



HOME

User Manual

DELMIA Process Engineer[®]

Standard Time Management (STM)



Foreword

This manual provides an introduction to the Process Engineer Standard Time Management operations and functions.

While developing these functions we have made every effort to create a clearly organized, easy-to-understand program structure.

A user-friendly interface as well as a clear menu guide will enable you to quickly learn how to operate the program and to get familiar with its functions so that you can carry out your planning tasks in a quick and reliable way.

Nevertheless, there will certainly be some things that we could do even better. If you have any suggestions for improving our software, please be sure to let us know.

We look forward to receiving your constructive feedback. It helps us to make it even easier for you to work with the Process Engineer functions.

The same holds true for the manual that you are now reading. If, at any point when using these instructions, you feel you are not being provided with the clear, unambiguous, and proper guidance necessary to work with this application, please be sure to let us know. We look forward to receiving your comments and tips.

Please feel free to call, send us an E-mail, or contact our user hotline.

Please Send your Suggestions to:

DELMIA GmbH

Raiffeisenplatz 4

D-70736 Fellbach

Phone: +49/711/27 300-0

Fax: +49/711/27 300-599

E-mail: delmia.de.info@3ds.com

User Hotline:

If you have problems when using DELMIA products, please contact our user hotline at:

Phone: +49/711/27 300-400

Fax: +49/711/27 300-599

E-mail: delmia.de.support@3ds.com

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DELMIA GmbH

Raiffeisenplatz 4

D-70736 Fellbach, Germany

Phone: +49 (-400)711/27 300-0

Fax: 49/711/27 300-599

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1. Introduction

This manual explains how to use the Process Engineer Standard Time Management for your planning purposes.

1.1 How to Use this Manual

This manual enables you to get familiar with the operation and functions of the Standard Time Management. This manual briefly describes:

- How to start and exit the STM process
- Menus and views required for STM
- How to start and exit the program
- How to execute menu functions and how to navigate in views



Note

When handling the Standard Time Management functions, please remember that there is a general introduction to the Process Engineer in the Basic Manual.



Click [General Introduction](#) to access the manual.

1.2 Documentation Conventions and Symbols

The symbols used in this manual are intended to provide you with keys to the contents in an immediately understandable manner.



This symbol is used to introduce key concepts that are covered in the sections immediately following this symbol. As a result, this symbol most frequently appears at the beginning of chapters or sections.



Note

*This symbol is used to mark notes, which provide you with additional information you need to have for further work. You will either find the Note sign at the beginning of a chapter or in a particular text passage in the chapter. Texts bearing this sign are additionally marked with **Note**. The text is always in italics.*




Caution

This symbol indicates that the text that follows describes particular circumstances that you must avoid to avoid potential errors with the operation of the program or harm to data. You will either find the Caution sign at the beginning of a chapter or near a particular text passage in the chapter. Texts that are in-

roduced by this sign are additionally marked with **Caution**. The text is always in italics.

Example

This symbol marks examples which serve to illustrate a certain situation.

- 1) This symbol marks the individual operational steps involved in a particular operating instruction. Operating instructions describe operational steps, for example, how to open a menu or execute a function.
- This symbol marks listed subjects. The symbol for listed subjects can be either used to structure a continuous text or to list main subject keywords.
- This symbol marks list inside a bulleted or numbered list.
-  This symbol marks cross reference information that is available in another manual.

1.3 New Functions in Standard Time Management

No new functionality has been added for this release.

2. Licensed Analysis Methods

This section discusses the licensed analysis methods used in STM.

2.1 Standard Analysis Methods

In STM the analysis methods **UAS**, **MEK**, **STD**, and **general time component** are configured as standard. In addition, further analysis methods can be licensed and used in STM.

All analysis methods created and edited in STM are taken into consideration and described in detail in this manual. This ensures that a complete description of the operation and functionality are available even for analysis methods that have been subsequently licensed.

2.2 Additional Analysis Methods

What additional analysis methods apart from the standard analyses are available to you depends on whether you have a license.

In [Figure 1](#) all analysis methods are shown, including the subsequently licensed additional analysis methods **MTM-I** and **MTM-2**.

STM - Allgemeiner Zeitbaustein
STM - BasicMOST
STM - MEK
STM - MTM-1
STM - MTM-2
STM - RWF
STM - SAM
STM - STD
STM - UAS

Figure 1: Analysis Methods

Datacards

The editing of datacards is deactivated in the standard configuration. This means that datacards can be imported and used; one cannot, however, create one's own datacards or edit existing ones.

3. Analysis Methods

DELMIA Time Control

Based on internationally recognized methods for time calculation, DELMIA Time Control provides a detailed process description for manual or partially automated manufacturing processes, a reliable calculation of the required execution time, complete, and transparent documentation.

Available Analysis Systems

- MTM Methods
- Basic Procedure (MTM-I or GV0-Analyses)
- MTM-II Analyses
- Standard Data Analyses (STD Analysis)
- UAS Analyses
- MEK Analyses
- Work Factor
- SAM
- General time component or time analysis (AZB analysis)
Time periods of diverse origins and quality are calculated and administered in this category (estimated times, process times, and planning time components).

The time component codes required for the said analysis systems are included in the installation and they are available to you.

Analysis with Datacards

DELMIA Process Engineer® provides its own datacards for the individual analysis processes; they provide time values in a clear format and thus increase the efficiency of the analysis method. DELMIA Process Engineer® furthermore allows the creation of your own datacards. This allows company-specific data to be integrated quickly and easily into the time control.

3.1 Process Times

Process times are important for the process planning. The following sections focus on the processing and calculation of the process times.

3.1.1 Calculating Process Times

You can specify estimated times for the rough planning at the lowest level, the process level. These estimated times can be converted to calculated time at a later stage of planning. Different analysis procedures are available for time conversion. *Please refer to the [Analyzing Process Times](#).*

Use **Valid time** to set which of the times is used for further calculations. Only these **valid** times are passed onto the next highest level. This is displayed in the below example. *Please refer to the [Figure 2](#).*

E = estimated and C = calculated

Example

Process Flow 1 default time = 5 [min]

Element of Work Cycle 1 Valid time = E

Calculation E = 0.0 min

C = 2.5 min

Process 1 Valid time = E

E = 1.0 min

C = 0.0 min

Process 2 Valid time = C

E = 2.0 min

C = 1.5 min

Element of Work Cycle 2 Valid time = E

Calculation E 6.0 min

C 0.0 min

Process 21 Valid time = C

E = 2.0 min

C = 0.0 min

Process 22 Valid time = C

E = 4.0 min

C = 0.0 min

The calculated time for Element of Work Cycle 1 is 2.5 min.

The calculated time is the sum of the valid times of processes one and two.

The valid time for sequence stage 1 is the estimated time.

In this example the estimated time 0 min is used, as it is used in further calculations.

All though estimated times are available for both processes, the calculated time is not ascertained.

6 min is the time used for further calculations in Element of Work Cycle 2.

You would have arrived at the same result if you had selected the estimated time as the valid time for both processes.

In this case the calculated time would be 6 min. The estimated time of 6 min is used as the valid time for further calculations. The cumulative value of 6 min would be used for both processes for further processing only if the **calculated value** was set as the valid time.

Figure 2: Calculate Process Time

Summary

You can enter estimated times for the rough or preliminary planning in the active input fields. These estimated times are assigned to the process until you create a detailed process analysis. This process is described in the next section.

In order for a process analysis time to be taken into consideration, the value calculated must be activated in the selection field **Valid Time** in the **Properties** dialog of a process.

Select the valid time for the calculation here:

Input field for the "estimated times".

Display fields for the total times: estimated or calculated times including the allowances.

Display field of the sums of the calculated times.

Figure 3: Time Structure of a Sequence Tab

3.1.2 Analyzing Process Times

DELMIA Process Engineer® has a variety of analysis procedures for the processing of process times. Datacards are available for individual analysis systems and their time components; these datacards provide the time values in diverse forms and thus make the analysis process more efficient. Furthermore, custom datacards can be created in DELMIA Process Engineer®. This makes it possible to integrate company-specific data conveniently and quickly into the DELMIA Process Engineer®.

Prerequisites

- The existence of a plantype set that provides the plantypes for the individual analysis procedures for processes in the PPR-Navigator.
- The attributes for the various time types and allowances must be configured.
- If the individual process times are examined with regard to their value added percentages, the plantype set must be extended in this respect **before** the actual analysis procedure.

Procedure

Datacards and datacard groups are managed and processed in the system library. The processing of the datacards and datacard groups is optional; process analyses can be processed with the standard datacards and datacard groups.

The settings for the individual analysis procedures are made on the respective plantype set in the system library. Before creating or starting a process analysis the settings must be revised and saved.

Value-added percentages can be defined for every plantype set of the system library. The value added should be created before the first editing of a process analysis and not afterward in retrospect. Retrospective changes should be avoided, especially the retrospective deleting of value added groups and entries. The editing of the value added percentages is optional; process analyses can be created and calculated without value added percentages.

The allowance sets for this project are defined in the project library. There are eight preconfigured attributes available. This, however, does not mean that you cannot define only eight allowance sets; the preconfigured attributes represent only the most common allowance sets used in practice. You can adapt the number of allowances to your needs by using free or custom defined attributes. The processing of the allowance sets is optional; process analyses can also be created and calculated without allowances.

Detailed process analyses can be created via the context menu of a process. During the processing of the process analysis an additional menu item and an additional icon bar are shown.

3.1.3 Time Types

The process times in DELMIA Process Engineer® are divided into four time types. These time types include Manual, Process, Waiting, and Setup times.

Manual Time

Manual times refer to manual activities or manual sequences (i.e. performed by people).

Process Time

The process time is the machine runtime (automatic processes, time which cannot be influenced).

Waiting Time

Waiting or maintenance times are sequence-dependent interruptions of the activity. Waiting times thus include planned manual maintenance during a process or sequence.

Set-Up Time

Setup time is the machine setup time.

Figure 4: Time Structure of a Process Tab

The Figure 5 describes how the individual times behave with regard to one another in a somewhat more detailed depiction of the default time.

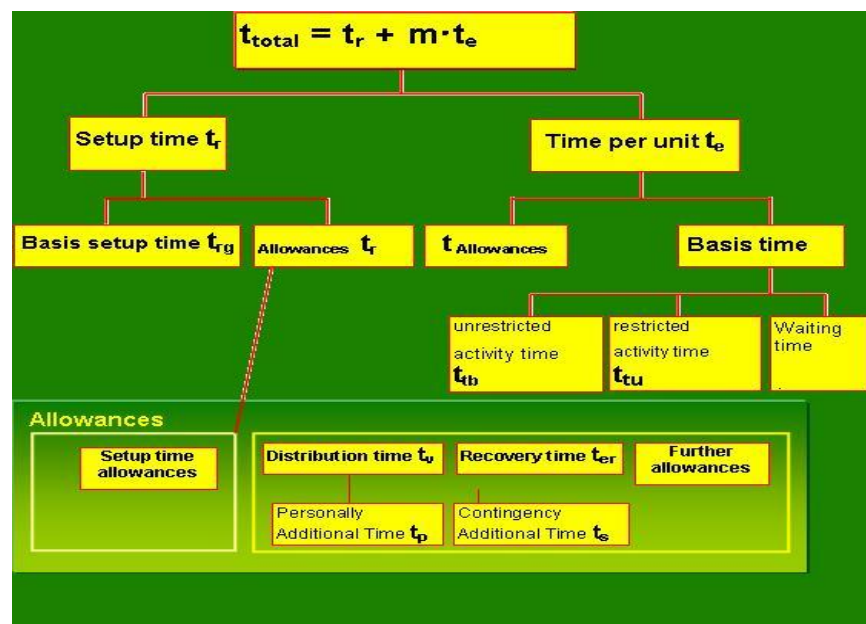


Figure 5: Individual Times

3.1.4 Allowances Sets

Times can be supplemented by an allowance set. Allowance sets are created in the project library.



For more information on how allowances are created, *Please refer to the [Project Library Manual](#).*

The allowance sets are controlled by two attributes. If the attributes for **allowance sets** and **calculated allowances** are not displayed, you must have the attributes Allowance Set (allowanceset) for the allowance set and Calculate Allowances (calculateallowances) for calculated allowances displayed in your plantype set or configuration.

Two allowance sets with three allowances each are defined in the example database:

- Personally Additional Time
- Contingency Additional Time
- Recovery Time

Another allowance can be freely configured.

Assign Allowances

Allowances can be assigned on the sequence or sequence stage. You can select an allowance set that is valid for all objects in the hierarchy on the technical nodes above the processes. For example, if you select the allowance set Without, all objects under this node are supplemented by the allowance set Without.

Figure 6: Allowance Set

Exceptions

If processes already have an allowance set assigned to them, i.e. the property allowance set is NOT empty; these allowance sets are not overwritten. The pre-assignment Allowance set applies only to objects that have not yet had an allowance set assigned to them on the process itself.

- 1) Select the allowance type.

If you have selected a valid allowance set, the individual allowances are displayed under **Allowance %** and are added to the respective time types. The value supplemented can be found under allowance times.

- 2) You can overwrite the individual percentages of the allowances and thus define allowances deviating from the allowance set. This is possible only if the allowance set Standard has been selected.

3.1.5 Selecting New Analysis Methods

- 1) Right-click a process object.
- 2) Select **Edit (Create) Time Analysis** entry from the context menu.

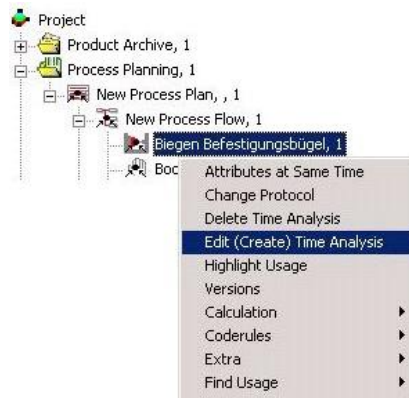


Figure 7: Assigning Analysis Methods to Process Objects

- 3) A selection list is opened (Figure 8) from which you can select an analysis method.

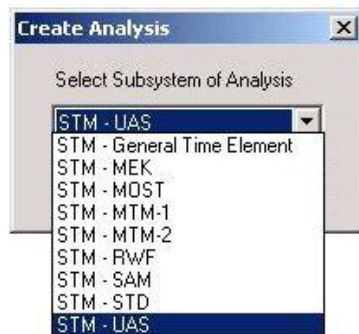


Figure 8: Create Analysis Combo Box

- 4) You can open a new analysis method by double-clicking on an analysis method or by marking the analysis method and then confirming with the button **OK**.
- 5) The process analysis form shown in Figure 9 is opened, and you can set the analysis code and its name.

Figure 9: Process Analysis Form

The exact description and the way of working with the process analyses are described in [Analysis Form](#).

Every time analysis has a numbering column on the left side of the data grid. The rows are numbered consecutively in ascending order with step size 1. Insert, Delete, Cut, Copy, and Paste retains the sequence of the row numbers.

The default value for the Partial Frequency of a MOST sequence is set to 1.

Showing Te-Time in Analysis Lines

To activate the Te-Times column, follow the directions below to show the Te-Time column in the Lines tab.

- In the DELMIA directory for the \\PPRServer\data\STM\ server, three .xml files are found: *stm.xml*, *stm_allowance.xml*, and *stm_parameter.xml*.
- The layout of the analyses is controlled by way of the *stm.xml* file. The default setting does not allow for a parameter to be entered in the XY-column or allowances to be shown in the TE-Time column.
- The *stm_allowance.xml* file in *stm.xml* must be renamed (of course the *stm.xml* file must first be renamed to *stm_org.xml*). This results in the availability of a new column in the Line tab. More details on the *stm_parameter.xml* file can be found in the section [Activating the Formula Assistant](#).

Analysis Lines | Basic Data | Long Text										
	Description	H	P	D	Code	Time (t)	Tim	Freq	Total Time (t)	Te Time (tmi)
1	Get and place				AA1	12,00	TTB	1	12,00	13,20
2	Get and place				AA2	21,00	TTB	1	21,00	23,10
3	Get and place				AA3	30,00	TTB	1	30,00	33,00
4	Restricted Process Time				PTU180	108,00	TTU	1	108,00	118,80
5										

Figure 10: Activate the Te-Times Column

Allowances are not calculated if Calculate Allowances has not been activated. In the case of a new plantype set or a reinstallation, it is suggested that the Calculate Allowances (calculateallowances) attribute be set as the default. In addition to this, the attribute should not be displayed in the **Properties** dialog. So for each newly created analysis, the entry is active and unchangeable. This eliminates the constant need to check entries.

Time Analysis UAS (ergocomptimeanalysisuas)

- Base Type: Time Analysis (ergocomptimeanalysis)
 - Base Type: Process Component (ergocomprocessdefault)
 - Editors
 - Attributes
 - CalcPeriod (tecalcperiod)
 - CalcQuantity (tecalcquantity)
 - Calculate Allowances (calculateallowances)**

Basics	
Name	calculateallowances
Physical name	m_bCalculateAllowances
Prompt	Calculate Allowances
Data Type	Bool
Control type	Checkbox
Group	Group::1100 (J-Page::1000 (General))
Description	
Use master	No
Data Type Definition	
Length	0
Precision	0
Unit category	
Unit	
Integer min	0
Integer max	2147483647
Double min	0.0000000000000000
Double max	9999999999.9999008000000000
Default value	1
Copy prefix	
Data Type Reference (Pointer)	
Type Attribute Name	
Value scope	
Target	
Display and Position	
Display in editor	No
Display in browser	No
Display in finder	No

Figure 11: Set Calculate Allowance as Default



For more information on how allowances are created, *Please refer to the [Project Library Manual](#).*

There are a few key points that distinguish the allowances used in analyses from those used for processes. The below section discuss how you can create the allowances.

To Create Allowance Sets for Analyses

- 1) Open the project in which the allowance sets to be used are found.
- 2) Open the Project Premises directory in the project library followed by allowance set.
- 3) Open the Process Allowance Set directory and create a new allowance set by way of the **New < Process Allowance Set** context menu.
- 4) Enter the name and number into the corresponding text fields and confirm by left-clicking **OK**.
- 5) Open the new directory and create a new allowance using the **New < Process Allowance** context menu. The **Attribute Filter Settings** dialog opens. *Please refer to the [Figure 12](#).*

Figure 12: Dialog Containing the Allowance Definition

All fields are not needed to create an allowance for an analysis. Most important is **Name** in the section **Description** and the entire **Calculation** section.



For more information on individual fields, *Please refer to the [Project Library Manual](#).*

Condition Fields

These input fields are only to be filled out if the allowance assignment is dependent on the pre-defined values of an attribute. *Please refer to the [Figure 12](#).*

Calculation

These input fields are filled out if an allowance is to be created for a particular time type (an attribute is given in the case of a "normal" allowance definition). The calculation fields do not require any prerequisite conditions. *Please refer to the [Figure 12](#).*

Table 1: Calculation for Input Fields

Attributes	Input Fields
Calculation Attribute 1	Enter the time type here. The entry must be in square brackets. The following time types can be entered: [TTB], [TTU], [TTW], [TRG], and [TG], although $TG = TTB + TTU + TTW$
Operator	Select the operator with which the attributes are to be linked. +: Adds the value given in the calculations attribute 2 to the base time -: Subtracts the value given in the calculations

Attributes	Input Fields
	attribute 2 from the base time
Calculation Attribute 2	Enter the allowance value in percent, here (a number in between inverted commas).
Attribute Allowance	Not used

3.1.6 Menu Analysis and Tool Bar

The tool bar and the menu analysis appear only if a process analysis was opened for editing..

Analysis Menu

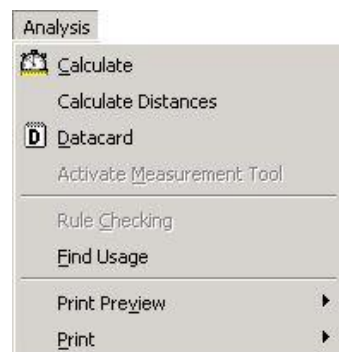


Figure 13: STM Menu

- 1) Start all calculations in a process analysis or formula by using the menu item **Calculate**.
- 2) If you have created a process analysis with the help of the measuring tool you can start an update of the scan points via the menu item **Calculate Distance** after changing the graphic. *Please refer to the [Distance Component](#).*
- 3) Open the datacard appropriate for the current process analysis via the menu item **Datacard**. *Please refer to the [Datacards](#).*
- 4) The graphics available can be directly accessed for an optimal analysis procedure. You can activate the graphic tools via the menu item **Activate Measurement Tool**. *Please refer to the [Distance Component](#).*
- 5) You can manually activate the MTM-I or MTM-II rule checking via using the menu item **Rule Checking**.

MTM-I and MTM-II Rule Checking

Use the function **Rule Checking** to manually call up the rule checking for all (configured) processes. It is opened in the dialog shown in [Figure 14](#); in it the configuration of the current process analysis is compared to the system-wide analysis - i.e. the reference analysis set by the function settings.

Here you can use the **Configuration**, **Analysis**, or others (user rights must be fulfilled) and adjust.

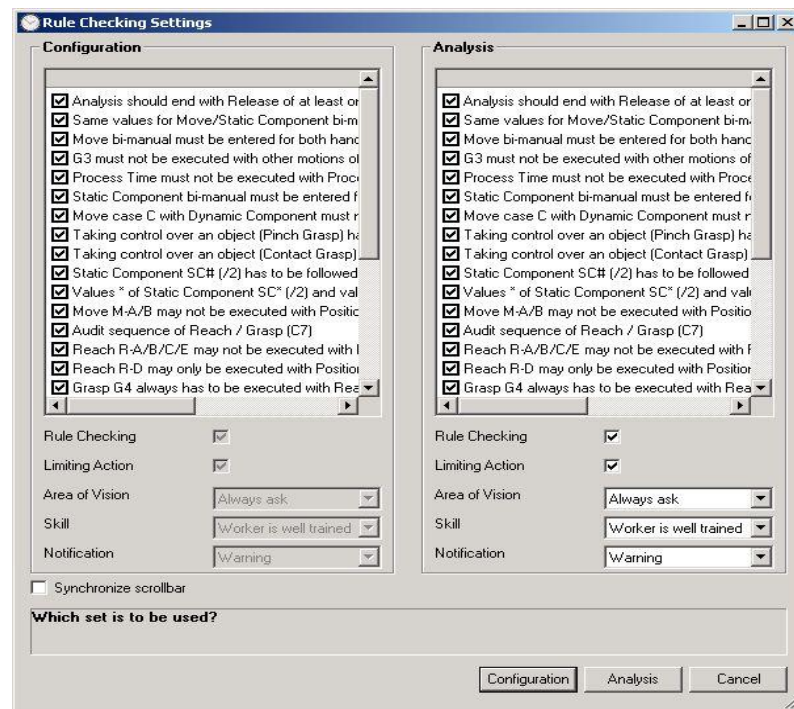


Figure 14: Editor Rule Checking Settings

The use of an analysis in the hierarchical structure is shown via the menu item **Find Usage Data**.

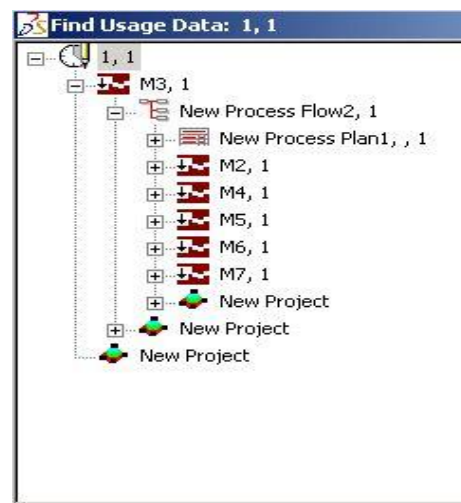


Figure 15: Example of Parts Use of an Analysis







Tool Bars

Click icon in order to open one of the process analysis functions of the tool bar.



Figure 16: STM Tool Bar

Table 2: Tool Bar Functions

Icons	Icons Description	Functions
	Open Datacard	Opens the datacard appropriate for the current process analysis.
	Left Hand	Only active in two-handed analysis methods. The code is only entered into the "Left hand" column.
	Both Hands	Only active in two-handed analysis methods. Code is entered in both columns.
	Right Hand	Only active in two-handed analysis methods. The code is only entered into the "Right hand" column.
	Open Formula Assistant	Opens the Formula Assistant. The Formula Assistant is not active by default. To activate the Formula Assistant further setting adjustments must be made. Read more about this in this section Formula Assistant .
	Start Calculation	Starts the calculation

3.1.7 Editing an Existing Process Analysis

The previously created process analysis is displayed in the **Properties** dialog of the process plantype under the tab Lines. The process analysis cannot be edited here; this tab has only an informative purpose.

The analyzed time corresponds to the calculated time in the PPR-Navigator. It is shown in the properties window of the process object.

To Open Edit Time (Create) Analysis in the Context Menu

- 1) Open the context menu by right-clicking on the process in order to edit the process analysis.
- 2) Select the entry **Edit Time (Create) Analysis** in the context menu.



Note

*If the entry **Delete Time Analysis** is active, this means a process analysis has already been created.*

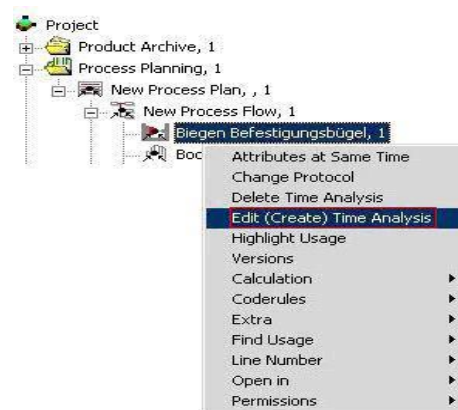


Figure 17: Context Menu Edit Time (Create) Analysis

The process analysis form of the assigned analysis method opens.

Deleting a Process Analysis Method

If a process analysis is assigned to a process, you can cancel the assignment by using the context menu entry **Delete Time Analysis**.



Figure 18: Delete Time Analysis



Note

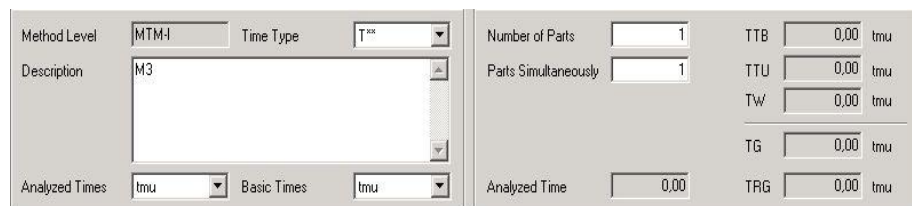
The creating and deleting of process analysis requires that the access rights to do this are defined. Process analyses with active references cannot be deleted.

3.1.8 Analysis Form

3.1.8.1 Process Analyses Header

The process analysis header is identical in all process analysis methods.

Header Area



The form contains the following fields and controls:

- Method Level:** A dropdown menu showing 'MTM-I'.
- Time Type:** A dropdown menu showing 'T**'.
- Description:** A text input field containing 'M3'.
- Number of Parts:** A text input field containing '1'.
- Parts Simultaneously:** A text input field containing '1'.
- Analyzed Times:** A dropdown menu showing 'tmu'.
- Basic Times:** A dropdown menu showing 'tmu'.
- Analyzed Time:** A text input field containing '0,00'.
- TTB:** A text input field containing '0,00' with unit 'tmu'.
- TTU:** A text input field containing '0,00' with unit 'tmu'.
- TW:** A text input field containing '0,00' with unit 'tmu'.
- TG:** A text input field containing '0,00' with unit 'tmu'.
- TRG:** A text input field containing '0,00' with unit 'tmu'.

Figure 19: Process Analysis Header

Display Field “Method Level”

In this field you cannot enter anything since the STM automatically displays the currently used process analysis method.

Input Field “Description”

In this input field you can enter the name of the process analysis. DELMIA Process Engineer® always assigns the name of the corresponding process as a standard value. This name can be overwritten or left as it is, since the process analysis is uniquely marked with the code.

Input Field “Time Type”

You can open a list for the selection of time types by left-clicking on the control device **unrestricted**. The selections include:

- **T**:** **Separate Time Calculation:** The background of the process analysis is added separately according to the time types of the background analyses: i.e. TTB, TTU, and TRG times are treated separately.
- **TTB:** **Unrestricted Time:** If **TTB** is specified as the time type, all background times are added to the TTB time field without taking their time type into account.
- **TTU:** **Restricted Time:** If **TTU** is specified as the time type, all background times are added to the TTU time field without taking their time type into account.
- **TRG:** **Base Setup Time:** If **TRG** is set as the time type, all background times are added to the TRG time field without taking their time types into consideration.

- **TW: Waiting Time:** If TW is specified as the time type, all background times are added to the TW time field without taking their time type into consideration.

Input Field "Analyzed Times"

Use this input field to set the calculation time in the actual process analysis form. Calculations in TMU are possible here (Time Measurement Units), minutes, seconds, hours, or hundredths of minutes (HM = min/100).

Input Field "Basic Times"

Use this input field to set the unit in the analysis header. Calculations in TMU (Time Measurement Units) are possible here i.e. minutes, seconds, hours, or hundredths of minutes (HM = min/100).

Input Field "Number of Parts"

In this input field you can enter how often the analyzed activity is to be executed for an item.

Input Field "Parts Simultaneously"

Here you can specify how many parts are edited simultaneously for the analyzed activity.

Output Field "Analyzed Time"

The sum of the times is calculated by the system in accordance with the code lines. If the time type TRG, i.e. a base setup has been selected, no Analyzed time is displayed.



Calculations are executed only if there are entries in the worksheet "lines".

The selected procedure is triggered via the icon **Calculate** or the menu **Analysis < Calculate** if the entries to be calculated are on the worksheet "Lines".

Output Fields of Individual Time Types

These fields are filled in differently depending on the selected time type. The system automatically calculates the sum of the times corresponding to the code lines or input times on the Header data, *Please refer to the [Figure 20](#)*.

The screenshot shows a 'Basic Data' window with two main sections. On the left, 'Entered Times' contains four input fields with values: 100,0000, 100,0000, 100,0000, and 50,0000. On the right, there are input fields for 'Number of Parts' (2) and 'Parts Simultaneously' (2). Below these are output fields for 'Analyzed Time' (916,67) and a list of time types with their values: TTB (100,0000 sec), TTU (100,0000 sec), TW (100,0000 sec), TG (300,0000 sec), and TRG (50,00 sec). A blue arrow points from the 'Entered Times' section to the 'Analyzed Time' field.

Figure 20: Output Field of Individual Time Types

Output Field "Time per Item"

The time per item is displayed according to the following formula:

Time per item = (time X number of items/parts simultaneously X round-off rule)

3.1.8.2 Analysis Lines Tab

Analysis Lines | Basic Data | Long Text										
	Description	Frequ	M	Code L.H.	Time (tmu)	Setup	Code R.H.	M	Frequ	Description
1	Reach	1		R-B						
3	Grasp	1		G1A	2,00					
5	Apply pressure	1		APA	10,60					
7					26,60		P2NSD		1	Position
9	Position	1		P2NSD	26,60					
11					37,20		TBC2		1	Body motion
13					69,40				1	Body motion
15	Body motion	1		STD	43,40					
17	restricted process time	1		PTU50	50,00					

Figure 21: Analysis Lines Tab

The following codes are managed:

- Internal datacards (UAS, MEK, STD, and MTM-I)
- Generated PTUxxx, PTBxxx, and PTWxxx
- Code from process analyses of the project library
- Code from process analyses of the system library

Generated Codes are always entered with the keyboard. The code consists of the letters PTU and a number that specifies the code in the TMU unit. The code PTU55 thus indicates a process time of 55TMU. You can also enter the fixed times in other units than the TMU. To do this, you only have to change the entry as shown in the [Table 3](#). For more information on editing, *Please refer to the [MTM-I Analysis](#).*

Table 3: Generated Codes

TMU	PTBxxx, PTUxxx, PTWxxx
in MIN	MINxxx, PTBMINxxx, PTUMINxxx, PTWMINxxx
in HMIN	HMINxxx, PTBHMINxxx, PTUHMInxxx, PTWHMINxxx
in SEC	SEKxxx, PTBSEKxxx, PTUSEKxxx, PTWSEKxxx SECxxx, PTBSECxxx, PTUSECxxx, PTWSECxxx

**Note**

In all analyses using the single-handed method (UAS, MEK...) you can insert a heading line in the visual arrangement by entering an asterisk () in the code column. This line is not printed. Please refer to the [Figure 22](#).*

Analysis Lines | Basic Data | Long Text										
	Description	H	P	D	Code	Time (tmi)				
1	Caption				*					
2	Get and place				AA1	12,00				

Figure 22: Analysis Lines**3.1.8.3 Basic Data Tab**

Analysis Lines: **Basic Data** | Long Text

ZT	Calculated Times	
TTb	55,0000	sec
TTU	0,0000	sec
Tw	0,0000	sec
TRG	0,00	sec

Code:

Work Description

Start:

Include:

End:

Limitation:

Figure 23: Basic Data Tab

Code

Enter an unambiguous name here. You can find the corresponding components in the project library by using this name.

Work Description

The Work Description can be seen as a short description of the analysis. You can retain the content as well as the general conditions of the analysis in the fields **Start**, **Include**, **End**, and **Limitation**.

3.1.9 Examine Changes in Time Analysis

The changes made in the time analysis can be examined through the following steps:

- 1) Open the STM Plantype Settings via the context menu. *Please refer to the [Figure 30](#).* The **STM Plantype Settings** dialog appears.

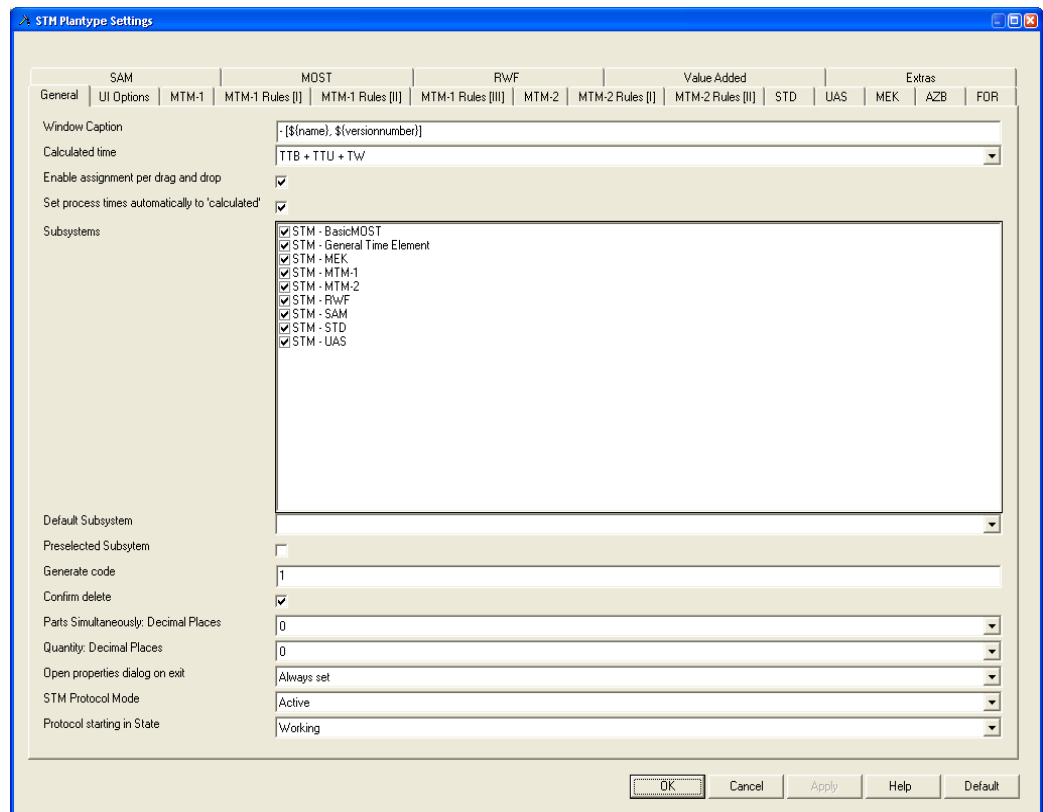


Figure 24: STM Plantype Settings

- 2) Select the required option in **STM Protocol Mode** drop-down list. Three options are available:
 - OFF: No protocol
 - Silent: STM creates entries automatic. No user interaction
 - Active: The user can enter a comment on every save of data
- 3) Based on the settings, changes are reflected in the time analysis lines.

Figure 25: Changes in Time Analysis Line

The green arrows indicate a textual change. Only the code (short name) and the description of the analysis and changes in the description of an analysis line are monitored. The name of the attribute is not stored in the change protocol. The text on the change protocol entry is 'textual change'

The red color indicate a time change. Only the base times are monitored.

The name of the changed attribute is not stored in the change protocol. The text on the change protocol entry is 'time change' With both options a text field is displayed where you can enter a text to describe the reason for this change.

- 4) Every change in an analysis line create entries in **Change Protocol**.
Open the **Change Protocol** via the context menu and view the changed entries.

Date	User	Operation	Object	Attribute	OldValue	NewValue	Descr. chan...	Index
10.12.2003 14:00:11	admin	SetAttributes	Process Name	New Ablauf	Fertigung			0

Figure 26: Change Protocol

3.1.10 Integrating Process Analyses and Formulas

There are exactly four ways to integrate other process analyses or formulas into the process analyses:

- 1) Drag and drop the process analyses or formulas from the project library to the process analysis.
- 2) Enter the process analyses or formulas directly into the process analysis. In order to directly enter a process analysis or formula into process analysis, type code (name) of the formula under the tab **Analysis Lines** in the column **Code**. Press enter to confirm your entry. Enter the values in the dialog.
- 3) Assign the formula via the project finder of the process analysis by drag and drop.
- 4) Drag and drop the process analyses or formulas from the system library to the process analysis.

The last options requires that the formula or process analysis is in a template of a plantype set. The advantage of this option is that the formulas from the templates of a plantype set can be used in all projects that are derived from this plantype set.

To Create the Formulas in a Template

- 1) Open the system library.
- 2) Select a plantype set and create a new template.
- 3) Open this template as a project.

The rest of the procedure is same as in the "normal" project library.



For more information on How to work with templates, Please refer to the [System Library Manual](#).

In the following example the procedure is demonstrated in formula mode which has been added from the project finder.

The **formula** is an aid with which parameterizable time components can be created. The formula itself is created in a formula editor on the process plan-type STM formula in the project library. . For more information on how to create formulas in the formula editor, *Please refer to the [Creating Formulas \(Macros\)](#)*.

To Create Formulas

- 1) Open project finder. Select STM form (process) in the project finder.
- 2) Click **Search next** button. All formulas created in the project library are displayed in the display field of the finder.
- 3) Select the formula. With the left mouse button pressed, drag the selected formula onto the process analysis.
- 4) The mouse pointer takes on the form of a square while the formula is being moved. If instead a prohibition sign is shown (a crossed-out circle): Ø, the formula cannot be added. The reasons for this are the type of the object does not fit or there are no processing rights for the "target object".
- 5) In the dialog enter the number of process and length of the processes, for example, for the blow off points.



Figure 27: Parameter Input Mask of a Formula

- 6) After the parameters are entered, the formula is entered into the process analysis line with its name and the time corresponding to the entered parameters is calculated.
- 7) The standard value of zero is used for the parameters with the button **Standard**.

You can view the number of parameters by clicking the button **Help**.

To Change the Formula Parameters

- 1) Open the dialog for parameter input by double-clicking on the process analysis line.
- 2) Change the values in the dialog.

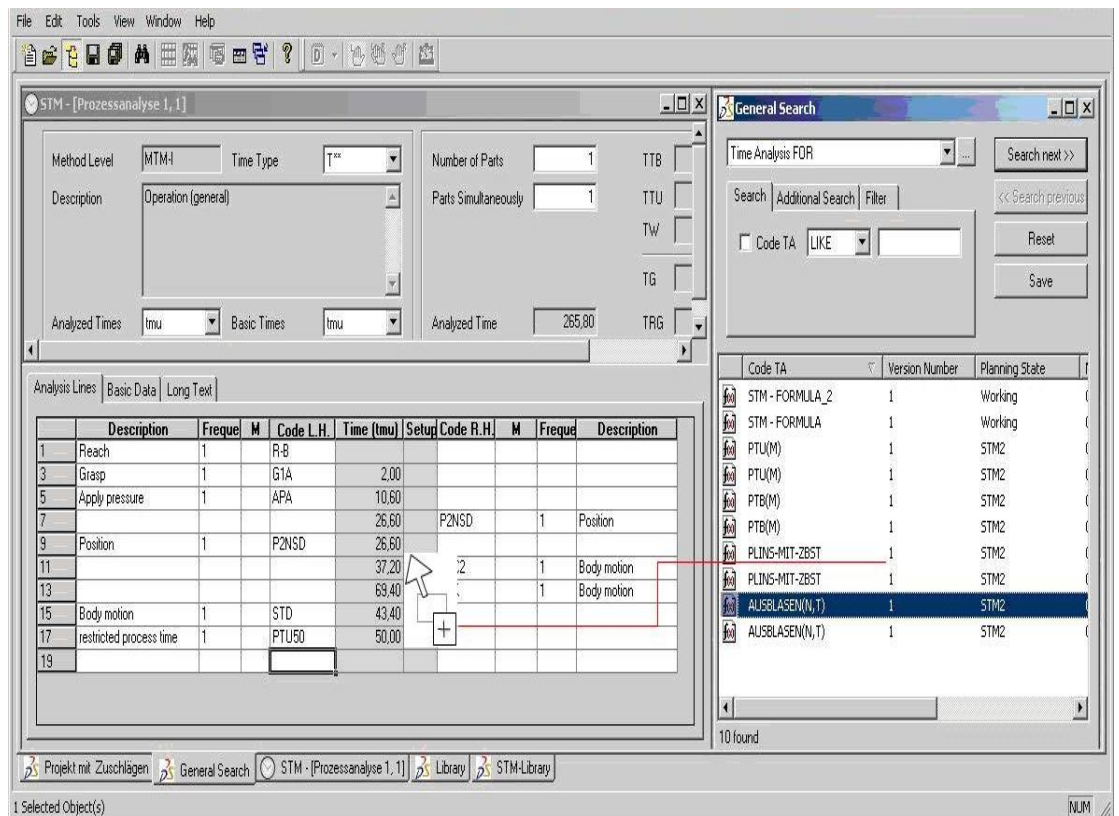


Figure 28: Example of Integrating a Formula into a Process Analysis

3.2 Plantype Sets in the System Library



The settings as well as the configuration of the value added can be found in the system library.

- 1) Open the system library via the corresponding icon in the tool bar or via the menu **File < Library**.
- 2) Select a plantype set.
- 3) Next to the three views: product, process, and resource view, the script actions, the script assignments, templates, and the directory value added can be found here. You can configure the value added under this directory.

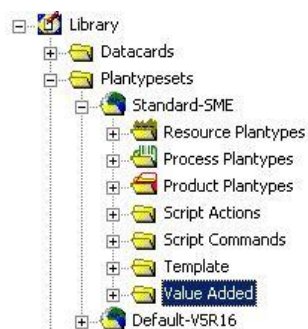


Figure 29: Configure the Value Added

- 4) Open the settings of the process analyses via the context menu.



Figure 30: Settings of the Process Analysis

3.2.1 Value Added

The values added can be found in the following analysis methods: AZB, UAS, MEK, SAM, and STD.

You can switch off the value added via the **Settings**. You can also configure the value added here.

To Create New Value Added Entries and Groups

Value added groups and value added entries can be found under a plantype set of the system library.

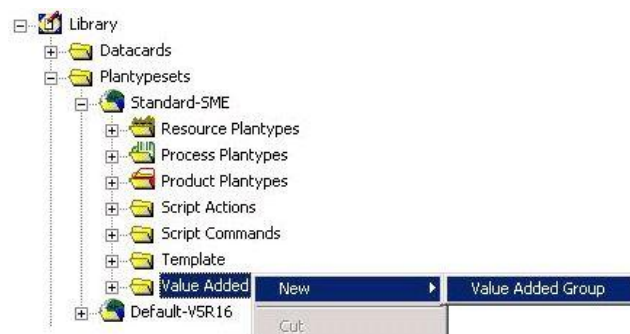


Figure 31: Directory Value Added

- 1) Select a plantype set and open the context menu on the directory Value added.
- 2) Select the entry **New < Value** added group.
The properties of a value added group are opened.

 A screenshot of a dialog box titled 'Value Added Group properties'. It has a 'General' tab. Inside the tab, there are three input fields: 'Name' with the text 'Value-Added', 'Short Name' with the text 'VA', and 'Number' with the text '1'.

Figure 32: Properties of a Value Added Group

- 3) Enter the names, the short name, and the number for the value added group.



Note

The numbers 1 to 30,000 can be used. The numbers must not exceed 30,000.

- 4) If you want to create further value added groups, proceed exactly as described above.
- 5) If you want to further subdivide **non-value-adding** activities you have to create new value added entries.
- 6) In order to create value added entries, select a value added group and open the context menu.
- 7) Select the entry **New < Value Added Entry**. The properties of a Value added entry are opened.

Value Added Entry

Figure 33: Properties of a Value Added Group

Über das Kontrollkästchen *Aktiviert* haben Sie hier die Möglichkeit den jeweiligen Eintrag in der Prozessanalyse zu aktivieren bzw. zu deaktivieren

To Mark Activities or Activity Sequences as Value Added

The following are the options for doing this:

- 1) You can mark any code as value added, non-value-added, and/or mark further value added definitions in the code input on the page Lines. The entries set in the settings are available in a pop-up menu for non-value-added.

	Description	H	P	D	Code	Time (sec)	Tim	Frequency	Total Time (sec)	Setup Time (sec)	VA	NVA
1	M4				1		1"	1				
2	M2				1		1"	1				
3	New Montagevorgang				New MTM UAS	220,00	1"	1	220,00			
4	Biegen Befestigungsbügel				1		1"	1				
5	Hoppel				HOPEL POPPEL	93,42	1"	1	93,42			
6	New M1											
7	New M2											
8												
9												
10												

Figure 34: Code Markings

Page Value Added

Open the page Value added for further editing. An evaluation of the individual value added percentages of the process analysis are shown on the page Value added. The individual value added percentages are summarized with regard to percent and time.

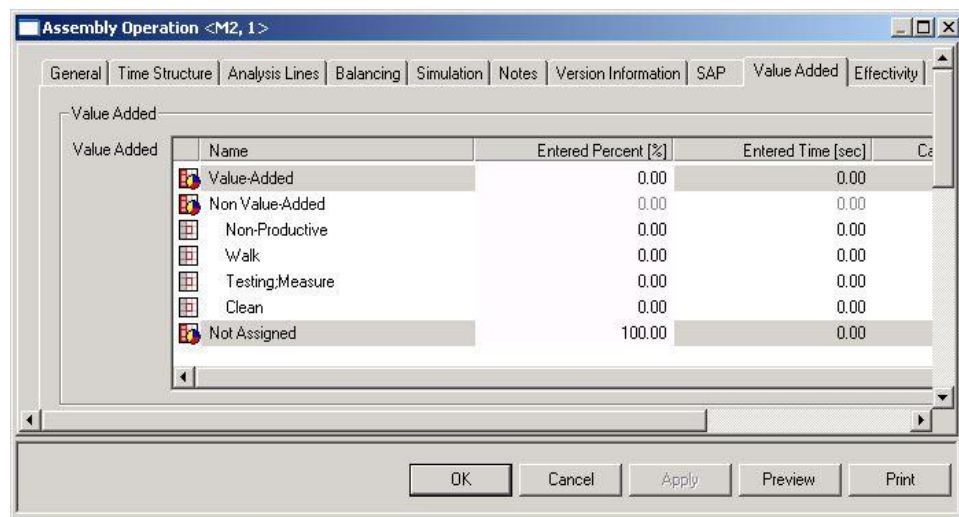


Figure 35: Page Value Added

- 2) In the **first column** are the value added groups and entries defined and activated on the plantype set.
- 3) The corresponding percentages and times can be found in **columns 4 and 5**.
- 4) The **second column** can be edited. If the calculated times and percentage values do not correspond to your expectations, you can manually change the percentages in this column. The times corresponding to the manual percentages are shown in **column 3**.



Note

The manual values always have priority over the calculated values.

- 5) All of the times to which no value added was assigned are summarized in the line **Not assigned**.

3.2.2 Plantype Settings

You can configure the appearance and individual analysis methods with the function **Settings**. The settings for the process analysis are made for every plantype set.



Figure 36: Directory Datacards

To Open the Settings Dialog

- 1) Open the STM Plantype Settings via the context menu.
- 2) The **STM Plantype Settings** dialog gets open. Please refer to the [Figure 37](#). The **General** tab of the dialog is described in the following section.



Note

Although some settings are not available by default, they can be activated using an XML file and/or registry entries.

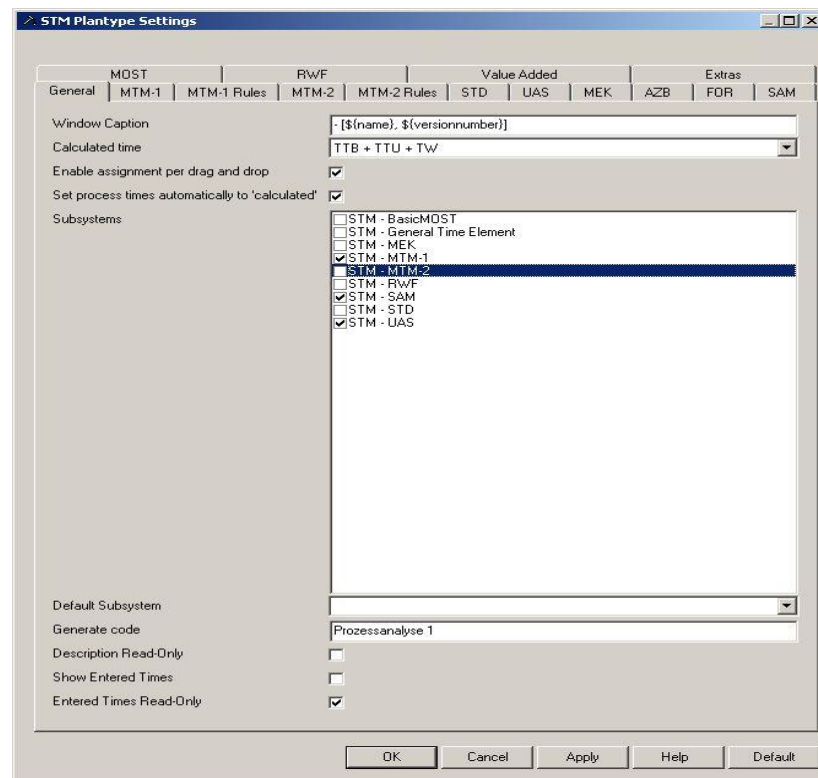


Figure 37: Selection of the Data Source

These settings affect all analysis methods.

Windows Caption

Enter the attributes displayed in the title of a process analysis. These entries can be made only by an administrator who is familiar with the procedures and has access rights to work in the Configuration Manager.

Standard = - [{name}, {versionnumber}]

Attributes must have the format \$xxx or \$ {xxx}. Only if one attribute is used, the format \$xxx can also be used.

Calculated Times

Set the standard type for the calculated time here.

Enable Assignment per Drag and Drop

You can set whether process analyses or formulas from the project or system library can be linked to the process analysis by drag and drop.

Set Process Times Automatically to Calculated

If you activate this function, the **valid time** is set to **calculated** after a process analysis is saved and created.

Subsystems

A selection list of the analysis methods is provided when creating a new process analysis. Here you can set the entries of the selection list.

Default Subsystem

Here you can select the standard analysis method if no selection list is set to be displayed when creating a new process analysis. This leads to the prompt no longer appearing, and the analysis is created with the same procedure. In order to activate the query again, you must select no value in this selection dialog.

3.2.2.1 Copying an Analysis

There are two possible ways to copy a process analysis:

- **A Copy of the Analysis is Attached to the Process:** If this option is active when the process analysis is copied, the analysis belonging to it get also be copied. In the following example, the manufacturing process was copied with the *Eine Kopie der Analyse wird dem Prozess angehängt* activated. Following the copying, two analyses with the same code are found in the project library.

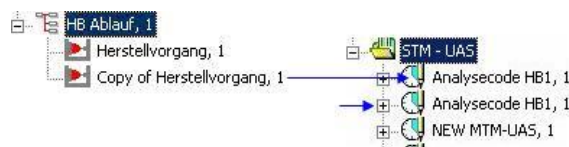


Figure 38: Copying an Analysis

- **Do not Execute the Operation:** As the process analysis is copied, the analysis belonging to it is **not** copied.

3.2.2.2 Delete Analysis

The Analysis is Deleted

Both the process analysis and the analysis belonging to it are deleted.

Do not Execute the Operation

If the process analysis is deleted, an analysis copy is not made.

Generate Analysis Code

On the page Header data you can set the name of the process analysis in the input field **Code**. Use this name to find the corresponding process analysis in the project library. If you have not made any entries in the input field **Code**, the name that you entered under Generate analysis code is used.

3.2.2.3 Write Protect Analysis

Activate this function if a process analysis is to be write-protected.

- Write-protected

Method Level: Standard data Time Type: T^{xx}

Description: M2

Analyzed Times: tmu Basic Times: tmu

Figure 39: Write Protected

- Not write-protected

Method Level: UAS Time Type: T^{xx}

Description: M2

Analyzed Times: tmi Basic Times: tmu

Figure 40: Not Write-Protected

3.2.2.4 Display Input Times

These settings refer to the page Header data. You can display or hide the **input times** on the page header data. Please refer to the [Figure 41](#) and [Figure 42](#).

- Hidden

Analysis Lines: Basic Data Long Text

Calculated Times

ZT	Calculated Times	
TTB	0,0000	tmu
TTU	0,0000	tmu
TW	0,0000	tmu
TRG	0,00	tmu

Figure 41: Hidden Input Times on the Page Header Data

- Displayed

Analysis Lines: Basic Data Long Text

Calculated Times

ZT	Calculated Times		Entered Times
TTB	0,0000	tmu	
TTU	0,0000	tmu	
TW	0,0000	tmu	
TRG	0,00	tmu	

Figure 42: Displayed Input Times on the Page Header Data

The input times are used when time data are imported from external systems or older versions of the DELMIA Process Engineer®, there is a possibility that these data contain estimated times. These estimated times are transferred to input times.

3.2.2.5 Block Input Times

If you have the input times displayed, you can just display the times or also unlock them for editing via this setting.

Figure 43: Settings to Block Input Times

Show Allowance Times

The base times for an analysis are displayed in the process analysis header. These are the combined times from the analysis lines divided into three groups: manual time, process time, and waiting time. Please refer to the [Time Types](#) and [Basic Data Tab](#).

Figure 44: Base Times in the Process Analysis Header

To show the assigned allowances, which are the Te-Times, activate the **Show Allowance Times**. Please refer to the [Figure 45](#).

Description	H	P	D	Code	Time (t)	Time (T)	Time (F)	Total Time (t)	Total Time (T)	Total Time (F)
1				AA1	12,00	TTB	1	12,00		
2				AA2	21,00	TTB	1	21,00		
3				AA3	30,00	TTB	1	30,00		
4				PTU180	108,00	TTU	1	108,00		
5										
6										
7										
8										
9										
10										

Figure 45: Process Analysis Header Showing the Base Times and TE-Times

By activating the **Show Allowance Times** function the Te-Times are shown, but this does not activate the calculation of allowances. To get more information on the prerequisites for calculating allowances of analysis lines, *Please refer to the [Allowances Sets](#) and [Showing Te-Time in Analysis Lines](#).*

Quantity of Decimal Places

Here you can set the number of decimal places to be simultaneously displayed in the Parts fields.

Parts Simultaneously Decimal Places

Here you can determine the number of decimal places to be simultaneously displayed in the Parts field.

Figure 46: Determine Number of Decimal Places

STM_ConfirmAnalysisDeleting

If an analysis is deleted by way of the context menu of a process analysis, a dialog appears to confirm the deletion.


Figure 47: Delete an Analysis via Context Menu

If this function is deactivated, the dialog is no longer displayed and the analysis is deleted directly after the context menu entry has been activated.

STM_OpenPropertiesDialog

In the properties dialog of an analysis there is a check box **Back to Process Properties**. If this check box has been activated, the properties dialog of the process analysis opens after exiting the analysis.

☒ Back to process properties

If the properties dialog of the analysis is exited by way of the **OK** button, then the check box **Back to Process properties** is evaluated. Even after exiting the dialog following a modification by way of the system menu (or the  Close button), two choices are still available, to return to the process analyses dialog or to end the process.

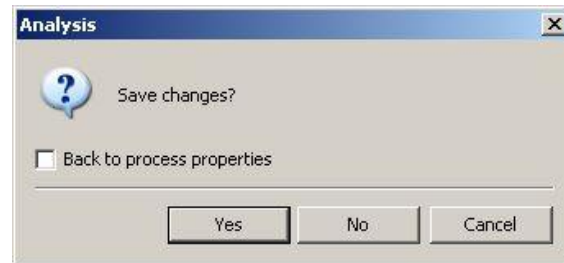


Figure 48: Process Analysis

The check box **Back to process properties** is controlled by the **STM_OpenPropertiesDialog** function. There are three options to choose from:



Figure 49: STM_OpenPropertiesDialog Options

- If **Always set** is selected, the check box is always active after opening.
- If **Never set** is selected, the check box is not active. To still return to the process analyses dialog, the check box must be activated.
- If **Set only if time analysis is called from properties dialog** is selected, the check box is only set to active, if the analysis is called up directly from the process analyses dialog (by way of a button).

2.2.6

Page MTM-1

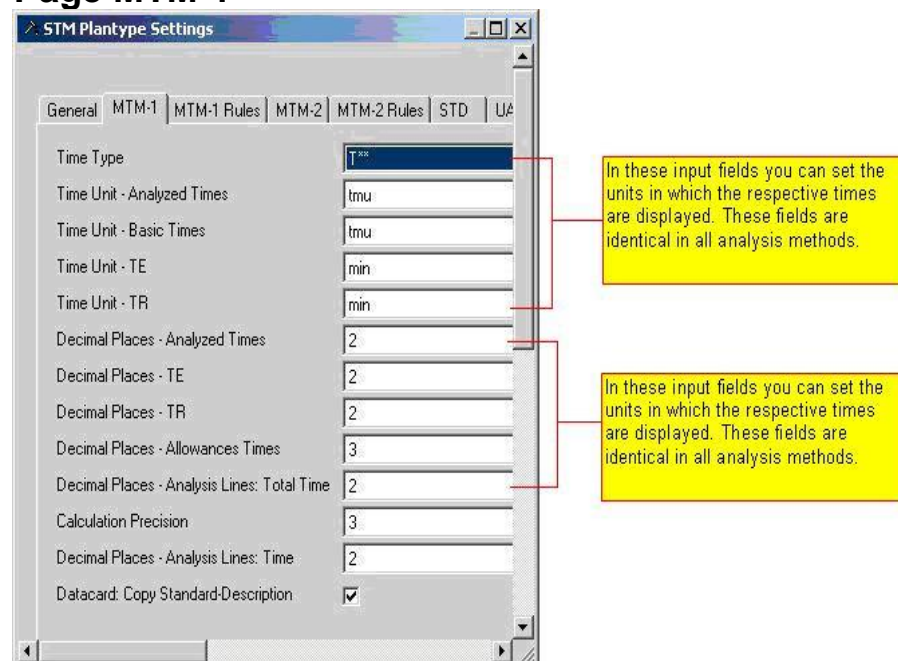


Figure 50: Selection of the Data Source

Exactness of the Calculation

The internal decimal place setting ranges from 0 to 7. The internal decimal places are used in the calculation and in the exactness of rounding off. For example, no decimal places are used in the calculation if the entry is 0.

Decimal Places – Analyzed Times

Here you can set the number of decimal places displayed in the process analysis lines.

Datcard: Copy Standard Description

This setting refers to the **Lines** tab. When the checkbox is activated, the standard code descriptions are displayed in the Description column.

MEK analyses are MTM analyses for individual and small batch series. The settings of the other analysis methods are identical with the exception of the rule checking.

3.2.2.7 Page MTM-1 Rules

MOST		RWF		Value Added			Extras			
General	MTM-1	MTM-1 Rules	MTM-2	MTM-2 Rules	STD	UAS	MEK	AZB	FOR	SAM
Rule Checking Monitoring		<input checked="" type="checkbox"/>								
Limiting Action		<input checked="" type="checkbox"/>								
Final Check		<input checked="" type="checkbox"/> Analysis should end with Release of at least one hand (A1)								
Simultaneous Motion		<input checked="" type="checkbox"/> G3 must not be executed with other motions of the hand simultaneously (B3) <input checked="" type="checkbox"/> Move bi-manual must be entered for both hands (B2) <input checked="" type="checkbox"/> Process Time must not be executed with Process Time simultaneously (B4) <input checked="" type="checkbox"/> Same values for Move/Static Component bi-manual (B1) <input checked="" type="checkbox"/> Static Component bi-manual must be entered for both hands (B5)								
Consecutive Motion		<input checked="" type="checkbox"/> Audit sequence of movements of the hand (C13) <input checked="" type="checkbox"/> Audit sequence of Reach / Grasp (C7) <input checked="" type="checkbox"/> Grasp G4 always has to be executed with Reach R..C in advance (C10) <input checked="" type="checkbox"/> Move case C with Dynamic Component must not be executed with Position Easy (C1) <input checked="" type="checkbox"/> Move M-A/B may not be executed with Position (C6) <input checked="" type="checkbox"/> On two consecutive Body Turn, the first is always a Body Turn case 2 (C12) <input checked="" type="checkbox"/> On two consecutive Side Step, the first is always a Side Step case 2 (C11) <input type="checkbox"/> Reach R-A - Grasp G1B -> Check for correctness (C15)								
Insert Code		<input checked="" type="checkbox"/> Distance of Reach is 10 cm with Side Step in advance (D6) <input checked="" type="checkbox"/> Do not limit out Grasp case G2, when distance of Move is smaller than 12 cm (D5) <input checked="" type="checkbox"/> Grasp case G1C3 with Reach case D in advance (D1) <input checked="" type="checkbox"/> Incorporate dimension at Grasp case 4 with Reach case C in advance (D2) <input checked="" type="checkbox"/> Walk: Obstructed/Weight with Turn Body case 2 followed by Turn Body case 1 in advance (D4) <input checked="" type="checkbox"/> Walk: Unobstructed with Turn Body case 1 in advance (D3)								
Area Of Vision		Always ask								
Skill		Worker is well trained								
Notification		Warning								
Time Update: Use Rules from		Configuration								

Figure 51: MTM-I Rules Tab

Rule Checking Monitoring

If this control element is activated, the system executes a rule checking in the calculation. A notification window is opened if the sequence of activities is implausible. Simultaneously a suggestion for an improvement is issued. The MTM rule to be checked is set in the following settings (final check, simultaneous motion, consecutive motion, insert code, area of vision).

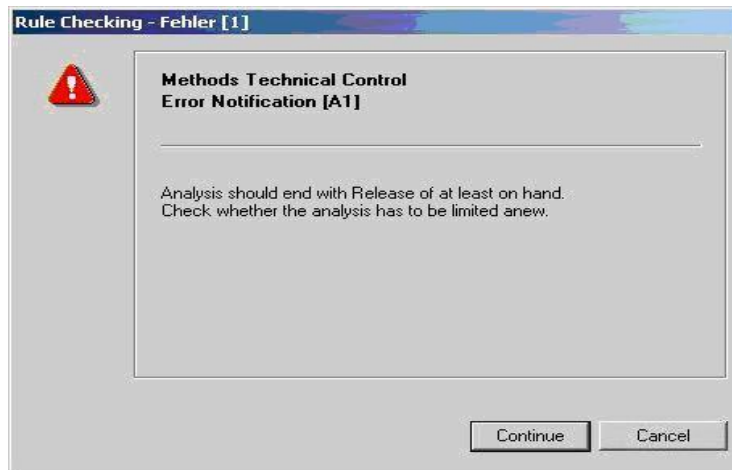


Figure 52: Warning for Rule Checking Violations

Notification

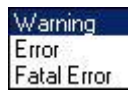


Figure 53: Errors Notification

An internal hierarchy of the messages is implemented in the time analyses. Via the pull-down menu you can set which messages are to be displayed. Messages are classified as Alerts in the rule checking.

Example

- If you select "alert", all messages are displayed, including "error" and "fatal error".
- If you have selected "error", there is no "alert"; instead only "errors" and "fatal errors" are displayed.

3.2.2.8 MTM-2 Tab

MTM 2 analyses are MTM analyses, but MTM 2 analyses have fewer codes. The settings of the other analysis methods are identical with the exception of the rule checking.

MOST		RWF		Value Added				Extras		
General	MTM-1	MTM-1 Rules	MTM-2	MTM-2 Rules	STD	UAS	MEK	AZB	FOR	SAM
Time Type			T''							
Time Unit - Analyzed Times			tmu							
Time Unit - Basic Times			tmu							
Time Unit - TE			min							
Time Unit - TR			min							
Decimal Places - Analyzed Times			2							
Decimal Places - TE			2							
Decimal Places - TR			2							
Decimal Places - Allowances Times			3							
Decimal Places - Analysis Lines: Total Time			2							
Calculation Precision			3							
Decimal Places - Analysis Lines: Time			2							
Datacard: Copy Standard Description			<input checked="" type="checkbox"/>							

MOST		RWF		Value Added				Extras		
General	MTM-1	MTM-1 Rules	MTM-2	MTM-2 Rules	STD	UAS	MEK	AZB	FOR	SAM
Rule Checking Monitoring <input checked="" type="checkbox"/>										
Options										
<input checked="" type="checkbox"/> Bend and Arise is always entered in Right Hand column (A3) <input checked="" type="checkbox"/> Combined Actions: Get/Put Weight is not limited out (A8) <input checked="" type="checkbox"/> Eye Action is always entered in Right Hand column (A1) <input checked="" type="checkbox"/> Get Weight should be associated with Get or Put (A4) <input checked="" type="checkbox"/> Put Weight must have an associated Get Weight preceding it (A7) <input checked="" type="checkbox"/> Put Weight should be associated with Put (A5) <input checked="" type="checkbox"/> Regrasp should not be assigned in conjunction with Apply Pressure (A6) <input checked="" type="checkbox"/> Step is always entered in Right Hand column (A2)										
Area Of Vision <input type="text" value="Always ask"/>										
Limiting Action <input checked="" type="checkbox"/>										
Skill <input type="text" value="Worker is well trained"/>										
Time Update: Use Rules from <input type="text" value="Configuration"/>										

Figure 54: Settings; Tab MTM-2 Rule [I]

3.2.2.9 Value Added Tab

General		MTM-1	MTM-1 Rules	MTM-2	MTM-2 Rules	STD	UAS	MEK	AZB	FOR	SAM
MOST		RWF		Value Added				Extras			
Activated	<input checked="" type="checkbox"/>										
Multiselection	<input checked="" type="checkbox"/>										
Display Format	<input type="text" value="Name"/>										
Decimal Places - Times	<input type="text" value="2"/>										
Decimal Places - %	<input type="text" value="3"/>										

Figure 55: Value Added Tab

Activated

These settings refer to the page Line. You can use these settings to activate or deactivate the value added for all analysis methods.

Multiselection

These settings refer to the page Line. Activate this property if you want to select several value added entries simultaneously. More than two value added entries (value added and non-value-added) should be available for this. For example, another entry could be Logistics. By using multiple selections you can mark this work step as non-value-added as well as belonging to Logistics.

Display Format

These settings refer to the page Line. Here you can set how the value added entries are displayed.

Example

Short name – Name Name

value added	non-value-added	value added	non-value-added
<input type="checkbox"/>	NVAP - Unproduktiv	<input type="checkbox"/>	Unproduktiv
<input type="checkbox"/>	NVAW - Gehen	<input type="checkbox"/>	Gehen
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	

Figure 56: Display Format

Decimal Places - Times and Decimal Places - %

These settings refer to the page Value added. Here you can set the number of decimal places for the times displayed on the page Value added.

Example

Decimal Places - % = 2, Decimal Places - Lines= 2 Decimal Places - % = 3; Decimal Places - Lines = 4

DecimalPlaces[%]	DecimalPlaces[Lines]	DecimalPlaces[%]	DecimalPlaces[Lines]
21.74	6.93	21.738	6.9300
78.26	24.95	78.262	24.9500

Figure 57: Set Decimal Places

3.2.3 Enhancements in MTM-I and MTM-II**MTM-1 Rule Checking Notification Dialog**

- 1) Open the STM Plantype Settings via the context menu. *Please refer to the Figure 30.*
- 2) Click MTM-2 tab The following dialog apperas. *Please refer to the Figure 58.*

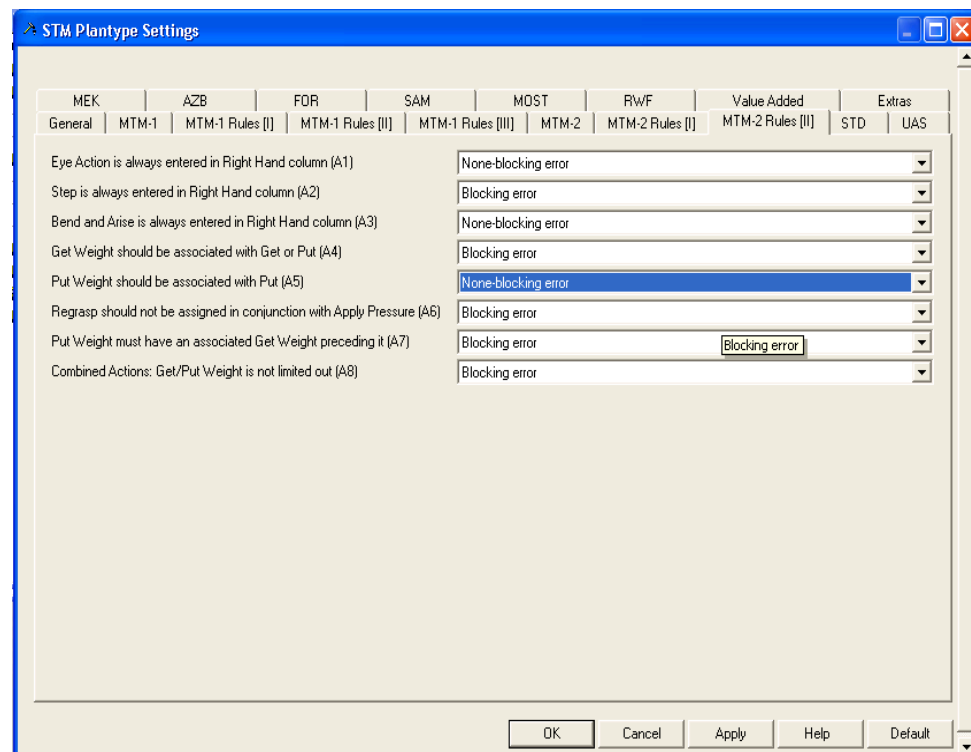


Figure 58: MTM-2 Dialog

- 2) Configure the Blocking' and 'Non-blocking' for MTM-2.
- 3) Create a MTM time analysis. Open time analysis.

- 4) Enter some codes in the left hand column. For example, Line 1 "M20A"
Line 3 "R30C".

Analysis Lines | Basic Data | Long Text |									
	Description	Frequency	M	Code L.H.	Time (tmu)	Setup Time (tmu)	Code R.H.	M	Frequen
1	Move	1		M20A	9,60				
3	Reach	1		R30C	14,10				
5									

Figure 59: Time Analysis

- 5) Calculate the time analysis. A rule checking dialog is displayed.

MTM2: PC, GC, PB, or GW should not be hidden during Body Motions

- 1) Create a MTM-2 time analysis. Open time analysis.
2) Enter some codes in the left hand column. For example, Line 1 "(" "B"
Line 3 "(" "PC45")

Analysis Lines | Basic Data | Long Text |									
	Description	Frequency	M	Code L.H.	Time (tmu)	Setup Time (tmu)	Code R.H.		
1									
3	#Stoop, Arise	1	(	B	61,00				
5	#Place	1	(	PC45	36,00				
7									

Figure 60: Time Analysis

- 3) A dialog appears. Confirm the diaog with **Yes**.

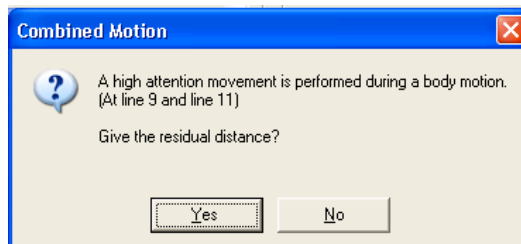


Figure 61: Combined Motion Dialog

- 4) Calculate the time analysis.

Analysis Lines | Basic Data | Long Text |									
	Frequency	M	Code L.H.	Time (tmu)					
1	1	(	B	50,83					
3	1	-(	PC45						
5	1		PC5	17,50					

Figure 62: Time Analysis

A dialog is displayed asking whether to insert the remaing motion or not. Depending on the choice there are these results.

- Result with remaining motion

Analysis Lines | Basic Data | Long Text |									
	Description	Frequency	M	Code L.H.	Time (tmu)	Setup Time (tmu)	Code f		
1									
3	#Stoop, Arise	1	(	B	61,00				
5	#Place	1	-(	PC45					
7	#Place	1		PC5	21,00				
9									

Figure 63: Result with Remaining Motion

■ Result without Remaining Motion

Analysis Lines | Basic Data | Long Text							
	Description	Frequency	M	Code L.H.	Time (tmu)	Setup Time (tmu)	Code R.H.
1							
3	#Stoop, Arise	1	(	B	61,00		
5	#Place	1	{	PC45			
7							

Figure 64: Result without Remaining Motion

Add Code PW2 in MTM2

- 1) Create a MTM-2 time analysis. Open time analysis.
- 2) Enter a code in the left hand column. For example, "PW2" or "PW7"

Only factors of 5 are valid e.g "PW5", "PW10", "PW15" etc. The maximum limit is for PW/GW is 50.

- 3) A dialog is displayed on non factor 5 values.

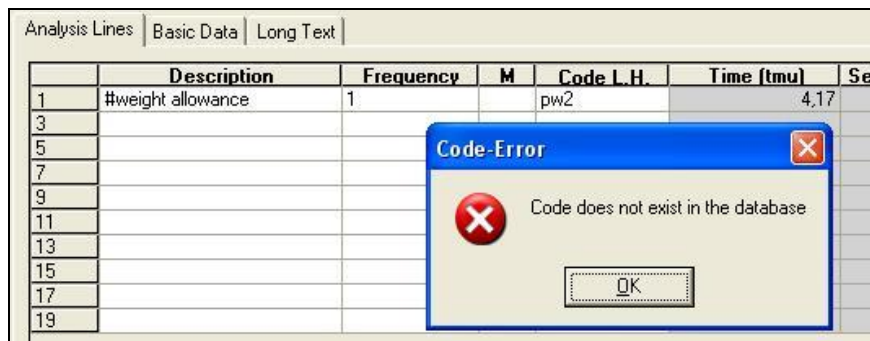


Figure 65: Code Error Dialog

Configuration Options

- 1) Open STM plantype settings of plantype set. *Please refer to the Figure 36.*
- 2) Select options 1-4 to customize time analysis presentation.

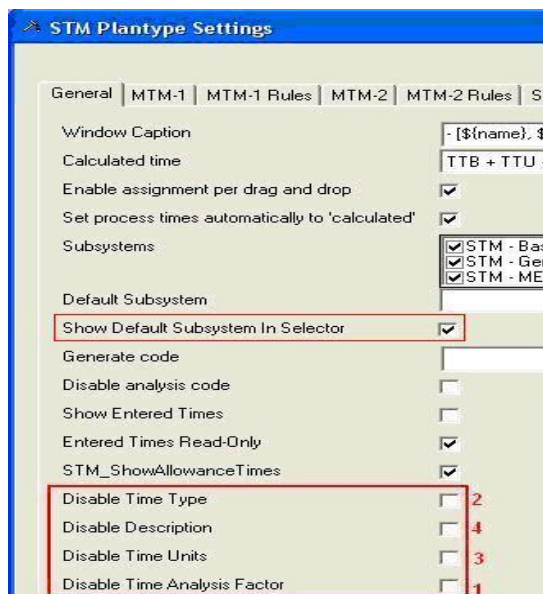


Figure 66: Customize Time Analysis Factors

- 3) Create any time analysis and open the time analysis.

The controls 1-4 are enabled/disabled as configured in STM plantype settings of the plantype set. Also make sure the cursor is placed at the right hand code column at the first line.

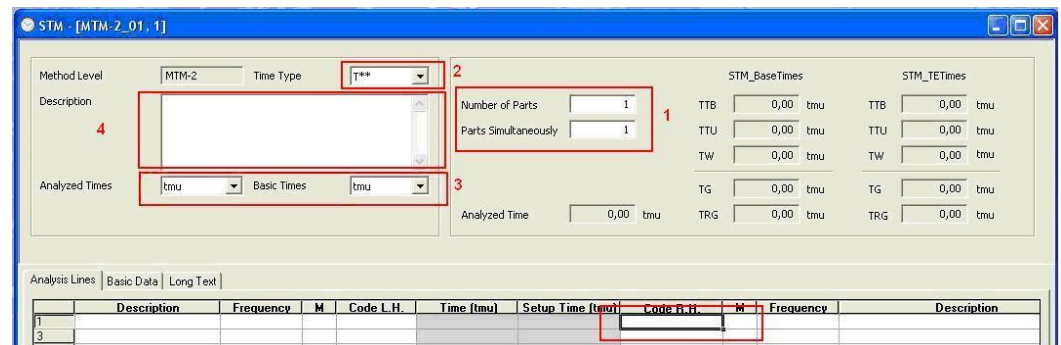


Figure 67: Window with Disabled/Enabled fields as Configured in Plantype Settings

- 4) Check **Show Default Subsystem In Selector**. Please refer to the [Figure 66](#).

Example

In below example subsystems MTM-1, MTM-2 and UAS are checked. UAS is the default subsystem whereas MTM-1 and MTM 2 can be selected as an alternative. On creating a time analysis a dialog is displayed where UAS is pre selected and MTM-1 and MTM-2 are in the list.

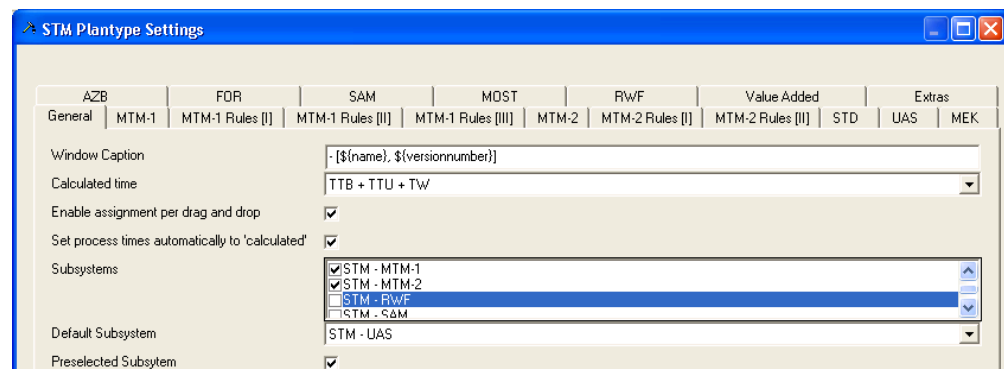


Figure 68: Example - Subsystems

3.3 Databards

DELMIA Process Engineer® supplies databards for individual analysis systems and their time component codes; these databards provide the time values in a clear form and thus increases the efficiency of the analysis process. In addition DELMIA Process Engineer® permits the creation of custom databards. This makes it possible to integrate company-specific data conveniently and quickly into the process analyses.

The graphic databards permit the quick and efficient creation of sequence descriptions to manual and partially automated workplaces.

3.3.1 Databards in the DELMIA Process Engineer®

Databards are available in the DELMIA Process Engineer® for the following analysis methods:

MTM-1, MTM-2, MEK, STD, UAS, and SAM

3.3.1.1 Example: MTM-I Datacards

The MTM-I datacards consist of "MTM-I data", "MTM-I manual", and "MTM-I body":.

- Databcard "MTM-I manual" describes activities of the hands and arms as well as area of vision functions.
- Databcard "MTM-I body" defines body, leg, and foot motions.
- Databcard "MTM-I data" combines the two databcards.

DELMIA Process Engineer® recognizes two different types of MTM-I data-cards:

- The "**normal**" databcard (Figure 69) with abundant information on the table values.
- The "**narrow**" databcards with little or no information on the table values. The "**narrow**" databcards contain all table values of the "green" MTM card. The narrow databcard is suitable for the everyday user of the MTM-I analyses.

The screenshot shows the 'Datacard - MTM1-1' window. It contains several tables for MTM-I activities:

Reach		Position		Body movements	
Case A	R-A	loose	S	Foot movement	FM
Case B	R-B		SS	Foot movement with heavy pressure	FMP
Case C	R-C		NS	Foot movement <= 15 cm	LM15
Case D	R-D		S	Foot movement > 15 cm	LM-
Case E	R-E		SS		
		close	NS	Body turn Case 1	TBC1
			S	Body turn Case 2	TBC2
			SS	Side step Case 1	SS-C1
		tight	NS	Side step Case 2	SS-C2
			S	Walk	W-P
			SS		
		Disengage	D-	Bend, stoop, kneel on one knee	B
			T-	Arise	AB
				Kneel on both knees	KBK
		Apply pressure	without Regrasp	Arise	AKBK
			APA	Sit down	SIT
			APB	Stand up	STD
		Eye-actions		restricted	PTU-
				unrestricted	PTB-

Other sections include Grasp (Get, Regrasp, Transfer, Selecting-grasp, Contact, Bring), Release (Open Fingers, Release contact), and Process time. A pop-up dialog 'M-A-' is shown on the right with buttons M-A-, M-B-, M-C-, SC-, and Cancel. Another dialog 'M-A-' is shown below it with fields for Distance and Weight, and buttons OK and Cancel.

Figure 69: MTM-I Datacard

3.3.1.2 Example of a UAS Databcard

Different types of UAS databcards are also available. The databcard with little or no information on the table values is used in the standard implementation. This databcard is suitable for the everyday user of UAS_analyses. Furthermore the area for the analysis lines remains open with this type of databcard.

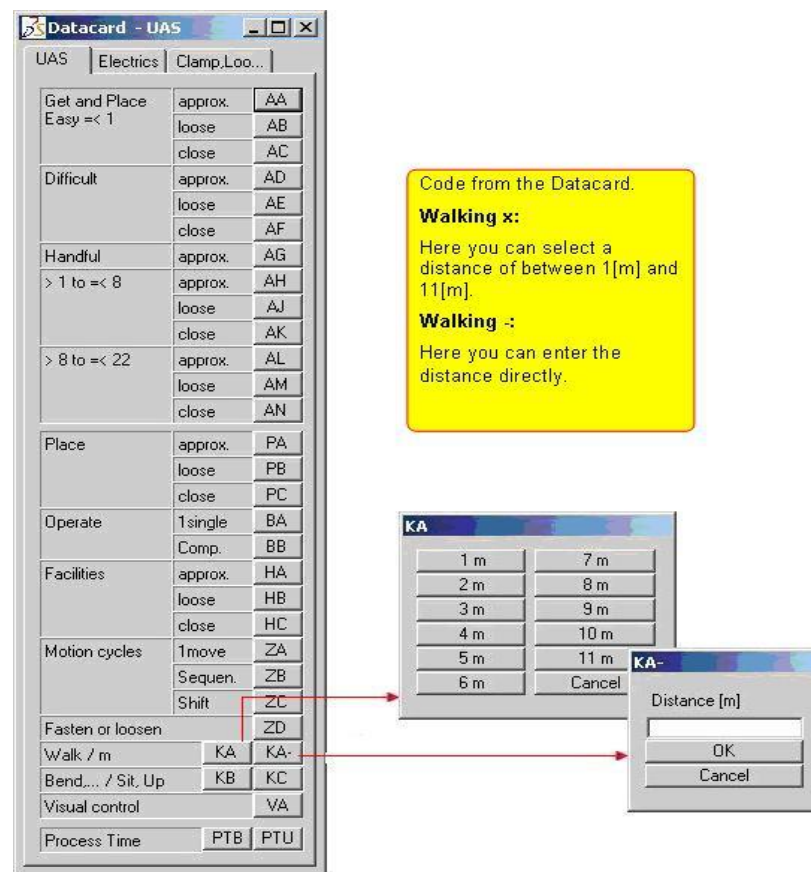


Figure 70: UAS Datacard

3.3.2 Creating New Datacard/Datacard Groups

You can create datacards and datacard groups in the directory Datacards in the system library.



Figure 71: Datacard Directory

To Create New Datacards

- 1) Open the directory Datacards in the system library.
- 2) Select **Datacard < New < Datacard**.

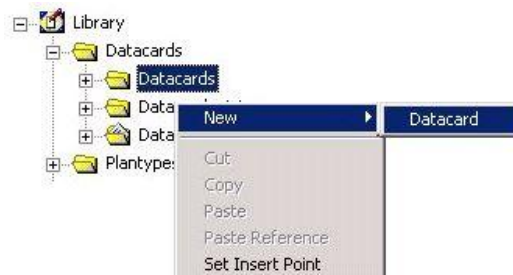


Figure 72: Create New Datacard

- 3) Enter the following values in the properties dialog of the datacard.
- 4) The datacard can be assigned any name under **Name**.
- 5) The text entered under **Description** is later displayed in the tab of the datacard.
- 6) The subsystems for which the datacards are available are entered under 'subsystem'. If several subsystems are entered, the individual short names of the subsystems are entered so that they are separated with a comma. **Subsystems** refer to the individual process analysis methods.

For customer defined datacards enter MOST/SAM in **Subsystems**.

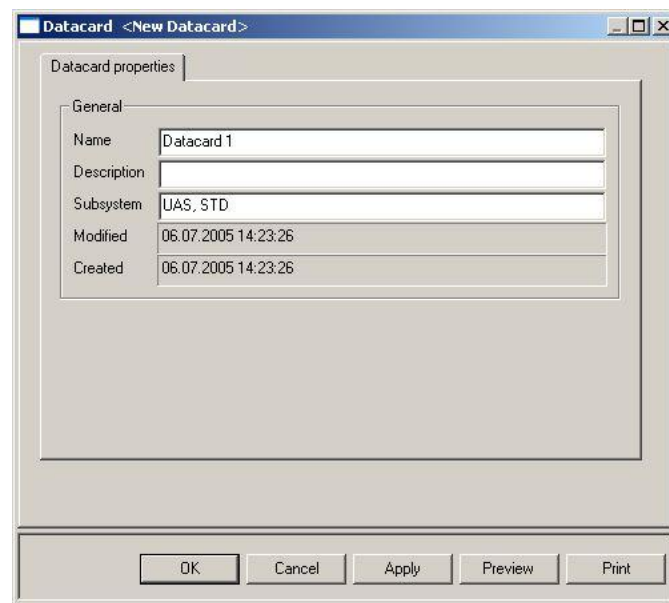


Figure 73: Datacard Properties Dialog

- 7) Select **Edit Datacard** in the context menu in order to edit the datacard.

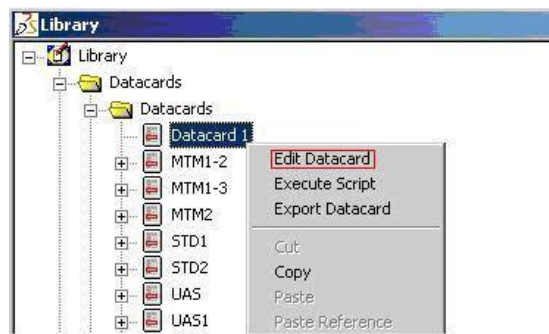


Figure 74: Edit Datacard

- 8) The **Datacard Editor** dialog appears. The properties **Name**, **Description**, and **Subsystem** can be edited in the dialog that appears. The source code of the datacard can be edited in the input field **Source Text**.

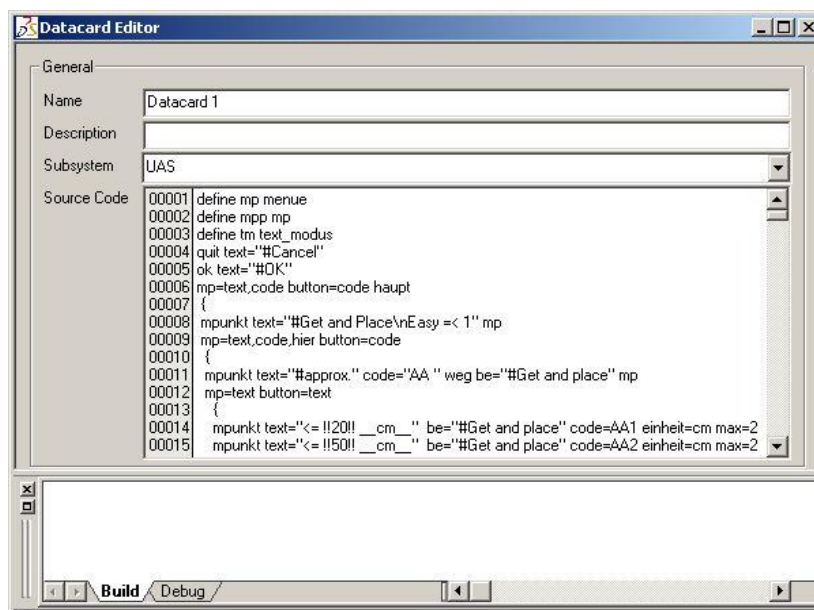


Figure 75: Datacard Editor

A new menu item and new icon bars feature here.

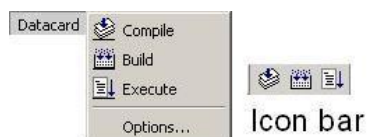


Figure 76: Menu Items and Icon Bar

- 9) Select the menu item **File < Save** in order to save all changes.

Options...

- 10) If the field **Save Before Execution** is activated in the properties, the changes are saved whenever the menu items **Datacard < Compile**, **Datacard < Create** or **Datacard < Execute** are selected.

- 11) If the menu item **Datacard < Execute** is selected, the datacard is executed and displayed in a separate window. As soon as the code is selected, its parameters appear in the output window of the datacard editor.

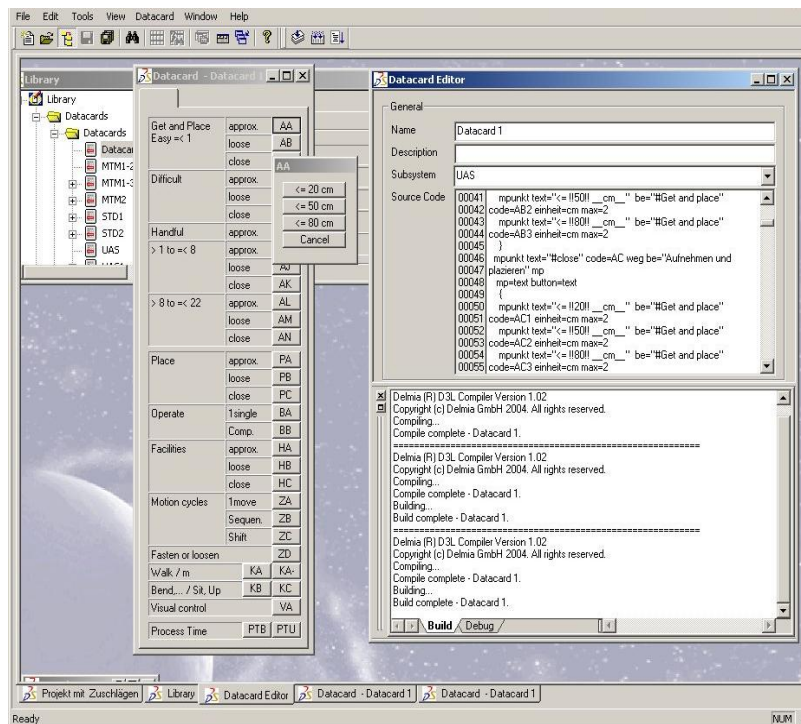


Figure 77: Datacard Execute

To Create New Datacard Groups

- 1) Open the directory Datacards in the system library.
- 2) Select **Datacard groups < New < Datacard group** (Please refer to the [Figure 72](#)). The **Datacardgroup properties** dialog appears.
- 3) The datacard group can be assigned any name under **Name**.
- 4) The subsystems for which the datacard group is available are entered under **Subsystem**. If several subsystems are entered, the individual short names of the subsystems are entered so that they are separated with a comma.

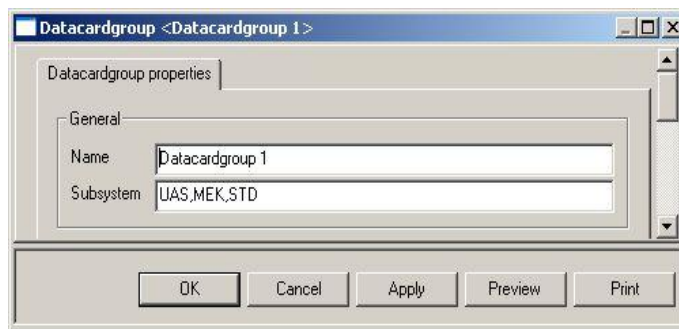


Figure 78: Datacard Group Properties

- 5) If you want to edit a datacard group select **Edit Datacardgroup** in the context menu.

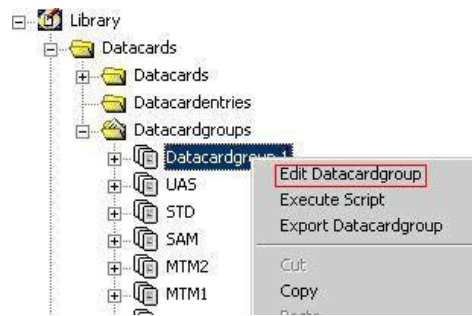


Figure 79: Edit Datacard Groups

- 5) The **Datacardgroup Editor** dialog appears. Datacards can be edited in the datacard group editor. *Please refer to the [Figure 80](#).*
- 6) The subsystems that receive access to the datacard group can be selected in the selection list **Subsystem**.
- 7) The available datacards appear on the right side under **Available datacards**, corresponding with the marked subsystems.

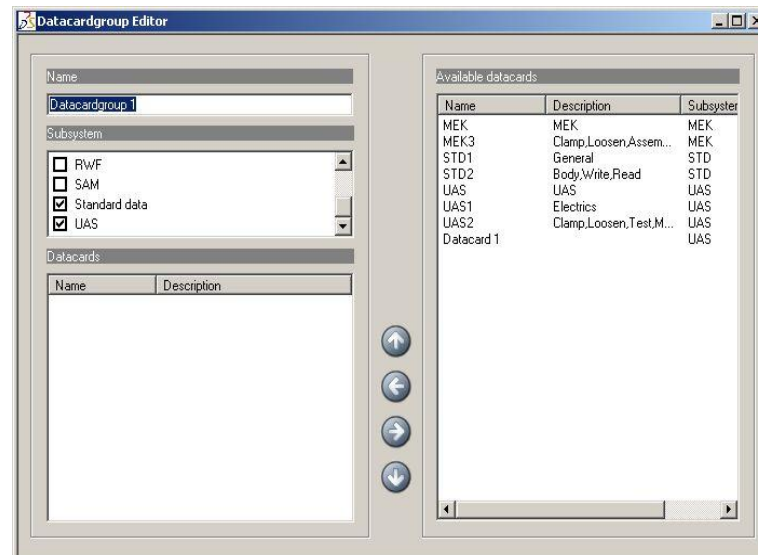






Figure 80: Datacard Group Editor

- 8) These can be assigned by a double-click or by pressing the push button . The assigned datacards are listed in the list view **Datacards**.
- 9) You can use the push button  to remove the marked datacards from the set. These removed datacards are then listed in the **Available datacards**.
- 10) In order to change the sequence of the datacards in the compilation, they must be marked and moved upward or downward either with the corresponding push buttons in the list   or by drag and drop.
- 11) If a subsystem is deactivated, the corresponding datacards are removed from the editor – the tab **datacards** and the tab **Available datacards** are removed.
- 12) The changes made are saved via the menu item **File < Save**.

3.3.3 Opening, Importing, and Exporting a Datacard

To Open Datacards

If you want to open a datacard, you must first open a process analysis.

- 1) Select a process in the process structure.
- 2) Open the context menu by right-clicking and select **Edit (Create) Time Analysis**.

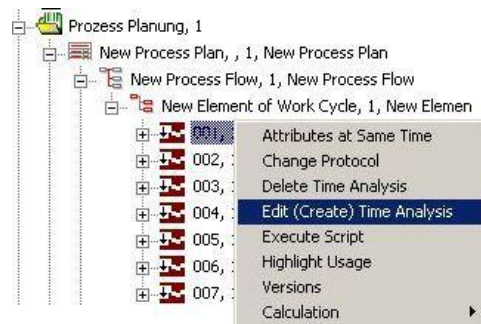


Figure 81: Open Process Analysis





- 3) Select , the subsystem (process analysis method or datacard group) from the selection list under the icon for datacards.
- 4) All available datacards for datacard groups and process analysis methods are displayed in the selection list.
- 5) The last selected subsystem is opened every time the icon  is activated.
- 6) If a subsystem is selected the datacard is opened in a separate window.



Figure 82: Example: Datacard

- 7) If only one code is selected from the datacard, it is entered in the analysis lines of the process analysis.

STM - [Prozessanalyse 1, 1]

Method Level: UAS Time Type: T**

Description: 001

Number of Parts: 1 TTB: 50.0000 tmu

Parts Simultaneously: 1 TTU: 0.0000 tmu

Tw: 0.0000 tmu

TG: 50.0000 tmu

TRG: 0.00 tmu

Analyzed Time: 30.00

Analysis Lines: Basic Data Long Text

code from datacard

	Description	H	P	D	Code	Time (tmi)	Tim	Frequen	Total Ti	VA	NVA
1	Caption				*					<input type="checkbox"/>	
2	Aufnehmen und Plazieren				AA1	12.00	1	12.00		<input checked="" type="checkbox"/>	Unproduktiv
3	Caption				*					<input type="checkbox"/>	
4	Get and place				AB1	18.00	1	18.00		<input type="checkbox"/>	
5	Get and place				AC1	24.00	1	24.00		<input checked="" type="checkbox"/>	
6	Get and place				AL1	48.00	1	48.00		<input checked="" type="checkbox"/>	

Figure 83: Use Code from Datacard

To Import Datacards/Datacard Groups

- 1) Select **Tools < Import < Datacards...** in order to import datacards and datacard groups.

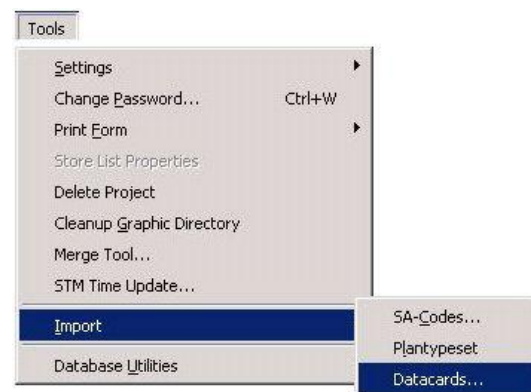


Figure 84: Importing Datacards

- 2) In the subsequent dialog the XML files to be imported (which contain the datacards/datacard groups) are selected. *Please refer to the Figure 85.*

The datacards are re-compiled when they are imported via the graphic interface, but they are not re-compiled when they are imported with the tool **dcimex**. *Please refer to the Figure 87.*

Notes on Importing

New objects are created in the database whenever datacards and datacard groups are imported. If several datacard groups with the same datacard have been exported, the previously identical datacards exist in duplicate with different poet-IDs in the database after an import. In order to prevent this, all datacards/datacard groups must be in one file.

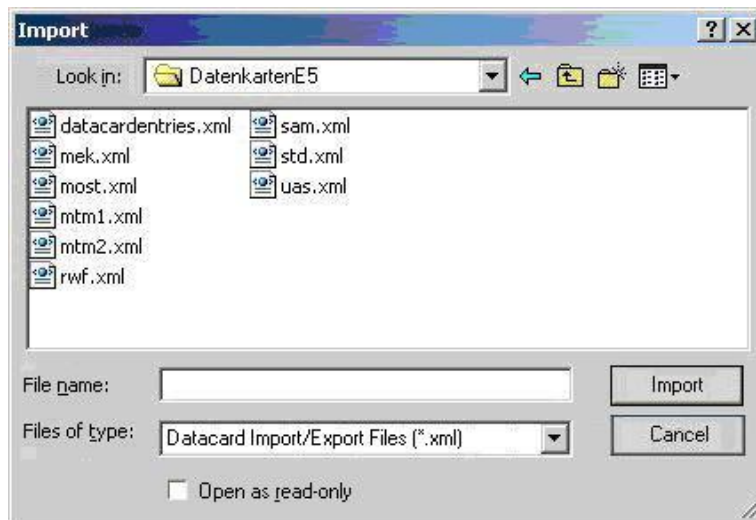


Figure 85: Select XML Files

To Export Dacards/Dacard Groups

- 1) Select the dacard.
- 2) Open the context menu with the right mouse button by clicking on a selected dacard or dacard group.
- 5) Select either **Export dacard** or **Export dacard group**.

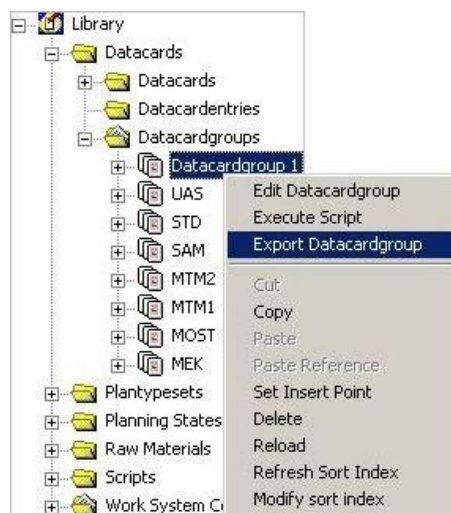


Figure 86: Export Dacard Group

- 6) The **Export** Dacard dialog appears. Specify the directory and the name of the target file in the dialog.



Note

When exporting dacard groups, the corresponding dacards are also exported.

3.3.4 Import - Export in Batch Mode; "dcimex.exe" Tool

You can use the tool "dcimex" to import dacards into the database in batch mode (via the input prompt). The database settings for this are taken from the

registration editor. Only the user name, the corresponding password, and the file to be imported need to be specified as transfer parameters.

```

C:\WINNT\system32\cmd.exe
D:\ep_enext_pe512\ergoplan-pe512_vot\ergoplan\bin\debugu>dcimex -u=admin -p=admin
n D:\ep_enext_pe512\ergoplan-pe512_vot\ergoplan\epclient\ergotime\datenkarten\dk
_standard\uas.xml
*** DCIMEX 1.0 (R12) - Copyright (c) 2003 DELMIA GmbH ***

Progress: 100%

Import result:
    3 Datasheets
    1 Datasheetgroups
Object(s) successfully imported.

D:\ep_enext_pe512\ergoplan-pe512_vot\ergoplan\bin\debugu>

```

Figure 87: Example for the Tool "dcimex"

Examples:

Use the switch **-h** or **-help** to find out which parameters you can use.

Decimex -h or decimex -help

```

D:\DELMIA\PPRServer\program\bin>dcimex -h
Usage: DCIMEX [-u username] [-p password] [FILE] -h
Import datasheets/-groups and -entries into database.

-u username  Username used for login
-p password  Password used for login
-v           Print version information and exit
-h           Display this usage information and exit.

Example: DCIMEX -u "admin" -p "admin" import.xml

```

Figure 88: Decimex -h or decimex -help

Example of File Import:

dcimex -u=admin -p=admin uas.xml

dcimex -username=admin -password=admin uas.xml

3.3.5 Customer Defined Data Cards for Subsystems

Perform the following steps to create customer defined data cards for MOST and SAM. The steps for creating both the cards remain same.

- 1) Create a new datacard. *Please refer to the [Create New Datacard](#).*
- 2) Enter the datacard properties and make it a MOST data card.

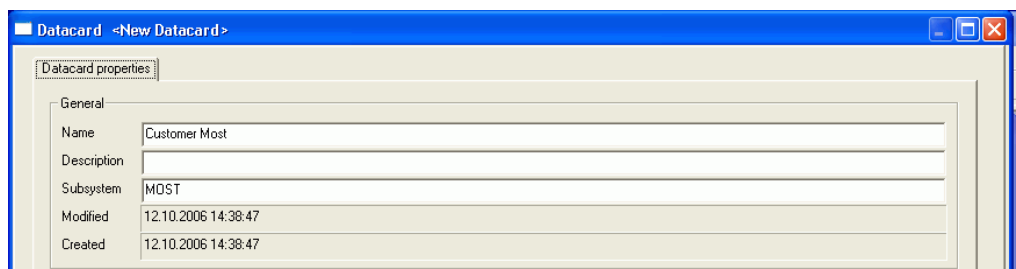


Figure 89: MOST Datacard

- 2) Create datacard group. *Please refer to the [Create New Datacard Group](#).*

- 4) Select the data card 'Customer Most' from the right side to the left side to make it active.
- 5) The standard MOST/SAM data card is displayed in a separate window, not in the same like the user defined one.

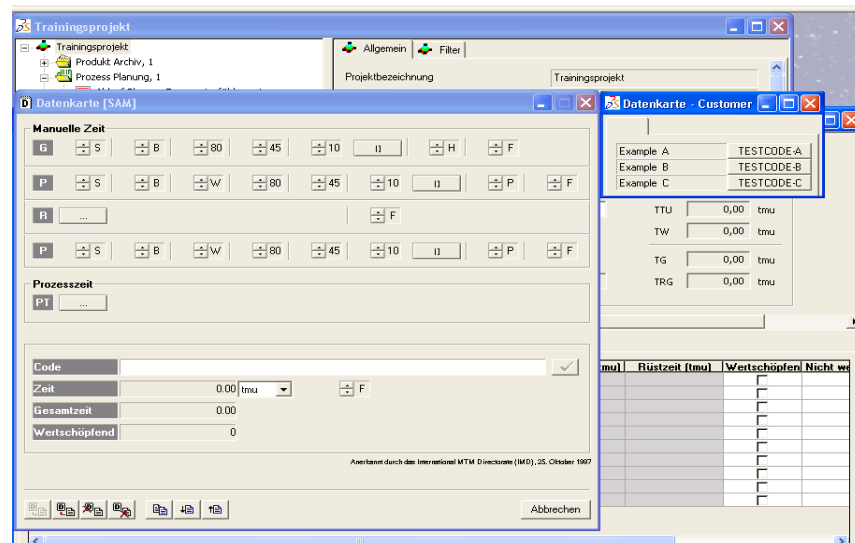


Figure 90: MOST Data Card Displayed in a Separate Window

- 7) Three digit numbers are displayed in MOST datacard index number list when size of windows system font is changed. To change system font, right click on windows desktop. Open **Properties** < **Appearance** < set font size to **Extra Large Fonts**.

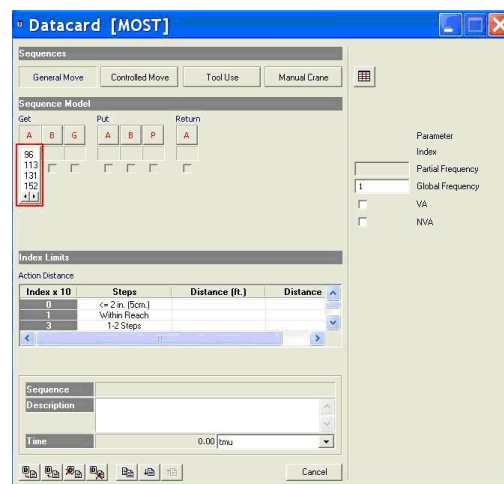


Figure 91: Display of Index Number List

3.4 Formula Assistant

This section discusses how to activate and use the formula assistant.

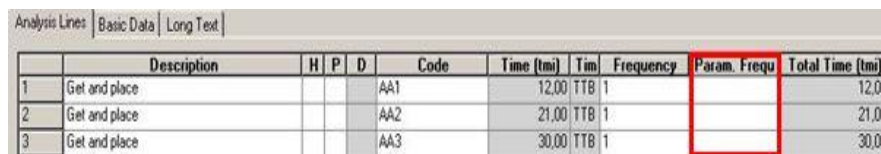
3.4.1 Activating the Formula Assistant

Follow the steps described below to activate the Formula Assistant:

In the DELMIA directory for the \\PPRServer\data\STM\ server, three .xml files are available: *stm.xml*, *stm_allowance.xml*, and *m_parameter.xml*.

The layout of analyses can be managed by means of the *stm.xml* file. The default setting does not allow for a parameter to be entered in the XY-column or allowances to be shown in the TE-Times column.

- 1) To activate the Formula Assistant you must rename the *stm_parameter.xml* file found in *stm.xml*. This results in the availability of a new column in the Line tab.



Analysis Lines | Basic Data | Long Text										
	Description	H	P	D	Code	Time (tmi)	Tim	Frequency	Param. Frequ	Total Time (tmi)
1	Get and place				AA1	12,00	TTB	1		12,00
2	Get and place				AA2	21,00	TTB	1		21,00
3	Get and place				AA3	30,00	TTB	1		30,00

Figure 92: New Column in Lines Tab

The *stm_param.reg* file is found in the same (\\PPRServer\data\STM\ directory. Run this file.

Two new entries are found under the settings for analyses:



STM_ShowAllowanceTimes	<input checked="" type="checkbox"/>
STM_ShowParamFrequency	<input checked="" type="checkbox"/>
STM_ParamFreqPrefix	<input type="text"/>
STM_ConfirmAnalysisDeletion	<input checked="" type="checkbox"/>

Figure 93: New Settings for Analyses



In addition to this, the Formula Assistant icon is active the next time an analysis is opened.

This explains the warning mentioned at the beginning of this section. To show the TE-Times column, the *stm_allowance.xml* in *stm.xml* must be renamed. It is not possible to combine the *stm_allowance.xml* and *stm_parameter.xml* files. Only one of the two options can be active.




Caution

It is not possible to display the Formula assistant and the Parameter Frequency column with the TE-Time column and the allowance addition simultaneously on Base times. Only one function can be active at a time.

3.4.2 Using the Formula Assistant

The **STM_ShowParamFrequency** function must be activated to call up the Formula Assistant. This function can be found under the settings for analyses in the plantype set.

- 1) Open an analysis.
- 2) Activate  icon in the Analysis toolbar.
- 3) The Formula Assistant opens. Please refer to the [Figure 94](#).

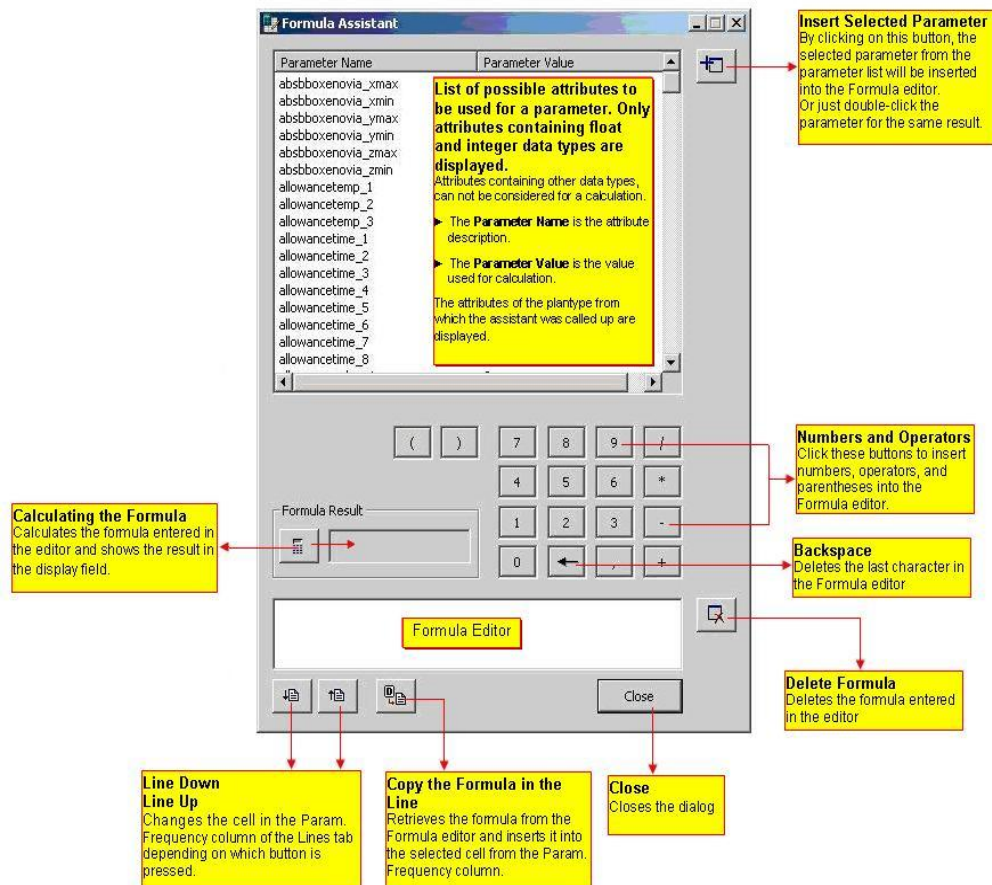


Figure 94: Formula Assistant

The Formula Assistant can be used to extend the analysis code with the assistance of predefined attributes.

The **Frequency** column can be used to enter the frequency with which the time component is utilized in the analysis. However, formulas can also be entered in the **Frequency** column. Theoretically you may use all functions as described for creation of macros. In practice, however, using all these functions does not make sense and in most cases it is sufficient to use the four basic calculation options. This also applies to the Formula Assistant.

The Formula Assistant overwrites the formulas entered in the **Frequency** column. The formula created with the assistance of the Formula Assistant is entered in the **Param. Frequency** column. At the same time, the values for the formula are entered in the **Frequency** column and marked as write-protected.

This is illustrated by the following example:

The following three analysis lines are found in a UAS analysis:

Code	Time (tmi)	Tim	Frequency	Param. Frequ	Total Time (tmi)
AA1	12,00	TTB	1		12,00
AA2	21,00	TTB	1		21,00
AA3	30,00	TTB	1		30,00

Figure 95: Analysis Lines in UASAnalysis

The first cell is selected in the **Param. Frequency** column.

The Formula Assistant is opened and the formula described is created.

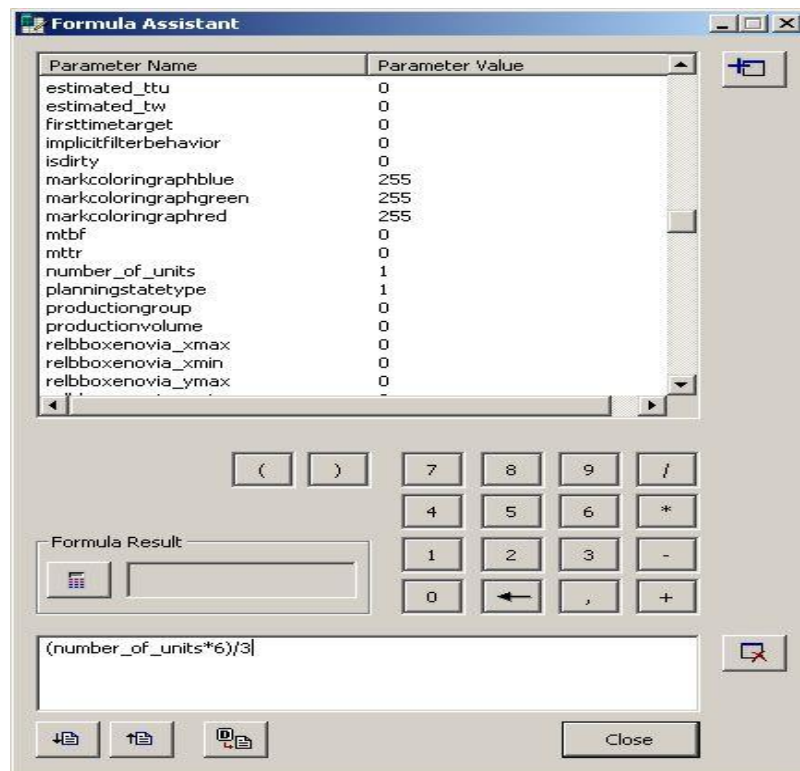


Figure 96: Formula Assistant



After creating and calculating the formula, press the button **Copy the formula in the line**.

- 4) The formula created is now written into the selected cell of the **Param. Frequency** column.
The values of the formula are in the frequency column and the cells are shaded grey.
The Formula editor in the Formula Assistant is empty and the second cell of the column is selected.
The Total Time has been increased by the formula value.
- 5) A new formula is created in the Formula Assistant and the **Copy the formula in the line** button is pressed.

Code	Time (tmi)	Tim	Frequency	Param. Frequency	Total Time (tmi)
AA1	12,00	TTB	(1,000*6)/3	(number_of_units*6)/3	24,00
AA2	21,00	TTB	(4+2)/3	(4+2)/3	42,00
AA3	30,00	TTB	1		30,00

Figure 97: New Formula

- 6) The formula created is now written into the second cell of the **Param. Frequency** column.
The values of the formula are found in the frequency column and cells are shaded grey.
The Formula editor in the Formula Assistant is empty and the third cell of the column is selected.
The Total Time has been increased by the formula value.



With the assistance of both the **Line down** and **Line up** buttons, the formula can be removed from the **Param. Frequency** column and be reloaded in the Formula Assistant.



When working with the Formula Assistant, notice the large number of parameters in the parameter list that often have the value of zero. Most of these parameters are therefore not suitable for creating formulas.

STM_ParamFreqPrefix Function

The settings for analyses have been extended by a further entry that can be used as the Formula Assistant is activated, the **STM_ParamFreqPrefix** function. To use this function, enter the first letter of the parameter to be seen in the Parameter list of the Formula Assistant.

STM_ParamFreqPrefix allowancetime_

Figure 98: STM_ParamFreqPrefix Function

Once the Formula Assistant has been opened, only the attributes in the parameter list that begin with test are available. This setting enables the use of displayed Parameter only. All other attributes are no longer suited for a parameter.

Parameter Name	Parameter Value
allowancetime_1	0
allowancetime_2	0
allowancetime_3	0
allowancetime_4	0
allowancetime_5	0
allowancetime_6	0
allowancetime_7	0
allowancetime_8	0

Figure 99: Parameter List Attributes

In [Figure 99](#), three new attributes have been created including values at the STM – UAS plan type.



For more information for description of how attributes are created and edited is found, *Please refer to the [Administration Manual](#).*

Comment on Attributes

The only attributes used are those from the plantype utilized to open the assistant, or in other words, from the **Time Analysis** type. Attributes from other plantypes (i.e. processes) cannot be used.

Tips for Working with the Formula Assistant

A negative result from the Formula Assistant cannot be evaluated. The following error message appears when calculating the formula.



Figure 100: Wrong Value

Only the parameters found in the Parameter list can be used. All mathematical functions, including those used to create macros, can be utilized when working with the Formula Assistant. *Please refer to the [Creating Formulas \(Macros\)](#) and [Procedures and Functions](#).* An incorrect parameter or any mistakes occurring while entering the formula are recognized during calculation. For example, the formula contains: *sinus(test_dbl2*

Two errors are noticed: The sinus' function is not recognized by the Formula Assistant and the closing parenthesis is missing. During calculation the following error message appears:



Figure 101: Error in Parameterized Formula

Correct this error by using the appropriate spelling for the sinus function *sin(test_dbl2*.

Following the correction, the missing parenthesis is recognized as an error.



Figure 102: Wrong Value

Before copying the formula into the analysis, it is always advisable to check the calculation. By doing this any errors can easily be identified and removed.

3.5 Distance Component

3.5.1 Measuring Distance via Graphics

In DELMIA Process Engineer® it is possible to design workplaces (stations and work systems) graphically and ergonomically. These graphics can be directly used in a process analysis for distance measurement.

The graphics can be used in MTM-I, UAS, or MEK analyses.

Procedure

- 1) Check whether this station/workplace has a graphic assigned to it.
- 2) Drag the workplace group to a process analysis in the **project library**. The search for a suitable process analysis is facilitated if you have filled out the Code input field on the **Header data** tab.
- 3) Select a relation.

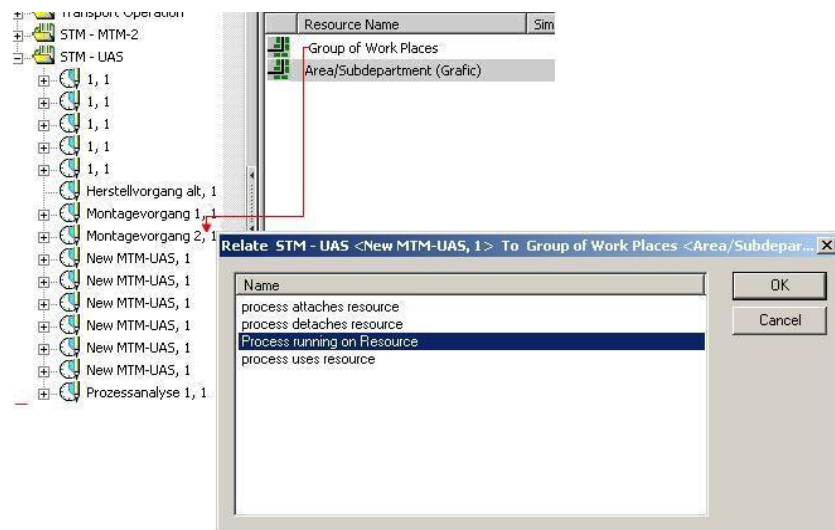


Figure 103: Link a Resource with a Process Analysis

The preliminary work is thus complete.

- 4) Open the process analysis on the process.
- 5) The entry **Activate measurement tools** is now unlocked for editing in the Analysis menu. Activate the entry.

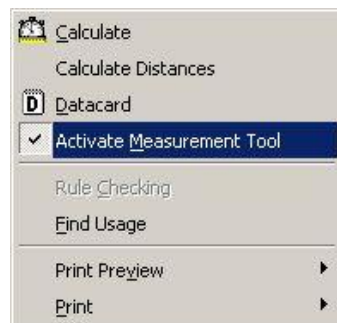


Figure 104: Analysis Menu

- 6) Open the data card and select a code.
The graphic and a dialog for distance input opens.

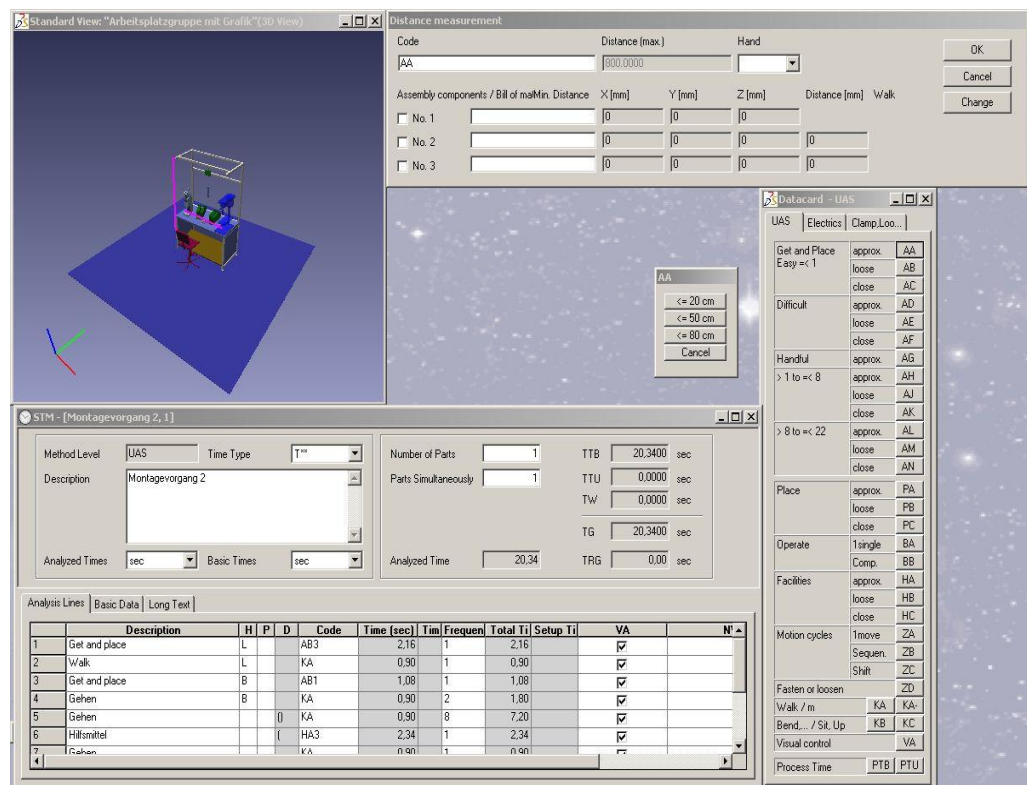


Figure 105: Distance Input

Now you can adapt the analysis procedure to the given or planned conditions using the graphic and the **Distance Measurement** dialog.

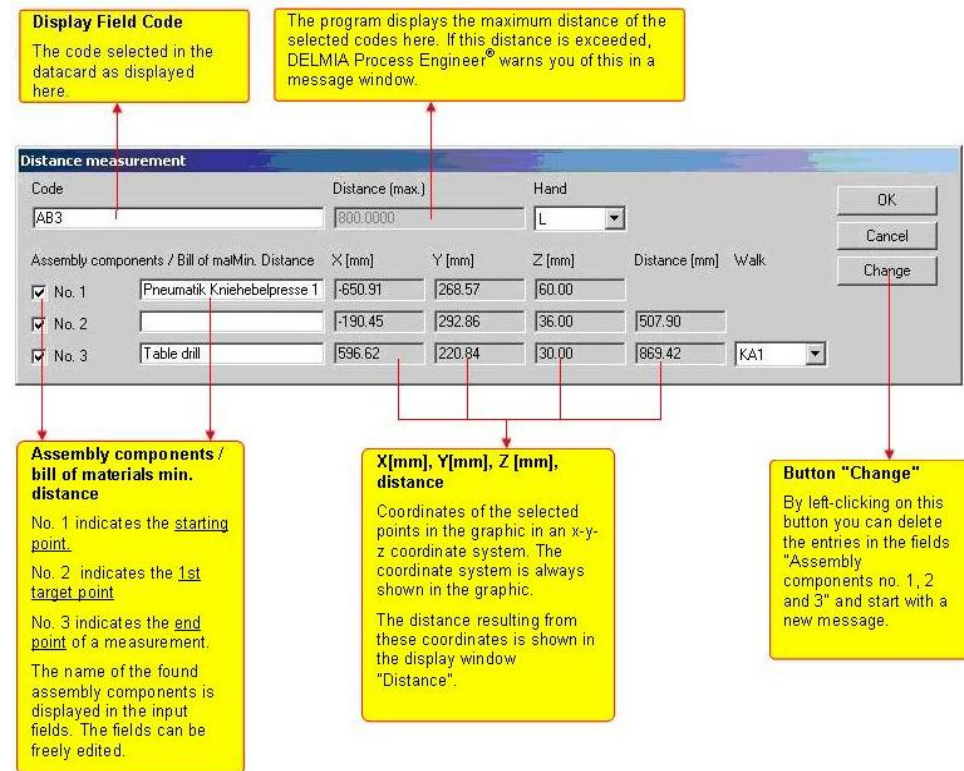


Figure 106: Distance Measurement

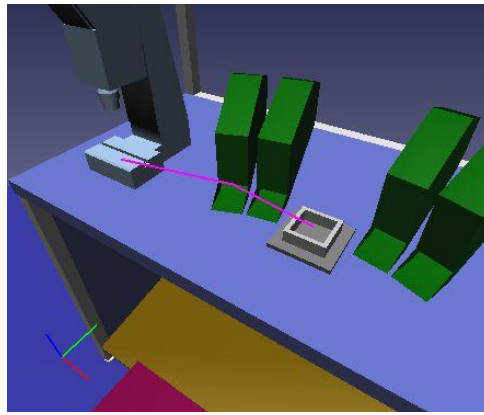


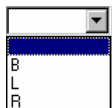
Figure 107: Distance Measurement Graphic

If the distance measurement is to be precise, zoom in on the graphic. The detail level increases along with the zoom factors.

- 7) Select the starting point.
- 8) The selected component is marked in the graphic, the checkbox to point no. 1 is activated, and the name of the marked components as well as their coordinates is displayed.
- 9) Select the end point.
- 10) The selected component is marked in the graphic, the checkbox to point no. 2 is activated, and the name of the marked components as well as their coordinates is displayed. The total distance is displayed at the same time.
- 11) This value is entered into the table if you click **OK**.

If you want to change one of the points, deactivate the corresponding checkbox. Then you can select a new point.

You can leave the graphic mode by switching off the datacard.



Unique Points Regarding the UAS Process Analysis

In UAS process analyses you can choose between the left, right, or both hands in an additional input field.

- 11) If the end point was selected to be larger than the maximum distance, another input field in which the additional KA code is displayed is made available.
- 12) You can also enter an intermediate point for AB and AC codes.
- 13) The starting point and the end point are marked in parentheses () in column E of the table.

The rules applicable to the use of measurement tools are listed in the following sections.

3.5.2 Effect of Changing Graphics in Distance Measurement

If the graphic changes, you get the following message when you open the process analysis.

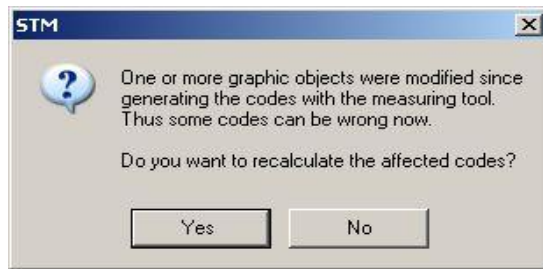


Figure 108: Message when you Open the Process Analysis

If you click **Yes** as a response to the message, DELMIA Process Engineer® try to implement the changes of the graphic in the process analysis as well.

The rules applicable to the use of measurement tools are listed in the following.

3.5.3 Rules for Measuring Distance

Longest motion of a consecutive motion is decisive for the time
For example, picking up of a component with a distance of 10cm and placing with a distance of 25cm.

= AA2

Combined motions (pick up and placing with walking)

Motion lengths that occur immediately after walking motions are analyzed with distance range 1

For example, picking up a part (10cm), walking 2m, placing the part (50cm)

AA 1

KA 2

ABER: Picking up a part (40cm), walking 2m, placing the part (80cm)

AA 2

KA 2

since the motion of picking up is the longer motion, it determines the time period

AUTOMATICALLY ADDING BODY MOTIONS:

If an AA code on the datacard is selected and points in the graphic between which there is a distance larger than 80cm are selected, then

™DELMIA Process Engineer® automatically adds a body motion

KA (with the corresponding number).

Picking up and placing (Axx): 3 points

Starting point (position of the hand before the motion)

1st Target point (position of the when picking up the part)

End point (position of the hand after releasing the part)

Placing: (Pxx): 2 points

Starting point (position of the hand before the motion)

End point (position of the hand after releasing the part)

Handling of auxiliary devices (Hxx): 4 points

Starting point (position of the hand before the motion)

1st target point (position of the hand when picking up the auxiliary device)

2nd target point (position of the hand when placing the auxiliary device)

End point (position of the hand after releasing the auxiliary device)

Actuate: (Bxx): 4 points

Reaching of the actuator component (i.e. the first two points) is in this case essential for the calculation of the motion length

Starting point (position of the hand before the motion).

1st target point (position of the hand when picking up the actuator component)

2nd target point (position of the hand after the first motion of the actuator component)

End point (position of the hand after releasing the actuator component)

The remaining points are nevertheless required for the definition of the position of the following motions.

Cyclic motions (Zxx): 3 points

The necessary motion lengths (i.e. the last two points) required for a simple path are in this case essential for the calculation of the motion length

Starting point (position of the hand before the motion)

1st target point (position of the when picking up the part)

End point (position of the hand after releasing the part)

WALKING (KA) SIMPLE

Starting point (position of the body before the motion)

End point (position of the body after the motion)

= Distance between two points KA (e.g. number = 4)

WALKING (KA) MULTIPLE

Starting point (position of the body before the motion)

1st intermediate point

2nd intermediate point

nth intermediate point

End point (position of the body after the motion)

= sum of all distances KA (i.e. number = 8)s

CALCULATION OF THE DISTANCE:

Since the motion of the human hand is not linear but curved, the distance measured is multiplied by the **factor 1.2**. (except when WALKING)

3.6 Time Update

Time change within an analysis is followed by a test and, if necessary, a new calculation (time tracking) of process time components.



Note

Changes within individual processes are always tracked, regardless of the active settings!.

To do Time Update for a Project Manually

- 1) The property **Allow Time Update** is available in the properties of a project. With it you can set whether this project is taken into consideration in the time update. An update is permitted if the box is checked. These properties make it possible for you to exclude data that should not be changed from a calculation.

Allow Time Update ☐

Figure 109: Project Properties

- 2) Use the time update in order to make changes in imported data, analyses from older versions, or allowance sets take effect. A completely new calculation of the selected project(s) is started whenever the time update is activated.



Note

The time update can be very time intensive in larger projects, and it should therefore be executed only when it is absolutely necessary (For example, after an import).

3.6.1 Starting the Time Update

To Start the Time Update

- 1) The update is started using the menu item **Tools < STM Time Update**.

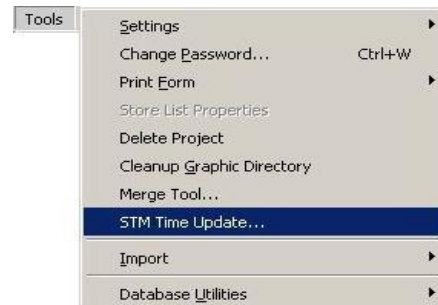


Figure 110: Start STM Time Update

- 2) A **PlanttypeSets** dialog for selecting the planttype set opens. Select a planttype set.
- 3) A **Time Update** dialog with all of the projects that use this planttype set is opened.

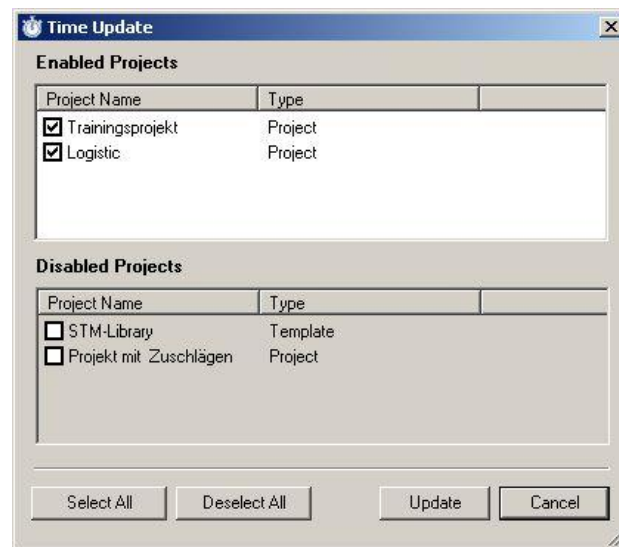


Figure 111: Time Update Dialog

In the lower part of the dialog are all projects that have the property **Allow update** deactivated in the project properties. These projects cannot be selected.

In the upper part of the dialog are all projects that have the property **Allow update** activated in the project properties. For the update you can select an individual project, several at once, or all projects.

- 4) Start the update process using the button **update**. You can cancel the update with the button **Cancel**.

The progress of the update is displayed in the following dialog.

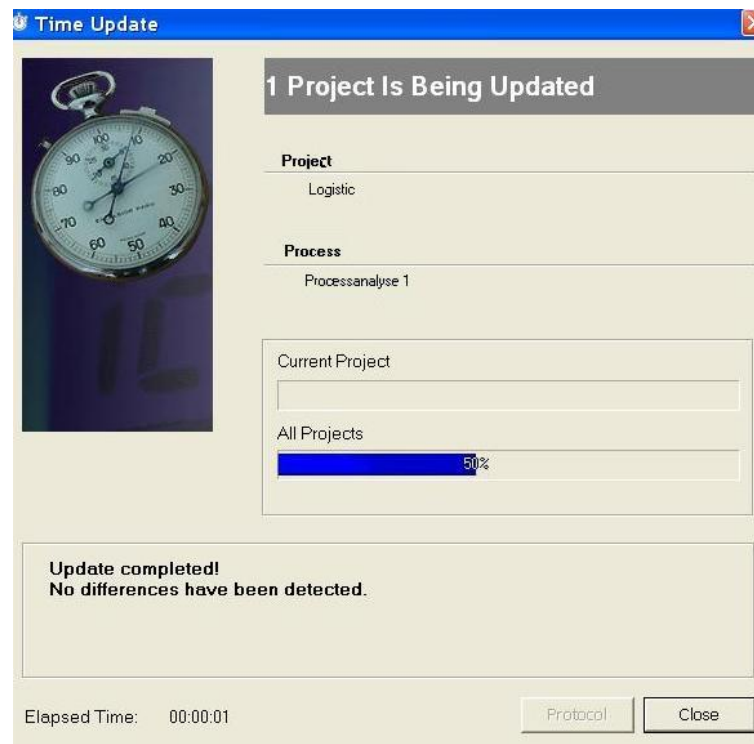


Figure 112: Update Process Progress Dialog

3.6.2 Time Analysis Reference Report

- 1) Open a project in DPE.
- 2) Open a Process in the structure. In [Figure 113](#) the selected process is 'Hauptprozess Motor X35 Linienfertigung'.

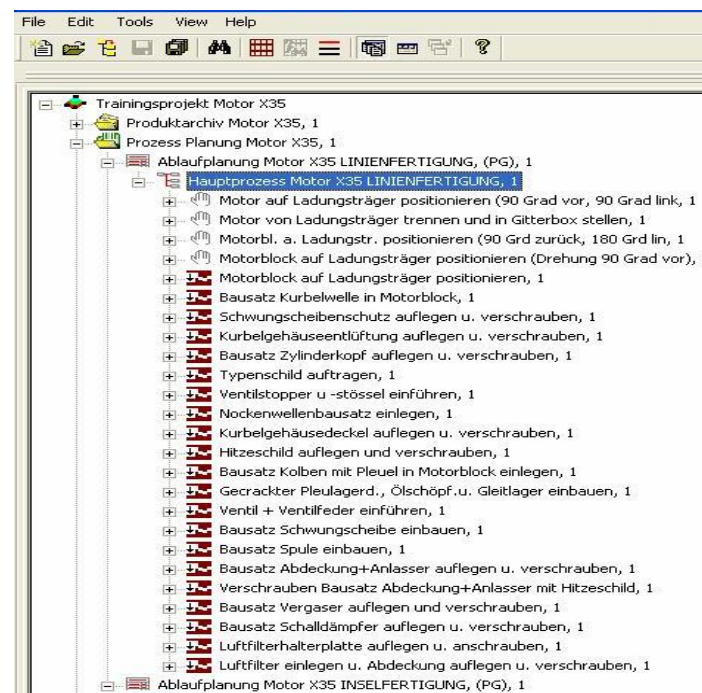


Figure 113: Select Process in DPE

- 3) Right-click the selected process node and start time analysis reference report, the entire subtree is searched for attached time analysis.

If a time analysis is attached the data of the time analysis is read to create a time analysis reference report. The **Search for Code** dialog apperas to filter the codes.

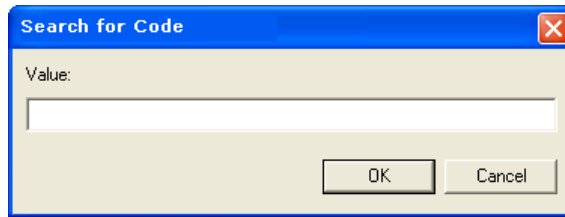


Figure 114: Search for Code dialog

- 4) In the **Search for Code** dialog enter:
 - A distinct code like 'AA1'
 - A code family like 'A*'
- 5) After entering the code and exiting the dialog with **OK** the **Save Report As** dialog is displayed.

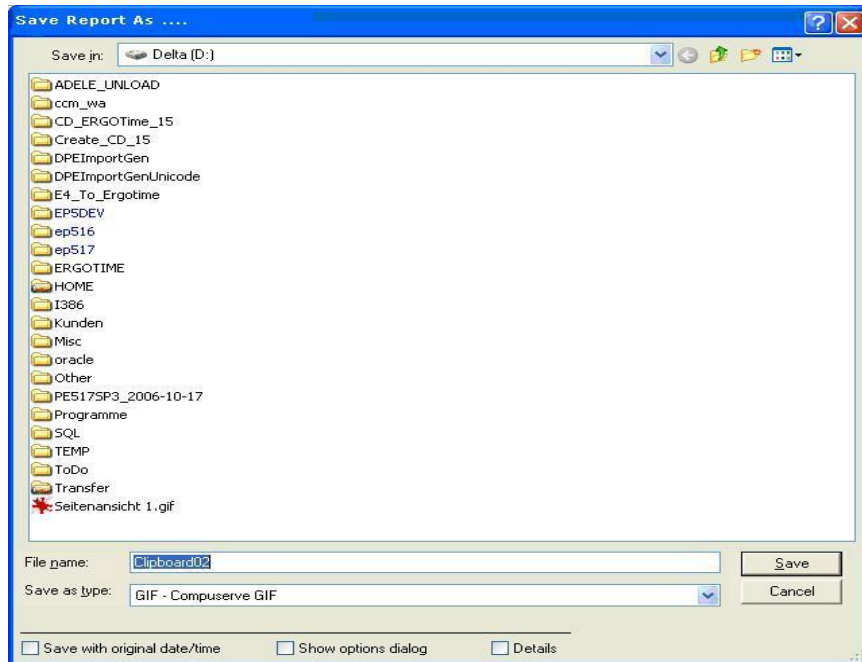


Figure 115: Save Report Dialog

- 6) Select the name and the location for the report file.
- 7) The content of the report are displayed in an Excel file.

To Define Content of a Report

- 1) Click **Tools < Settings < Maintenance Tool < Global < New Value**. Define a new entry **genReferenceReport** in the settings.

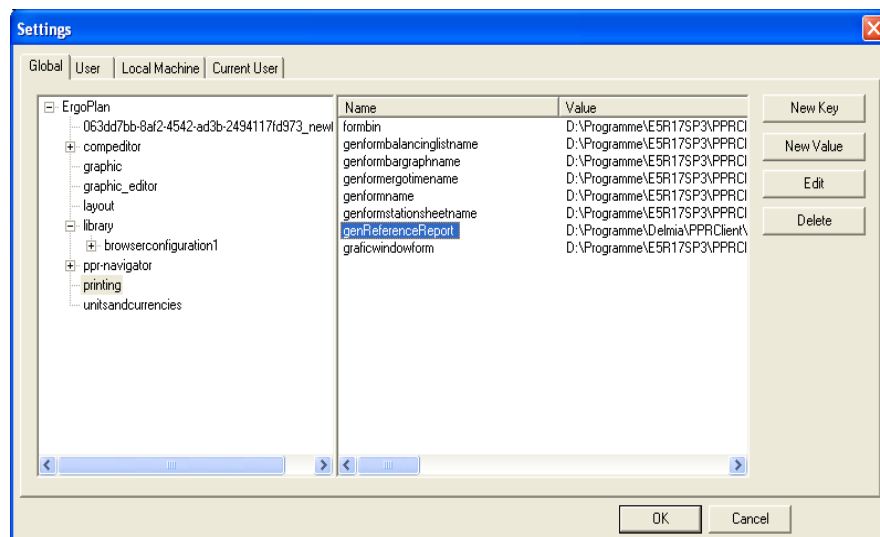


Figure 116: Settings Dialog

Report Description

You can define the contents and sequence of report. Most attributes of process, analysis, and analysis lines can be reported. The content of report includes:

- <HEADER>attribute; is the object where the report was started on
- <PROCESS>attribute; is the object where the report was started on
- <ANALYSIS>attribute; is the time analysis

A attribute is the logical name of an attribute. The entries in definition file are:

```
<HEADER>nameshort
<PROCESS>name
<PROCESS>nameshort
<ANALYSIS>name
<ANALYSISLINE>code
<ANALYSISLINE>analysisdescription
<ANALYSISLINE>factor
<ANALYSISLINE>totaltime
```

In header the attribute nameshort of the starting node is displayed. The attribute of the header must be inserted as a block. The result table shows:

- The name and name short of the process
- The name of the analysis
- The code, description, factor, and totaltime of the time analysis line

The attributes of the process and analysis can be mixed.

```
<ANALYSISLINE>analysisdescription
<PROCESS>name
<ANALYSIS>name
<ANALYSISLINE>code
```

```
<ANALYSISLINE>factor
<PROCESS>nameshort
<ANALYSISLINE>totaltime
```

3.7 Starting Process Time Analysis Directly from DPM V5

In DPM V5 the time analysis of a process can be viewed by selecting the corresponding process and can be edited via the context menu in the DELMIA Process Engineer®. As of version PE 5.17 a process time analysis can be opened via the command line.

Required Requirements

The existence of a plantype set is required, which provides plantypes for the individual analytical methods of processes in the PPR-Navigator.

If the plantype set is new or adjusted, a process analysis can be created or edited only after the **STM setting** is edited and **saved** in the system library.

How to proceed?

Open the command line and enter the path of the start file for DELMIA Process Engineer®. For example,

```
\\DELMIA\PPRClient\program\bin\DPFFrame.exe
```

The syntax of the command is generated as following:

```
DPFFrame.exe "<USERNAME></USERNAME> <E5_PWD></E5_PWD>
<STARTOBJECT></STARTOBJECT>
<PROCESS_UUID></PROCESS_UUID>"
```

The individual parameters have the following meanings:

Parameter	Description
USERNAME	DELMIA Process Engineer® register name
E5_PWD	DELMIA Process Engineer® password
STARTOBJECT	COM Object: analysiswnd.analysiswndmanager
PROCESS_UUID	UUID of a process. The UUID of an object is obtained by displaying the corresponding attribute or using a script (<i>Please refer to the Scripting Manual</i>).

When this command line is executed, the corresponding analysis gets opened. If the process analysis does not yet exist, the selection dialog for analytical methods is opened (if multiple analytical methods exist and no standard method is set). After this, the process time analysis can be edited or a new one created.

Example

Assume there is a DPE user named **User1** and his password is **user1 exists**. Further a process with the UUID **7c98b184-9ad2-42f7-917c-888aa1d1b51f**.

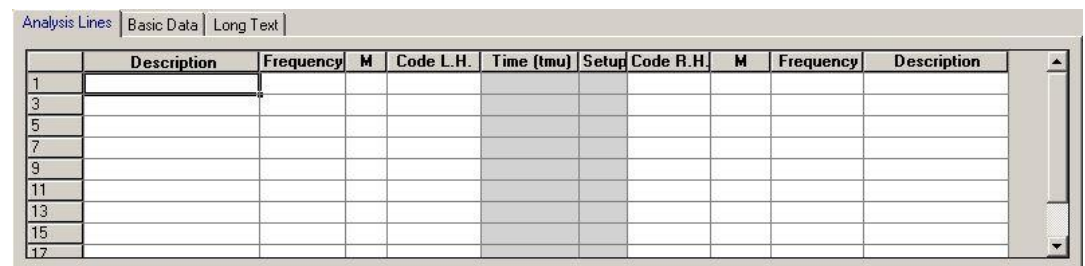
The call-up then looks like this:

```
\\DELMIA\PPRClient\program\bin>DPFFrame.exe
"<USERNAME>User1</USERNAME> <E5_PWD>user1</E5_PWD>
<STARTOBJECT>analysiswnd.analysiswndmanager</STARTOBJECT>
<PROCESS_UUID>cca18e9c-59c7-4191-a572-5b79b810d1f1</PROCESS_UUID>"
```

4. Process Analysis in Detail

This section discusses the MTM-I analysis, UAS Analysis, MEK Analysis, and General Time Component Analyses.

4.1 MTM-I Analysis – Lines Tab



	Description	Frequency	M	Code L.H.	Time (tmu)	Setup	Code R.H.	M	Frequency	Description
1										
3										
5										
7										
9										
11										
13										
15										
17										

Figure 117: Tab Lines in the MTM-I Analysis

4.1.1 Deleting and Inserting Lines


To Delete and Insert a Line

- 1) Selected lines can also be deleted directly with the **DEL** key.
- 2) Lines can be inserted with the **INS** key. A new line is inserted **above** the selected line.

4.1.2 Arranging of Columns

You can move columns within the lines worksheet. To do this, position the mouse pointer on the title of a column and left-click to activate it. The rectangular symbol for “moving” is then displayed below the mouse pointer. Hold the mouse button down, drag the column to the intended position and release the button. A vertical red column line designates the position at which the moved column is placed.

Description Column

The type of action is entered in this field. This can be done manually using the keyboard or automated – if the default code description option is active – via datacards. The datacards are opened by pressing the function key **F5** clicking the “Datacards” icon  or with the menu **Analyses < Datacards**.

Transferring Datacard Entries

For analyses with datacards, the codes are entered into the form by left-clicking the corresponding fields in datacards which are always displayed on the screen. To transfer entries from a datacard to the currently open worksheet, first position the mouse pointer at the desired position in the worksheet. After opening the datacard, the MTM codes stored there can be transferred to the worksheet.

Some codes in the datacards require additional information. For instance, the distance of the hand motion must be entered for the “R-A” button.

The **Turn** button opens a pull-down menu in which you can choose between small, medium, and large.

Once the required entries have been made, the datacards can be closed by left-clicking the **x** button in the upper right of the top title bar of the window.

Quantity and frequency are initially automatically set to **1** with entering of an MTM code. These default values must be overwritten with the actual values, if necessary.

If these changes are confirmed with the **Enter** key, the value in the **Time** field (total time, i.e. the larger value of the left or right hand with basic procedures) of this line changes automatically.

Frequency Column

Here, you can enter the frequency with which the time component is utilized in the analysis. As of version V 2.0 it is possible to enter formulae into the **Frequency** column. Theoretically you may use all functions as described for creation of macros. In practice, however, use of all these functions does not make sense and in most cases it is sufficient to use the four basic calculation options.

Quantity Column

Here, you can enter the number of times that the time component is utilized in the analysis.

Selection Column (Column Before “Code L.H.” or “Code R.H.”)

Combined motions can be defined with a “(character in the selection column of the right or left hand. In the time calculation, a “-“character is automatically inserted for the downward time portion.

▪ Internal Blister Formation

The program sets this if no external blister area is defined. If no body motion or process time is included in the compensation between the left and right hand, the “*” symbol indicates downward motions.

▪ External Blister Formation

Blister formation is performed according to blocks. The external block blister areas are specified according to the selection set by the planner. A “*” character in the left selection column can be used to define the external blister formation, which then applies to both hands. Within a blister, compensation takes place between the process time and manual movements or between manual movements and body movements. The remaining downward motion is designated by a “>” symbol.

Code Column

A point <.> can be used as an abbreviation for a downward “G” with bringing.

Checking for Simultaneous Motions⁸⁵

Entering “=” suppresses the check for simultaneous motions.

“Code L.H.” / “Code R.H.” column



Note

Setting the LH = RH option transfers all entries from the left to the right hand until the option is deactivated. This can be disruptive if codes should not be transferred from the left to the right on a permanent basis.

You can also achieve the same effect by placing a "=" directly before the code in the code column (=R22A), thereby directly controlling the individual input.

"=" left entry → transfers the content to the right code column

"=" right entry → transfers the content to the left column

In addition to '=' the following combinations are also possible:

(M30C → (M30C

=(M30C → (M30C left and right

(=M30C → (M30C left and right

A point <.> can be used as an abbreviation for a downward grip "G" with bring "M".

M30C → (M30C

. → (G2

4.2 UAS Analysis - Lines Tab

A UAS analysis differs from the MTM-I analysis only in the tab **Lines** if value added is activated.

	Description	H	P	D	Code	Time (tmi)	Tim	Fr	Total Time (tmi)	Set	VA	NVA
1	Caption				*						<input type="checkbox"/>	
2	Get and place				AA1	12,00		1	12,00		<input checked="" type="checkbox"/>	
3	Caption				*						<input type="checkbox"/>	
4	Get and place				AB1	18,00		1	18,00		<input type="checkbox"/>	
5	Get and place				AC1	24,00		1	24,00		<input checked="" type="checkbox"/>	
6	Get and place				AL1	48,00		1	48,00		<input checked="" type="checkbox"/>	
7											<input type="checkbox"/>	

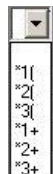
Figure 118: Tab Lines in the UAS Analysis

Column "H"



If you left-click a field in this column, a pull down menu appears with the options "L" (left hand), "R" (right hand), "B" (both hands - both hands on one part) and "S" (Synchronous - both hands carry out the same activity on the left and the same text is printed on the right). If one of these four alternatives is selected, it is applied at the cursor position.

Column "P"



Clicking on the input field of this column opens a pop-up menu for marking parallel processes.

If two compactions are carried out simultaneously, this simultaneity can be marked in column "P", by entering a "*" in both lines.

Selection *1): All non-interrupted analysis times are compared to each other and the longest time is entered.

Selection *1),*2): The longest time for every block is calculated for the compacted blocks.

The longest time of all of the blocks is entered.

Selection *1+,*2+: The sums of the times are compared to one another for compacted blocks. The block with the longest time is displayed.

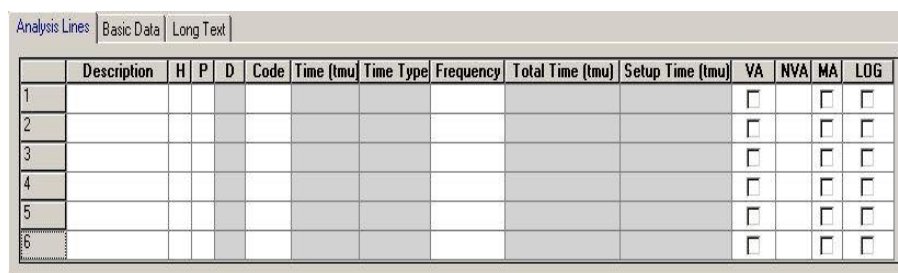
Column "WS", Column "NWS", Column "MA"

As previously mentioned in the PPR-Navigator for value added, you can custom define the column headings. Standard headings include:

- Value added
- Non-value-added

4.3 MEK Analysis (MEK)

All tabs of the MEK analysis are identical to those of the UAS analysis.

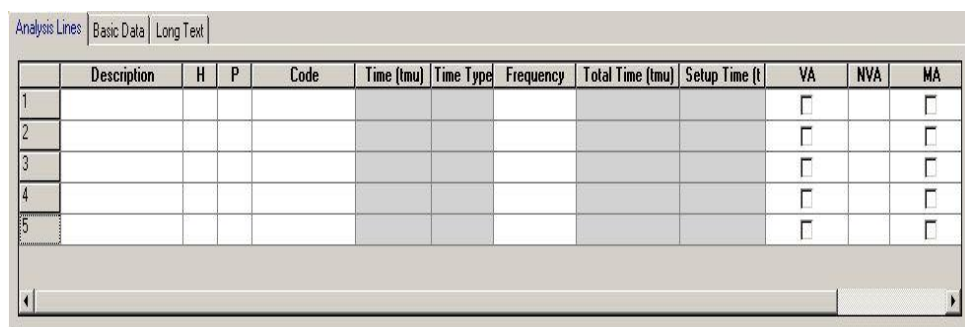


	Description	H	P	D	Code	Time (tmu)	Time Type	Frequency	Total Time (tmu)	Setup Time (tmu)	VA	NVA	MA	LOG
1											<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2											<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3											<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4											<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5											<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6											<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 119: MEK Analysis

4.4 General Time Component Analyses (AZB)

The tabs of the general time component correspond to those of the UAS analysis.



	Description	H	P	Code	Time (tmu)	Time Type	Frequency	Total Time (tmu)	Setup Time (t	VA	NVA	MA
1										<input type="checkbox"/>		<input type="checkbox"/>
2										<input type="checkbox"/>		<input type="checkbox"/>
3										<input type="checkbox"/>		<input type="checkbox"/>
4										<input type="checkbox"/>		<input type="checkbox"/>
5										<input type="checkbox"/>		<input type="checkbox"/>

Figure 120: AZB Analysis

5. Creating Formulas (Macros)

Formulas are created in the project library (or in the project library of a template).

You can create new formulas using the button **New** in the selection **Formula** in the dialog **Analysis Type**. Below, you are provided with a brief overview of the functions of the formula editor.

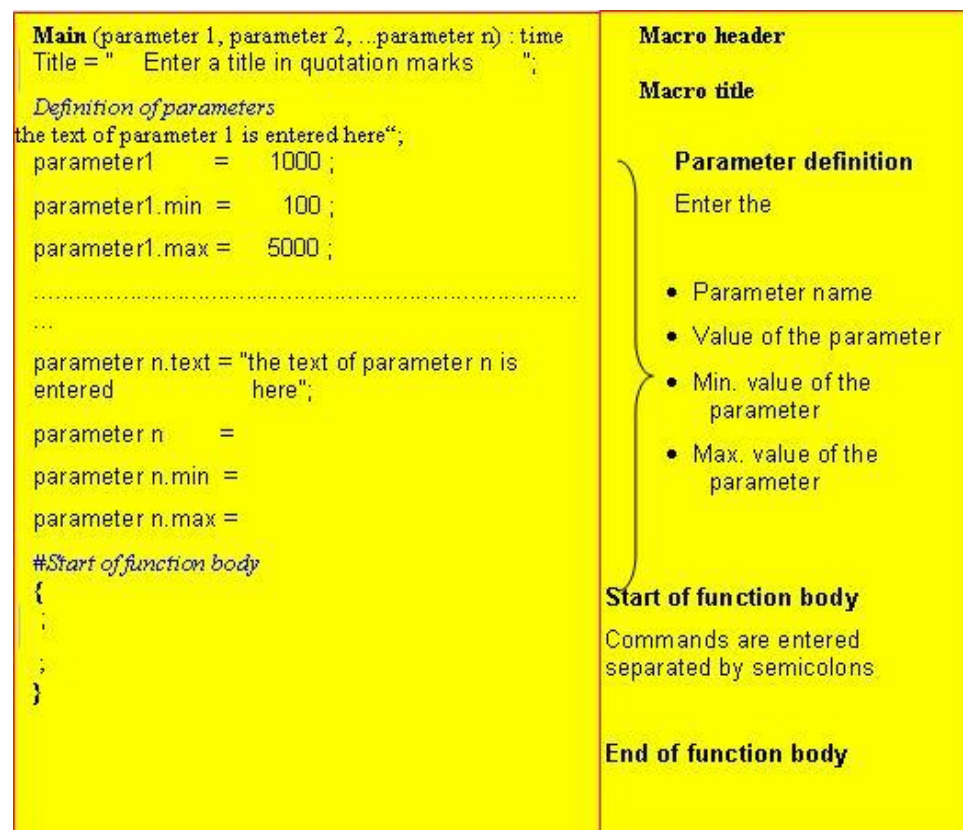


Figure 121: Structure of Time Macro

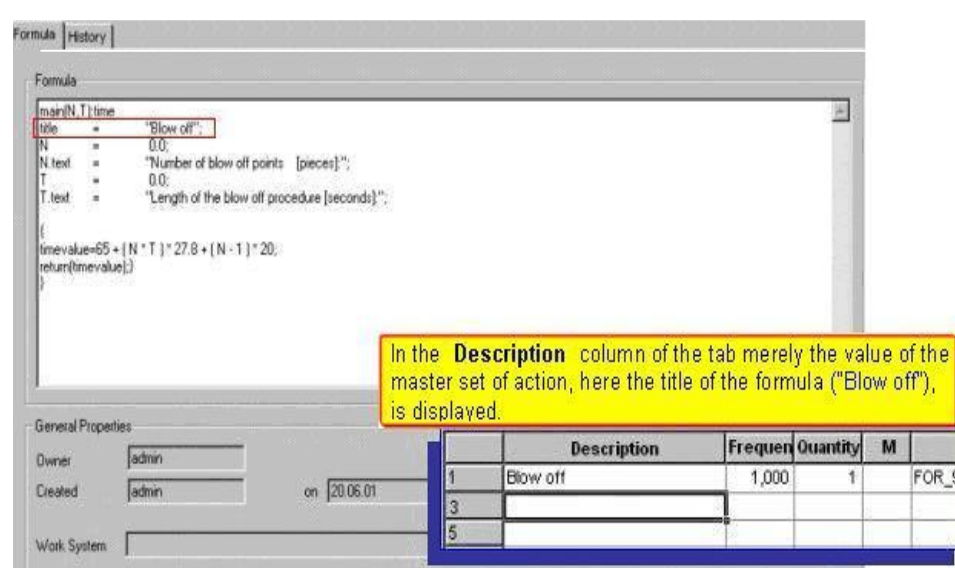


Figure 122: Example of a Time Macro and its Display in the Lines Tab

The **return** command: The result values are returned to the calling location or the quitting of a subprogram can be controlled with this command.

The [Table 4](#) describes the special characters

Table 4: Special Characters

Characters	Descriptions
#	Defines the start of a comment; all subsequent commands are ignored. The comment symbol can be placed at the start of a command line or at any location within the command line. The comment then extends to the end of the line.
;	A semicolon is used to separate or close individual commands.
{ }	Curved brackets are used to group all commands which belong to a single code block.
()	Parentheses are used for defining lists and in mathematical formulas.

5.1 Procedures and Functions

A Procedure is a function which does not provide a return value.

Table 5: Procedures

User Stacks	Call Examples	Comments
Print	Print (parameter...);	
Push	Push (result)	To be used in connection with "pop"

Table 6: Functions

Various to Integer	Call Examples	Comments
ceil	y = ceil(x)	Rounds a number up; 2.6 → 3.0
floor	y = floor(x)	Rounds a number down; -2.4 →

Various to Integer	Call Examples	Comments
		2.0
round	y = ceil(x)	Truncates a number; 2.6 → 2.0
intr		Return value = integer

Table 7: Procedures and Functions of the Formula

Mathematical Functions	Call Examples	Comments
sqrt		alpha = angle in degrees x = value, for which the sine (cos...) is to be calculated
sin	alpha = sin (alpha)	
cos	angle = cos (alpha)	
tan	alpha = tan (alpha)	
cot	alpha = cot (alpha)	
arcsin	alpha = arcsin (x)	
arccos	alpha = arccos (x)	
arctan	alpha = arctan (x)	
sec	alpha = sec (alpha)	
cosec	alpha = cosec (x)	
arccot	alpha = arccot (x)	
sinh	alpha = sinh (x)	
cosh	alpha = cosh (x)	
tanh	alpha = tanh (x)	
coth	alpha = coth (x)	
arsinh	alpha = arsinh (x)	
arcosh	alpha = arcosh (x)	
artanh	alpha = artanh (x)	
arcoth	alpha = arcoth (x)	
sech	alpha = sech (x)	
cosech	alpha = cosech (x)	
Text Functions	Call Examples	Comments
strlen	Length = strlen(t);	Return value: = text of length t
leftstr		Return value t : = left text
rightstr		
midstr		
str_tolower		
str_toupper		
str_char		
Special Functions	Call Examples	Comments
min	y = min(a, b)	
max	y = max(a, b)	
sig	y = sig(x)	
bool		Return value: 0 if x < 0

boolx		Return value: 0 if $x \leq 0$
pop	$x = \text{pop}()$	Contains the highest value of "push" (user stack)
abs		
codetime	$t = \text{codetime}(\text{"Code of analysis"})$	Return value: Time in TMU (analysis time of another analysis)
Exponential Functions	Call Examples	Comments
exp	$y = \exp(x)$	
ln	$y = \ln(x)$	
ln10	$y = \ln_{10}(x)$	
log	$y = \log(x)$	

If you **want to display formula values in an analysis line**, you have to adapt the definition as follows:

Description = "Parametertext1" + P1 + "Parametertext2" + "P2" +

Example

Example 1

main program(N,T):time

title = "Blow off";

N = 0.0;

N.text = "Number of blow off points [pieces]:";

T = 0.0;

T.text = "Duration of the blow off procedure [seconds]:";

{

Description = "Quantity = " + N + ", Duration = " + T;

timevalue=65 + (N * T) * 27.8 + (N - 1) * 20;

return(timevalue);

}

This results in the following analysis line:

Quantity = 2, Duration = 24.2



Note

The library function (library function = procedure or function recognized by the interpreter) "print" can be used to test the formula during creation or to obtain additional information when using the formula. The "print" procedure can be included to help test the above example. In addition, comment lines can be added for easier readability of the formula.



Figure 123: Blow Off

To Execute and Test the Formula

- 1) Click **Calculate** icon in the toolbar; the [Figure 123](#) appears. Using this dialog box, you can now specify which values are used in the calculation.
- 2) If the number of blow off points is limited, the following value entries are conceivable for the N parameter: **N = (1, 2, 4, and 6).**

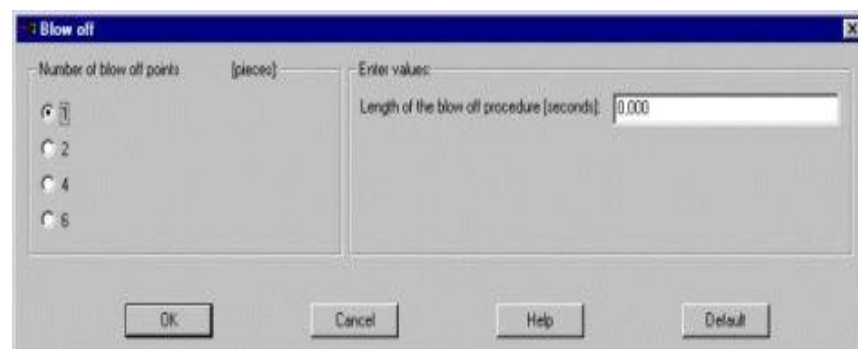


Figure 124: Number of Blow off Parts

- 3) The dialog box which now appears allows the user to choose between only four values for the number of blow off points in the formula.
- 4) After entering the values and confirming with the **OK** button, the output window appears.

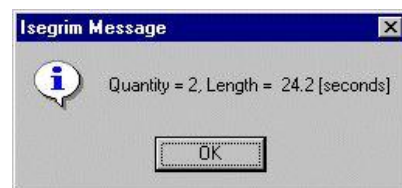


Figure 125: Output Window

In this window, you can check whether the formula was executed correctly. If you have mistyped or made any other mistake ISEGREM displays a message. At the same time, you are presented with a suggestion for correcting the error (*Please refer to the [Figure 126](#)*).

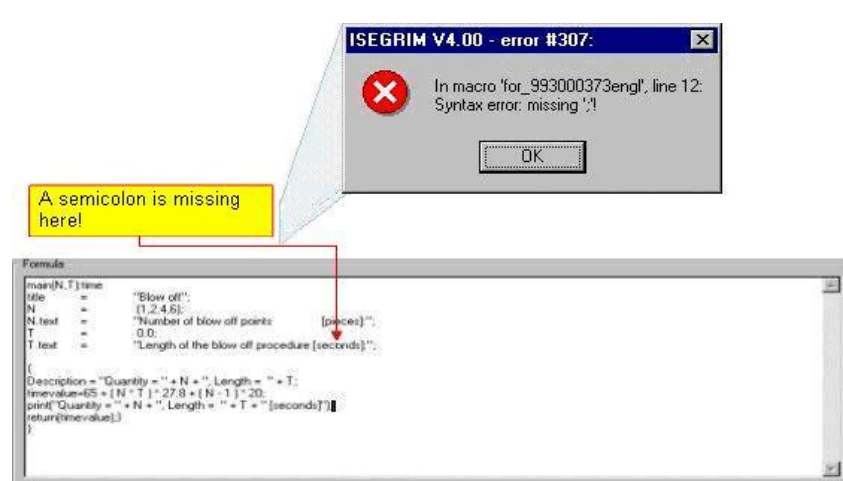


Figure 126: Time Macro with a Syntax Error and the Resulting Error Message

5.2 Control Structures and Sub-Programs

Control Structures

Control structures are language elements that are supposed to affect the sequence of the formula processing. If no control structures are used in a formula, each command is executed in sequence, one after the other.

Two control structures are available in ERGOTime for creating formulas:

- **Branching**

when...then...else...;

The condition to be tested is located between the key words **if** and **then**. The condition is a true/false expression.

If the condition is met, the command or the command sequence enclosed in { } is executed.

If the condition is not met, the command or the command sequence enclosed in { } is skipped and the formula processing continues with the next command.

With the key word **else**, you can execute a specific command sequence only if the condition between **if** and **then** is not met.

- **Loop**

from...to...step...;

With the loop, you can repeatedly execute specific commands or command sequences.

The counter is defined after the key word **from** and assigned a start value (for $i = 1$, i is the counter name).

Following this is the key word **to** which is itself followed by any arithmetic expression that defines the so-called cancel condition (from $i = 1$ to 10).

The next key word is **step** and an arithmetic expression that defines the step size of the counter. (for $i = 1$ to 10 step 0.5)

If no step value is defined, the default value 1 is used; i.e. the counter is incremented by 1 (for $i = 1$ to 10, step was not specified).

Sub-programs

Individual process regulations can be collected into a single command with sub-programs. A sub-program always consists of a function header and a function body (*Please refer to the [Example 2](#)*).

If input from the user is also required with the execution of the subprogram, the parameter definitions may (still) be located between the function header and body. Hence, the sub-program has the same structure as the main program.

The name of the sub-program is specified in the function header, as well as the quantity and type of parameters it should receive. Furthermore, it is specified which type of a return value is required.



Note

The name of sub-program need not necessarily be introduced with the word “Sub-program”. Rather, each name should be short (making it easier to enter with the execution from the main program or another sub-program) and meaningful, with reference to what the sub-program does. For this reason, the first sub-program in example 2 was called “Sub-program_Standard” and the second was simply called “Special”. Of course, the second sub-program could also have been named “Sub-program_SpecialUnit”.

Sub-programs must always be located before the main program. The same also applies to sub-programs that are called from other sub-programs: they must be located before the first use of the subprogram.

When calling a sub-program, it is not clear at a glance whether it is a function call or a sub-program. Calling a function or a subprogram always follows the same rule:

Function name/procedure name/subprogram name (parameter list)

Example

Example 2:

Example 2 shows the structure of a structured formula.

To make it easier for you to work with formulas, this example deals primarily with the method of creating a formula.

▪ Task

The times for the installation of a **standard** air conditioner (another product respectively) into various vehicle types should be determined. Numerous influencing factors can be important here. In our example, only the number of mounting points is considered. You can deal with this task according to example 1. In addition, the same formula shall include the installation of a **special** air conditioner. For the special air conditioner, the number of mounting points is identical, only the number of connecting hoses is variable.

Using control structures and sub-programs, this task can be solved very quickly and easily. The advantage of such a formula is that once it has been created, it can also be used for other analyses because the parameters can be freely selected.

▪ Formula

First a main program with the parameter “ac” is created. The main program only asks what kind of air conditioner should be considered with the time calculation (the parameter definition as a list ("standard", "special")). Text parameters must be placed in quotation marks.

In the function body a **when...then...else...** branching serves to call two sub-programs which take on the main work.

The first sub-program is structured like a main program. If the formula user selects the standard air conditioner, the main program calls the sub-program for the standard air conditioner. Here, one can specify the number of mounting points in a second input dialog.

The second sub-program is also structured like a main program. Here the user of the formula can also specify the number of the variables in an input dialog. The number of mounting points is defined in the main program. Because the time value is determined in the subprogram, the parameter value for the mounting points must be passed on to the subprogram.

Parameters to be used in sub-programs must be passed over when calling the sub-program. The same applies to calling a sub-program from a sub-program.

If values from the sub-program are to be used in the main program or another sub-program, this is possible with the use of **push** and **pop** functions.

With *push*, values are placed on a stack. With *pop*, the stack values are accessed. Here you must note that working with stacks is based on the LIFO principle (Last In First Out); that is, the last value placed on the stack is the first value popped out.

Sub-program

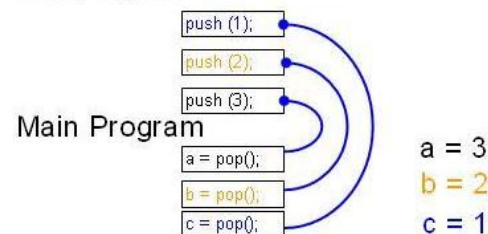


Figure 127: Sub-Program and Main Program

In the last step, the results of the sub-programs are inserted into the description line and the calculated value is passed on to ERGOTime with a **return** command. In [Figure 129](#), the finished formula is shown again, as it is displayed in the editor window. In addition to the comments mentioned above, more comment lines are added here and the **print** function is called twice to allow the function of the formula to be tested. If the formula functions correctly, the line with the print function can be deleted or commented out.

```

# 1st Subprogram
Special(mount_points, hose_num) : time
title = "Number of hoses";
hose_num.text = "Number of hoses :";
hose_num = (2,3,4);
{
specialtime = (mount_points * 0.5) + (hose_num * 0.6);
push(specialtime);
return(specialtime);
}

# 2nd Subprogram
Subprogram_Standard(num) : time
title = "Number of mounting points.";
num.text = "Number of mounting points :";
num.min = 2;
num.max = 5;
num = 3;
{
standardtime = num * 0.5;
push(standardtime);
return(standardtime);
}

# Main Program
main(ac) : time
title = "Installation of an Air Conditioner";
ac.text = "What kind of air conditioner should be installed?";
ac = ("standard", "special");
{
if ac = "standard"
then {
a = Subprogram_Standard();
# Call the 2nd subprogram
standard = pop();
timevalue = standard;
}
else {
mount_points = 5;
b = Special(mount_points);
# Call the 1st Subprogram ("Special")
special = pop();
timevalue = special;
}
description = "Installation of a " + ac + " air conditioner in" + timevalue + " [sec]";
return(timevalue);
}

```

Number of hoses

Number of hoses :

☒ 2
☐ 3
☐ 4

OK Cancel Help Default

Number of mounting points.

Enter values:

Number of mounting points : 3

OK Cancel Help Default

Installation of an Air Conditioner

What kind of air conditioner should be installed ?

☒ standard
☐ special

OK Cancel Help Default

either or

Figure 128: Return Command

```

Formel

##### Unterprogramm für die Sonderaustattung #####
Sonder(bef_punkte,schlauch_anz): zeit
titel = "Anzahl der Schläuche.";
schlauch_anz.text = "Anzahl der Schläuche.";
schlauch_anz = {2,3,4};
{
sonderzeit = (bef_punkte * 0.5) + (schlauch_anz * 0.6);
merke(sonderzeit);
zurueck {Sonderzeit};
}

##### Unterprogramm für die Standardlösung #####
Unterprogramm_Standard(anz): zeit
titel = "Anzahl der Befestigungspunkte.";
anz.text = "Anzahl der Befestigungspunkte.";
anz.min = 2;
anz.max = 5;
anz = 3; #Standardwert, wenn der Wert nicht geändert wird, wird im weiteren Verlauf der Formel mit diesem Wert gerechnet
{
standardzeit = anz * 0.5;
merke(standardzeit);
zurueck {Standardzeit};
}

##### Beginn Hauptprogramm #####
hauptprogramm(klima): zeit
titel = "Einbau einer Klimaanlage";
klima.text = "Was für eine Klimaanlage soll eingebaut werden?";
klima = {"Standard", "Sonderaustattung"};

{
wenn klima = "Standard"
dann {
a = Unterprogramm_Standard();
standard = hole();
zeitwert = standard;
ausgabe("Standardzeit = " + standard);
zurueck(zeitwert);
}
sonst {
bef_punkte = 5; # Hier liegt die Anzahl der Befestigungspunkte fest
# und wird im nächsten Schritt an das Unterprogramm "Sonder" weitergegeben
b = Sonder(bef_punkte);
sonder = hole();
ausgabe("Sonderaustattungszeit = " + sonder);
ausgabe("Standardzeit = " + standard);
zurueck(zeitwert);
}
sonst {
bef_punkte = 5; # Hier liegt die Anzahl der Befestigungspunkte fest
# und wird im nächsten Schritt an das Unterprogramm "Sonder" weitergegeben
b = Sonder(bef_punkte);
sonder = hole();
ausgabe("Sonderaustattungszeit = " + sonder);
zeitwert = sonder;
}
beschreibung = "Einbau einer " + klima + " Klimaanlage " + zeitwert + " [sec]";
zurueck(zeitwert);
}

```

Figure 129: Display of a Formula in the Formula Editor; Example 2

Calling a Formula from a Formula

By calling a formula directly from a formula, you have an additional possibility of optimizing branches and complex situations. This provides you with a tool that can be used to call up formulas rather directly by means of another formula than from the analyses.

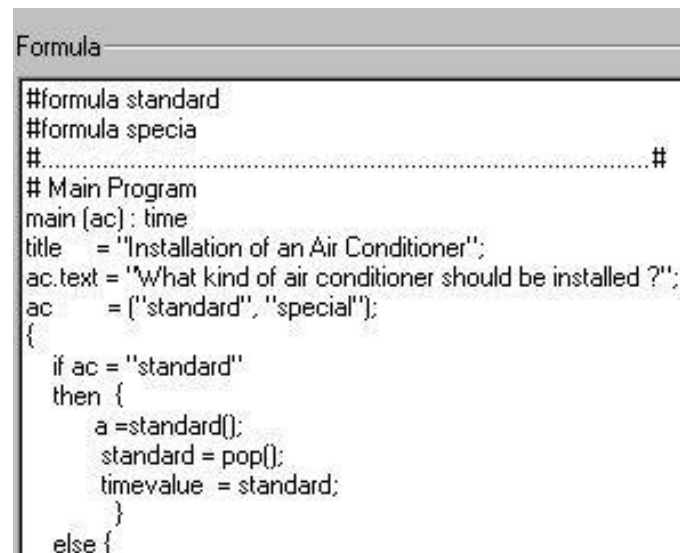
To remain with the previous example, you can now create three small formulas:

- Formula for the time calculation for the installation of a **standard** air conditioner
- Formula for the time calculation for the installation of a **special** air conditioner
- Formula which calls up both formulas

You can create the first two formulas as described in example 1 (Main program():time; title = ...; parameter definition; function body;).

The third formula is interesting. For the interpreter (line-oriented program language) to recognize the formulas, they must be defined right at the beginning. This is done as follows:

In the first line of the formula, the formula to be used must be declared. All additional formulas to be used are declared in the following lines. The declaration of a formula begins with a pound sign **#** followed by the key word **formula**. After a space, the code of the formula is entered. For example: **#formula formula code**, or as shown in the Figure 130.



```
#formula standard
#formula special
# .....#
# Main Program
main (ac) : time
title   = "Installation of an Air Conditioner";
ac.text = "What kind of air conditioner should be installed ?";
ac      = ("standard", "special");
{
    if ac = "standard"
    then {
        a = standard();
        standard = pop();
        timevalue = standard;
    }
    else {
```

Figure 130: Calling a Formula from a Formula

A formula declared in this way can be called up in the same way as a function or subprogram.

Name = formulaname();

for example: b = SPECIAL();



Note

What advantage results from the fact that you can call up a formula from within a formula? From observing the previous example, the advantage is not necessarily clear. The purpose of formulas (macros) is to work quickly and avoid repetitions.

And exactly this is possible with this function. Using a time conversion as an example rather makes this clearer: if you write a simple formula for converting from TMU to another time unit (minutes, seconds ...), this is always available to you and you must simply call up the formula from the appropriate location in other formulas.

Appendix

Additional Information about Basic Procedure (MTM-I) Analyses

General Information

Codes for process times, body movements, and analyses codes created by the user must be assigned to the right hand. If this rule is not observed, the times are not handled according to their time types.

Permissible Codes

Two types of time components can be used in the program system:

- 1) Time components created by the user in STM (user codes) (User Codes)
- 2) MTM basic procedure codes (datacard codes)

The basic movements (codings) listed in the following table can be used to describe movement sequences. In the list, "*" and "#" serve as wildcards for the first and second parameter of a code (i.e R*A). If the parameter is unknown or meaningless, a dash can be entered instead (i.e R-A).

Parameters

Parameters with "#" as a wildcard, however, must always be specified with a numerical value; a dash is not permitted.

Table 8: Overview of the Basic Procedure Codes

Code	Comment
R*A	Reach
R*B	* = movement length in cm
R*C	1 <= * <= 120
R*D	
R*E	
SC*	Static component (one-handed bring)
	* = Force application in kp 2 <= * <= 22
SC*/2	Static component (two-handed bring)
	* = Force application in kp 2 <= * <= 44
M*A#	Bring (possible with force application)
M*B#	* = movement length in cm
M*C#	1 <= * <= 120
	# = force application in kp
	2 <= # <= 44 or no entry
M*A#/2	Two-handed bring
M*B#/2	* = movement length in cm
M*C#/2	1 <= * <= 120

Code	Comment
	# = force application in kp 2 <= # <= 44
G1A	Grasp
G1B	
G1C1	
G1C2	
G1C3	
G2	
G3	
G4A	
G4B	
G4C	
G5	
P1SE	Join
P1SD	
P1SSE	
P1SSD	
P1NSE	
P1NSD	
P2SE	
P2SD	
P2SSE	
P2SSD	
P2NSE	
P2NSD	
P3SE	
P3SD	
P3SSE	
P3SSD	
P3NSE	
P3NSD	
D1E	Separate
D1D	
D2E	
D2D	
D3E	
D3D	
APA	Press
APB	
T*	Turn
T*S	* = turn angle in degrees

Code	Comment
T*M	
T*L	
RL1	Release
RL2	
EF	Inspect
ET*/#	Perspective change
	* = distance between viewing points T in cm
	1 <= * <= 999
	#=distance from eyes to connecting line of the viewing points D in cm
	10 <= * <= 999
SS*C1	Side step
SS*C2	* = movement length in cm
	1 <= * <= 120
TBC1	Body turn
TBC2	
W*P	Walk
W*PO	* = number of steps
W*PL	1 <= * <= 999
LM*	Leg movement
	* = movement length in cm
	1 <= * <= 60
FM	Foot movement
FMP	Foot movement with pressure
KPK	Kneel on both knees
AKBK	Stand from keeling on both knees
SIT	Sit down
STD	Stand up
B	Bend
AB	Stand up from bending
S	Stoop
AS	Stand up from stooping
KOK	Kneel on one knee
AKOK	Stand from kneeling on one knee
PTU*	Process time, uninfluenced
PTB*	Process time, influenced
	* = time in TMU
	0,1 <= * <= 99999,9

Combined Movements

Combined movements are connected with the "(".

Crossing out movements is performed by ZEBRA by activating the “Calculate” icon or during MTM-I rule checking and cannot be influenced manually.

Rules

Contiguous movement sequences of combined movements must be separated by an EMPTY LINE.

WITH empty line = 2 blocks

WITHOUT empty line= 1 block

```
( M45B      16.8
- ( G2

( P1SSE      9.1
- ( G2
```

```
( M45B      16.8
- ( G2
- ( P1SSE
- ( G2
```

EXCEPTIONS: In the following constellation successive combined movements are ALWAYS interrupted AUTOMATICALLY, also without an empty line:

- 1) In the case of BODY MOVEMENTS with occurrence of a second IDENTICAL body movement.

```
- ( M2C
( EF      7.3
- ( M2C
( EF      7.3
```

- 2) In the case of successive M*x + G2 combinations

```
( M45C      16.8
- ( G2
( M45C      16.8
- ( G2
```

In a combined movement with BODY MOVEMENTS the time-determining body movement as well as the time-determining “other” movements are NOT deleted. For the time calculation only the movement with the highest time value is used.

```
( STD      43.4
(M30C
- ( G2
```

ET and EF (mental functions) are assigned to the BODY MOVEMENT group.

In combined movements with BODY MOVEMENTS or USER CODE NO INTERNAL blister is identified.

Combined movement with PTU is NOT permitted.

If a combined movement is used for only one hand, no single code should be entered for the other hand at the same level as a “G2”.

(M30C		better:	(M30C	G4A
(G2	G4A		(G2	
		or:	(M30C	
			(G2	
				G4A

Blister Formation

▪ External Block Blister Areas

Blister formation is performed according to blocks. The EXTERNAL BLOCK BLISTER AREAS are specified according to the selections set by the planner.

An EXTERNAL BLOCK BLISTER AREA is designated with a "*" pair in the 1st position of the designation field.

▪ Internal Block Blister Areas

Outside these areas specified by the planner, INTERNAL BLOCK BLISTER AREAS are formed according to the following scheme:

An area begins with two simultaneously executed movements. It ends with two simultaneously executed release movements (including) or with the occurrence of one of the following movements:

- 1) WITH INCL. simultaneously executed release movements RL1 or RL2
- 2) BEFORE a body movement
- 3) BEFORE a process time PTUxx
- 4) BEFORE a user code
- 5) BEFORE a two-handed bring with force application
- 6) BEFORE a highly controlled movement (join, R..C, R..D, G4.., D3.., M..C)
- 7) BEFORE transfer grip G3
- 8) BEFORE change of hand from single hand left to right and vice versa, or when changing from single hand to two hand.
- 9) In the case of simultaneous movements with exactly identical movement sequence (same times) the INTERNAL block blister is NOT identified
- 10) In combination with one BODY MOVEMENT no internal blister is identified.
- 11) An EXTERNAL BLOCK BLISTER (set manually by the user) ends the INTERNAL block blister.
- 12) A blister is interrupted at a PTBxxx as well as at a PTWxxx.
- 14) A blister can NOT start with a user code or PTUxxx, PTBxxx and PTWxxx.
- 15) RL1 - RL2 and vice versa are identified as blisters.

▪ Blister Formation within a Block Blister Area

Blister formation takes place within external and internal block blister areas according to the following logic:

If process times occur in the area, a comparison between the total of the process times and the other movements is performed. For this comparison, the process times are multiplied by the operational performance. The performance is changed under **Extras < Settings < Global**. If body movements occur and no process times or user codes are present, a comparison is performed be-

tween the total “times for body movements” and the other movements. Otherwise, a comparison is performed between the movements of the right and left hand.

Based on the applicable comparison, a block blister is set automatically. The block blister symbol is square for body movement times and process times (“>”), otherwise curved (“”).

▪ **Simultaneous Execution Feasibility of Movements**

In the creation of an analysis, the movements entered are automatically checked with regard to simultaneous execution feasibility. The “Simultaneous basic movements” on the MTM standard time value card is used as the basis for this. It is assumed that the worker is sufficiently practiced.

STM does not automatically distribute simultaneously executable movements to 2 lines.

▪ **Suppression of the Simultaneous Movement Check**

If the simultaneous movement check is to be suppressed, the user can enter the character “=” in the 3rd place of the designation field.

▪ **Simultaneous Movement Check with Pressing**

If a pressing type of movement takes place simultaneously with another movement in the analysis, the following message appears:

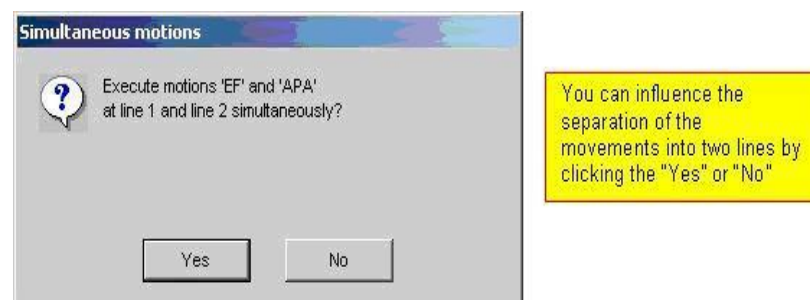


Figure 131: Simultaneous Movement Check with Pressing

▪ **Special Cases**

Motions that refer to the same part are treated as simultaneously executable. The following are treated as simultaneously executable with all other movements (group 1):

- APA, APB
- T-S, T-M, T-L
- RL1, RL2

The following (group 2) are treated as not simultaneously executable with any other movements (except for those in group 1):

- Join P3
- Separate D3

Automatic Code Generation

▪ **Highly Controlled Reach Movement Outside of the Diffuse Vision Field**

For simultaneous reach movements R-C and R-D outside of the diffuse vision field, rule 4.2.-8 of the MTM basic procedure applies. This reads:

For simultaneous reaching outside of the diffuse vision field, an interaction time must be taken into account for highly controlled reaching for the second hand. A remaining distance of at least 4cm is evaluated for the second hand.

The movement length of the hand with the greater movement length is reduced by 4cm. The reach is transformed into a R-E. In addition, a remaining motion R4C or R4D is inserted in the analysis.

Reach movements lie outside of the diffuse vision field if the quotient of the "Reach movement end points distance (=action points)" and the "Eye distance" is greater than 1.5.

Example

Example

R20C	R30C	→	R20C	R26E
G4B	G4B		G4B	
				R4C
				G4B

▪ Highly Controlled Bring Movement Outside the Normal Vision Field

Rule 4.6.-4 of the MTM basic procedure applies here.

For simultaneous joining outside the normal vision field, the two joins take place consecutively. For the second join, a view change and a short case C bring are analyzed.

For a simultaneous bring M-C outside the normal vision field, the program changes the bring movement with the larger movement length to a bring M-B with remaining distance of M2C. In addition, a view change is inserted into the analysis.

The bring movements lie outside the normal vision field if the quotient of the "Bring movement end points distance (=action points)" and the "Eye distance" is greater than 0.25.

Example

Examples

M30C	M40C	→	M30C	M40B
				ET*/#
				M2C
M30C	M40C	→	M30C	M40B
P1SSE			P1SSE	
				ET*/#
				M2C
M40C	M30C	→	M38B	M30C
P1SSE	P1SSE			P1SSE
				ET*/#
			M2C	
			P1SSE	
(M30C	(M40C	→	(M30C	(M40B
(G2	(G2		(G2	(G2
P1SSE	P1SSE		P1SSE	ET*/#
				M2C
				P1SSE

▪ Area of Vision Query

Information about the field of vision is required for the functions described above. The vision field queries take place in connection with the basic procedure analyses rule checking. The following dialog box is displayed:

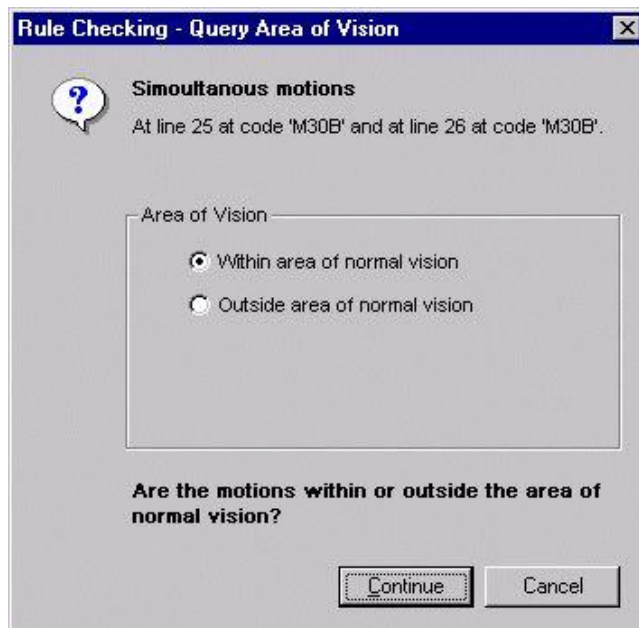


Figure 132: Query Area of Vision

The “Move” and “Distance” input fields are assigned the default values “10” and “40”. You can overwrite these values.

▪ Value Ranges

- Distance between the action points : 0 - 999
- Eye distance : 10 – 999

Time Values

The basic motion time values are automatically calculated. This calculation is based on the MTM standard time value card.

The times saved in the database are used for user time components.

For combined and/or simultaneous motions, the time-determining motion is determined automatically.

For reach and bring motions with movement lengths larger than 80 cm, the time values are extrapolated.

▪ Technical Method Check

After creation, a basic procedure analysis is checked for compliance with the rules using the “Calculate” command (using “ / or by after activation of the toolbar icon). At the same time, a plausibility check is performed on the motions.

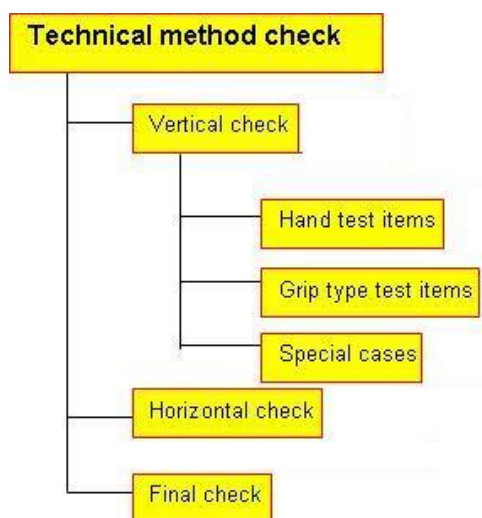


Figure 133: Technical Method Check

The technical method check is divided into the following sub areas:

- **Vertical Check**

1) HAND TEST ITEMS

The following hand states are taken into consideration:

Unspecific 0

Hand empty 10

Hand has reached 20

Hand has gripped 30

Table 9: Transition Table

Old Status	Code	New Status	Error Number
0	R*A	20	
	R*B		
	R*C		
	R*D		
	R*E		
	T*	10	
	RL1		
	RL2		
	Other hand G3	30	
	All other hand motions		

Old Status	Code	New Status	Error Number
10	G1A G1B G1C1 G1C2 G1C3 G3 G4A G4B G4C G5	0	F06
	T*	10	
	R*A R*B R*C R*D R*E	20	
	Other hand motions	0	F02
20	R*A R*B R*C R*D R*E T* P1SE - P3NSD (all joins)	20	
	G1A G1B G1C1 G1C2 G1C3 G3 G4A G4B G4C G5	30	
	Other hand motions	0	F07

Old Status	Code	New Status	Error Number
30	R*A R*B R*C R*D R*E T*	0	F08
	G1A G1B G1C1 G1C2 G1C3 G3 G4A G4B G4C G5	0	F03
	RL1 RL2 Other hand G3	10	F07

2) GRIP TYPE TEST ITEMS

The following hand states are taken into consideration:

Unspecific	0
Contact Grip	1
Grabbing Grip	2

Table 10: Transition Table

Old Status	Code	New Status	Error Number
0	G1A G1B G1C1 G1C2 G1C3 G3 G4A G4B G4C	0	
	G5	1	

Old Status	Code	New Status	Error Number
1	RL2 G2 P1SD P1SSD P1NSD P2SD P2SSD P2NSD P3SD P3SSD P3SSD	0	F06
	RL1	0	F02
2	RL2 G2 P1SD P1SSD P1NSD P2SD P2SSD P2NSD P3SD P3SSD P3SSD	0	
	RL2	0	F04

3) SPECIAL CASES

Table 11: Transition Table for Special Cases

1. Code	2. Code		Error Number
	exclusively permissible	Impermissible	
	M*A# M*B# M*C#	1	F09
SC*	Parameters * for SC and # and for M... must be identical		F10
SC*/2	M*A#/2 M*B#/2 M*C#/2	0	F09
	Parameters * for SC and # and for M... must be identical		F10

1. Code	2. Code		Error Number
M*A M*B M*A# M*B# M*A#/2 M*B#/2		P1SE P1SE (all joins) (all joins) P3NSD P3NSD	F11
M*C M*C#/2 M*C#/2		P1SE P1SSE P1NSE P2SE P2SSE P2NSE P3SE P3SSE P3NSE	F01
R*A R*B		G1C3 G4A G4B G4C	F12
R*C		G1A G1B G1C1 G1C2 G1C3 G3	F12
R*D		G1A G4A G4B G4C	F12
R*E		G1A G1B G1C1 G1C2 G1C3 G2 G3 G4A G4B G4C G5	F12
R*A R*B R*C R*E		P1SE - P3NSD (all joins) (all joins) (all joins)	FL13
R*D		P1SSE P1SSD P1NSE P1NSD P2SSE P2SSD P2NSE P2NSD P3SSE P3SSD P3NSE P3NSD	F14



Note

Combined/simultaneous motions are not considered 2nd codes.

Horizontal Checks

Table 12: Transition Table for Horizontal Checks

1. Code	2. Code		Error Number
	Exclusively permissible	Impermissible	
SC*	SC* or empty		F024
SC*/2	Match with 1 st code (identical)		F025

1. Code	2. Code		Error Number
M*A#/2 M*B#/2 M*C#/2	Match with 1 st code (identical)		F022
G3		All hand motions	F023
PTU*		PTU*	F024

▪ **Final Check**

G3, RL1, or RL2 must be the last motion in every work step for at least one hand. If this is not the case, error F040 is to be displayed.

Table 13: Error Messages with Technical Method Check

Error Message	SIMULT. MOT.	Correction Proposal
F021	SPECIFICATION EXPENDITURE OF FORCE/MOTIONL. DIFFERENT	Adjust expenditure of force to motion lengths
F022	CODE 2-HAND BRING ONLY SPEC. FOR 1 HAND	Add the code for the other hand.
F023	G3 HAND MOTION	Delete hand motion and insert after G3
F024	COMBINATION unusual	Change left or right hand code
F025	CODE SC ONLY SPEC. FOR 1 HAND	Add code SC for other hand
F040	ANALYSIS SHOULD END WITH RELEASE BY AT LEAST 1 HAND	Add new limits to the analysis

Error Message	MOTSEQ. Left/Right	Correction Proposal
F01	BRING WITH FORCE APP. - JOIN HANDLING "E"	Change P..E to P..D
F02	RELEASE MOTION ON/WITH OBJECT	Add reach and grip
F03	MOTION ON/WITH OBJECT - GRIP	Add release and reach
F04	GRIP - RELEASE RL2	Change RL2 to RL1
F05	CONTACT GRIP - RELEASE RL1	Change RL1 to RL2
F06	GRIP	Add reach
F07	REACH MOTION ON/WITH OBJECT	Add grip
F08	MOTION ON/WITH OBJECT - MOTION OF EMPTY HAND	Add release
F09	STATIC COMPONENT SC WITHOUT SUBSEQ. BRING	Add bring or delete SC
F10	FORCE APP. FOR SC AND BRING VARY	Change force application to match.
FL11	BRING M-A OR M-B - JOIN	Change M-A / M-B to M-C
FL12	COMBINATION REACH -	Change reach/grip to permissible

Error Message	MOTSEQ. Left/Right	Correction Proposal
	GRIP IMPERMISSIBLE	combination. <i>Please refer to the Table 14.</i>
F13	DESCENDING REACH - ADDING HAND/FINGER	Change descending reach to R.D
F14	HAND/FINGER - JOIN SYMMETRY "SS"/"NS"	Change P.SS/P.NS to P.S.
F26	BRING WITH FORCE APP. WITHOUT STAT. COMPONENT SC	Add static component SC. before bring
F41	HINL. REACH R.A - GRIP G1B → CHECK IF CORRECT	G1B is usually preceded by a R..B or R..D. Check whether it is necessary to change R.A to R..B/R..D.
F42	BRING LENGTH < 10 CM - COMB. SUBSEQ. REACH → RARE	A short bring with subsequent grip is rare. Check whether the subsequent grip really occurs



Note

If another part should be picked up, the motion sequence is correct.

Table 14: Combination Reach - Grip Permissible

	G1AG1B	G1C1	G1C2	G1C3	G3	G4AG4B	G4C	G5
R-A	XXXXXX	XXXX	XXXX	XX	XX
R-B	XXXXXX	XXXX	XXXX	XX	XX
R-C	XXXXXX	XXX	XX
R-D	. . . XXX	XXXX	XXXX	XXXX	XX	XX
R-E	

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