

## Test plan administration software ProcProg

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### 1. Introduction

The test plan administration software PROCProg is used for creating and administrating test plans and test instructions for the A&V PROCON Measuring Computer M40118.V03. The test plan is transferred into the measuring computer via the units' USB interface or via network connection (with PROCON OPTION "N").

Programming of the measurement task is divided into test plans and test instructions. Test plans refer to the workpiece which is to be measured. Test instructions refer to the measuring environment. A test instruction contains the necessary instructions which are needed to carry out a measurement at a machine or manual test location.

The terms and definitions used from the fields of quality management and statistic process control are assumed to be known.

#### **Note regarding the danger of confusion of terms used:**

The templates for creating test plans and test instructions contain some similar terms which may be confused easily:

sample n and sample scope  
nominal and nominal value

#### **Sample n**

(measurement points test instruction): Number of single measurements of which an average value is calculated  
(cf. 3.1.2 Edit test instruction: tab "Measurement points").

#### **Sample scope**

(control interface test instruction): For calculation purposes when using the control factors average value, Median and KUSUM  
(cf. 3.1.4 Edit test instruction: tab "Control interface").

#### **Nominal**

(test plan/test instruction): Nominal dimension of the measurement point  
(cf. 2.1.2 Edit test plan: tab "Measurement points" and 3.1.2 Edit test instruction: tab "Measurement points").

#### **Nominal value**

(test instruction): The correction value is put out in relation to the nominal value  
(cf. 3.1.4 Edit test instruction: tab "Control interface").

## 2. Test plans

Test plans refer to the workpiece which is to be measured. They contain the measurement points of the workpiece as well as the relevant tolerance limits and dimensions. A test plan comprises all relevant data that is needed for the measurement of a workpiece, independent of the machine at which the measurement is carried out or which measurement point is to be measured.

### 2.1 Create test plans

Start the ProcProg software. The main menu opens. On the left hand side, click on the upper "+" without further designation or on the "+" for the workpiece group that you wish to create a new test plan for. Choose a new test plan form in the upper left corner under "Neu" ("New") (see red mark, fig. 1).

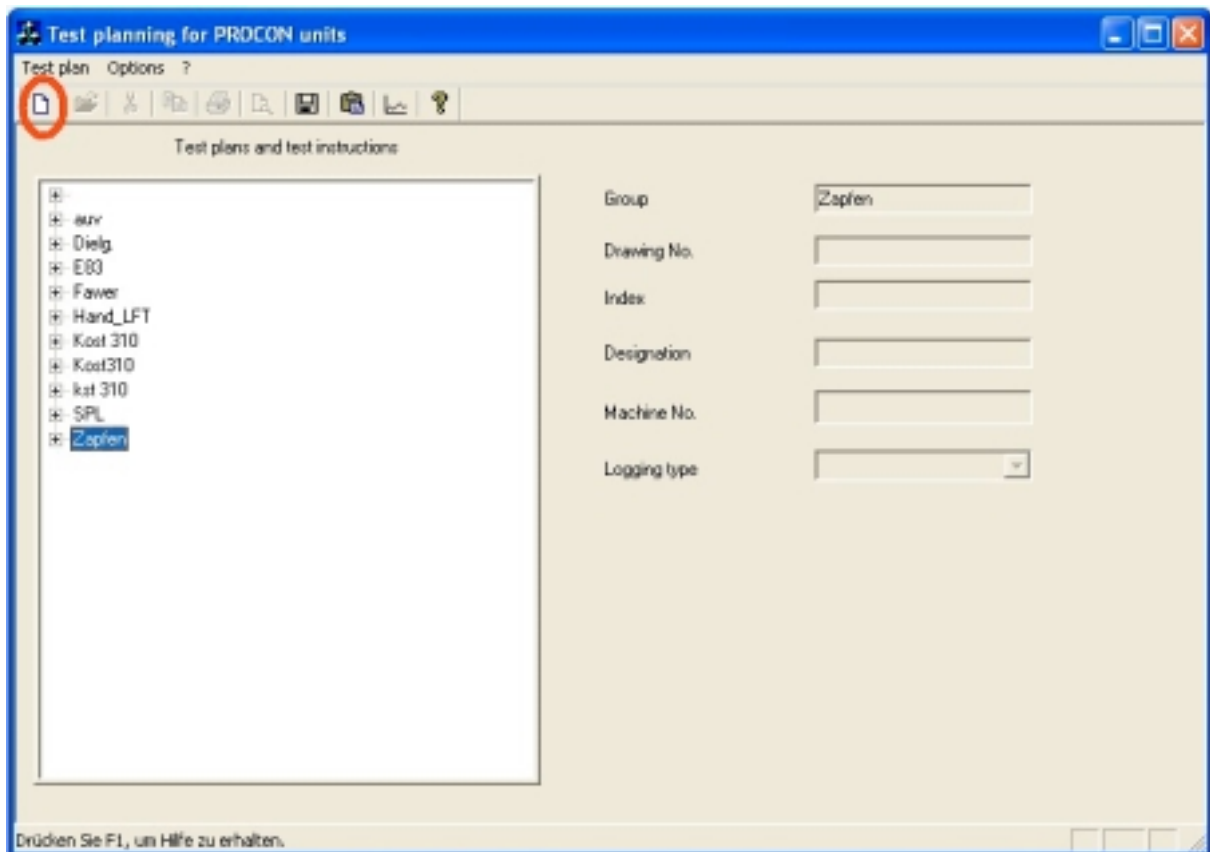


Fig. 1

The input fields for the test plan are opened (cf. fig. 2). They are divided into the two tabs "Heading" (cf. fig. 2) and "Measurement points" (cf. fig. 3).

### 2.1.1 Edit test plan: tab "Heading"

Name the test plan and enter its heading data (cf. fig 2). The heading data comprise the information which only exists once for each workpiece. The heading data of a test plan consist of the workpiece specifications which are independent of the measurement points. A test plan is unambiguously identified by the drawing number. The drawing number is entered when creating the test plan. It cannot be changed afterwards.

The screenshot shows a Windows-style dialog box titled "Edit test plan" with a close button (X) in the top right corner. It has two tabs: "Heading" (selected) and "Measurement points". The "Heading" tab contains the following fields:

- Group: Text box with "Zapfen"
- Drawing No.: Text box with "025 063 124 001"
- Index: Text box with "310.10.05"
- Designation: Drop-down menu showing "Kugelszapfen"
- Name: Text box with "Veen"
- Date: Date picker showing "27.11.2009"
- Catalog marker: Drop-down menu showing "PROCON"
- Not used: Drop-down menu showing "2"
- Note: Empty text box
- Measurement points: Text box with "4"
- Test instructions: Text box with "2"

At the bottom right are three buttons: "OK", "Abbrechen", and "Übernehmen".

**Fig. 2**

Some input fields are followed by a black arrow. This arrow opens a drop-down menu with selection criteria. It is also possible to make a free input in the field "Designation".

- |              |  |
|--------------|--|
| Group:       | Group of test plans in which the test plan will be displayed in the main menu  |
| Drawing No.: | Number that unambiguously identifies the test plan. The test plan is displayed under this number in the main menu.   |
| Index:       | Current state of the drawing (only for documentation purposes)   |
| Designation: | Name of the workpiece  |
| Name:        | When a new test plan is created, the user name under which the user is logged into the computer is automatically recorded here. If a test plan is edited and the changes are saved, the user name of the current user is also entered into this field automatically. The length of the saved name is limited to 10 characters. |
| Date:        | Date of the last editing of the test plan. When the test plan is newly created, the current system date is automatically recorded here. It needs to be changed manually by the user during editing.  |

Catalog marker: This field serves for documentation purposes and does not have any influence on the measuring.

Not used: Not used. This field serves for documentation purposes and does not have any influence on the measuring.

Note: Additional information regarding the test plan

Measurement points: Number of measurement points of the workpiece

Test instructions: Number of test instructions which are allocated to this test plan

The fields "Measurement points" and "Test instructions" are automatically recorded by the program as soon as any measurement points have been entered or test instructions have been created for this test plan.

Make sure that especially the fields "Group" and "Drawing No." have been filled out correctly. These two fields cannot be changed after saving the test plan. Click on "Übernehmen" ("Apply") to save the inputs. Then click on "OK" to return to the main menu or select the second tab "Measurement points".

### 2.1.2 Edit test plan: tab "Measurement points"

Name and define the specifications of the measurement points of the workpiece for this test plan (cf. fig. 3). The specifications of the measurement points for the test plan consist of workpiece specifications that are dependent on the measurement points.

No.	Meas. point	Nominal	UL	LL
01	Kugelh	24.985	0.020	-0.020
02	Kegelh	14.022	0.022	-0.022
03	Schafth	8.960	0.020	-0.020
04	Kegellänge	12.885	0.215	-0.215

Meas. point	Kugelh
Meas. dev	Procon
Group	Documentation obligatory
Aut	Normal distribution
Collect. evaluation	Reject Reject
Tolerance form	bilateral
Decimals	3
Unit	mm
Nominal	24.985 mm
Upper limit	0.020 mm
Lower limit	-0.020 mm
Upper plus. limit	0.060 mm
Lower plus. limit	-0.060 mm

New Delete

OK Abbrechen Übernehmen

Fig. 3

Click on the button "New" to include a new measurement point. In the list on the left hand side, click on the No. of the measurement point which you wish to define. The No. of the selected measurement point is marked in blue. This measurement point may be specified further through the input fields on the right side.

Some fields are followed by a black arrow. This arrow opens a drop-down menu with selection criteria. It is also possible to make a free input in the fields "Measurement point" ("Meas.point"), "Measuring device" ("Meas.dev") and "Unit".

Measurement point (Meas.point):	Measurement point of the workpiece which is to be measured								
Measuring device (Meas.dev):	Name/manufacturer/machine No. of the measuring device which is used								
Group:	Defines the level of documentation for the measurement point. <u>Alternatives:</u> Compulsory documentation = highly critical measurement points Main measurement point = critical measurement points Extra measurement points = non-critical measurement points none = no classification								
Art: (Type):	Defines the type of distribution of the measurement point which is considered for the evaluations. <u>Alternatives:</u> logarithmic normal distribution = unilateral, left-skewed distribution Weibull distribution = lifetime evaluation normal distribution = normal 1. Value distribution = one-dimensional value distribution 2. Value distribution = two-dimensional value distribution Mixed distribution = multivariate quality card, otherwise like normal distribution								
Collective evaluation:	Defines how the measurement point is included into the statistics. It is possible to define an overstepping or undercutting as reject or rework. <u>Alternatives:</u> <table><tr><td>UL</td><td>LL</td></tr><tr><td>Reject</td><td>Reject</td></tr><tr><td>Rework</td><td>Reject</td></tr><tr><td>Reject</td><td>Rework</td></tr></table> is not included	UL	LL	Reject	Reject	Rework	Reject	Reject	Rework
UL	LL								
Reject	Reject								
Rework	Reject								
Reject	Rework								
Tolerance form:	bilateral unilateral with upward limit unilateral with downward limit no limits								
Decimals:	For the measuring values, 6 significant digits are administered. The number of decimal places may be selected between 1 and 5. The number of pre-decimal places is hence concluded automatically. The number of decimal places is relevant for: - input nominal and tolerances - input control limits - labelling of classes								

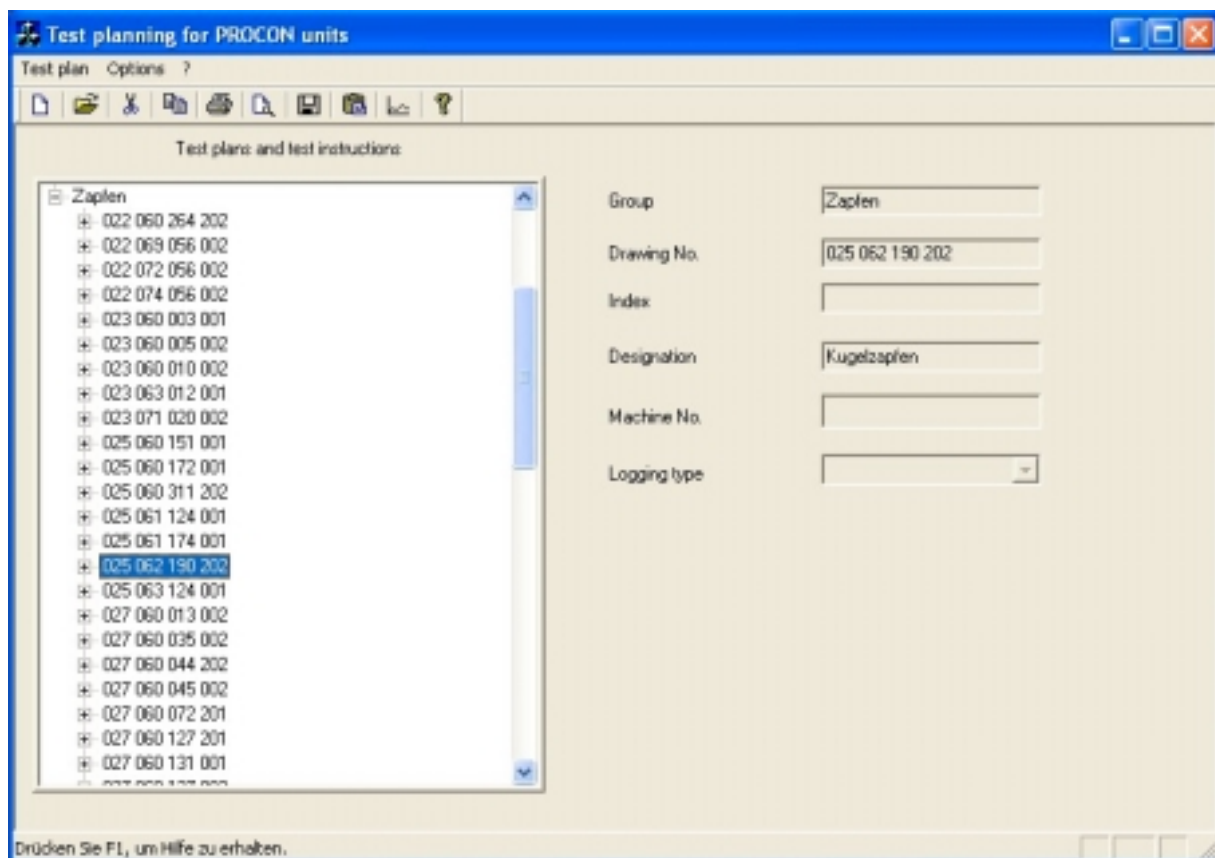
Unit:	Physical unit in which is being measured
Nominal:	Nominal dimension of the measurement point
Upper limit:	The input is carried out in relation to the nominal.
Lower limit:	The input is carried out in relation to the nominal.
Upper plausibility limit:	<p>Input of the upper plausibility limit is carried out in relation to the nominal. Measuring values which overstep the upper plausibility limit are not included in the statistical evaluation. The upper plausibility limit is pre-calculated by the program according to the formula:</p> <p>Upper plausibility limit = tolerance centre + 1,5 * tolerance width</p> <p>Tolerance centre = (upper tolerance + lower tolerance)/2</p> <p>Tolerance width = upper tolerance - lower tolerance</p> <p><u>Example calculation with symmetrical tolerances:</u></p> <p>Nominal: 35,000 mm</p> <p>Upper tolerance: 0,050 mm</p> <p>Lower tolerance: -0,050 mm</p> <p>Tolerance centre: (0,050 mm + (-0,050 mm))/2 = 0,000 mm</p> <p>Tolerance width: 0,050 mm - (-0,050 mm) = 0,100 mm</p> <p>Upper plausibility limit: 0,000 mm + (1,5 * 0,100 mm) = 0,150 mm</p> <p><u>Example calculation with asymmetrical tolerances:</u></p> <p>Nominal: 35,000 mm</p> <p>Upper tolerance: 0,006 mm</p> <p>Lower tolerance: -0,030 mm</p> <p>Tolerance centre: (0,006 mm + (-0,030 mm))/2 = -0,012 mm</p> <p>Tolerance width: 0,006 mm - (-0,030 mm) = 0,036 mm</p> <p>Upper plausibility limit: -0,012 mm + (1,5 * 0,036 mm) = 0,042 mm</p>
Lower plausibility limit:	<p>Input of the lower plausibility limit is carried out in relation to the nominal. Measuring values which undercut the lower plausibility limit are not included in the statistical evaluation. The lower plausibility limit is pre-calculated by the program according to the formula:</p> <p>Lower plausibility limit = tolerance centre - (1,5 * tolerance width)</p> <p>Tolerance centre = (upper tolerance + lower tolerance)/2</p> <p>Tolerance width = upper tolerance - lower tolerance</p> <p><u>Example calculation with symmetrical tolerances:</u></p> <p>Nominal: 35,000 mm</p> <p>Upper tolerance: 0,050 mm</p> <p>Lower tolerance: -0,050 mm</p> <p>Tolerance centre: (0,050 mm + (-0,050 mm))/2 = 0,000 mm</p> <p>Tolerance width: 0,050 mm - (-0,050 mm) = 0,100 mm</p> <p>Lower plausibility limit: 0,000 mm - (1,5 * 0,100 mm) = -0,150 mm</p> <p><u>Example calculation with asymmetrical tolerances:</u></p> <p>Nominal: 35,000 mm</p> <p>Upper tolerance: 0,006 mm</p> <p>Lower tolerance: -0,030 mm</p> <p>Tolerance centre: (0,006 mm + (-0,030 mm))/2 = -0,012 mm</p> <p>Tolerance width: 0,006 mm - (-0,030 mm) = 0,036 mm</p> <p>Lower plausibility limit: -0,012 mm - (1,5 * 0,036 mm) = -0,066 mm</p>

The plausibility limits are calculated and proposed by the program but may be changed.

Once all measurement points have been defined, click on "Übernehmen" ("Apply") in order to save the inputs and click on "OK" to return to the main menu.

### **2.2 Change test plan**

To change the inputs of an already existing test plan, select the test plan in the main menu so that it is marked in blue (cf. fig. 4). Right-click on the test plan and choose "Open".



**Fig. 4**

Make the necessary changes in the heading data as well as the specifications of the measurement points for this test plan as described under 2.1.1 and 2.1.2.

### **3. Test instructions**

Test instructions complete the test plans with additional information on the manufacturing process and orders. One test plan may contain several test instructions as one type of workpiece may be manufactured at different machines or tested at different test locations. A test instruction is selected through the drawing No. and machine No.

### 3.1 Create test instruction

In the main menu, click on the test plan for which you wish to create a test instruction. The selected test plan is marked in blue (cf. fig. 4). Right-click on the test plan and choose "New". The input fields for the test instruction are opened.

A test instruction consists of heading data, measurement point data, tracer data and – if needed – a user-specific control interface for automatic tool correction.

#### 3.1.1 Edit test instruction: tab "Heading"

Enter the heading data for this test instruction (cf. fig. 5).

The screenshot shows a software window titled "Edit test instruction" with a blue title bar and a close button in the top right corner. The window contains several input fields and dropdown menus organized into two columns. The "Heading" tab is selected, indicated by a blue underline. The fields include: "Machine No." (text box with "18214"), "Inspection interval" (dropdown menu with "1003"), "Logging type" (dropdown menu with "4368"), "Name" (text box with "Vc"), "Delay time" (text box with "0"), "Tracer inputs" (dropdown menu with "Inductive"), "Forced zeroing" (checkbox checked), "Control interface" (dropdown menu with "Magdeburger"), "Test lot" (text box with "0"), "Sample n" (checkbox unchecked), "Date" (calendar icon showing "08.01.2010"), "Collective start" (radio button selected), "Chaotic" (radio button unselected), "Control factor" (dropdown menu with "KUSUM"), "Note" (text box), and "Measurement points" (text box with "4"). At the bottom right, there are three buttons: "OK", "Abbrechen", and "Übernehmen".

Fig. 5

Some input fields are followed by a black arrow. This arrow opens a drop-down menu with selection criteria. It is also possible to make a free input in the fields "Machine No." and "Inspection interval".

The field "Measurement points" will automatically be completed by the program once the respective measurement points have been allocated to this test instruction.

Maschine No.: Number of the machine or equipment at which the measurements are to be carried out. Together with the drawing No., the machine No./equipment No. unambiguously identifies a test instruction.  
IMPORTANT: As soon as an input has been made and this field is left, it will be marked in grey and cannot be changed anymore.

Inspection interval:	Describes how often a measurement is to be carried out. (Only for documentation purposes.)
Logging type:	Defines the logging type. <b>Select 4368.</b>
Name:	When a new test plan is created, the user name under which the user is logged into the computer is automatically recorded here. If a test plan is edited and the changes are saved, the user name of the current user is also entered into this field automatically. The length of the saved name is limited to 10 characters.
Delay time:	Positive value = delay time in seconds before the measurement Negative value = delay time in seconds after the measurement A positive value delays the measurement after the start signal. This leads to a settling time for stabilizing the measuring value, for example after positioning the tracers on the workpiece. A negative value delays the acknowledge signal after a measurement when working at automatic measuring equipment .
Tracer inputs:	Analogue, Inductive, Inductive/Analogue <b>Select Inductive.</b>
Forced zeroing:	Yes = It is necessary to calibrate (i.e. carry out automatic zeroing) in the measuring computer after start of the measuring program as well as after switching from SETUP into AUTOMATIC mode.
Control interface:	Selection of a user-specific control interface for the automatic tool correction <b>Select "None" or "Magdeburger".</b>
Control factor:	Selection of single value, average value, Median or Kusum <b>(cf. 8 "Control interface for automatic tool correction")</b>
Note:	Additional information regarding the test instruction
Measurement points:	Display of the number of measurement points which are to be measured
Test lot:	Size of the taken sample (only for documentation purposes)
Real time clock:	Saving of measuring values with time and date. This input is not used.
Date:	Date of the last editing of the test plan. When the test plan is newly created, the current system date is automatically recorded here. Afterwards, it needs to be changed manually by the user during editing.
Collective start/ chaotic measurement:	Collective start: all measurement points are measured simultaneously after one start signal. Chaotic: There is one individual start signal for each measurement point.

Make the necessary changes. Then click on "Übernehmen" ("Apply") in order to save your inputs. Then click on "OK" to return to the main menu or select the next tab.

### 3.1.2 Edit test instruction "tab "Measurement points"

Specify which measurement points from the test plan shall be included in this test instruction (cf. fig. 6).

**Fig. 6**

The selected measurement points are checkmarked. If a measurement point shall not be included in the test instruction, click on the checkmark. It is marked in blue. Click on "Remove". The checkmark is deleted. If the measurement point is not yet marked but shall be included in the test instruction, tick the empty field in front of the measurement point and choose "Add". A checkmark is set in front of the measurement point.

Click on the checkmark in front of the measurement point in order to edit this measurement point. Some variable information regarding the measurement point which shall only be valid for this test instruction may be defined through the input fields on the right hand side. The fields marked in grey have been defined in the test plan and may not be changed here.

Measurement point:	Measurement point of the product which is to be measured
UL:	Upper tolerance limit in relation to the nominal
LL:	Lower tolerance limit in relation to the nominal
Nominal:	Nominal size of the measurement point
Procedure:	Manufacturing procedure of the measurement point
Channel No.:	Defines the tracer input for this measurement point If the measurement point is measured with several tracers, it is necessary to enter "zero" for programming the tracer linkage.
Zero value:	Reference value of the measuring equipment. Measuring value = tracer value + zero value

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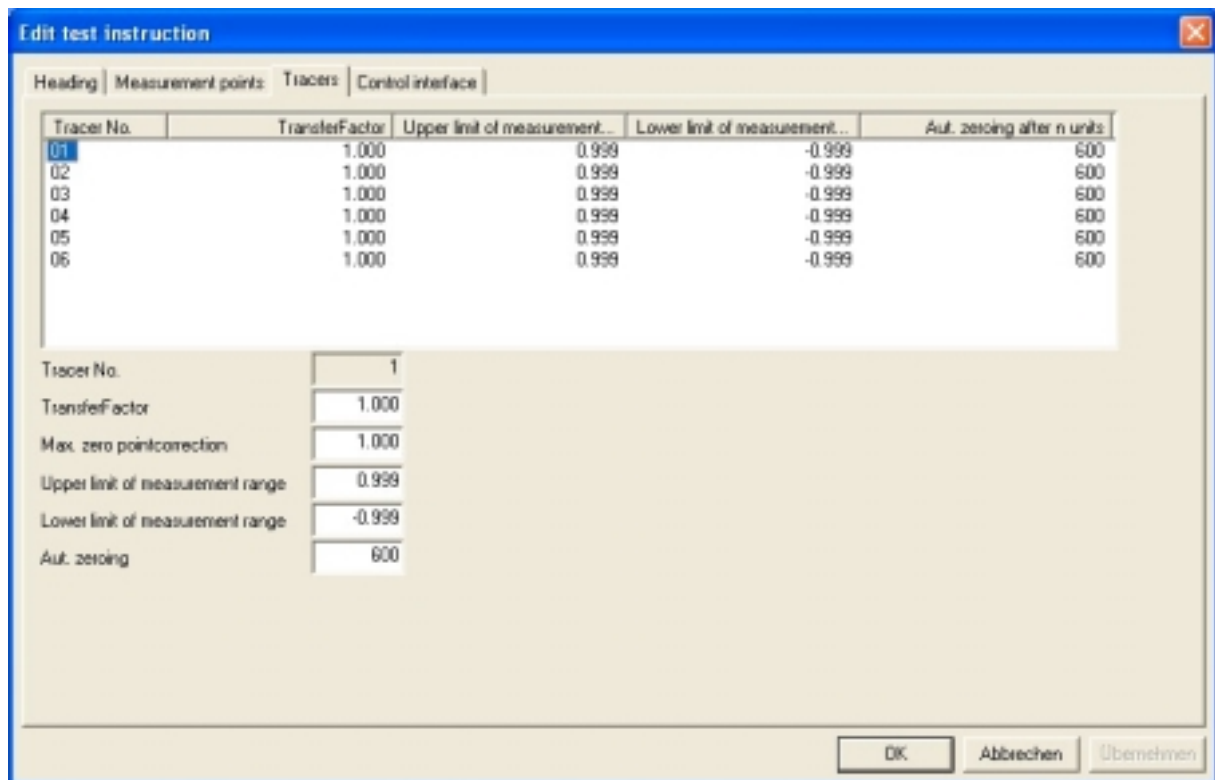
Setup master:	Setup master value for "Automatic zeroing"
Start:	This field only needs to be filled for a linkage. The entered input (1 to 8) defines the first tracer input for this linkage.
X01, X02:	Constants which may be used for defining a linkage
Linkage zero value +	For a linkage, the formula is entered here in reverse Polish notation. <u>Example 1:</u> Measurement of a cone diameter with 2 tracers (E01+E02) Linkage zero value + E01 E02 + <u>Example 2:</u> Measurement of the cone length based on the cone diameter with 2 tracers (E01+E02). In order to determine the constants X01 and X02, the position of both tracers on the cone must be defined. The values for X01 and X02 are not calculated in ProcProg. Linkage zero value + E01 E02 + X01 * X02 +
Sample n:	Number of single measurements of which an average value is calculated.
Histogram classes:	Number of classes between the tolerances (1 to 8 for the PROCON Measuring Computer; otherwise 1 to 15).
AMM:	Systematic change of the average value in processes with additional process variance.
Width:	The widths of the classes for the histogram and the quality cards are calculated automatically in case of bilateral tolerance limits: Width: $(UL - LL)/\text{number of classes}$ In case of unilateral tolerance limits, the width of the classes must be entered.

For single value card, xavg-card, s-card and r-card:

UCL:	Upper control limit for the single value card, xavg-card, s-card and r-card. The control limits of the single value card must lie within the tolerance limits and are recorded in relation to the nominal. The control limits of the xavg-card must lie within the control limits of the single value card and are recorded in relation to the nominal.
LCL:	Lower control limit for the single value card, xavg-card, s-card and r-card. The control limits of the single value card must lie within the tolerance limits and are recorded in relation to the nominal. The control limits of the xavg-card must lie within the control limits of the single value card and are recorded in relation to the nominal. The lower control limits of the s-card and r-card must be $\geq 0$ .
Class:	Number of classes between the control limits. Permitted inputs: single value card and xavg-card 1 to 10, s-card and r-card 1 to 10 (for PROCON Measuring Computer: 1 to 7).
Width:	The widths of the classes for the histogram and the quality cards are calculated automatically in case of bilateral tolerance limits: Width: $(UL - LL)/\text{number of classes}$ In case of unilateral tolerance limits, the width of the classes must be entered.

If all measurement points have been defined, click on "Übernehmen" ("Apply") in order to save the inputs. Then click on "OK" to return into the main menu or select the next tab.

### 3.1.3 Edit test instruction: tab "Tracers"



**Fig. 7**

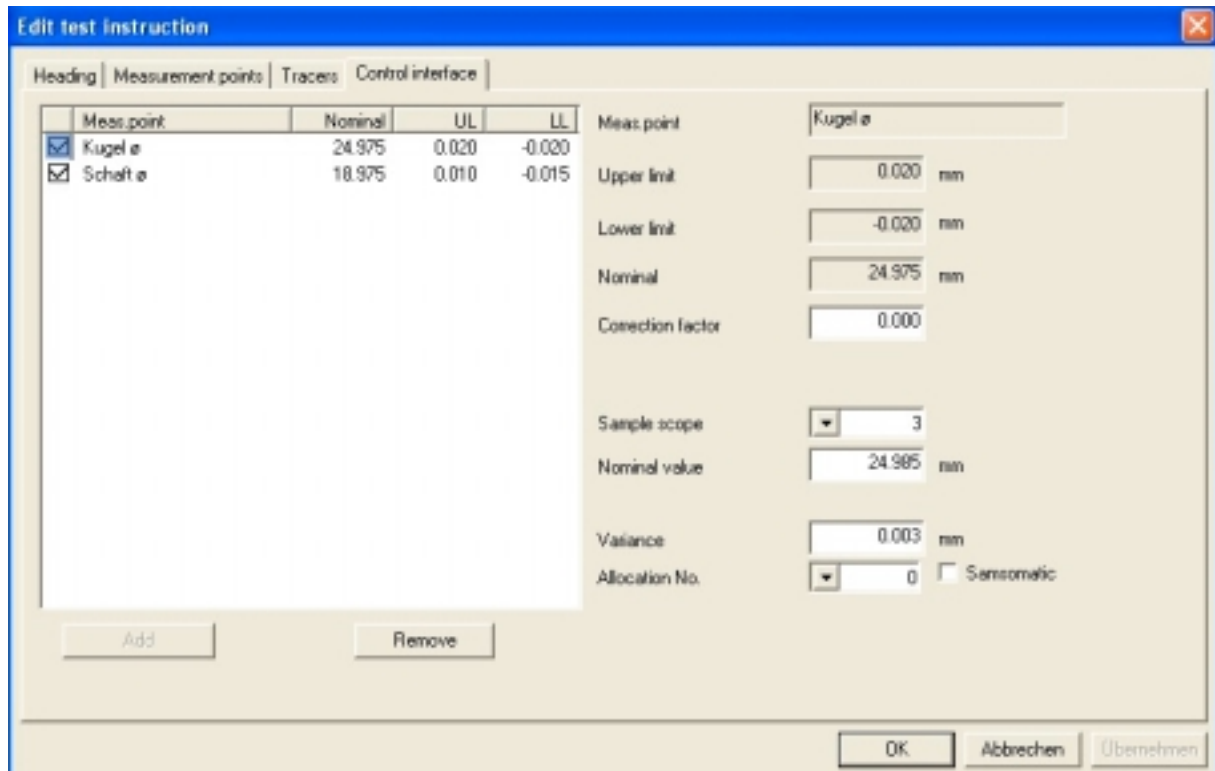
Under Tracer No. select the tracer that you wish to make inputs for. The selected tracer is marked in blue (cf. fig. 7).

- |                                   |   |
|-----------------------------------|---|
| Tracer No.:                       | Tracer input at the measuring unit. For each recorded channel No., a tracer is automatically generated.   |
| Transfer factor:                  | The measuring input is multiplied with the transfer factor and thus produces the input value for the accumulation of measuring values.<br>For a +/- 1mm tracer = 1.000.<br>A possible lever transmission of the tracer must be taken into consideration here. |
| Max. zero point correction:       | Max. absolute deviation of the zero point correction.<br>Deviation from the electrical zero point of the tracer.  |
| Upper limit of measurement range: | Upper limit of measurement range of the used tracer.<br>For a +/- 1mm tracer e.g. = 1.000 or 0.999.   |
| Lower limit of measurement range: | Lower limit of measurement range of the used tracer.<br>For a +/- 1mm tracer e.g. = -1.000 or -0.999.   |
| Aut. zeroing:                     | after n units: The user is requested to carry out "Automatic zeroing" after this number "n" of units.   |

If all inputs have been made, click on "Übernehmen" ("Apply"). Then click on "OK" to return into the main menu or select the next tab.

#### 3.1.4 Edit test instruction: tab "Control interface"

This tab only exists if a control interface was selected in the heading data of the test instruction.



**Fig. 8**

The measurement points included in the test instruction are checkmarked. Click on the field with the checkmark for which you wish to make changes. It is marked in blue (cf. fig. 8). It is now possible to make inputs in the white fields on the right hand side. The fields marked in grey are defined in the test plan and may not be changed here.

- Measurement point: Name/designation of the respective measurement point
- UL: Upper tolerance limit in relation to the nominal
- LL: Lower tolerance limit in relation to the nominal
- Nominal: Nominal dimension of the measurement point
- Correction factor: For control interface:  
 Presetting 0 corresponds to factor 1,000. In the measuring computer, the range is limited between 0,001 ... 2,000. The correction factor calculated from the measurement for the tool adjustment is multiplied with this factor and put out.  
 Thus, an attenuation or amplification of the control performance may be achieved.
- For manual test locations with dynamic measurements:  
 Input of the threshold value for recognition of a movement.
- Sample scope: For calculation purposes when using the control factors average value, Median and KUSUM.
- Nominal value: The correction value is put out in relation to the nominal value.

Variance: Default value for the control factor KUSUM. This value is calculated in ProcProg but may be changed.

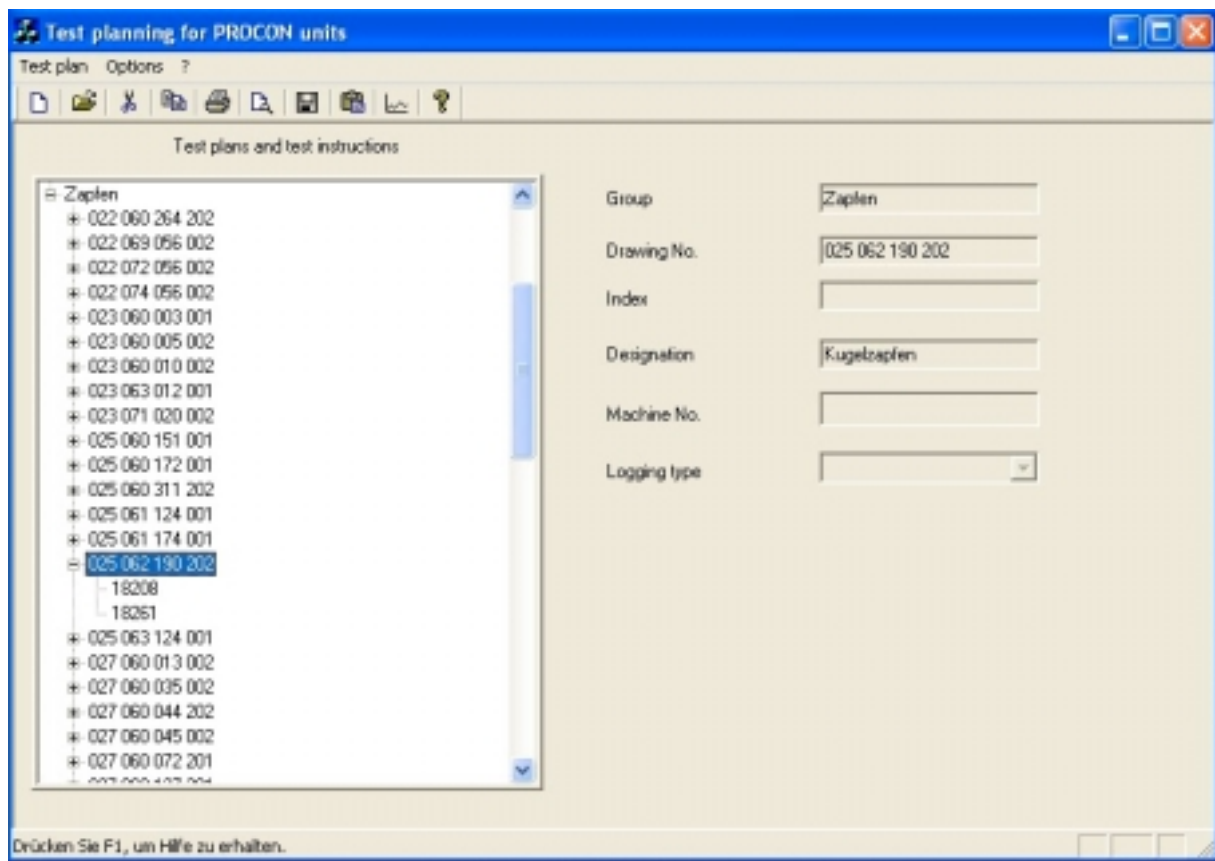
Allocation No.: Encoding of the measurement point number for the tool adjustment.

Samsomatic: Output of a control signal for an adjustment step in the tool machine.

If all inputs have been made, click on "Übernehmen" ("Apply") in order to save them. Then click on "OK" to return into the main menu.

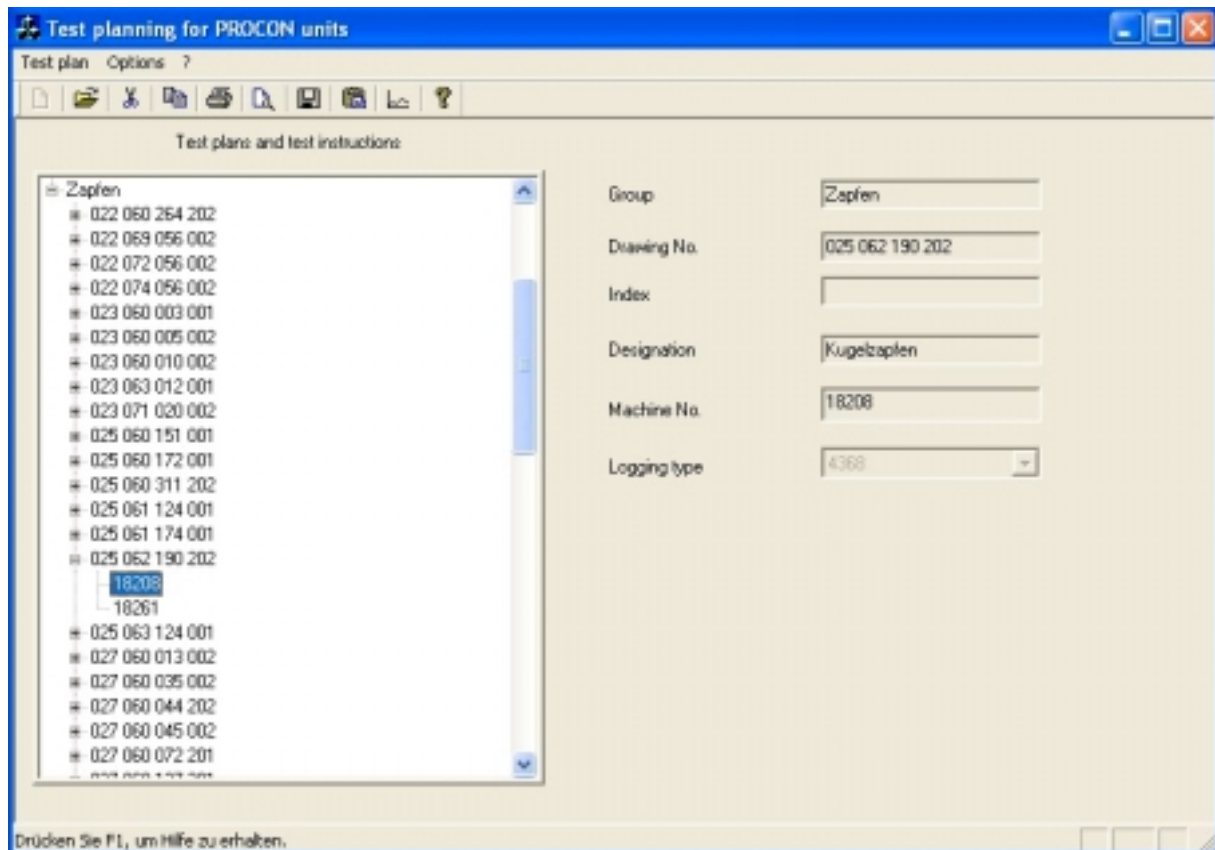
### **3.2 Change test instruction**

In order to edit the specifications of an already existing test instruction, select the test plan in the main menu so that it is marked in blue (cf. fig. 4). Click on the "+" in front of the test plan. All available test instructions are listed under the test plan (cf. fig. 9).



**Fig. 9**

Click on the test instruction which you wish to edit. It is marked in blue (cf. fig. 10).



**Fig. 10**

Right-click on the test instruction and select "Open". Make the necessary changes as described under 3.1.

#### **4. Editing of a PROCON data disk**

A PROCON data disk is used for measuring computers of the old generation with floppy disk drives.

### 5. Transfer of PROCON test plans

Test plans created in ProcProg may be transferred into a PROCON Measuring Computer via a USB storage device.

In order to save a test plan onto a USB storage device, click on the symbol "Übertragen von Procon Prüfplänen" ("Transfer of Procon test plans") (cf. red mark, fig. 11).

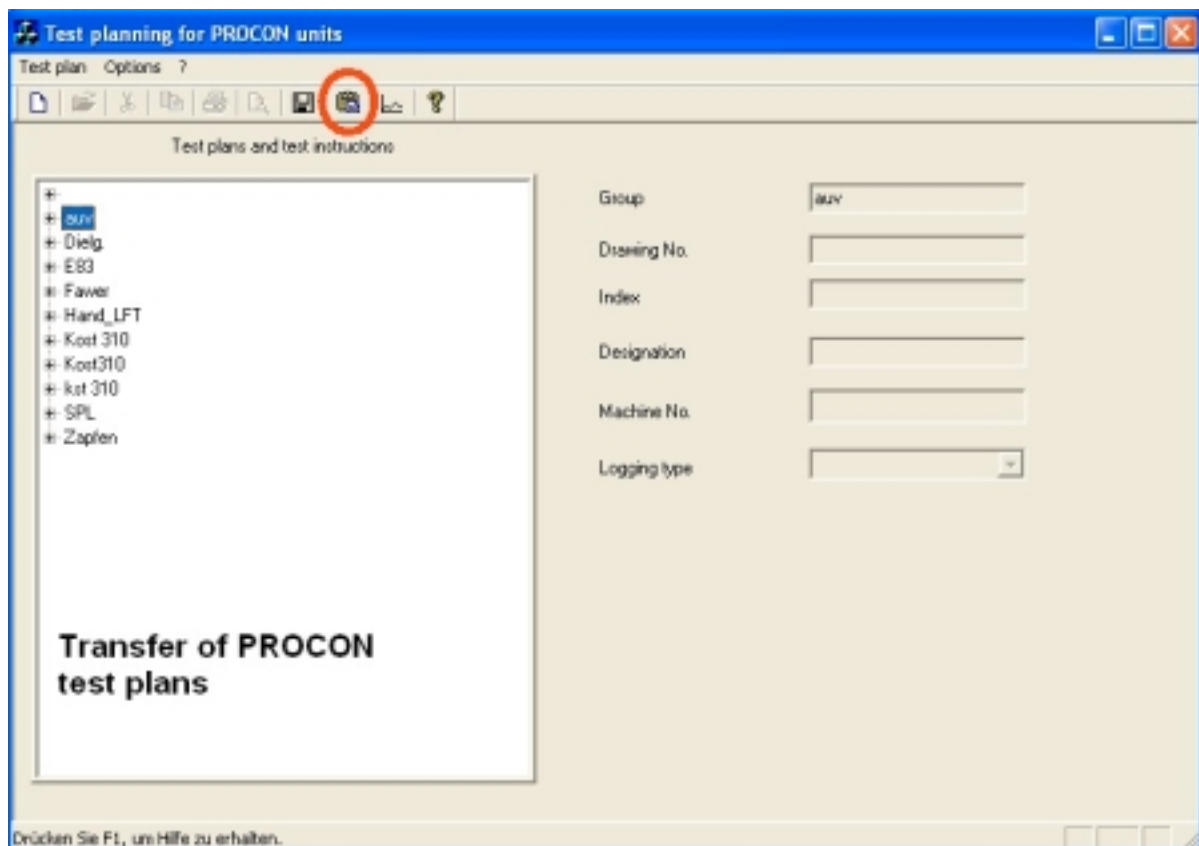


Fig. 11

Select the test plan which you wish to save. It is marked in blue. Then click on "Apply" (cf. red mark, fig. 12).

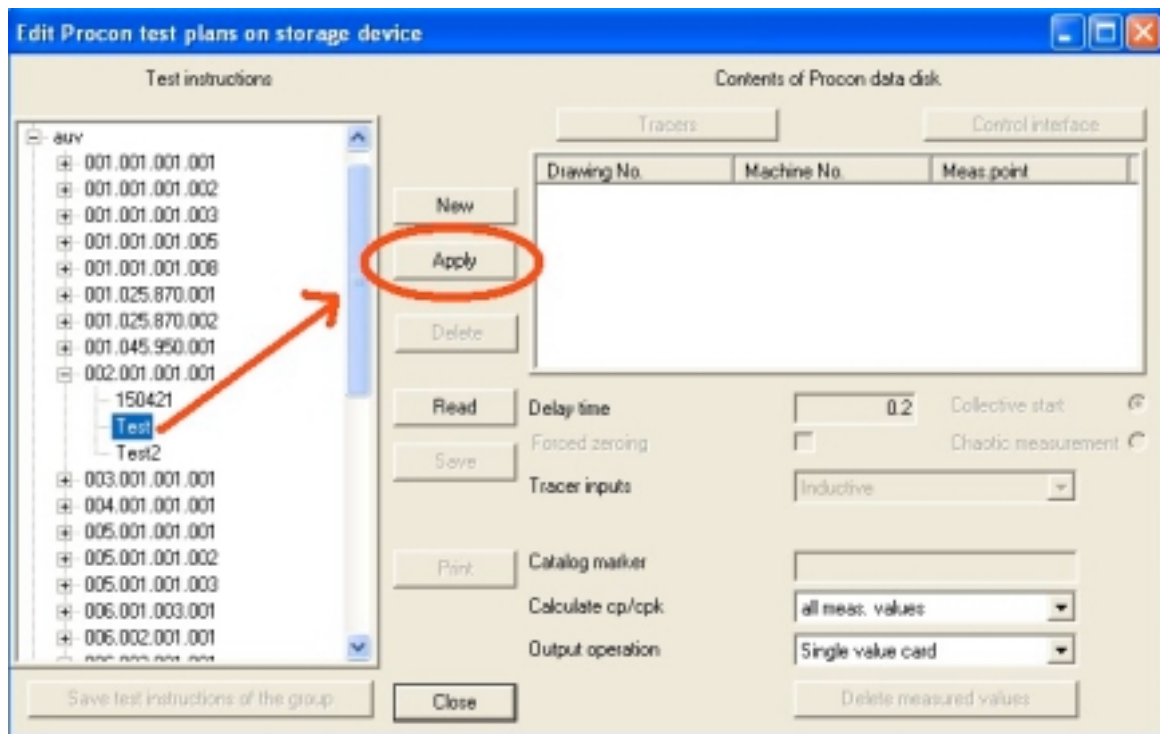


Fig. 12

The test plan is now listed in the white field on the right hand side. Click on "Save" (cf. red mark, fig. 13).

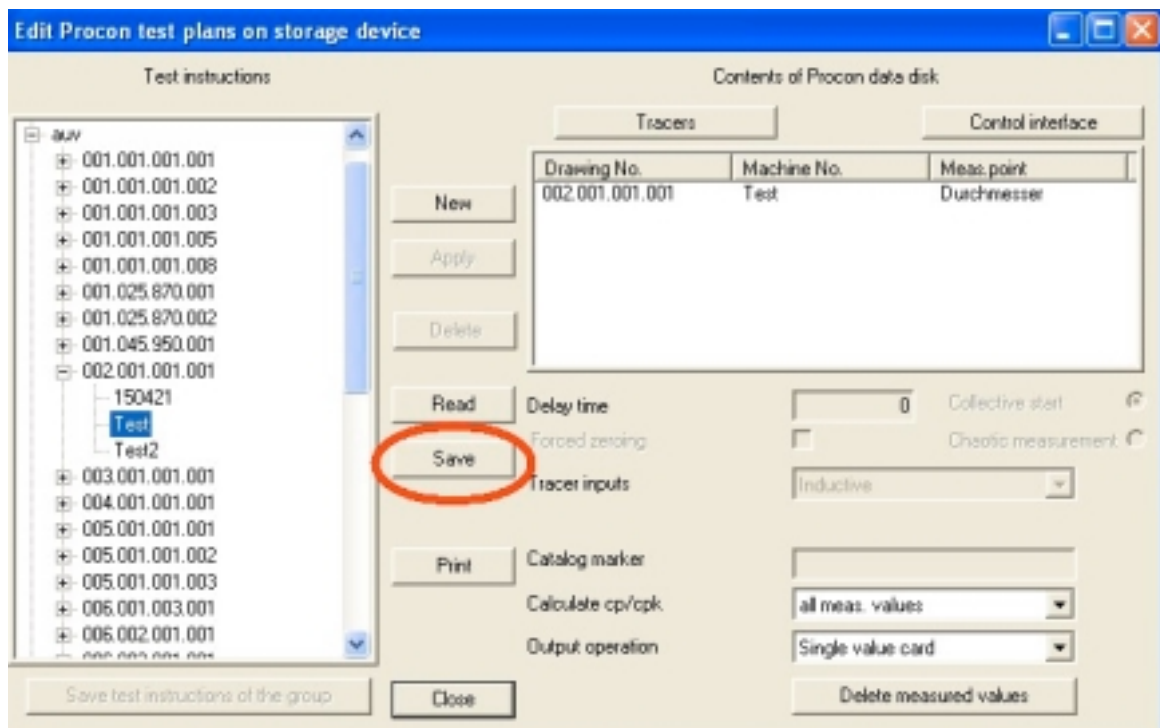
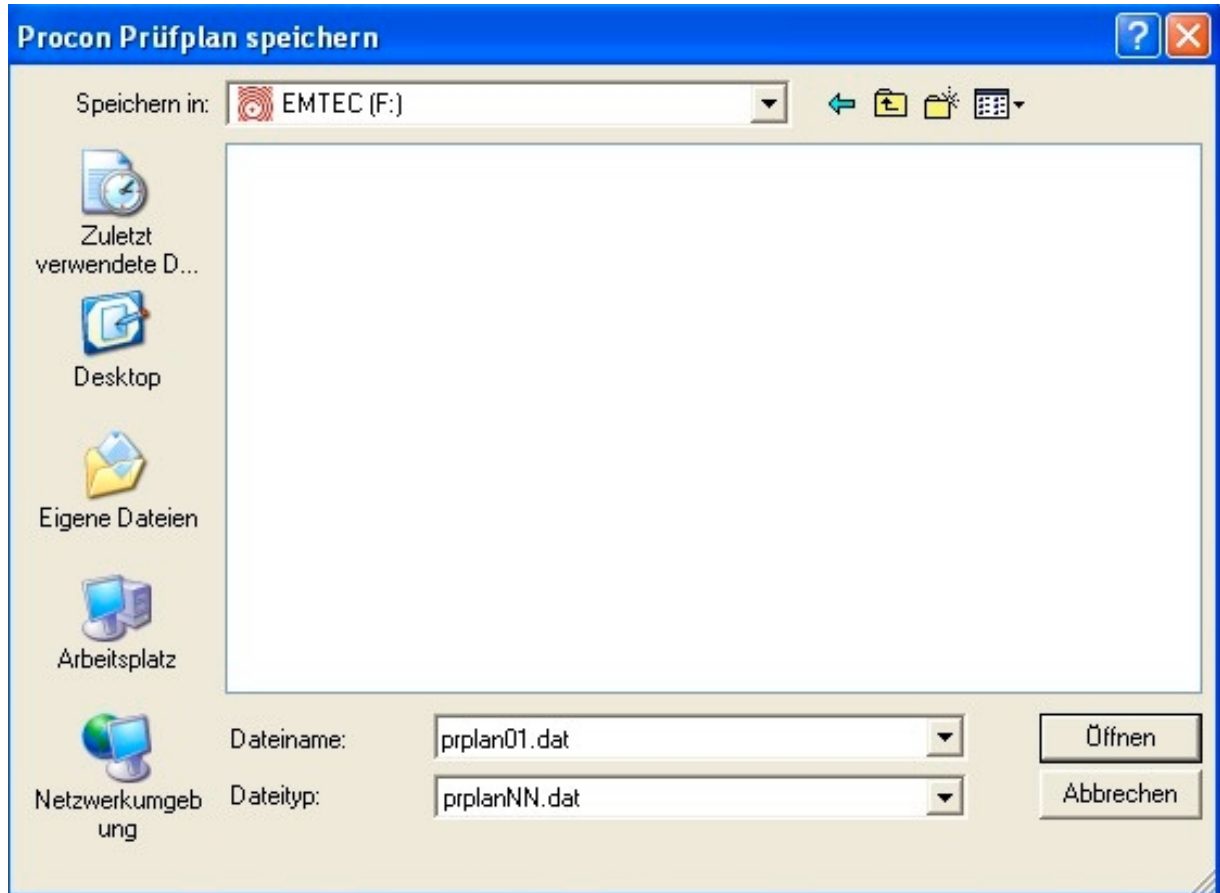


Fig. 13

As memory location choose the USB storage device on which the test plan is supposed to be saved (cf. fig. 14). The number (NN) of the file name may be changed. The format (.dat) and file type (prplanNN.dat) may not be changed.



**Fig. 14**

### 6. Transfer of all test instructions of one group onto the network

It is possible to transfer all test instructions of one group onto the network. This function requires that the PROCON Measuring Computer M40118.V03 contains OPTION "N". Furthermore, it needs to be connected with a predefined network.

Click on the symbol "Transfer of Procon test plans" (cf. red mark, fig. 11). Select the test plan group of which test instructions are to be saved. It is marked in blue. Then click on "Save test instructions of the group" (cf. red mark, fig. 15).

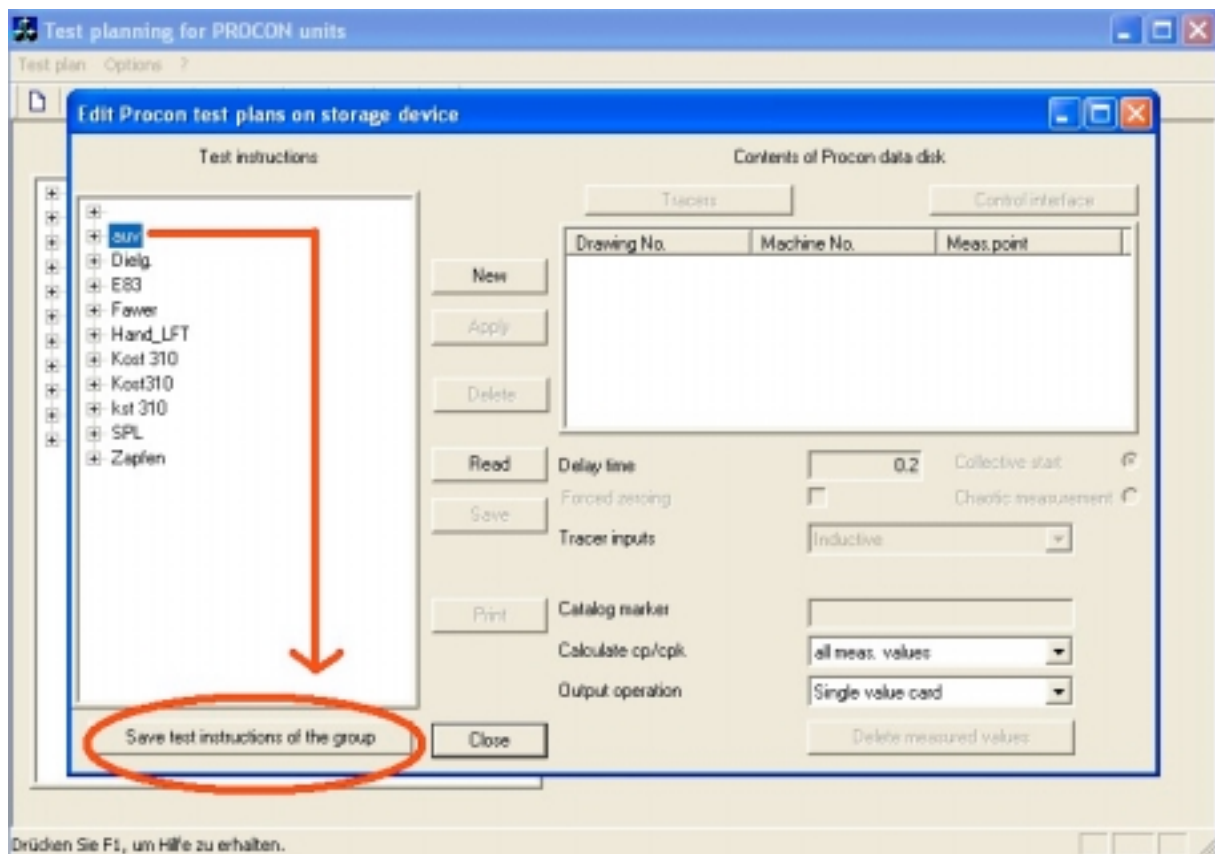
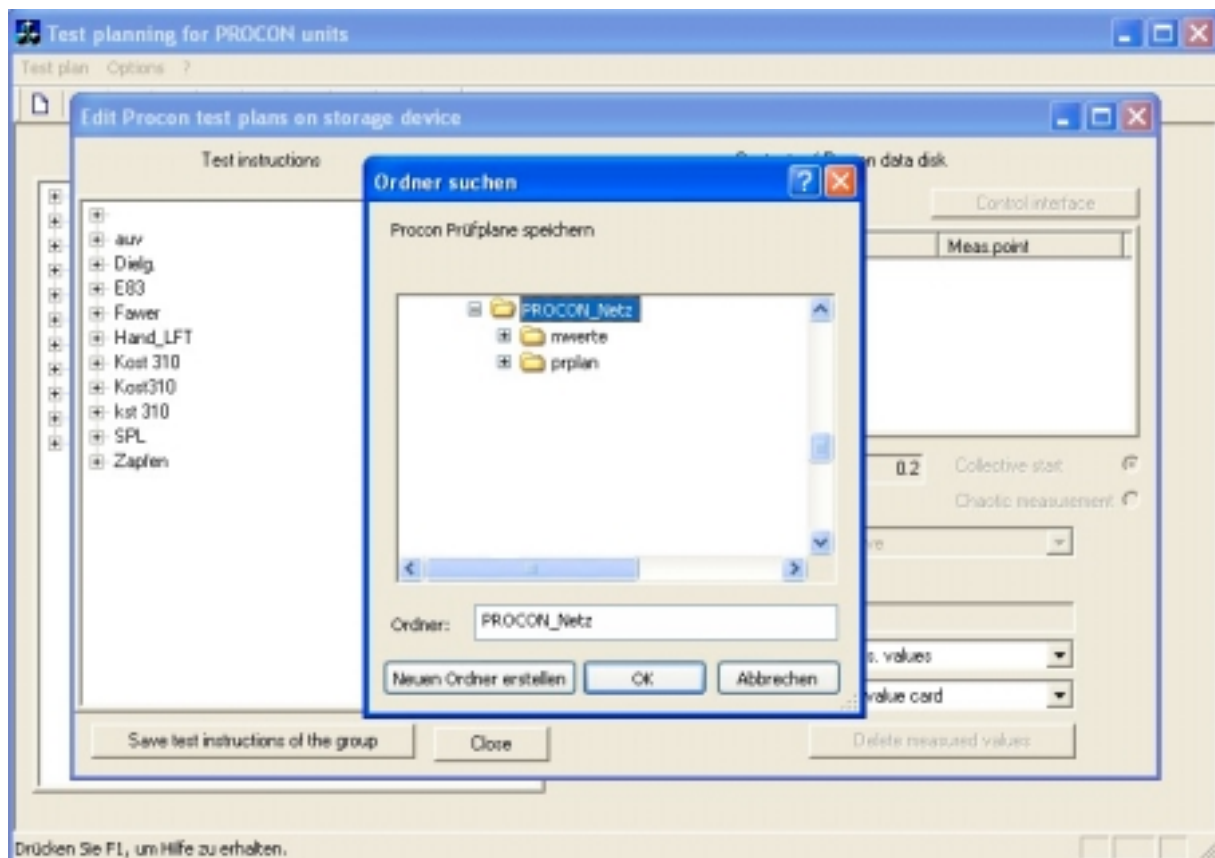


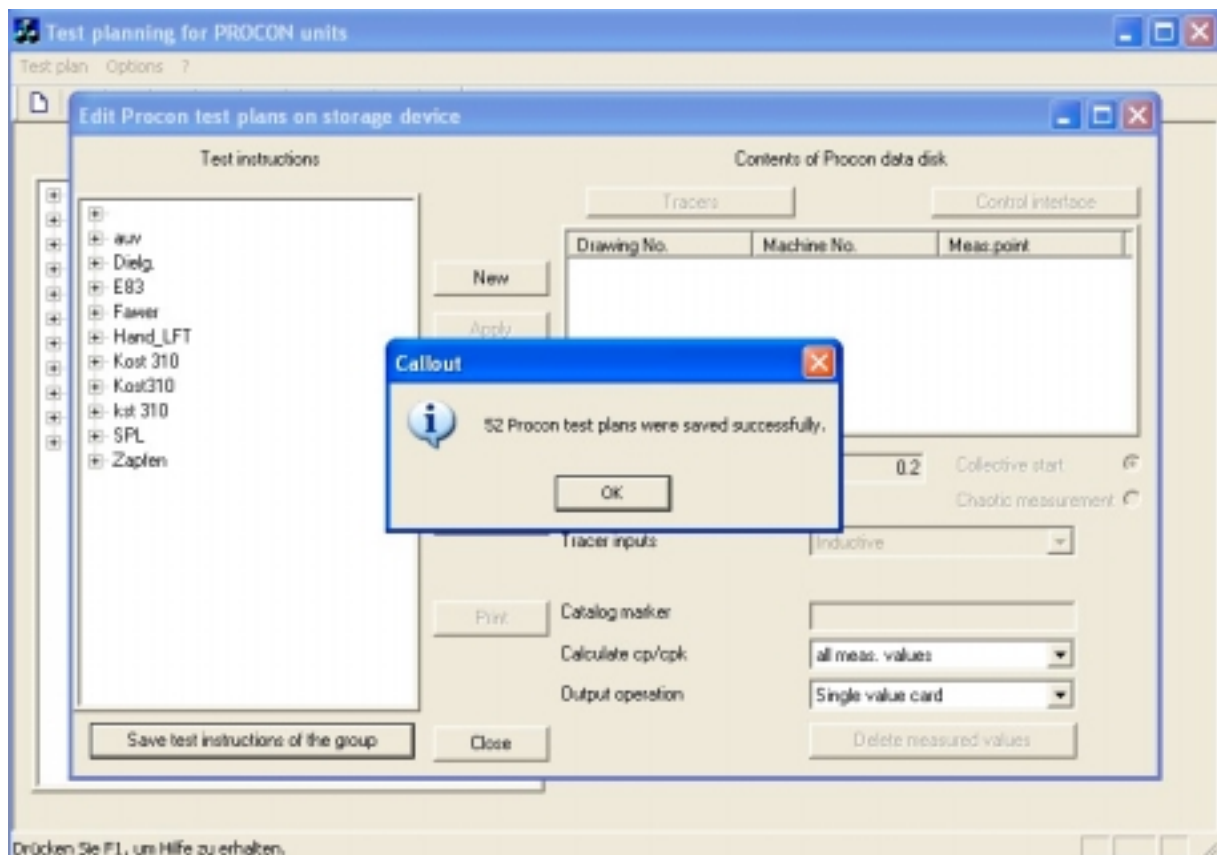
Fig. 15

Select the folder or the predefined network onto which the test instructions are to be saved (cf. fig. 16). Confirm with "OK" that the test instructions shall be saved.



**Fig. 16**

A callout message shows the number of test plans that were successfully saved (cf. fig. 17). Confirm with OK. The test plan files are named as follows: material No. + machine No.



**Fig. 17**

If the PROCON Measuring Computer M40118.V03 is connected with the network, all new or edited test plans will automatically be transferred from the network when starting the measuring program or selecting the function "Automatic Zeroing".

## **7. Export of measuring value files for MathCad evaluations**

This function is needed for the conversion of measuring value files from measuring computers of the old generation.

## **8. Control interface for automatic tool correction**

The transfer protocol "Neue Magdeburger" is integrated in the PROCON Measuring Computer. It defines the data exchange with the tool machine. Different control factors may be programmed in order to calculate the correction value which is to be put out:

**Single value:**

The deviation of the measuring value from the nominal value of the control interface is put out after each measurement. **PLEASE NOTE:** This refers to the nominal value entered in the tab "Control interface" and not the nominal (dimension) of the measurement point.

**Average value:**

The arithmetic average value is calculated from the single values of the sample scope programmed in the control interface and its deviation from the nominal value of the control interface is put out. **PLEASE NOTE:** This refers to the nominal value entered in the tab "Control interface" and not the nominal (dimension) of the measurement point.

**Median:**

The Median value is calculated from the single values of the sample scope programmed in the control interface and its deviation from the nominal value of the control interface is put out. **PLEASE NOTE:** This refers to the nominal value entered in the tab "Control interface" and not the nominal (dimension) of the measurement point.

**KUSUM:**

KUSUM stands for KUmulierte SUMme (= *cumulative sum*).

Cumulative sum is a statistical method which includes current values as well as the values of previous samples. Control acc. Kusum is a control loop with memory. By its help, deviations and reject values may be avoided. It is possible to intervene already when slight deviations appear and not only when tolerance limits are overstepped.

**Calculation:**

Based on sigma and sample scope n, a limit value (critical sum) H and a threshold value K are calculated during the setup of a test plan with ProcProg. Based on the data of the test plan, processing of the measuring values is carried out in the PROCON Measuring Computer. The deviation of the Median value of a complete sample from the nominal value is added together, if the deviation oversteps the threshold value K. The correction value (sum / number of samples) is calculated and put out as deviation from the nominal value of the control interface, if the sum oversteps the limit value H. **PLEASE NOTE:** This refers to the nominal value entered in the tab "Control interface" and not the nominal (dimension) of the measurement point. The sum as well as the number of samples will be reinitialized after output of a correction value OR a change of the algebraic sign of the sum of deviations:

**Sample-dependent factors:**

Table[1] = 1.0;  
Table[2] = 1.0;  
Table[3] = 1.16;  
Table[4] = 1.092;  
Table[5] = 1.198;  
Table[6] = 1.135;  
Table[7] = 1.214;

$\text{Sigma } n = \text{Variance} / \text{square root of (sample scope } n\text{)}$ ;

Threshold value  $K = 0.5 * \text{Table}[\text{sample scope } n] * \text{sigma } n$ ;

Limit value (critical sum)  $H = 5.0 * \text{Table}[\text{sample scope}] * \text{sigma } n$ ;

The variance as well as the sample scope are input parameters in ProcProg.