

Test&Motion
Application Module

**KU 16R – Tension Test for vulcanized rubber and
elastomers, method B (D412-06a)**

www.doli.de

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1 Introduction

Dear customer, thank you for choosing a product of **DOLI Elektronik GmbH**. **Test&Motion** is a modern application for the operating systems Microsoft Windows 7/10®.

This manual does not deal with the **Test&Motion software** in general but with the application module **KU 16R** in particular. Hence, it is recommended to read the **Test&Motion** application manual in order to get familiar with the software. Please follow the demands and safety hints listed in the manual!

1.1 Symbols

The different symbols in this manual will allow you to find your way more easily.

Table 1: Symbols and their meaning.

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 KU 16R – Tension test for vulcanized rubber and elastomers Test method B (acc. to ASTM D412-06a)

2.1 Field of application

Two different test methods for determination the characteristics of rubber compounds. These test methods are useful in comparing stiffness of rubber materials in tensile direction.

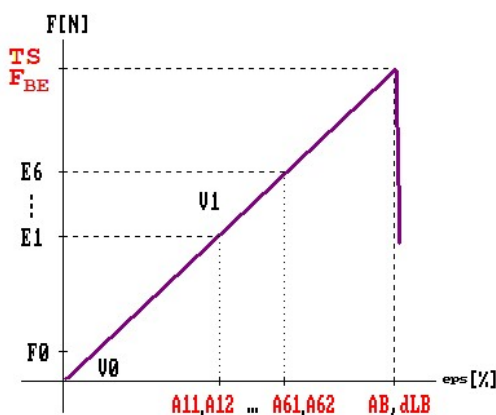
Test method A: Dumbbell and straight section specimen

Application module KU 16

Test method B: Cut ring specimen; autom. reference drive for O-Ring Test

Application module KU 16R

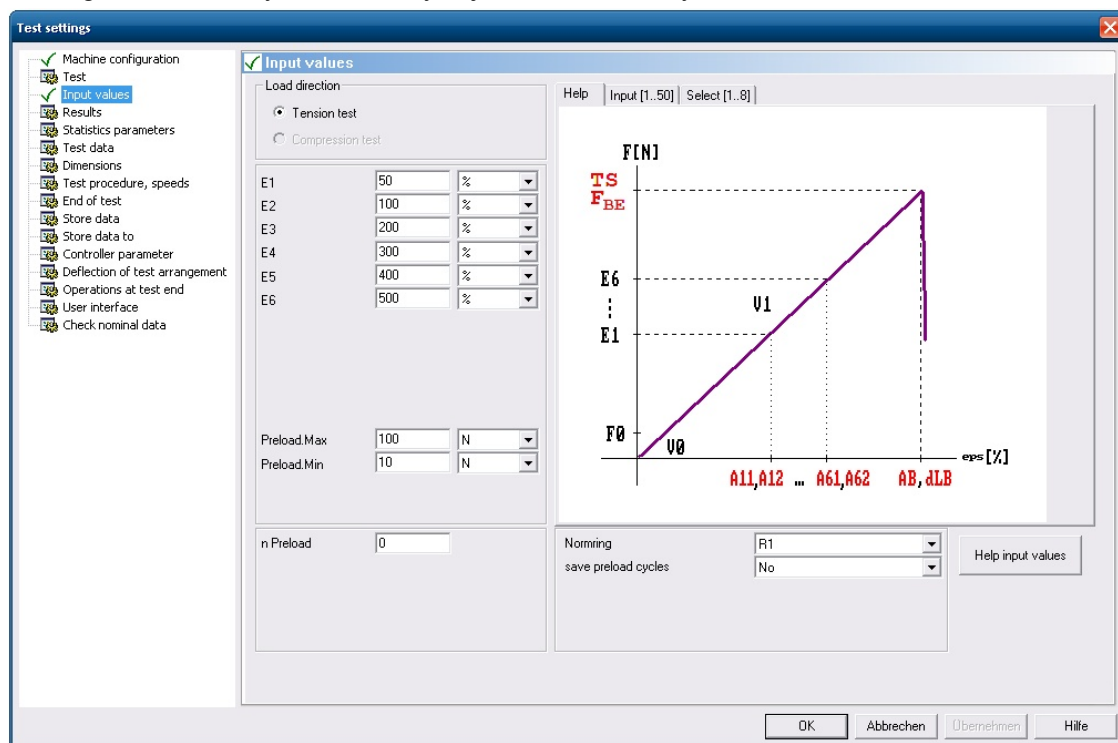
2.2 Test graphic KU 16R



2.3 Input values KU 16R



1. Click **Menu Test → Command Settings → Input values**. Here you can find expedient input values for this test regulation, already. If necessary adjust the values to your needs.



The button 'Help input values' opens a help page containing all input values and their meanings, as they are explained in the following tables, also.

Table 2: Input values for test KU 16.

Parameter	Meaning	Dimension / Selection possibilities
E1	Reference value 1	[N, kN], [N/mm ²], [mm_S], [mm_dL], [%], [s, min, h]
E2	Reference value 2	dimensions analogue E1
E3	Reference value 3	...
E4	Reference value 4	...
E5	Reference value 5	...
E6	Reference value 6	dimensions analogue E1
Preload max		[N]
Preload min		[N]
n-Preload	Number of preload cycles	
The following input values can be found in dialog Test procedure, speeds (Menu Test → Command Settings)		
F0	Preliminary force	
V0	Test rate until preliminary force F0 is reached	
V1	Test rate after reaching of preliminary force F0	
V2	Speed during preload cycles	

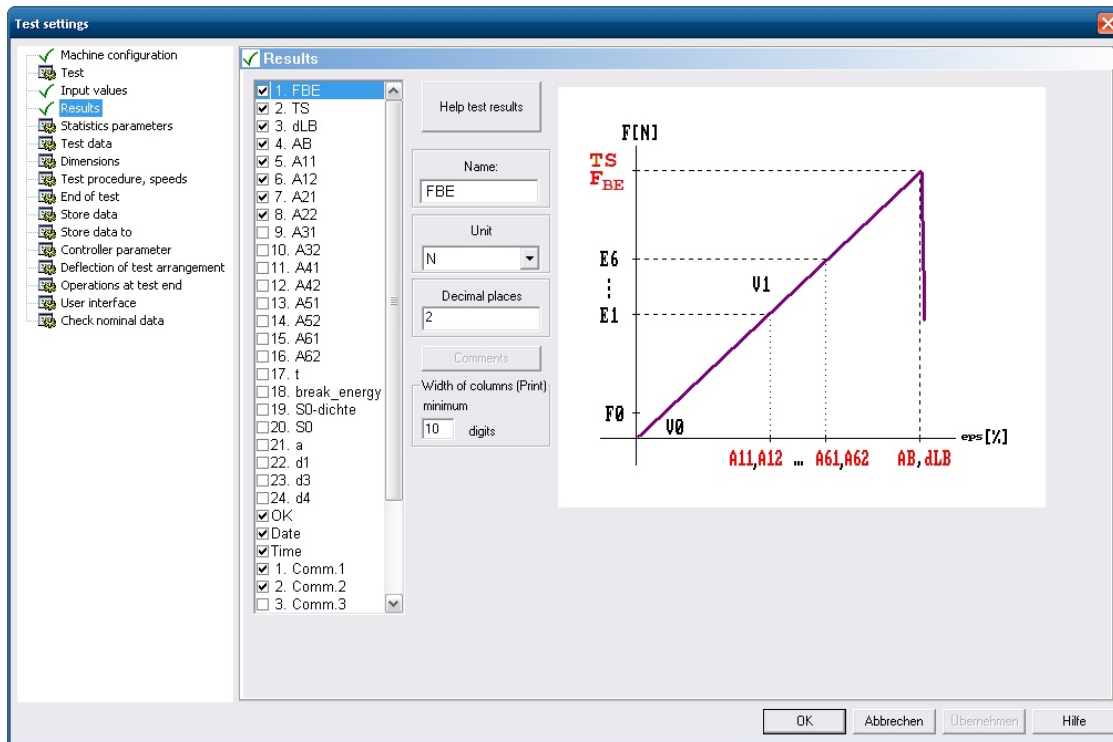
Table 3: KU 16R Selections and their meanings.

Selection	Meaning
Normring (standard ring)	define the type of ring you want to test: standard or individual dimensions:
R1	
R2	
Input values d3, d4	Individual dimensions, to be entered in dialog Dimensions (Menu Test → Command Settings → Dimensions)
Save preload cycles	Chose, whether you want the preload cycles to be safed

2.4 Results KU 16R



- Click **Menu Test → Command Settings → Results**. Here you can find expedient results, already. If necessary, chose and adjust the values to your needs.



- By clicking on one of the test results in the list, you can change its unit, decimal places and width of columns for the printout in the fields beside the list, if necessary.

The button 'Help test results' opens a help page containing all output values and their meanings, as they are explained in the following tables, also.

Table 4: Results for test KU 16R.

Parameter	Meaning
FM	Max. test force
TS	Tensile strength (tensile stress at max. test force)
AB	Max. test force / b
dLB	Breaking force
A11, A12	reference values at E1
A21, A22	reference values at E2
A31, A32	reference values at E3
A41, A42	reference values at E4
A51, A52	reference values at E5
A61, A62	reference values at E6
t	Duration of load (time from reaching F0 to end of test)
Break energy	[J/cm²]

S0	Test piece section
PA1	Test piece sample 1 (not for all test piece shapes)
PA2	Test piece sample 2 (not for all test piece shapes)

2.5 Notes for test KU 16R

2.5.1 Preliminary force F0

For the test control the elongation and the extension are set to zero at this point.

Switching over point of the test rate V0 to V1

The measuring length is corrected to $L0' = L0 + dL(F0)$

whereas

$L0'$ corrected measuring length

$L0$ measuring length

$dL(F0)$ sample deformation at F0

2.5.2 Input values E1 ... E6, output values A11, A12, ... A61, A62

At six different points of the measured value curve, defined by the input values E1 ... E6, you can determine two reference values (A11, A12, ... A61, A62) for each input value. The meaning of the output values depends on the chosen units:

Table 5: Dimensions of values and their meanings.

Dimension of the input value / result	Meaning
N, kN	Force
N/mm ²	Strength (stress)
%	Strain (extension)
mm_dL	Elongation
mm_S	Crosshead travel path
s, min, h	Time

2.5.3 Normring (standard ring) R1, R2 or defined by d3, d4

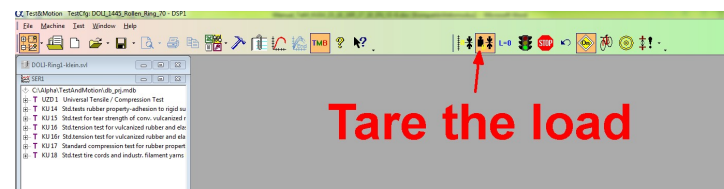
We can use either the standard ring type R1 or R2 for the test, or manually enter individual ring dimensions in dialog Dimensions (Menu Test → Command Settings → Dimensions).

2.6 Automatic Reference Drive for O-Rings

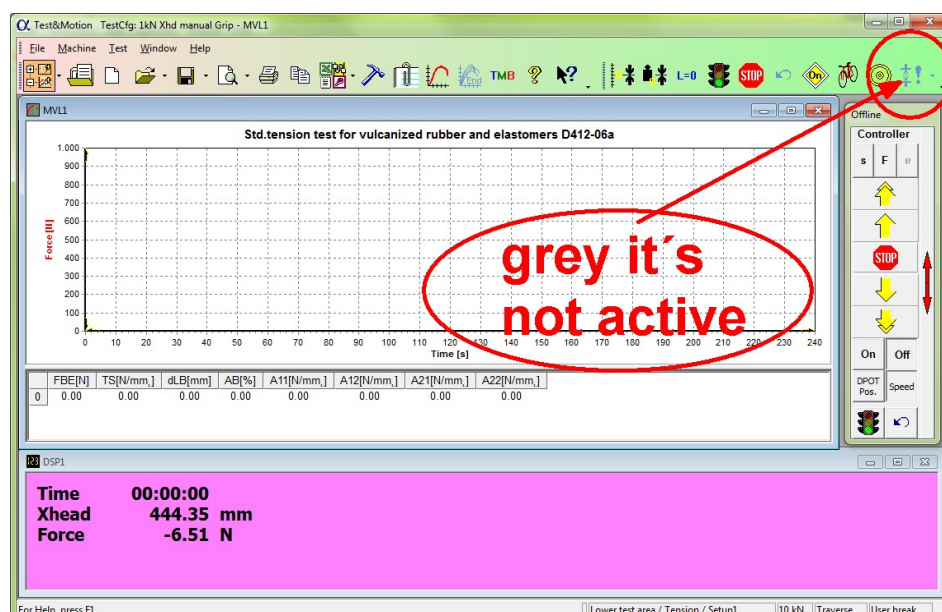
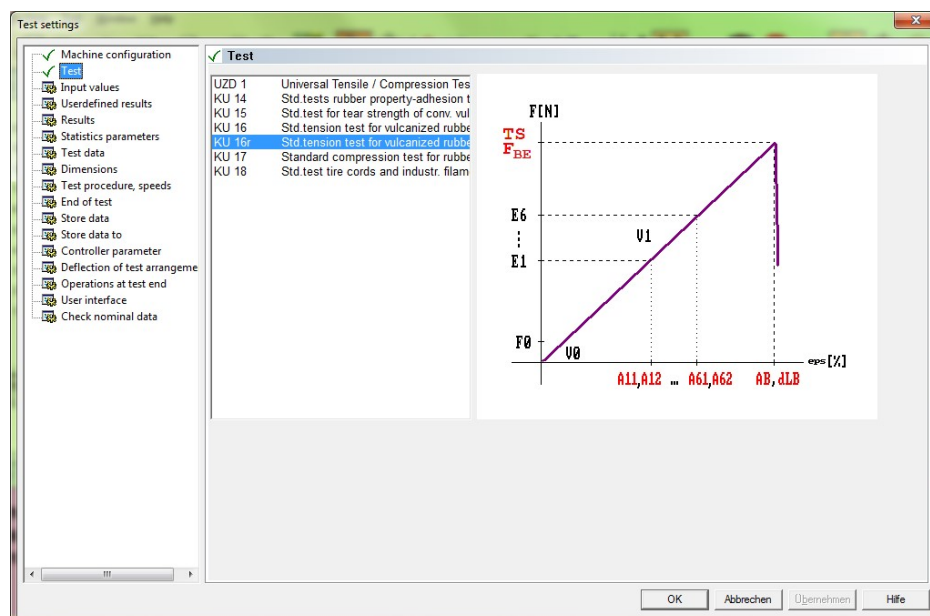


Note: For each new diameter of a roll-system, you have to define a separate 'Machine Configuration' and store this into a new svl-file. The rolls-system needs a absolute XHead position and that's the reason for reference drive!

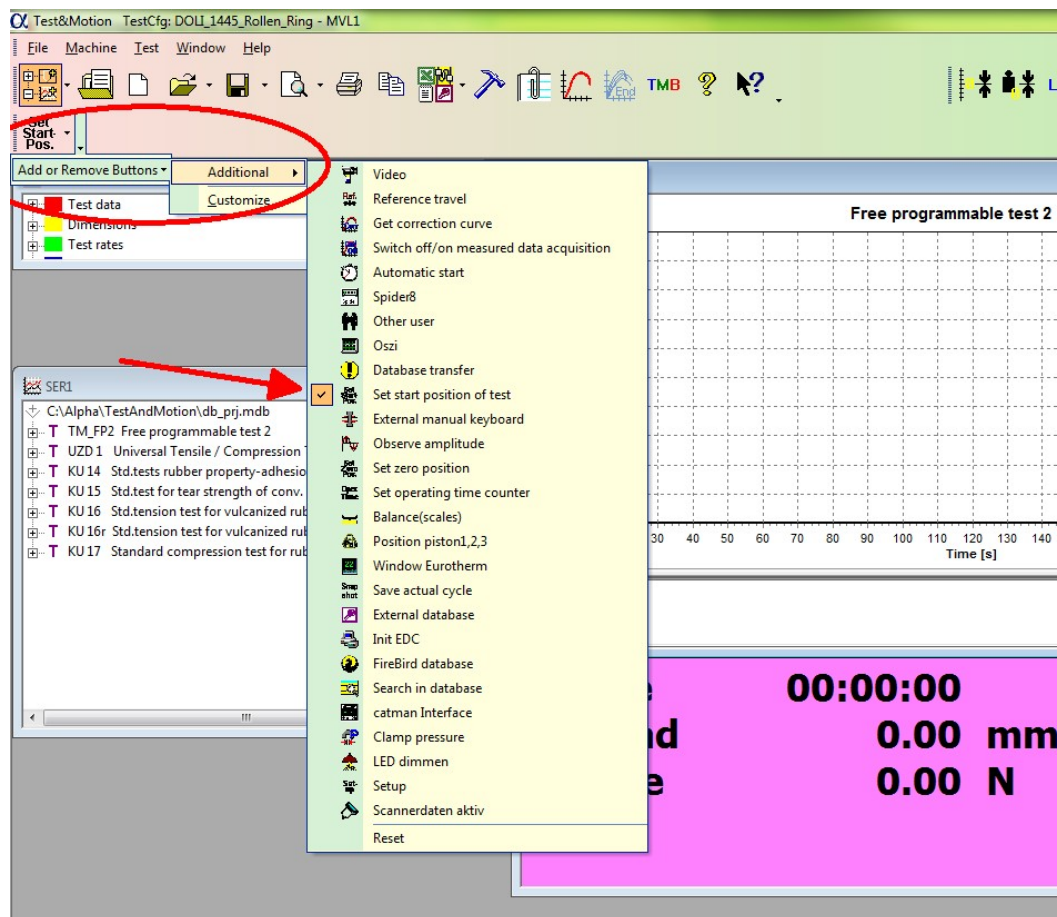
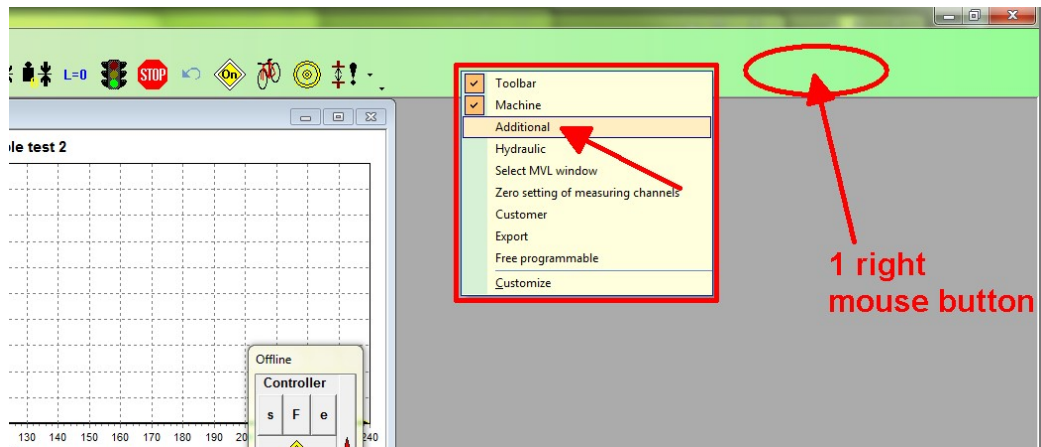
Tare the Load!



This feature is a part of the 16R method and has to be activated separately (icon for clamping device is grey, see picture below).

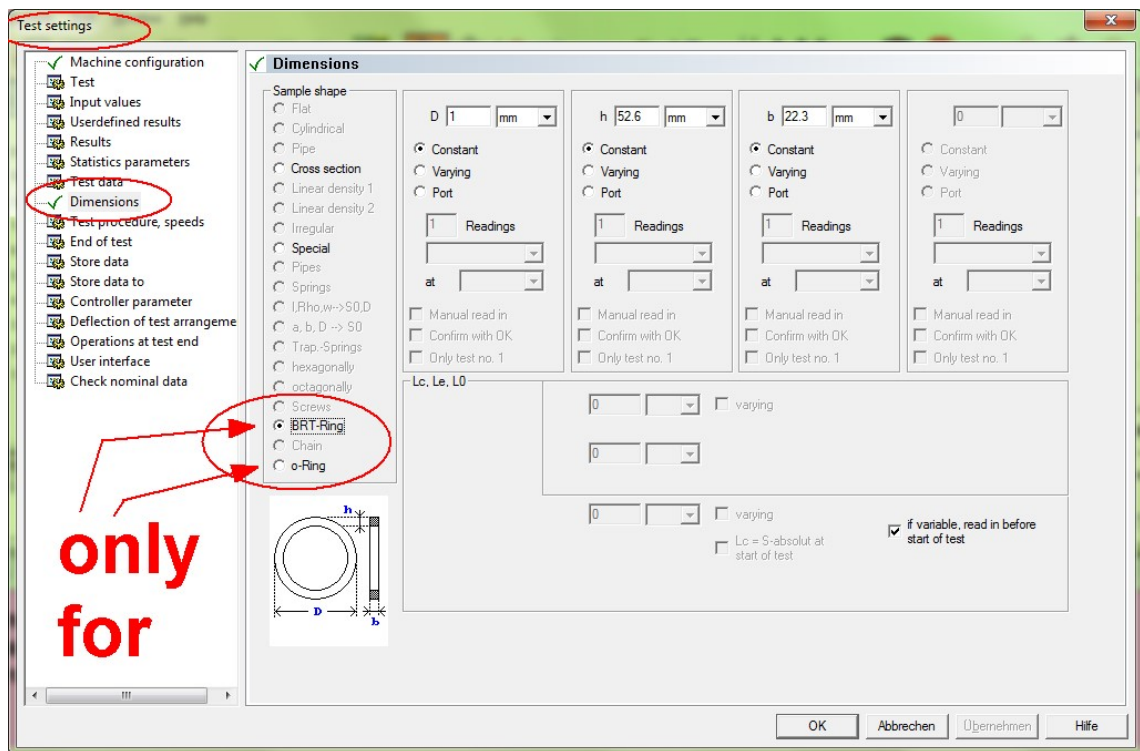


2.6.1 Activy the icon „Set Start. Pos.”

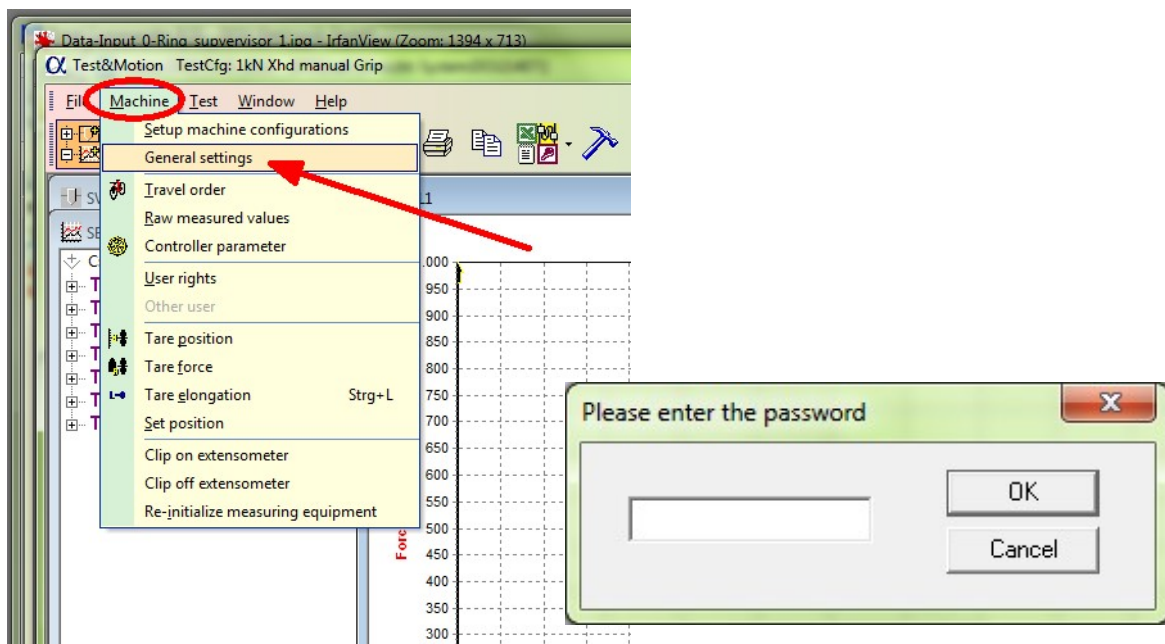


2.6.2 Activation of the feature Automatic Reference Drive

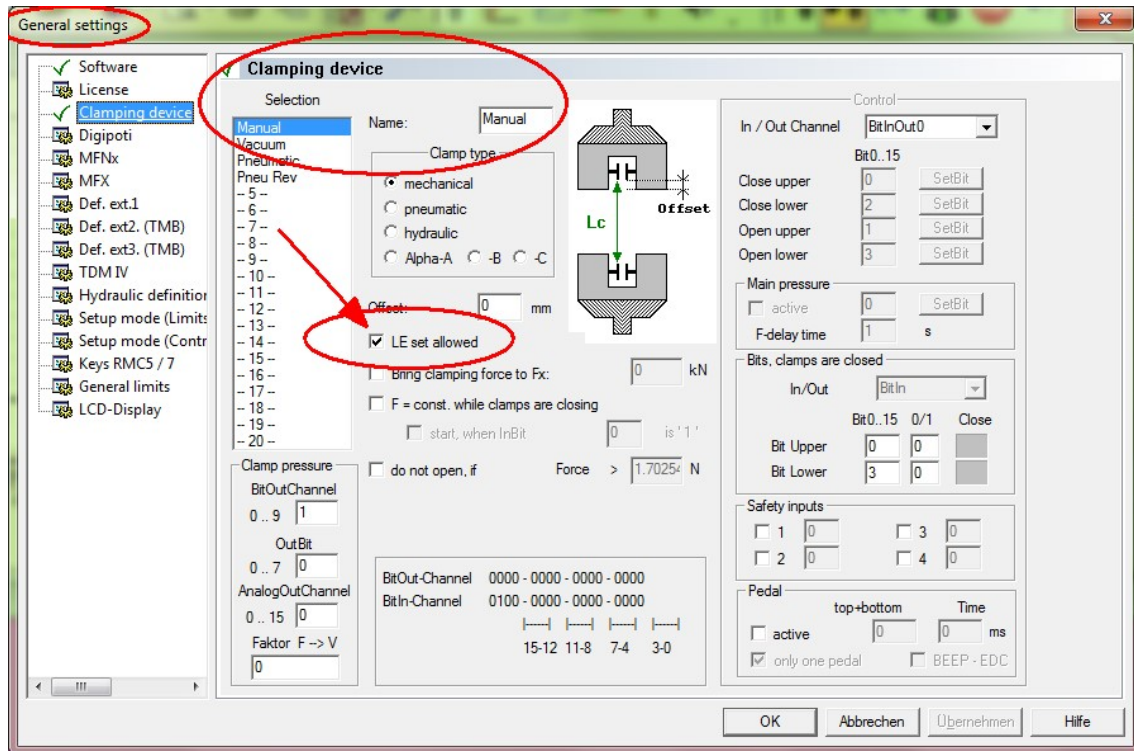
1. Click **Menu Test → Command Settings → Dimensions**. Here you can chose the sample shape BRT-Ring or O-Ring. The feature 'Automatic Reference Drive' is available for these two sample shapes, only.



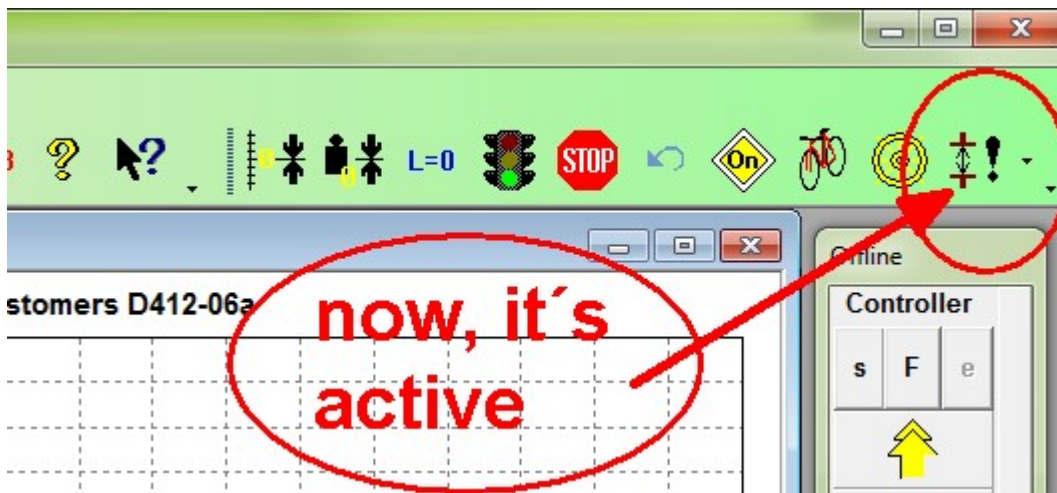
- Click **Menu Machine** → **Command General settings** → **Clamping device** and enter your password into the upcoming window.



3. In the window **Clamping device**, define the mechanical clamping device at point 'Selection', set a checkmark at the box 'LE set allowed' and confirm with OK.

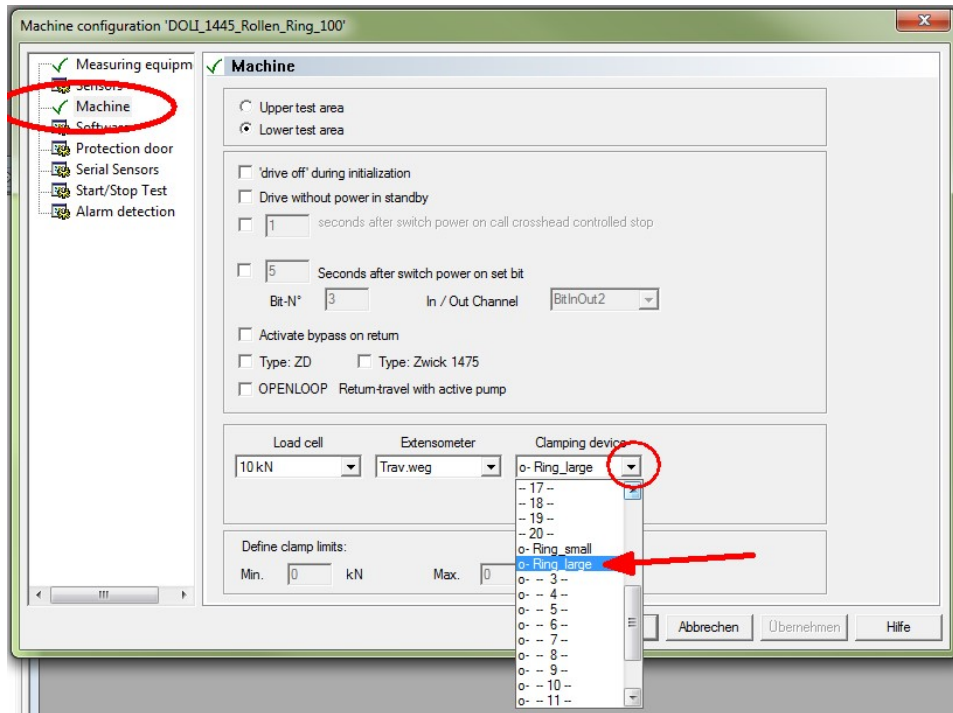


Now, the feature is available and the icon is coloured!

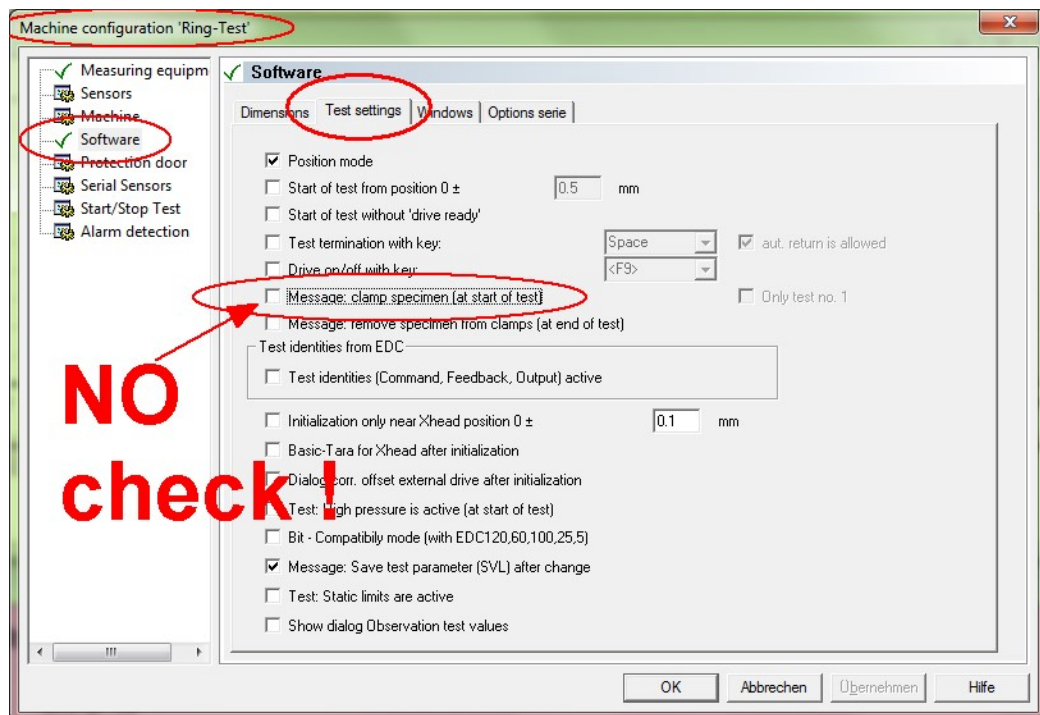


Every different Ring diameter **and/or** Rolls diameter needs it's own "machine configuration".

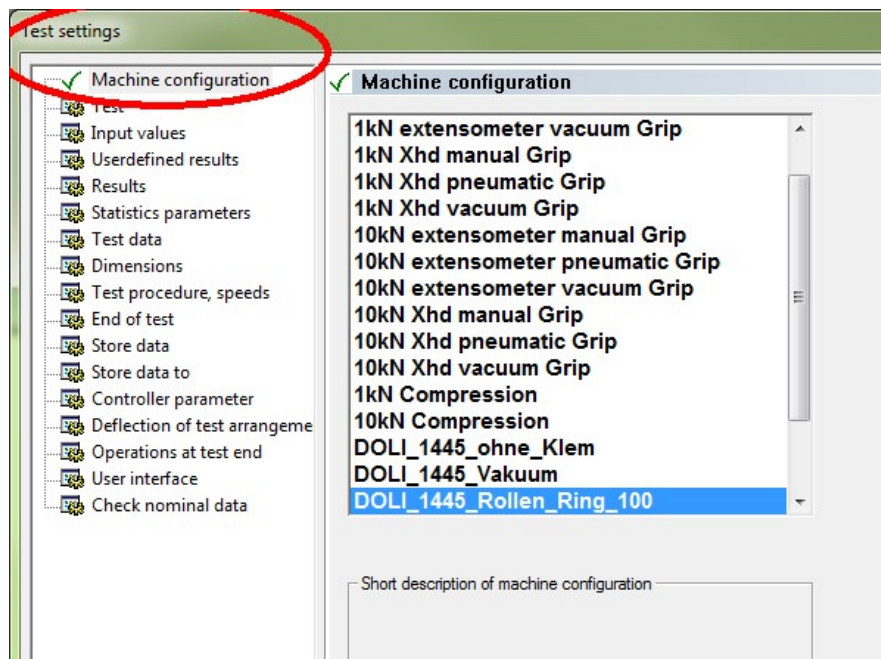
⇒ If you have 5 different Ring diameters => you need 5 different machine configurations.



Click command **Software**, remove the checkmark at 'Message: clamp specimen (at start of test)' and confirm with OK.



Every machine configurations => "Test settings"



Every "Test setting" => new SVL file (while it exist a new machine configuration for every Ring diameter).

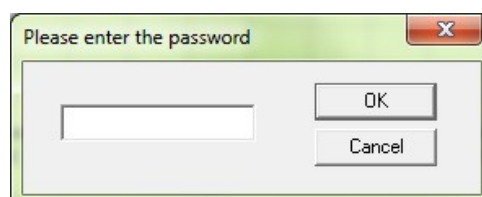
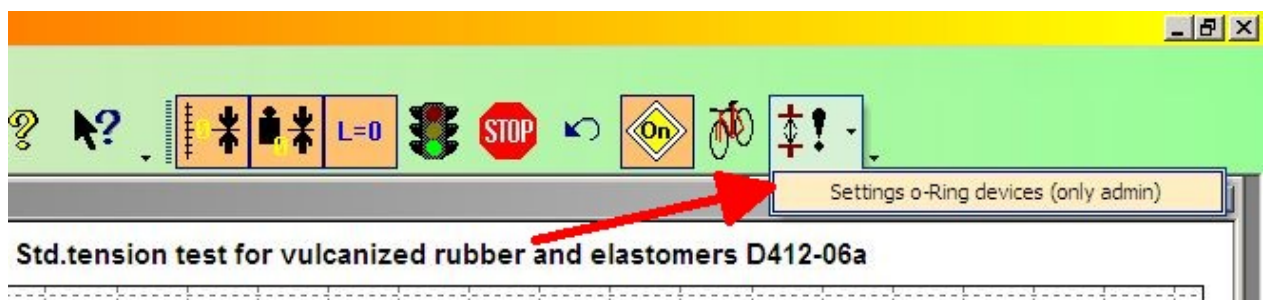
2.6.3 Configuration of the feature Automatic Reference Drive "



Note: Only the supervisor has the rights to change the configurations of the feature Automatic Reference Drive for O-Rings.

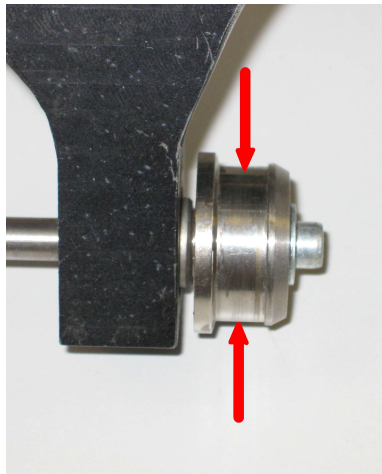


1. Click on the down arrow of the icon 'clamping device' and enter the supervisor password into the upcoming window.



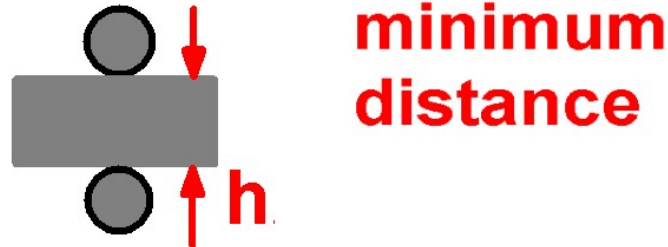
- In the window **Define start position O-Ring** (different position are possible) chose the rolls of a roll-system and enter the related values in the given fields as shown below one after the other and confirm with OK.

- Diameter rolls:** inner Diameter

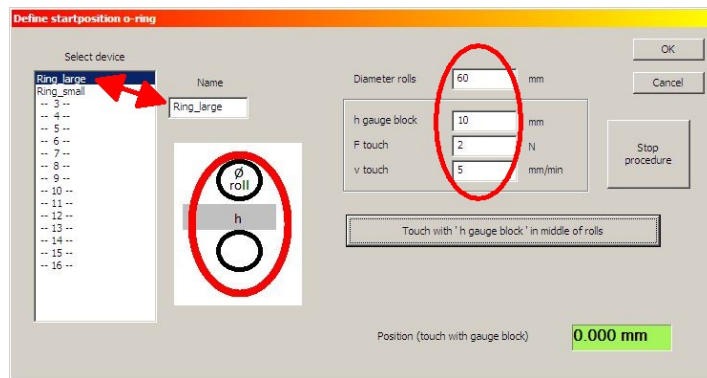


- h gauge block:** necessary to measure the distance between the rolls (inner diameter)
- F touch:** force to detect “contact” between the rolls
- v touch:** XHead speed to drive to the “F touch” point

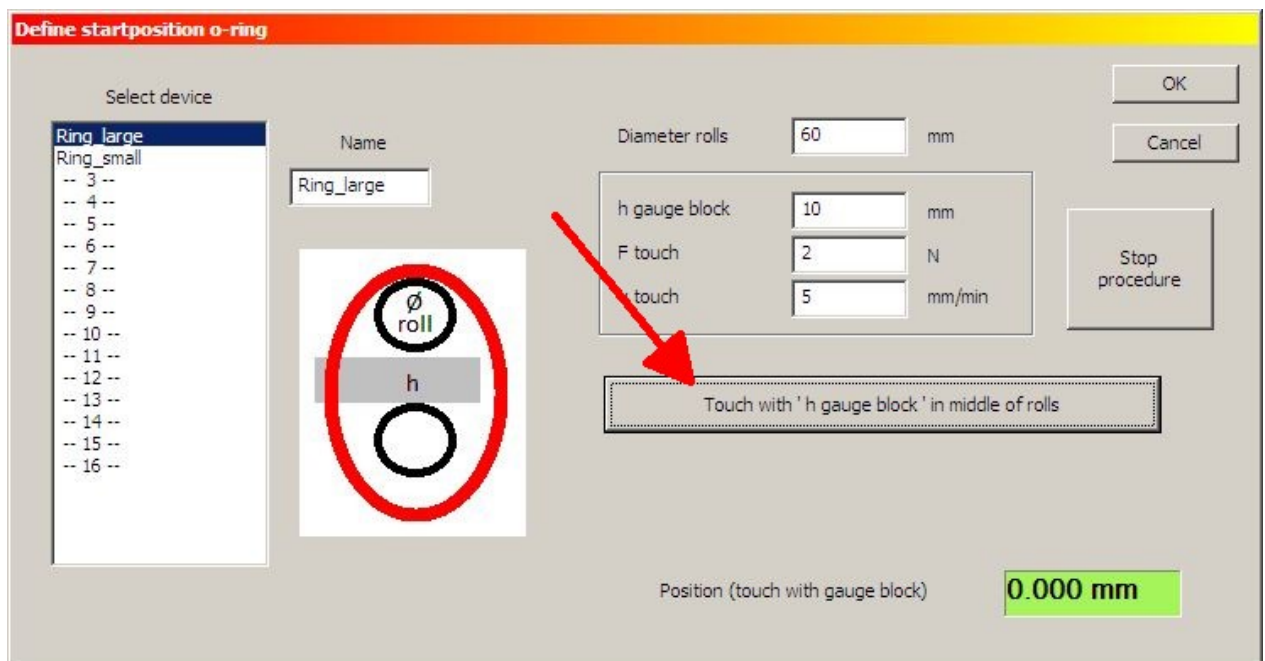
Procedure to define the reference position "rolls distance":



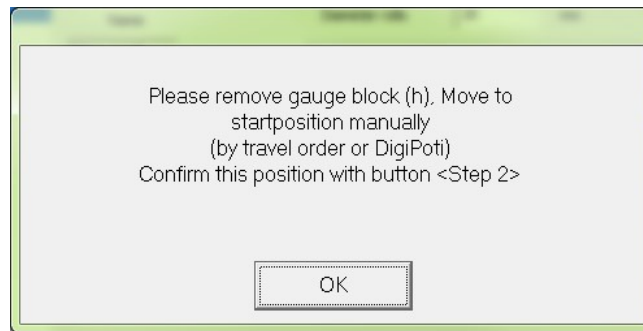
Check and edit the right parameters:



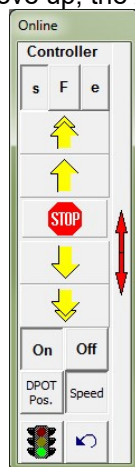
- Click "Step 1" button = XHead is moving to the smallest/minimum distance (**h gauge block**) between the rolls.



- The XHead is moving down and the rolls contact it with "**F touch**" (> absolutly 2N).
- The System tare the the XHead position => now we have the absolute position.



- Now, the Supervisor has the move up, the XHead to the right installing position for the Ring!



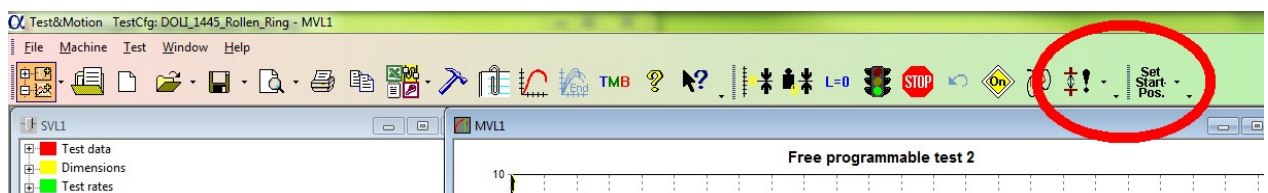
Push the UP buttons

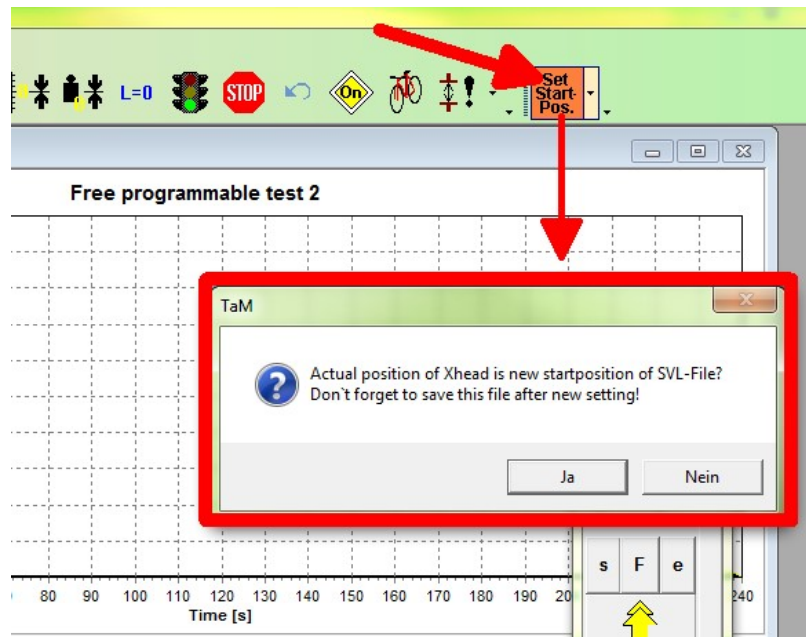
and move the XHead to the right position for the Ring!

Now, you can define the next Set of Rolls. Example: "Ring_small".....

The "start position", that's the XHead position to install the Ring, you have to define BEFORE you save the SVL configuration. Move the XHead >manually< to the correct Xhead position (it must be possible to install the Ring) and set this position.

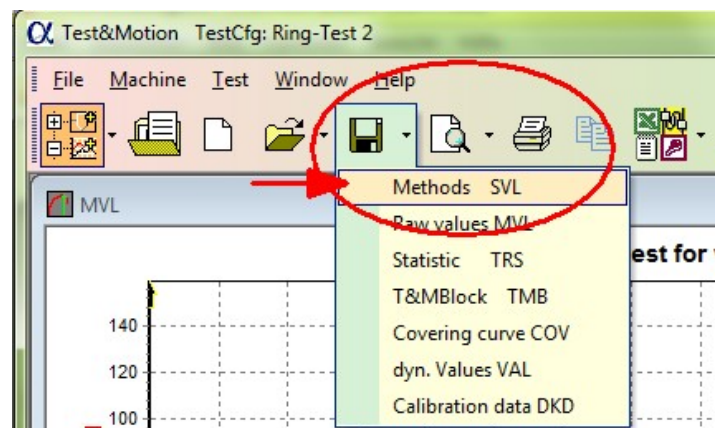
2.6.1 Set Start-Position





Now, the Start position (= install the Ring for the test) is defined and it's necessary to save this in the SVL files for this machine configuration (the right Rolls)!

Now, save this test configuration in a new SVL-file by clicking on icon 'store' → [Command Methods SVL](#) and defining a new name.



Now, the Supervisor can configure further roll-systems if existing as described in this chapter.

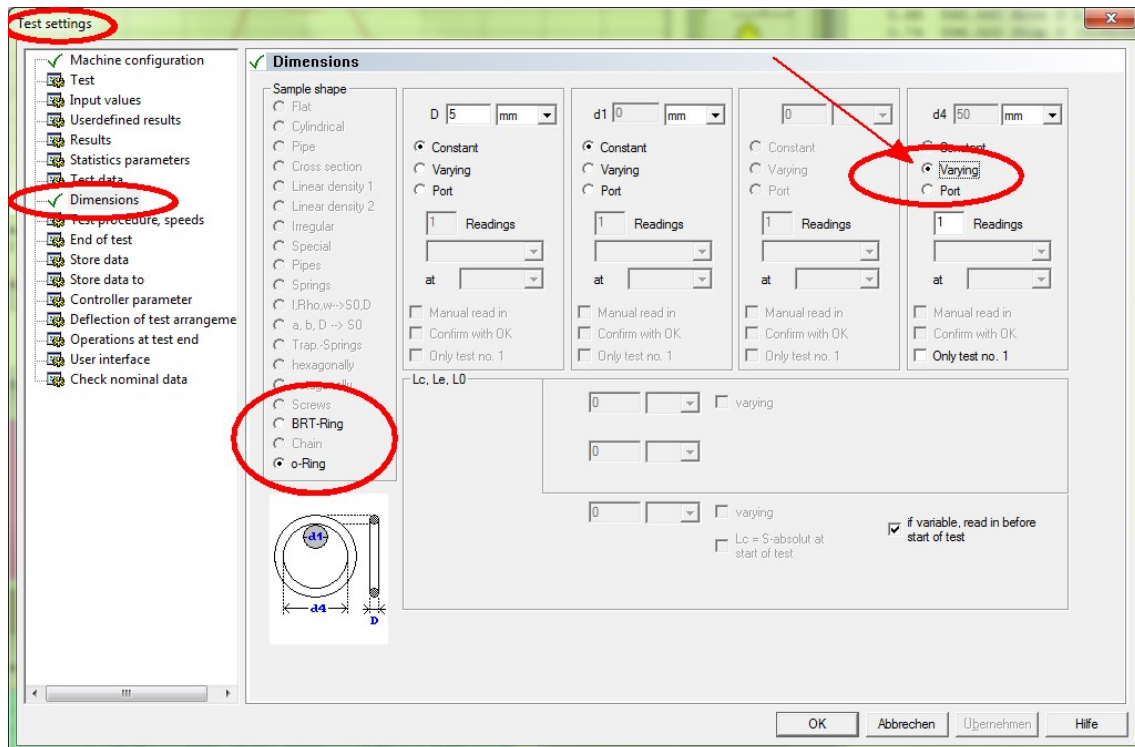
2.6.2 Reference drive (Operator Interface)

..... The "Reference drive" is deleted now..... you have to select the right SVL configuration!

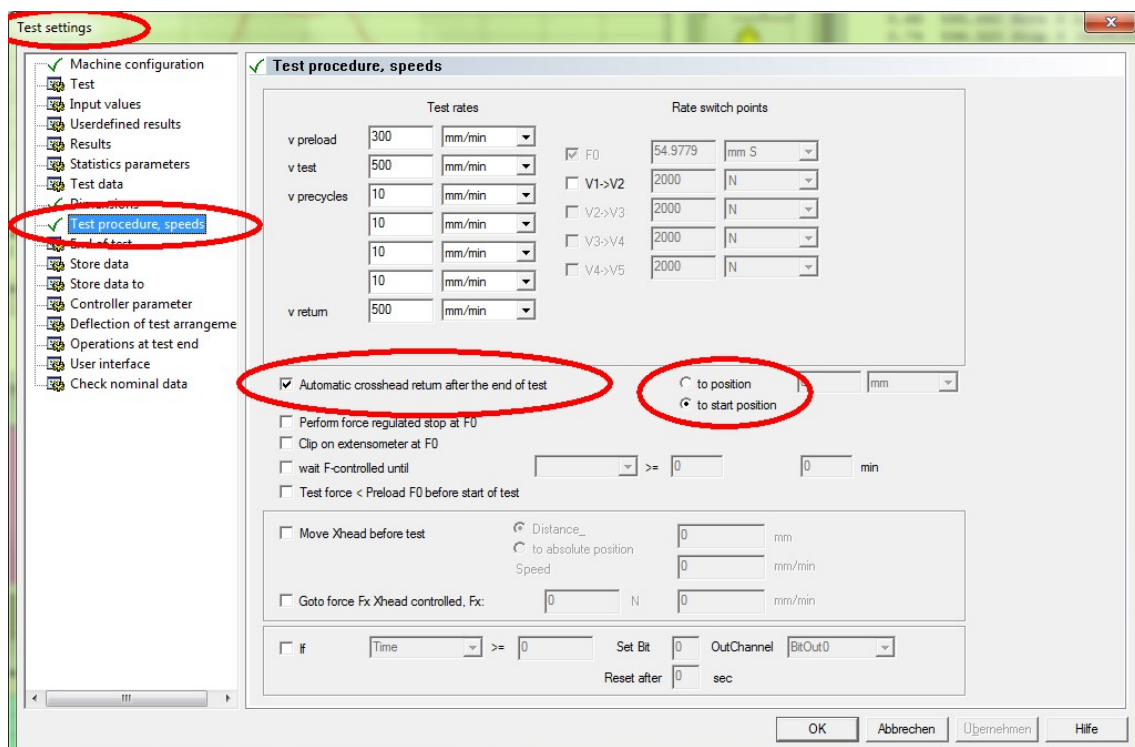
Definition of the O-Ring



1. Click **Menu Test → Command Test settings → Dimensions**, set the dimension d4 (= inner diameter of the O-ring) to 'varying' and confirm with OK. This way, O-Rings with different diameters can be tested with this machine configuration.



2. Click **Command Test procedure, speeds**, set a checkmark at point 'Automatic crosshead return at the end of test', chose 'to start position' and confirm with OK.



Now, the test settings are done and the test can be started.

Standard O-Ring Test with automatic diameter request



1. Start the test run with icon 'Start'. The window [Measure specimen dimensions](#) will open (when d4 = inner diameter of the O-ring has been set to 'Varying' in window Test Settings → dimensions, see chapter Definition of the O-Ring).
2. Enter the diameter of the specimen and confirm with OK.

Measure specimen dimensions

Reading 1 of 1

d4 mm

Now, the O-Ring test will be performed as defined.

