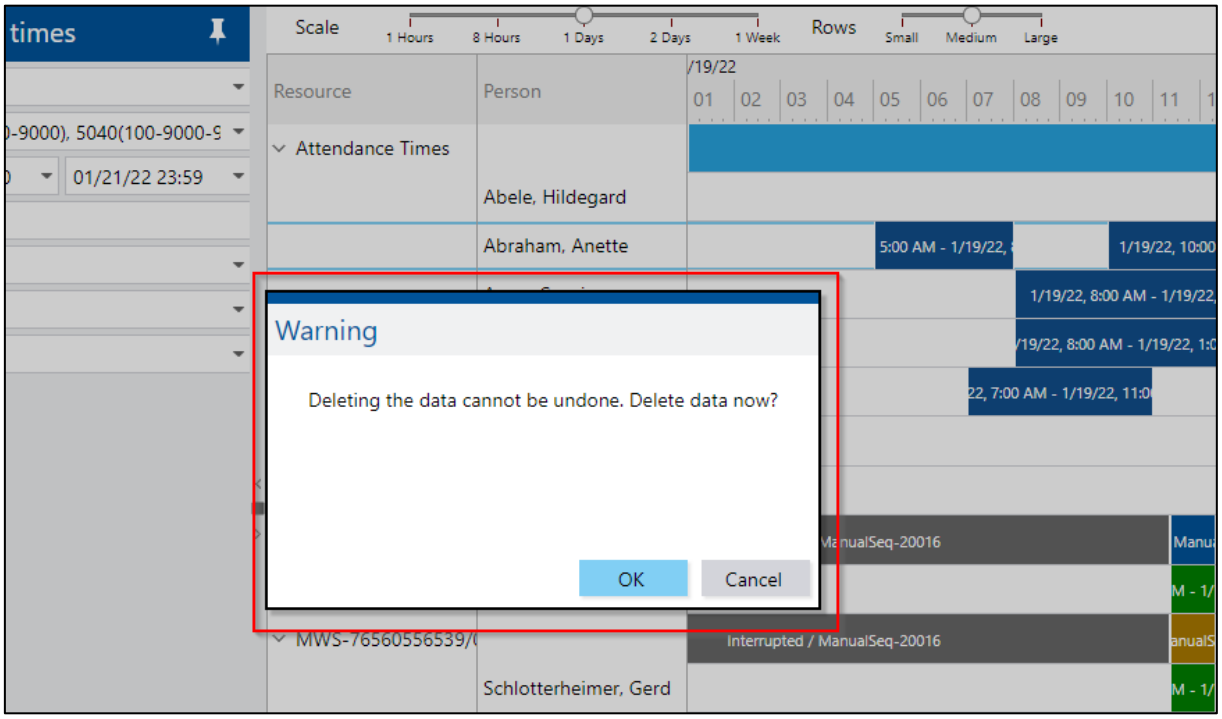




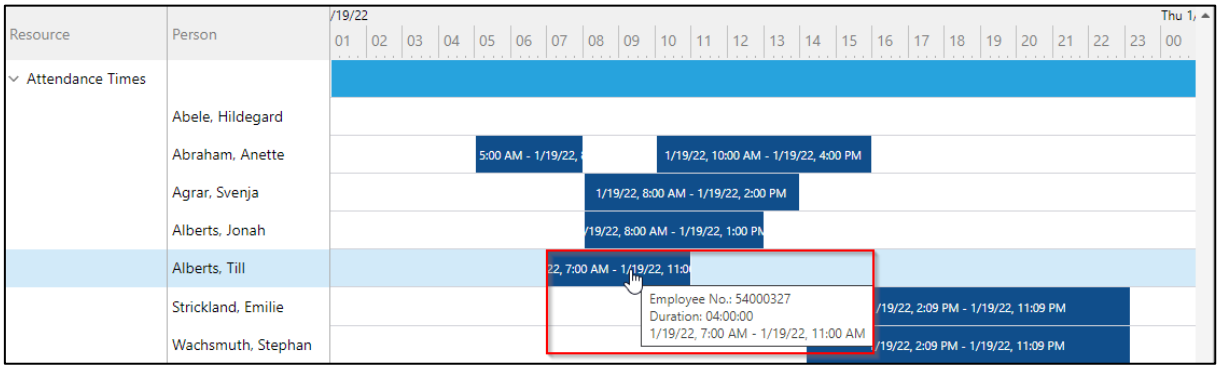
The time interval for attendance can be edited by the via the context menu action “Edit personnel time”.



An additional warning message is displayed for the “Delete personnel time” action.



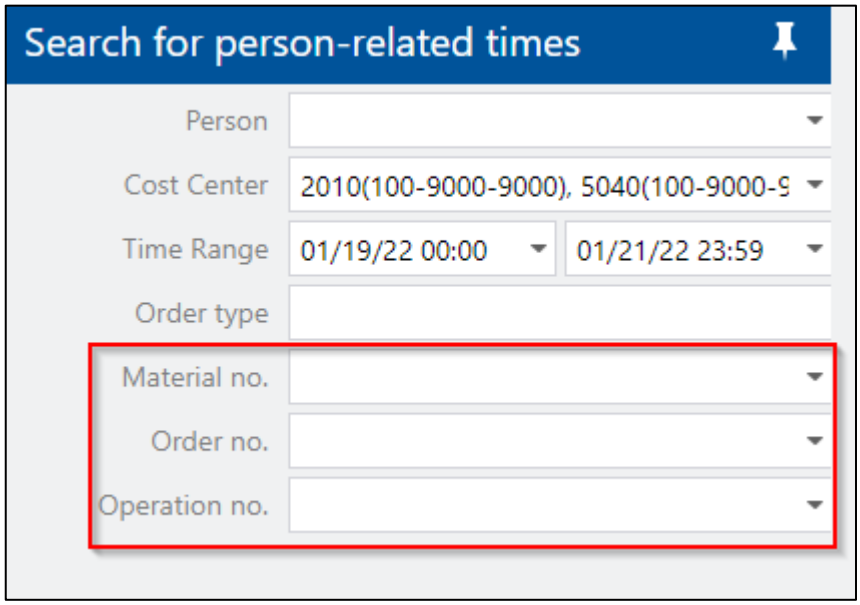
If the mouse hovers on a time attendance interval, then a tooltip message will be shown with relevant information about such things as employee number, duration, etc.:



All existing validations for the tabular correction of “Attendance times” are kept in the graphical UI for the correction of attendance times.

Path: Corrections > Person-related times → Search filters

The search filters are arranged as follows: “Material no.”, “Order no.” and “Operation no.”



In addition, global multisite administration has been introduced for the “Person” and “Cost center” filters.

Since intervals related to person operations as well as intervals related to person attendance are included in the graphical correction interface, the maximum number of intervals that can be retrieved from the runtime is limited as follows to avoid performance problems:

Intervals	Maximum number of entries
Attendance time	500
Person operation related time	1000

6 Process

6.1 Consumption configuration for Track & Trace

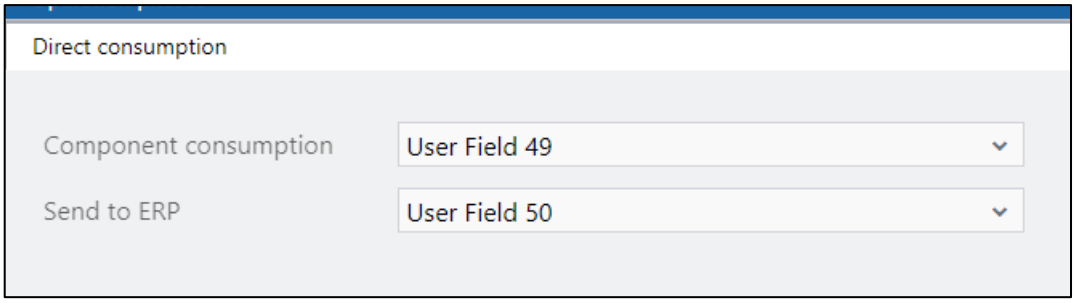
Affected module	Affected area	Status
FFNewOffice/DACQ	Track & Trace	New

FFNewOffice

Direct consumption configuration under System Configuration of Track & Trace.

The component user fields must be configured to determine whether or not the component is to be used as direct, and a separate configuration is done to send the consumption for that component to the ERP.

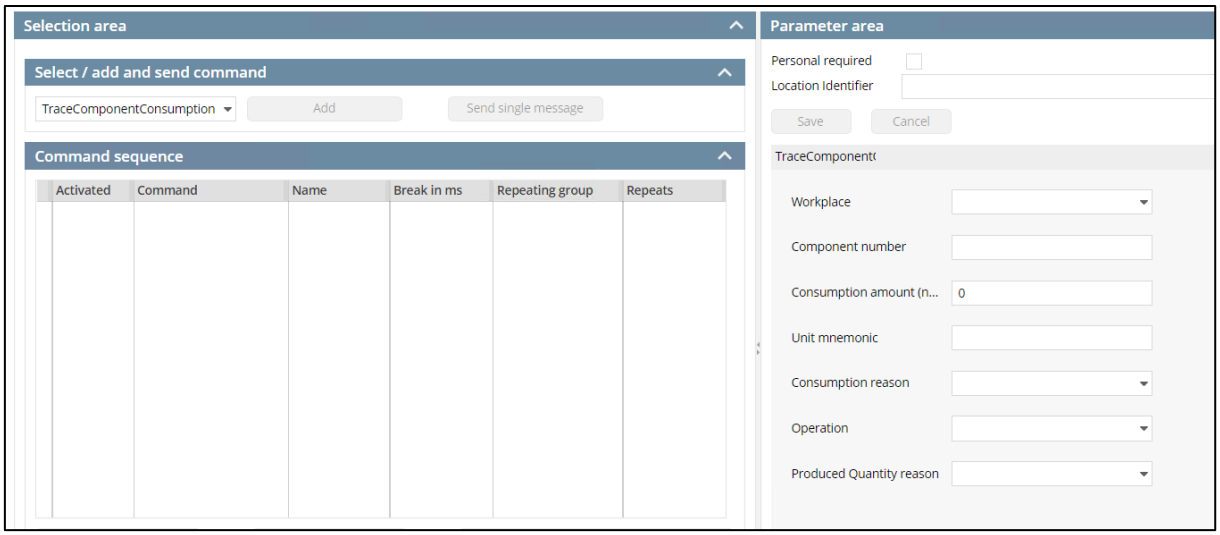
The values of these fields can be “true”, “TRUE”, “tRUe”, “on”, “yes”, “y”, “t” or “1”. Any other value will be treated as false.



DACQ

For “Direct consumption”, the user needs to send the command from the DACQ. It has following parameters:

- Workplace ID (mandatory): Specify the “workplace ID”
- Component number (mandatory): Component no. for which direct consumption will be done
- Unit (optional): Specify the unit for the consumption component
- Consumption reason (optional): Reason for determining the type of quantity to be consumed
- Operation (optional): Specify the operation where this component is to be consumed
- Produced quantity reason (optional): Quantity reason of produced quantity



Trace processing

Trace processing will consume the quantity based on the component number for the “Direct consumption”. It will check the registered input of the same component numbers and deduct the quantity from the input container. It will also link this consumption to the registered output container.

Limitation:

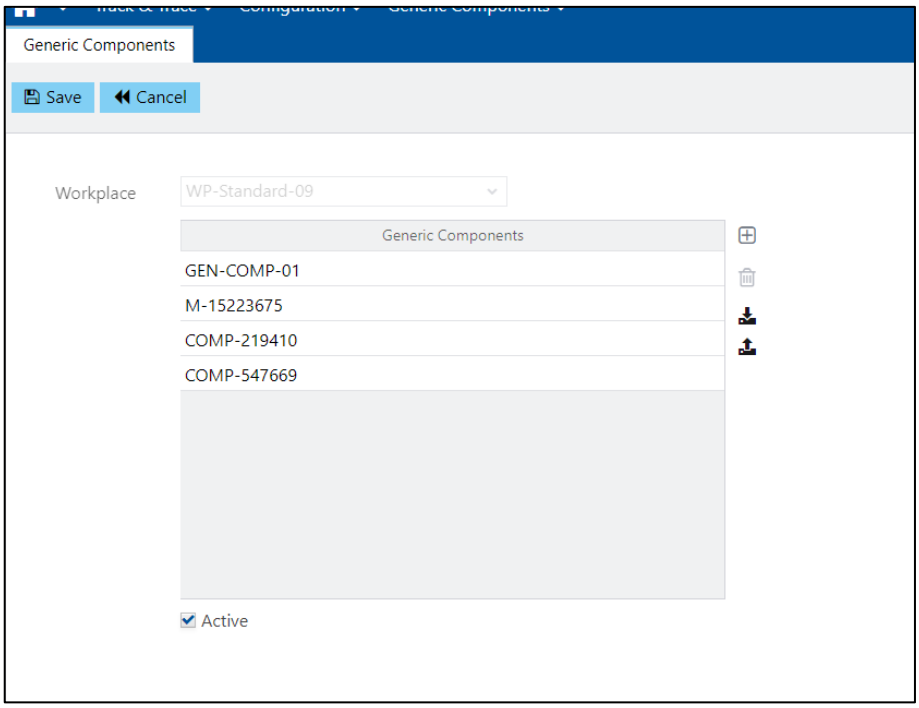
- The customer must set these component user fields values using the existing mechanism to identify the “Direct components”.
- If the direct consumption sends only mandatory fields, the trace processing behaves as follows:
  - To identify the input container for the registered workplace, follow the sequence below:
    - YIELD
    - Rework
    - SCRAP
    - UNKNOWN
  - To identify the output container for the registered workplace, follow the sequence below:
    - UNKNOWN
    - YIELD
    - REWORK
    - SCRAP

6.2 Automatic registration, adding, editing or deleting generic components

Affected module	Affected area	Status
FFNewOffice/DACQ	Track & Trace	New

Track & Trace configuration

A new configuration “generic components” was added under the configuration section of Track & Trace. Here, the user can configure the “generic components” for a workplace. Multiple components can be configured for each workplace. These generic components can be edited, deleted, and added. All generic components can also be activated or inactivated for a workplace via a checkbox. Import/Export is possible for generic components for a workplace.



Trace processing

- Container registration: When registering the container, the application checks whether the registerable material exists in the generic components of the workplace and registers the container as a generic container.
- Registration on operation start: At the start of an operation, the application checks if a container is registered as generic for the components of the operation of the same workplace, then this container is automatically registered for this operation, this means that no separate registration is required.
- Container un-registration: When a container is un-registered, it will also un-register from other operations automatically.

Limitation:

- The “generic components” configuration does not validate if the entered “generic component” exists in FORCAM FORCE IIOT.
- It is necessary to remove of the blank spaces from the added generic component in the configuration.
- No duplicate generic components are possible in the configuration.
- All added “generic components” are case insensitive.

⚠ If the component list of a workplace gets changed while a container is already registered as being generic at this workplace and the changed component list does not contain this component number anymore, then our system will not manage this case automatically.

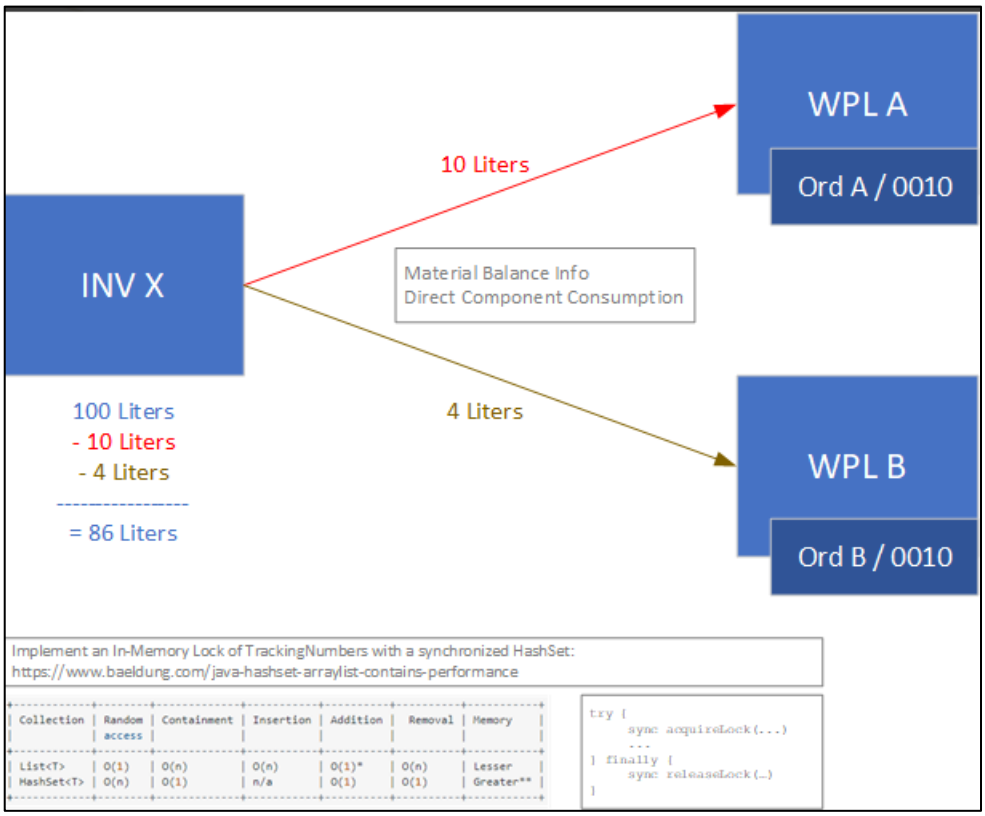
⚠ Currently, it is not possible to change or add the reference cache for a generic component from the cache management reference cache of the Office application. This is not part of the current requirement.

6.3 Consumption quantities for different workplaces or operations

Affected module	Affected area	Status
Office	Track & Trace	Changed

Trace processing

It is possible that an input and/or output container is registered at different workplaces/operations at the same time. When a MaterialBalanceInfoDTO was received, the quantities in an input/output container must be decreased/increased. Since this can be done in parallel (i.e., in parallel Akka worker threads) the containers must be locked if they are updated by a thread. In addition to the existing MaterialBalanceInfoDTO, the same must be implemented for the newly designed TraceComponentConsumptionCommand sent by the DACQ. The implementation will (most probably) use a synchronized HashSet, which has better complexity classes compared to an Array List (see the image below). The implementation will ensure (e.g., with a finally block) that a lock gets released properly. If a thread waits longer than 30 seconds to acquire a lock, a WARNING message is logged. If the log cannot be acquired after 60 seconds, an ERROR is printed, and the lock is acquired **hardly** to prevent the system from deadlocking.



6.4 Extended SFT dialog to add, edit or book consumption

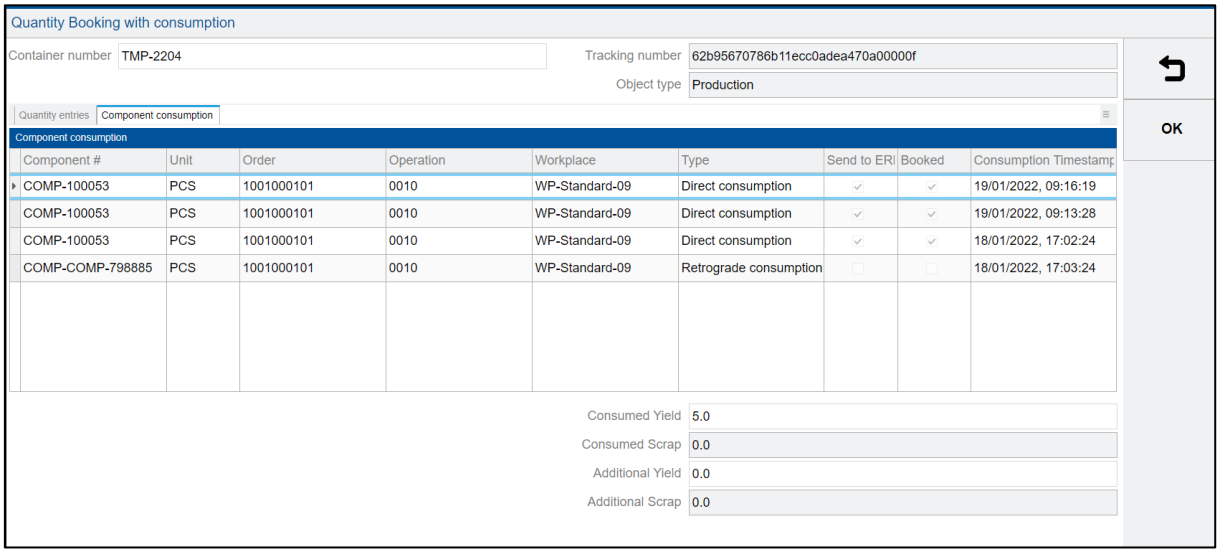
Affected module	Affected area	Status
Workbench	Shopfloor Terminal	New

Added the following configuration in “Qualified quantity correction of anonymous pieces” (TraceContainerQualifiedQtyCorrectionActivityStepUIConfiguration) activity steps:

- **Component consumption**:
  Default value is false. If it is true, then user can view the component consumption as a tab page on dialog
- **Yield consumption editable**:
  Default value is false. If it is true, then user can edit the component consumption yield quantity.
- **Scrap consumption editable**:
  Default value is false. If it is true, then user can edit the component consumption scrap quantity.

Component consumption	☑
Yield consumption editable	☑
Scrap consumption editable	☑

View of “component consumption” on “quantity booking” activity step UI.



Added the following configurations in “Booking of anonymous and identifiable single pieces” (TracingOperationQuantityBookingActivityStepConfiguration):

- **Send consumption to ERP**: Default value is false. If it is true, then the application checks if the component is configured to send the consumption to ERP.
- **Send additional consumption to ERP**: Default value is false. If it is true, then the application sends the additional consumption to ERP also.

Send consumption to ERP	☑
Send additional consumption to ERP	☑

Trace processing:

The application processes the consumption and sends the commands to the runtime and in turn, the runtime will be sent to the ERP based on logic.

Limitation:

- Column configurations for the component consumption are not configurable. These are fixed.
- Sending to ERP depends upon the runtime logic.
- There is no reporting for viewing the component consumptions.

7 Appendix

Abbreviation/Term	Meaning
API	Application Programming Interface
Array list	A tool to manage lists with changing size included in the “scope of delivery” of Java
DACQ	Data Acquisition
DOS	Detailed Order Scheduling
ERP	Enterprise Resource Planning
Excel	The most widely used spreadsheet program (actual name: Microsoft Excel)
FFAuth	FORCAM FORCE™ Authentication (single sign-on solution from FORCAM FORCE IIOT)
G, g	German abbreviation for “Gramm”, what means “gram” (UK/US)
GR	Besides “g” an English abbreviation for “gram” (UK/US)
HashSet	The realization of a set of objects in the mathematical sense
HTTP	Hyper Text Transfer Protocol
I ION	Infor is a global provider of business software for specific industries. ION stands for “Intelligent Open Network”.
JSON	JavaScript Object Notation is a compact data format in an easy-to-read text form for data exchange between applications.
KG, kg	International abbreviation for “Kilogramm” (D), “kilogramme” (F) and “kilogram” (UK/US)
LB	English abbreviation for “pound” (UK)
M, m	International abbreviation for “Meter” (D), “mètre” (F), “metre” (UK) and “meter” (US)
MDC	Machine Data Collection
MG, mg	International abbreviation for “Milligramm” (D), “milligrammes” (F), “milligram” (UK/US)
ML, ml	International abbreviation for “Milliliter” (D), “millilitres” (F), “millilitres” (UK) and “milliliter” (US)
MM, mm	International abbreviation for “Millimeter” (D), “millimètre” (F), “millimetre” (UK) and “millimeter” (US)
MQTT	Message Queuing Telemetry Transport
Node-RED	A graphical development tool developed by IBM
PB	English abbreviation for “pound” (US)

Abbreviation/Term	Meaning
PC	English abbreviation for “piece” (UK/US)
SFT	Shopfloor Terminal
ST, St	German abbreviation for “Stück”, which means “piece” (UK/US)
Swagger	Swagger is a collection of open-source tools to design, create, document and use HTTP web services (also HTTP API or REST-like API).
T, t	International abbreviation for “Tonne” (D), “tonne” (F), “tonne” (UK) and “ton” (US)
VPE	Virtual Production Environment
UI	User Interface
UUID	Universally Unique Identifier
Y	Yield