Test&Motion

Application Module:

TM_FP2 – Flexible Flow Control

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1 Introduction

Dear customer, thank you for choosing a product of **DOLI Elektronik GmbH**. **Test&Motion** is a modern application fitting for the operation systems Microsoft Windows 2000/XP/7©.

This manual does not deal with the **Test&Motion software** in general but with the application module **TM_FP2 Flexible Flow Control** in particular. Hence it is recommended to read the **Test&Motion** in order to get familiar with the software. Please follow the demands and safety hints listed in the manual.

1.1 Symbols

Just as the T&M user manual, this manual contains different symbols that should allow you to find your way more easy.

List 1: Symbols and their meanings.

Symbol	Meaning
	**Safety Instructions:** **In order to avoid interruptions in the work flow as well as damages to man and machine, follow the safety instructions at all cost.**
	**Job/work instructions:** **Instructive part of the document with precise work instructions.** **Here you are asked to do something.**
	**Information:** **General information and descriptions of working procedures, etc.**
	**Note:** **Important note for the operation, the function or for the working procedures.**
	**Tip:** **Gives tips for easy handling of the Test&Motion Software, the EDCs or the testing instrument.**

2 Test TM_FP2 - Flexible Flow Control

A lot of tests are carried out following fixed standard regulations. The test course is predefined and cannot be changed, while the input values are variable and customer specific. With the **Test&Motion** software, such tests have been realized in predefined **application modules**, that can be ordered according to the customers needs.

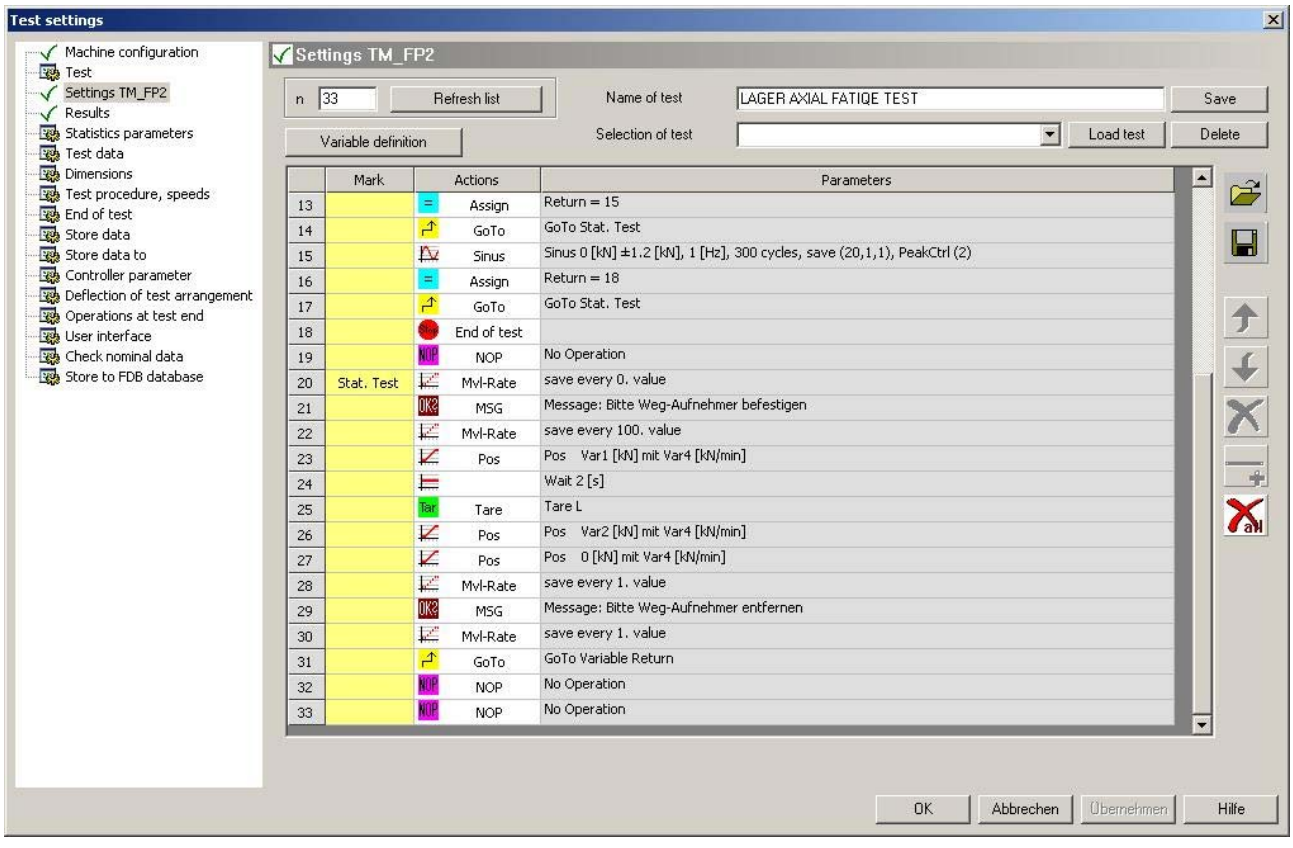
Some testing labs, on the contrary, have to carry out various tests following various standards and, furthermore, sometimes they even do not know, how their tests will look like during the next days. Such labs need application modules giving them the possibility to freely define test courses and the sort of results according to their changing demands.

Therefore, **Test&Motion** offers the application module **TM_FP Free Programming Module**. This module enables the user to freely define tests and detect results in most instances. However, the user has to write his programs in a syntax similar to “C”, which, in fact, is not so easy for everyone. Hence, programming experience is not necessary but helpful for this module. But as the user defines test course and the result evaluation according to his need, he can do almost everything he wants with TM_FP – a big advantage!

Exactly the same goal has been pursued with the application module **TM_FP2 Flexible Flow Control**, though this module offers the possibility to define the test course without programming. A test course generated with TM_FP2 consists of a sequence of commands standing in a command list. The contents of the lines in this list will be defined using different input dialogs. It is possible to define simple or more complex commands (sine, rectangle, triangle), define jump commands, test measuring values or variables and – depending on the results – it is possible to branch to different points.

2.1 Definition of the test course TM_FP2

1. Click on Menu Test → command Settings → Settings TM_FP2. In this dialog, you can define a new test course or upload a predefined one from the database. And you can re-store the current test course into the database again.



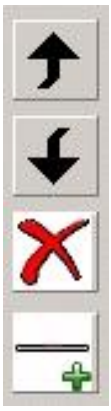
List 2: Possible settings for TM_FP2.

Settings	Function
n Refresh list	Number of lines in the command list Updates the command list to the new number of lines. If this causes a deletion of lines (new n < old n), a dialog will occur and ask for confirmation.
Selection of test Load Delete	The ComboBox contains a list of all stored test procedures. After one has been chosen, the procedure can be loaded clicking on button “Load test”. “Delete” removes the marked procedure after a confirmation. This procedure cannot be recovered.
Name of test	This field shows the description of the current test procedure. The current state of the command list can be stored under this description at every time using button “Save”.
Variable definition	This button calls up a dialog where up to 50 variables and their initial values can be defined. The program can use these variables for calculations and for the test. With each test start, the variables used by the program are set to the initial values given in this dialog.

	Mark	Actions	Parameters
1		= Assign	Var2 = 1
2	Cycle	? Test	if (Var2 > 10) then GoTo 'End'
3		Pos	Pos Var1 [N] mit 10 [mm/min]
4			Stop (F) , Wait 10 [s]
5		Sinus	Sinus Var1 [N] ±10 [N], 2 [Hz], 10000 cycles, save (100,1,5)
6		Pos	Pos 10 [mm S] mit 100 [mm/min]
7		Sinus	Sinus 0 [mm] ±0 [mm], 0 [Hz], 0 cycles, save (0,0,0)
8	Middle22	= Assign	Var2 ++
9		GoTo	GoTo Cycle
10	End	End of test	

List 3: Entries in the list.

Settings	Function
number (generated automatically)	Line number, counter for command lines, can be used as jump target in GoTo- and Test-commands
Mark	Jump target that can be entered in GoTo- and Test-commands
Actions	Icon and short description for the command to be performed
Parameter	Detailed description of the parameter of the command



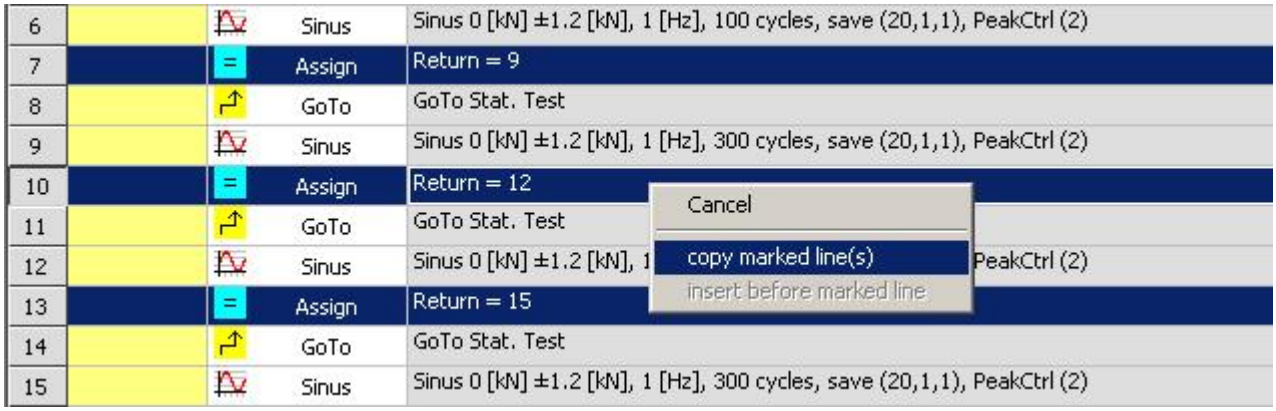
Moves the marked line up for one position

Moves the marked line up for one position

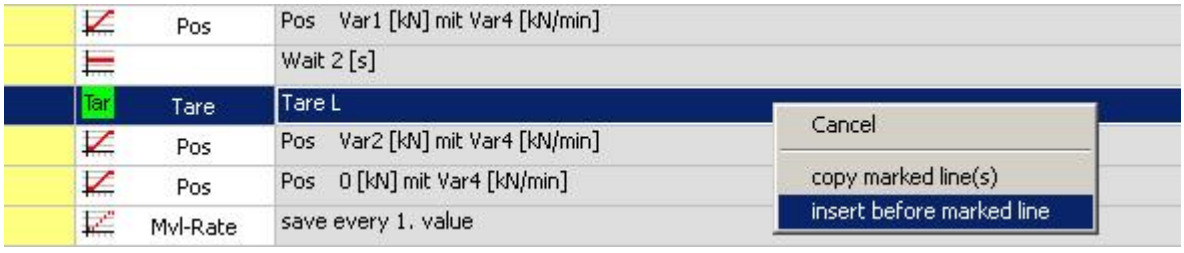
Deletes the marked line(s)

Inserts one line with „No operation“-command above the marked line (NOP – No Operation)

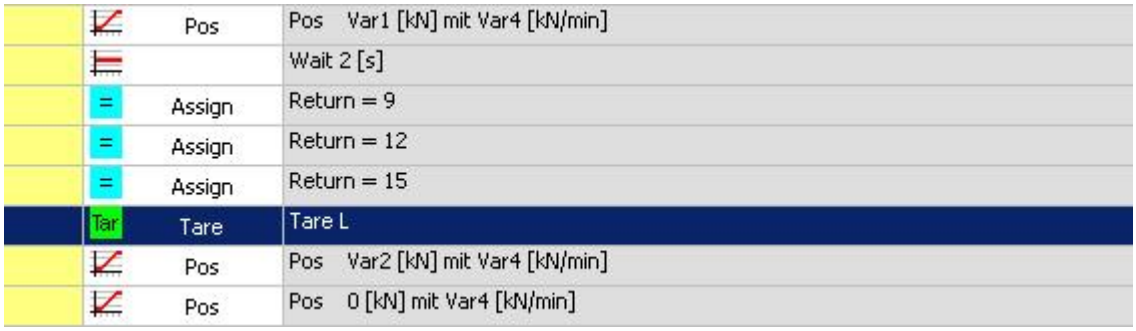
With a left mouseclick you can mark a line in the list, with left mouseclick + <Ctrl> you can mark more than one line at the same time. The “delete”-command deletes all marked line at a time. Marked lines (one or more) can be copied with right mouseclick and “**copy marked line(s)**” from the context menu.



These copied lines can be pasted with right mouseclick and „**insert before marked line**“ in the context menu at any position in the list.

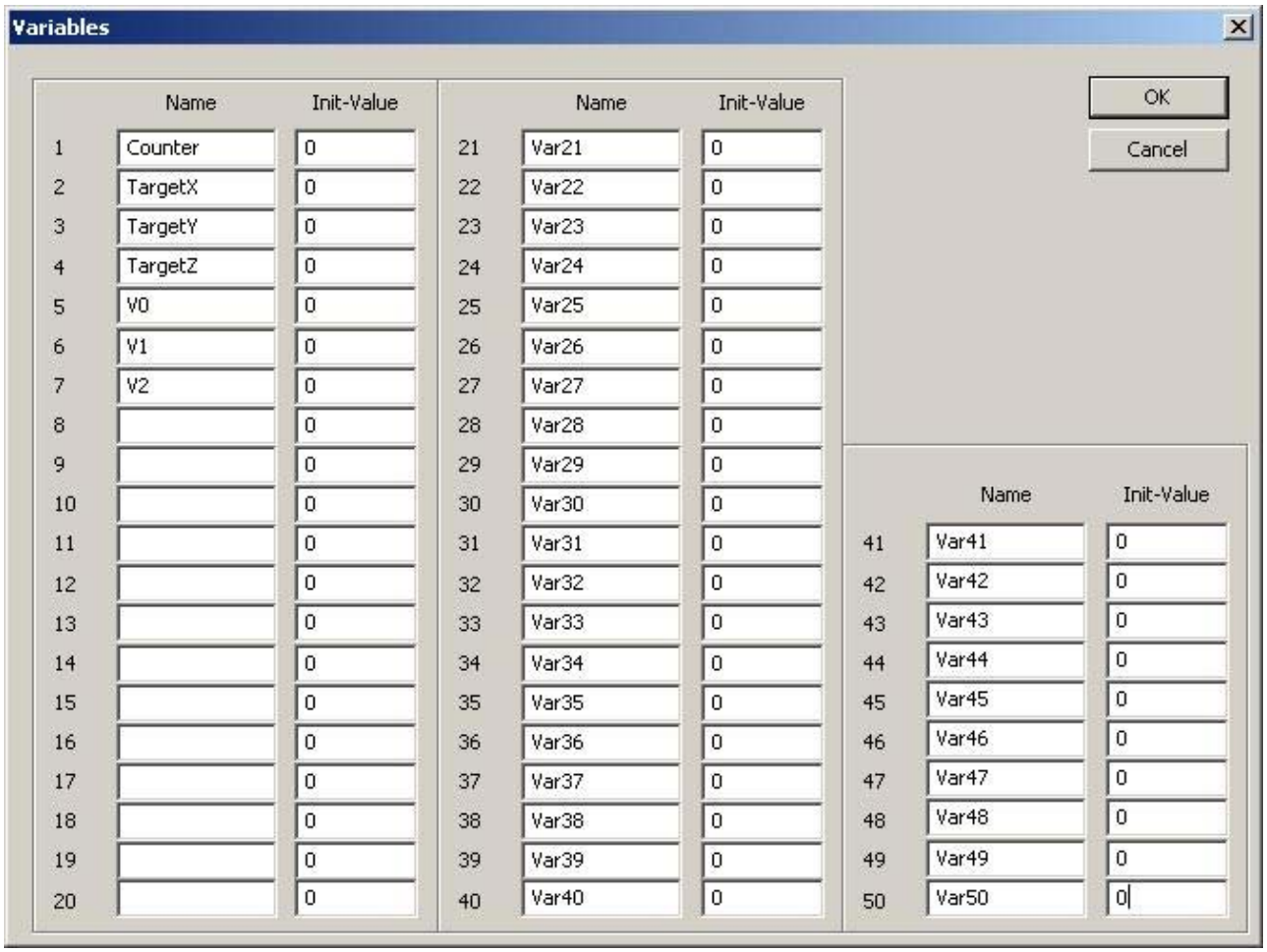


→ Outcome:



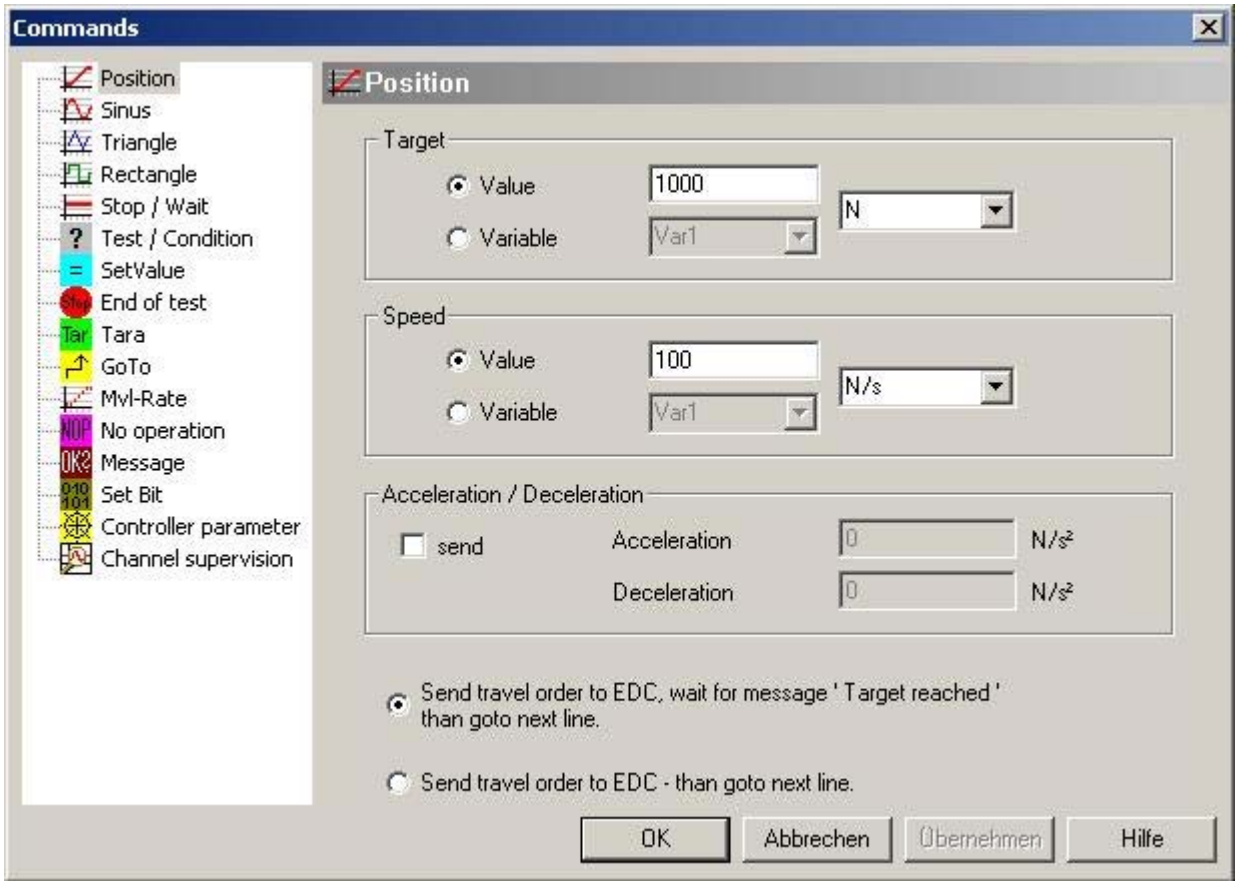
2.2 Dialog for the definition of variables

1. Click on Menu Test → command Settings → Settings TM_FP2 → Variables. This dialog offers the possibility to define up to 50 variables and their initial values. Right after the start of the test, the used variables will be set to their initial values.

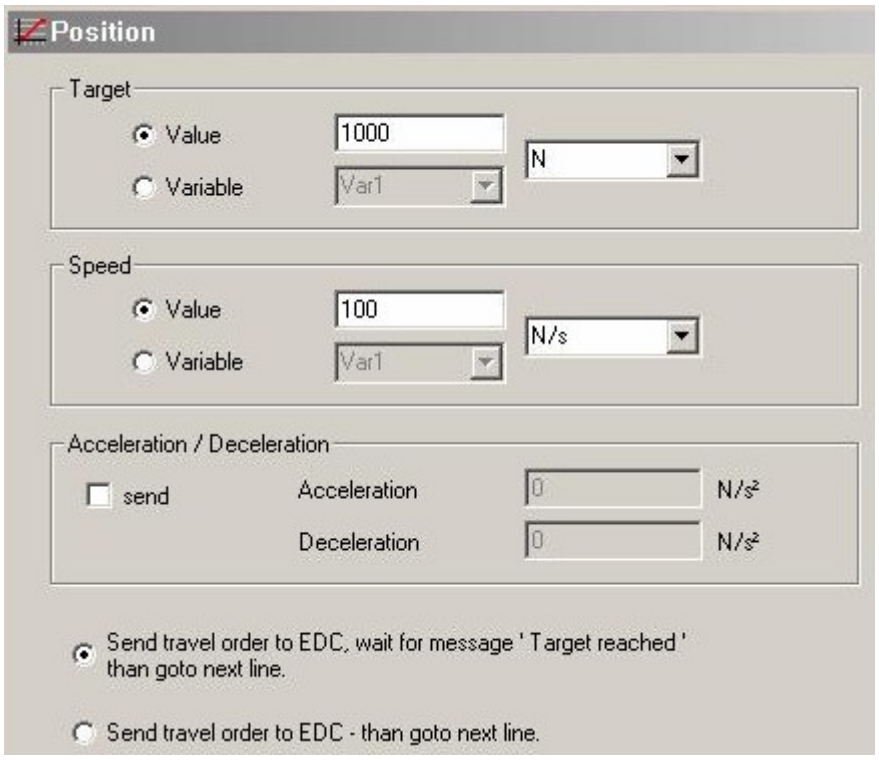


2.3 Dialog for the definition of commands

2. Click on Menu Test → command Settings → settings TM_FP2. In the list, double click on the line to be defined. A dialog offering all available commands will open. Click on the wanted command on the left side of the dialog. The right part will show a mask, where you can enter the related parameters.



2.3.1 Dialog Position



Defines a simple travel order. The Target of this travel order can be entered as number or a variable. The speed will be defined in a similar manner.

The dimension of the target defines, whether we approach a position, a load or stress value or an elongation value. The dimension of the speed defines the control type used to approach the target.

Note: A precondition for a successful drive command is: the chosen controller must be active and the control parameters must be set in a correct manner.

List 4: Dimensions for the drive command Pos - target

Target Dimension	Meaning
N, kN, cN	Load targets
N/mm², MPa	Stress values as target
mm_S	Crosshead position
mm_dL	Elongation as target
%	Strain / compressive strain
mm_h	Distance between plates / height of spring
Diff mm S	Position difference to the current position
Diff mm dL	Elongation difference to the current elongation
Diff N	Load difference in [N] to the current load
Diff kN	Load difference in [kN] to the current load

List 5: Dimensions for the drive command Pos - speed

Speed Dimension	Meaning
N, kN, cN	Load targets
N/mm², MPa	Stress values as target
mm_S	Crosshead position
mm_dL	Elongation as target
%	Strain / compressive strain
mm_h	Distance between plates / height of spring

Acceleration / deceleration:

Positioning happens with default-settings for acceleration and deceleration. When the checkbox “Send” is activated, the entered values will be used for this travel order.

Choice:

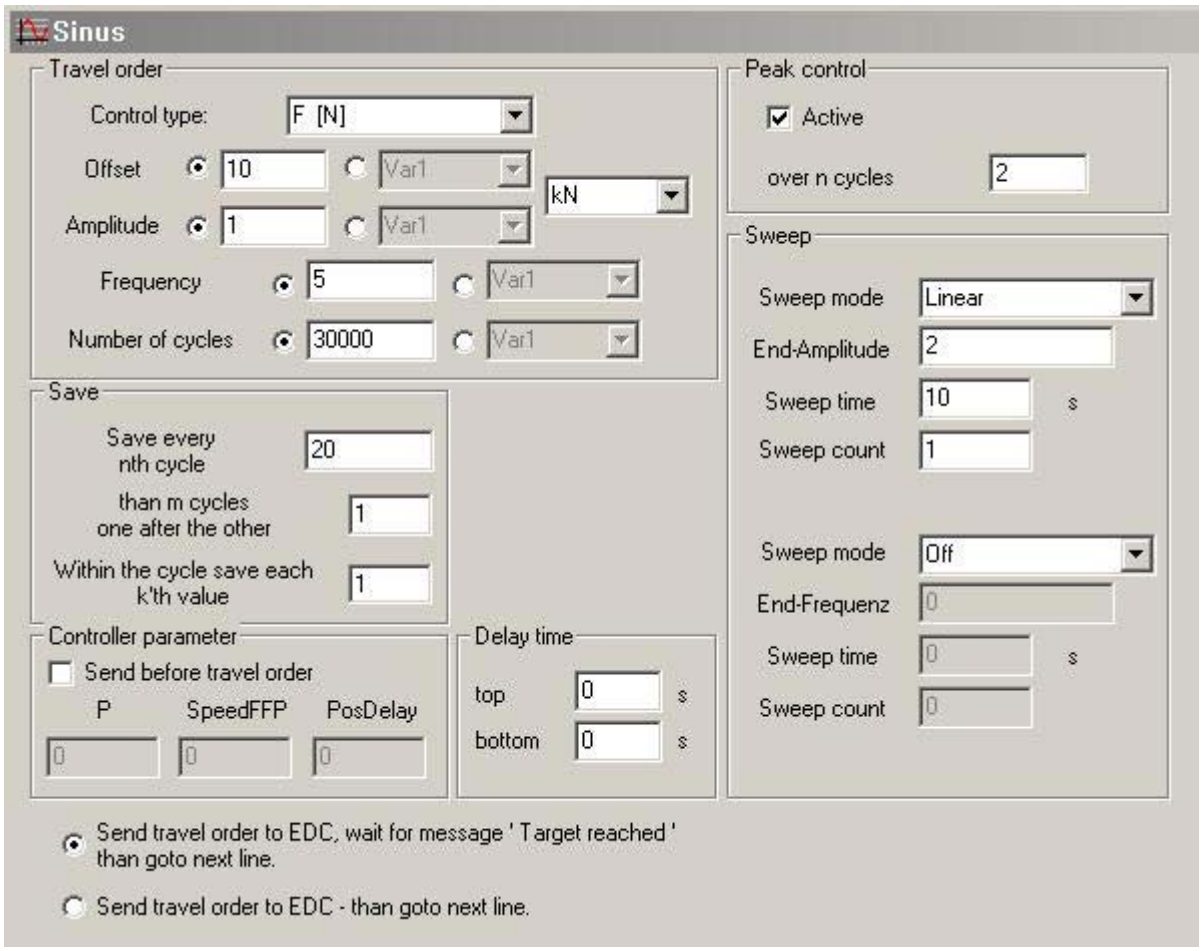
1. **Send travel order to EDC, wait for message „target reached“, then go to next line.**

   The travel order will be sent to the EDC. The EDC takes over the control of the crosshead and when the target is reached, it sends the message „target reached“ to the PC-software. After reception of this message, i.e. after the tester has reached the target position, the software forwards to the next command line. When the tester reaches the target position, the control type of the target is active. As long as the tester is approaching the target, it is not possible to carry out other actions or tests.

2. **Send travel order to EDC, then go to next line.**

   The travel order will be sent to the EDC. The EDC takes over the control of the crosshead and when the target is reached, it sends the message „target reached“ to the PC-software. The software forwards to the next command line, directly after the drive command has been given. Hence, this offers the possibility to carry out tests, e.g. the tester drives until an entered load is reached, followed by a drive with a different speed, all without halt inbetween them.

2.3.2 Dialog Sinus



Defines a complex travel order. The tester drives sine cycles in the given control type (load, position, strain) with the given offset, amplitude and frequency. After the cycles entered at “Number of cycles” are done, the EDC sends the message “target reached” to the PC-software. This message can be used by a testing command to branch to the next command line.

Save

In general, a high number of cycles is carried out here. It is not recommended nor makes it any sense to store each cycle (to much storage needed). In the region “Save”, you define the storage intervals:

In the first box, you define, which n-th cycle is to be stored (e.g. each 5th or each 20th). In the second box you enter, how many cycles (m) should be stored one after the other and in the third box, which k-th value of the cycle should be stored.

Hint: If you enter 1 in this box, the cycles will be stored with the acquisition rate entered in the EDC. Depending on this acquisition rate, a certain number of measurement values are stored for each cycle. If this number is to high, it will be enough to store each 2nd, 3rd, or k-th value, only.

Example: Acquisition rate at the EDC: 5 kHz
Entered load frequency 10 Hz
500 measurement values per cycle
if k = 10 → 50 measurement values per cycle

50 to 100 measurement values are enough to define a cycle with adequate exactness.

Control parameters

Before the sine travel order is sent, control parameters can be send as an option.

The control parameters will overwrite the previous set values. It may be useful to set different control parameters for different load frequencies.

Peak control

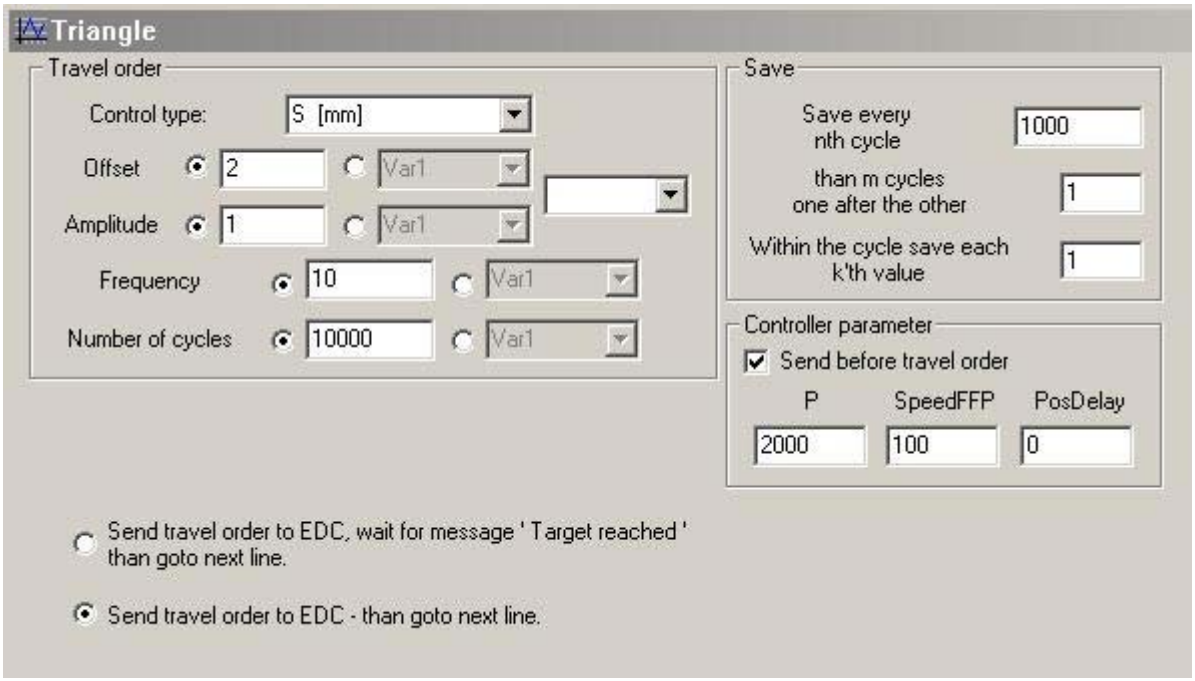
After the sine travel order has been started, the peak values will be kept in a more or less exact manner, depending on the current control parameters. The EDC will autonomuously analyze the current peak values and – in consequence of that – alternate the set value curve in a manner, that the current values of the amplitude meet the requirements (**Peak control**). The current value controlling the amplitude is being calculated as mean value of 1, 2, 4, 8 or 16 (2^0,..,2^4) cycles. Hence it makes sense to enter 1, 2, 4, 8 or 16 for n (**over n cycles**).

Sweep

An activation of this function results in a change of the amplitude and/or the frequency to the terminal value defined under **End-Amplitude** or **End-Frequenz**. The change will happen in a linear or logarithmic course within the given time (**sweep time**). Hence, it is possible to e.g. start with a low load and then continue by slowly approaching to the wanted terminal value of the amplitude/frequency.

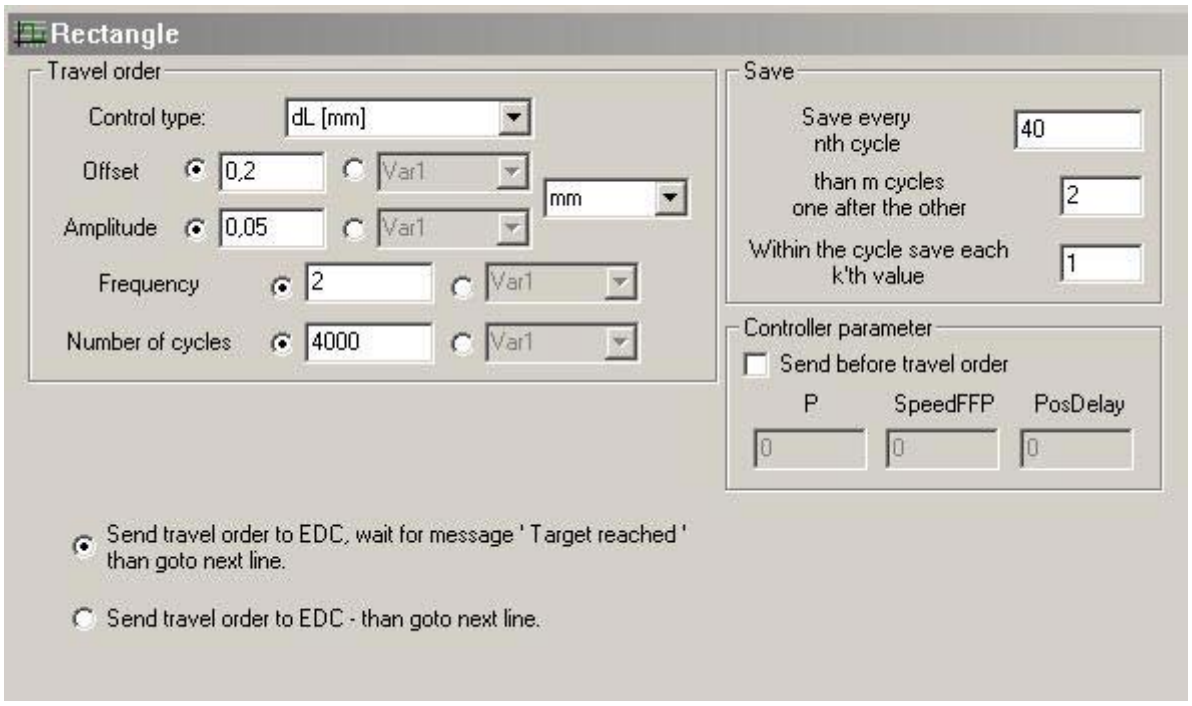
Example: In the dialog, we start with an amplitude of 1,0kN and rise it linearly and within the sweep time of 10 seconds to 2kN. The remaining cycles of the sine travel order will be driven with the terminal amplitude (or terminal frequency).

2.3.3 Dialog Triangle



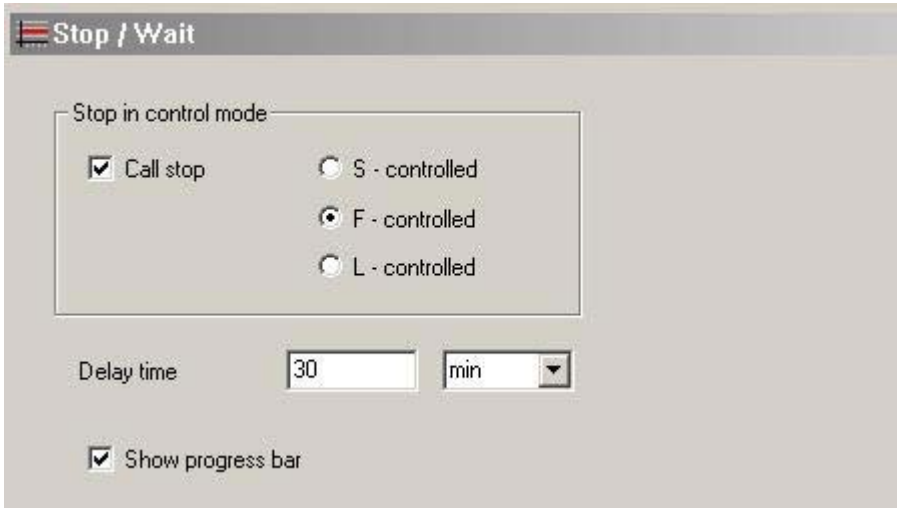
These setting have the same effect as with the sine travel order, whereas triangle-shaped loads will be driven. For a functional description, please see chapter **Dialog Sinus**.

2.3.4 Dialog Rectangle



These setting have the same effect as with the sine travel order, whereas rectangle-shaped loads will be driven. For a functional description, please see chapter **Dialog Sinus**.

2.3.5 Dialog Stop / Wait



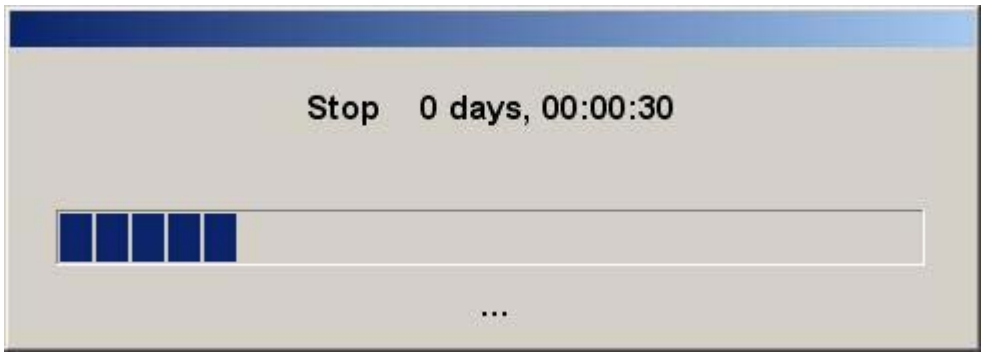
Stop in control mode:

An activation of this function calls up the command **Stop** in the given control mode.

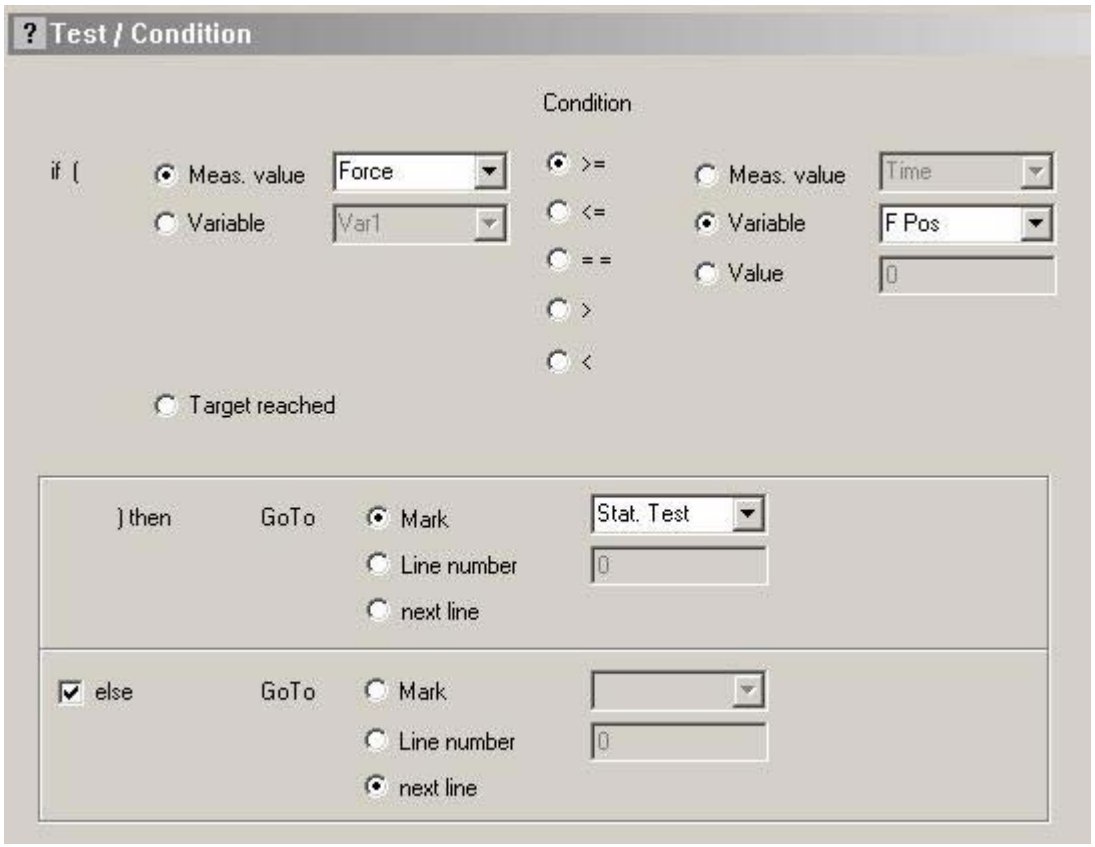
Subsequently, the program waits for the given time (**Delay time**) in the current command line. This time can be used e.g. to give a sample the time to relax.

Show progress bar:

It is possible to show a progress bar during the waiting time. –this dialog can be closed with <ESC> at any time without influencing the waiting time itself.



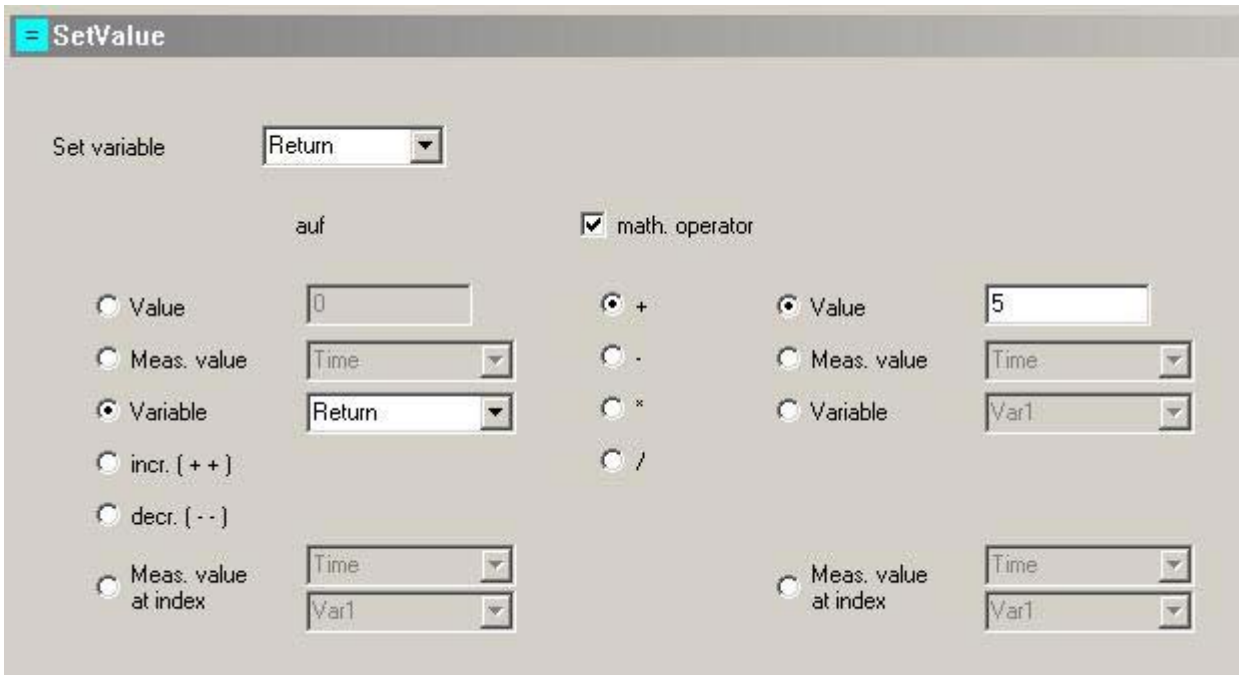
2.3.6 Dialog Test / Condition



This dialog offer the possibility to define operations as a function of defined conditions. Variables are compared and – as a result – a specific operation will follow depending on the result.
Here, force is compared with F Pos. If it is bigger or equal to F Pos, the program jumps to the mark Stat. Test, else it will continue with the next command line.

This way, special counting variables can be checked and then special program parts can be carried out in a cyclic manner.

2.3.7 Dialog SetValue



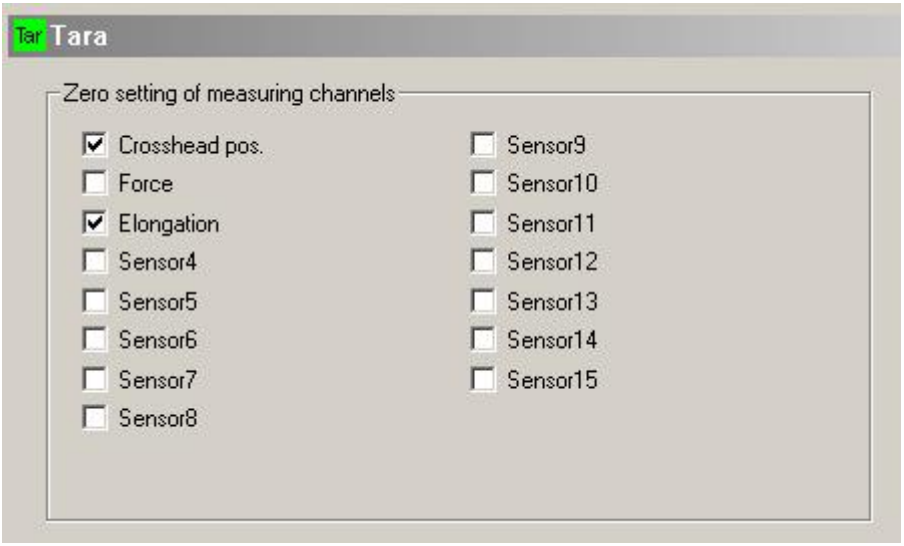
You can use this dialog to easily change the values entered in dialog **Position** (see chapter 2.3). Chose the variable at **Set variable**,. Then you have several possibilities:
Allocate a fix value to this variable (**value**), allocate a currently measured value to it (**Meas. value**), increase (incr. (++) or decrease it (decr. (--) by 1 or allocated the value of another variable to it. Furthermore, you can define mathematic operations (set checkmark at **math. operator**) with the same operands.

Example Return = 0
Return = Return + 5

2.3.8 Dialog End of test

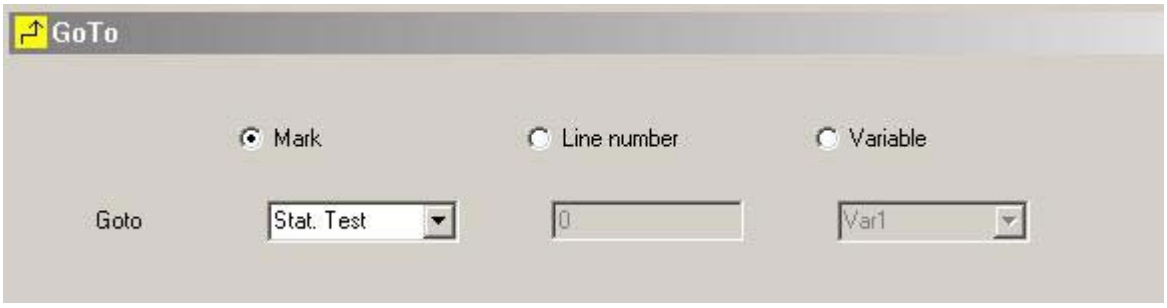
Ends the current test.

2.3.9 Dialog Tara



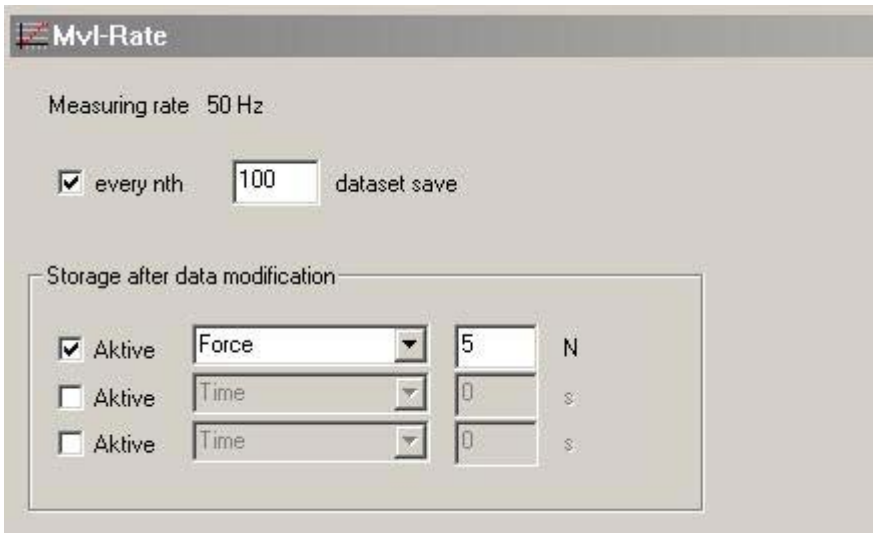
One or several measurement values can be tared with this command.

2.3.10 Dialog GoTo



With this dialog, you can define a jump to another command line. This command line can be defined via a mark (2nd column in the program list), its a line number (1st column in the program list), or the content of a variable.

2.3.11 Dialog Mvl-Rate



For simple static tension tests with short test time, each value is stored in general. However, for tests with longer test times (e.g. relaxation tests) or cyclic tests, it is recommended to reduce the data amount by modifying the measurement rate. Whereas the rate has been defined with the travel order already (e.g. dialog Sinus , see chapter 2.3.2) already, this dialog can be used to modify the measurement rate. You can reduce or deactivate (enter 0) the periodical data storage.

In addition, you can define a data storage as result of an incident at the sample, e.g. when the load at the sample rises or decreases for >= 5N.

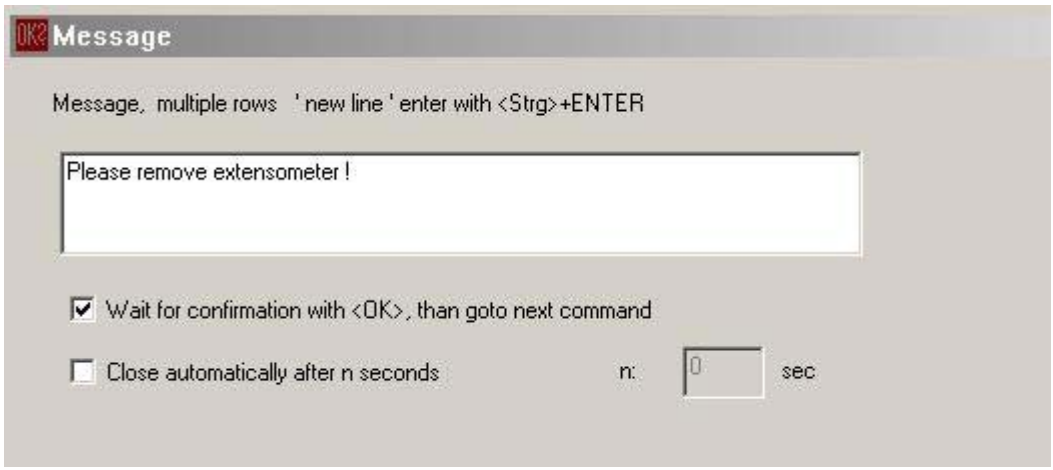
In this example, a cycle will be stored every two seconds (every 100th cycle at 50Hz measuring rate) and – additionally – when a load change of >= 5N is been detected at the sample.

2.3.12 Dialog No Operation

This dialog represents a place holder and has no other effect.

This command will be inserted when pressing the button “insert line” (right side of the command list).

2.3.13 Dialog Message

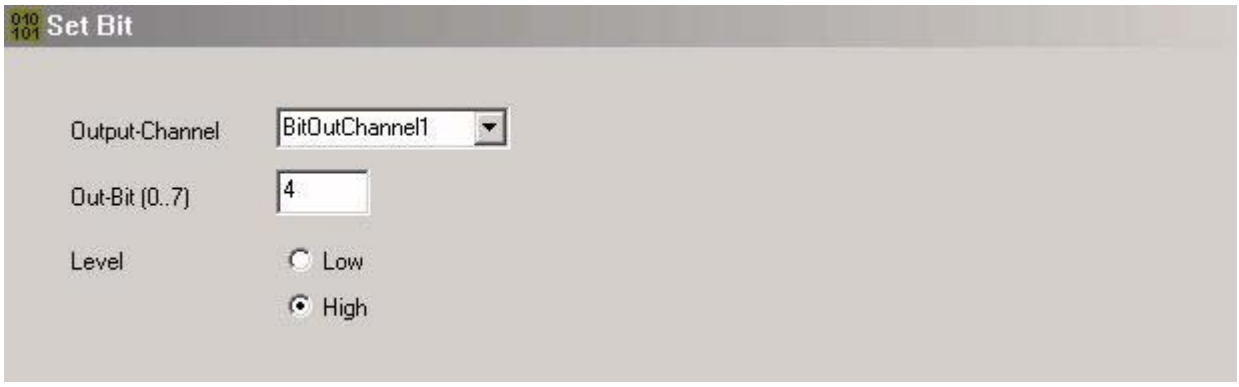


This dialog has been created in order to give the user the possibility to influence the program course in a time-based manner. You can enter a text as message for the user.

Attention: The appearance of this dialog does not interrupt the program course, i.e. the program will continue with the nex command line. If you want the program to be interrupted, set a checkmark at „Wait for confirmation with <OK>…", the the programm will wait for Ok tob e pressed.

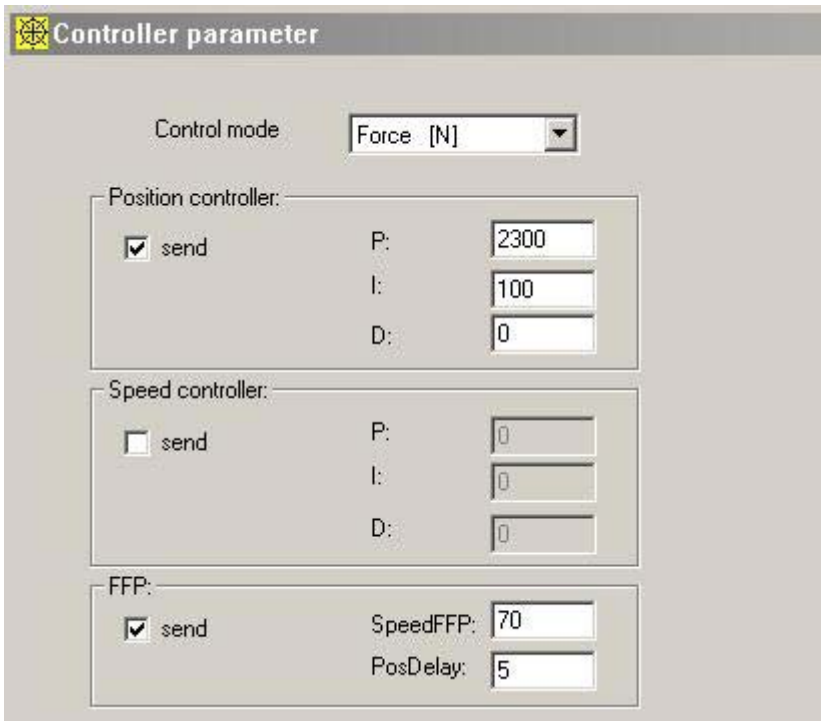
Furtheron, you can define the display time of this dialog (set checkmark and enter a time).

2.3.14 Dialog Set Bit



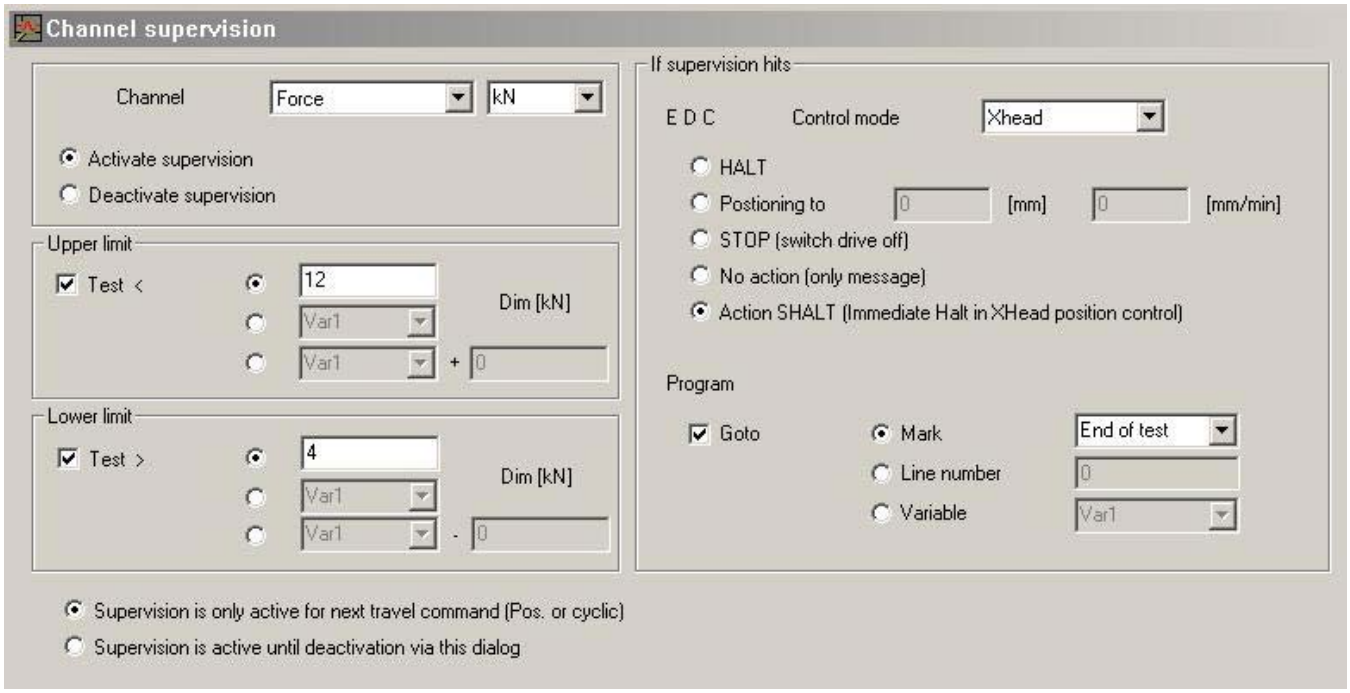
Here, you can set and reset an ouput bit.

2.3.15 Dialog Controller Parameter



The control parameters for a test differ depending on the material oft he sample, the load, amplitude and frequency. During the test course, the control parameters can be sent to the measuring sensors. At this juncture, the parameters for position, speed and the pilot control for the set value will be sent to the sensors for position, load and strain, either separately or all at the same time.

2.3.16 Dialog Channel Supervision



It is possible to secure either parts of the test course or the whole test course against overceeding of defined measurement values. The supervision will be done by the EDC with the channel supervision.

In this dialog, you can activate/deactivate the supervision of a distinct channel (**Channel**) and define the limits to be checked (**Upper limit**, **Lower limit**). Furthermore, you can define the reaction of the program, when the limits are hit (**If supervision hits**), e.g. the EDC gets the order to halt (SHALT) or drive to a defined position, and the program jumps to a defined position (checkmark at **Go to**) e.g. the end of the test.

Tip: Use the EDC based channel supervision rather than a pc-software based one. It reacts much faster, as the signal transmission time from the sensors to the PC is eliminated.