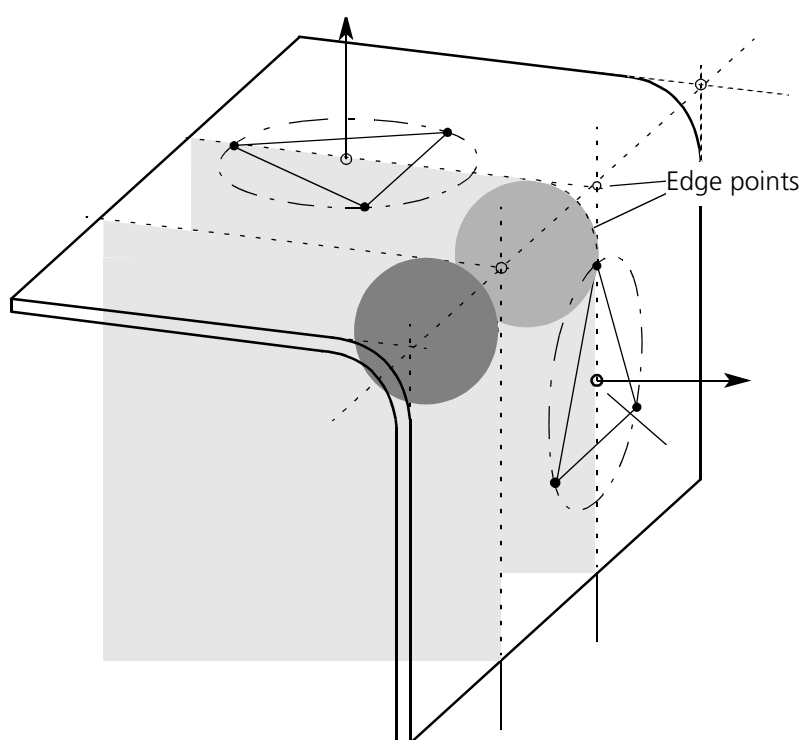


# UMESS

## **Option 6 Edge points for UNIX and LINUX**



## **Operating Instructions**



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# Preface

It is here assumed that the user is familiar with the coordinate measuring machine and its components. Please keep all printed materials delivered with the measuring machine ready to hand at all times.

## Principles in this operating manual

Before starting to work with this manual, the user has to familiarize himself with the applied principles.

In the following, you will find information on the used font types, signs and symbols.

### Typographic principles

The font types and font schemes used in this manual have the following meaning:

- **bold face**
  - Dialog element on the screen  
Example: "... the button <**TERMIN**>"
  - Term  
Example: "During calculation the location of a **measuring element** in relation to a **reference element** is determined."
  - File and directory names  
Example: **/home/zeiss/UB**
- *italic*
  - Highlighted text of which the contents are very important  
Example: "Click with the *right* mouse button ..."
  - Cross reference  
Example: "..., see also ► *"Differences between space point/grid point" on page 2-1*"
- Courier  
Program code, file contents
- **Courier bold face**  
Text in dialog windows and records

## Signs and symbols

Special signs and symbols are used in this manual.

### Symbols for warnings and information



#### Danger!

In this case, special care is called for. The warning triangle indicates risk of injury. Non-observance of this warning may cause personal injury.



#### Note!

This symbol warns against situations which may lead to loss of data, measuring errors, errors in the measuring run, collisions or damage to the machine and workpiece.



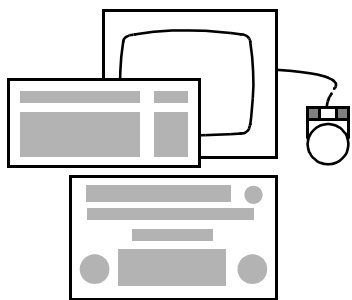
The **Note** symbol is shown next to important text and helpful additional information.

### Symbol for function call

There are several possibilities:

- Direct input by means of the DI number
- Function selection by means of the pull-down menu
- Selection by means of icons

Example:



DI	Softkey	FFK	Menu
1220	<GEO.ELEM>	<GEOM. ELEMENT>	<Element>
	<SPACE PT>	←	<Car body> <Space point>



### Symbol for softkey

Reference to softkeys in dialogs.

# Overview of chapters

These operating instructions describe the scanning of edge points UMESS Option 6.

The following subjects are described:

- *"General" on page 1-1*
- *"Differences between space point/grid point" on page 2-1*
- *"Administration of the space point-modes" on page 3-1*
- *"Mode input (DI 1121)" on page 4-1*
- *"Space point measurement run (DI 1120)" on page 5-1*
- *"Edge point (DI 1220)" on page 6-1*
- *"Corner point (DI 1216)" on page 7-1*
- *"Parabola edge point (DI 1173)" on page 8-1*



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<b>Chapter 3</b>	<b>Administration of the space point-modes</b>
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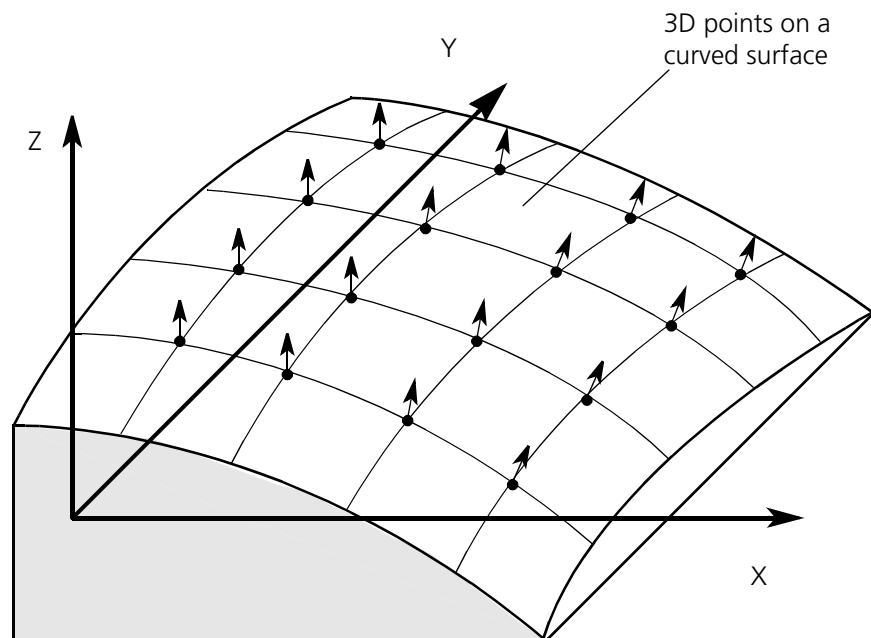


# Chapter



## General

3D (space) point is in general the identification for a point on any surface which is defined by three coordinates ( $X$ ,  $Y$ ,  $Z$ ) as well as the normal of the surface at this point ( $N_x$ ,  $N_y$ ,  $N_z$ ):



Grid points and space points are differentiated in UMESS.

Numerous parameters have to be specified for a space point measurement. To simplify operation, the parameters for different sequences can be set.



# Chapter

# 2

## Differences between space point/grid point

In UMESS differentiation is made in the result output between space point coordinates and grid point coordinates. The type of output required must be specified in the space point mode.

### Applications for space point coordinates

The space point measurement should be applied if all three actual coordinates of a surface point are of interest.

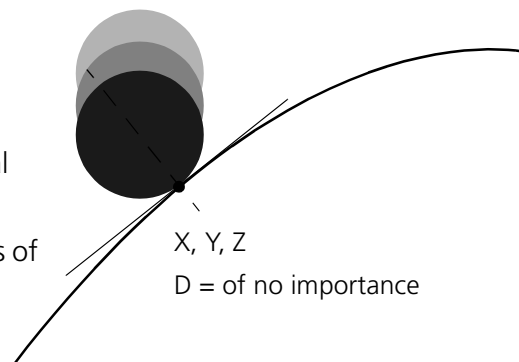
In this case the following is output in the record:

- the three actual coordinates of the probing point X, Y and Z
- the distance between nominal and actual contact point, converted in the normal direction, under D.

### (1) Nominal normal unknown, nominal coordinates unknown

Procedure:

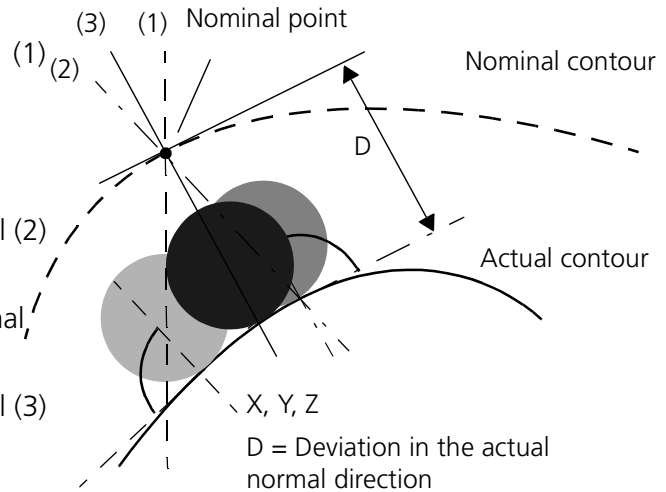
- Manual probing
- Automatic determination of the normal
- Automatic probing in the direction of the actual normal
- Output of the coordinates of the probing point



### (2) Nominal normal unknown, nominal coordinates known

Procedure:

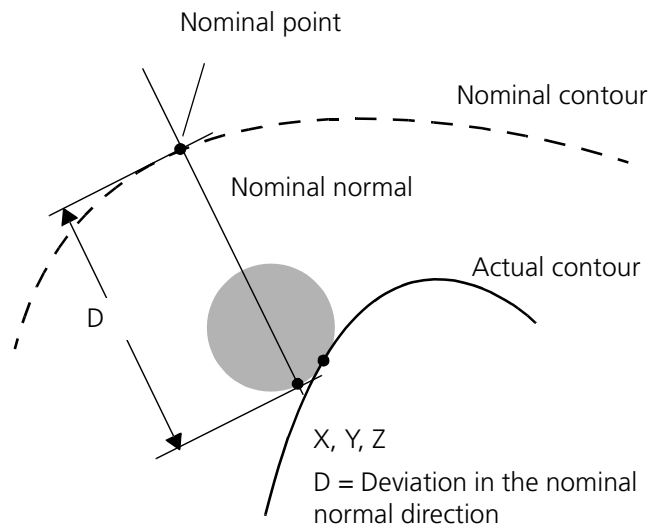
- Automatic probing at the nominal point
- Automatic determination of the actual normal
- Automatic probing in the direction of the actual normal (2)
- Repeat of the autom. determination of the actual normal,
- Automatic probing in the direction of the actual normal (3)
- Output of the coordinates of the probing point and the deviation in the direction of the actual normal



### (3) Nominal normal known, nominal coordinates known

Procedure:

- Automatic probing in the direction of the nominal normal which goes through the nominal point.
- Output of the probing point and the deviation in the direction of the nominal normal



## Applications for grid point coordinates

The grid point measurements must be used if the space points to be measured are so-called grid points, i.e. they lie exactly in the measuring plane (grid). The deviation of the **"grid nodes"** in the probing direction are of interest (e.g. struck line principle).

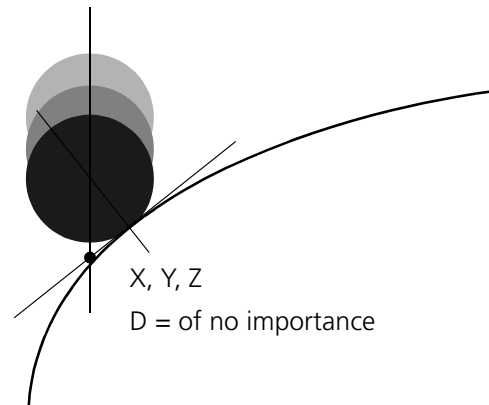
In this case the following is output in the measurement record:

- the two nominal coordinates in the probing plane (these are travelled to exactly);
- the actual coordinate in the probing direction;
- the nominal-actual deviation in normal direction under D.

### (1) Nominal normal unknown, nominal coordinates unknown

Procedure:

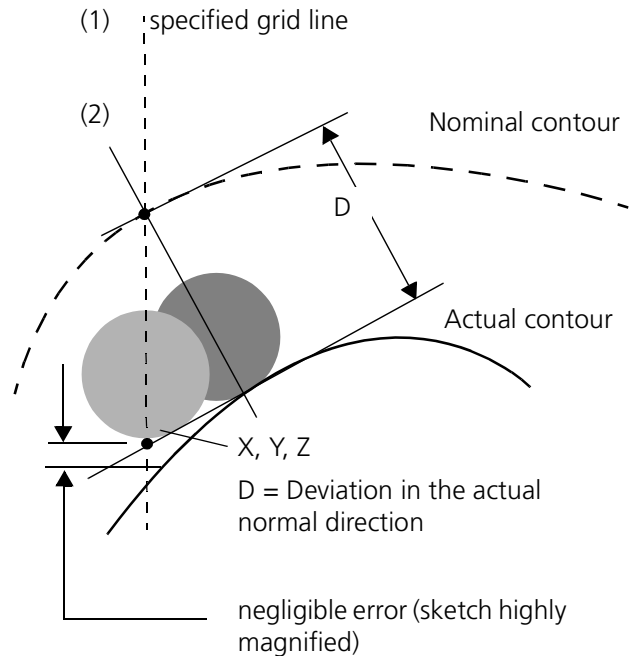
- Manual probing
- Automatic determination of the normal
- Automatic probing in the direction of the actual normal
- Output of the actual grid point



## (2) Nominal normal unknown, nominal coordinates known

Procedure:

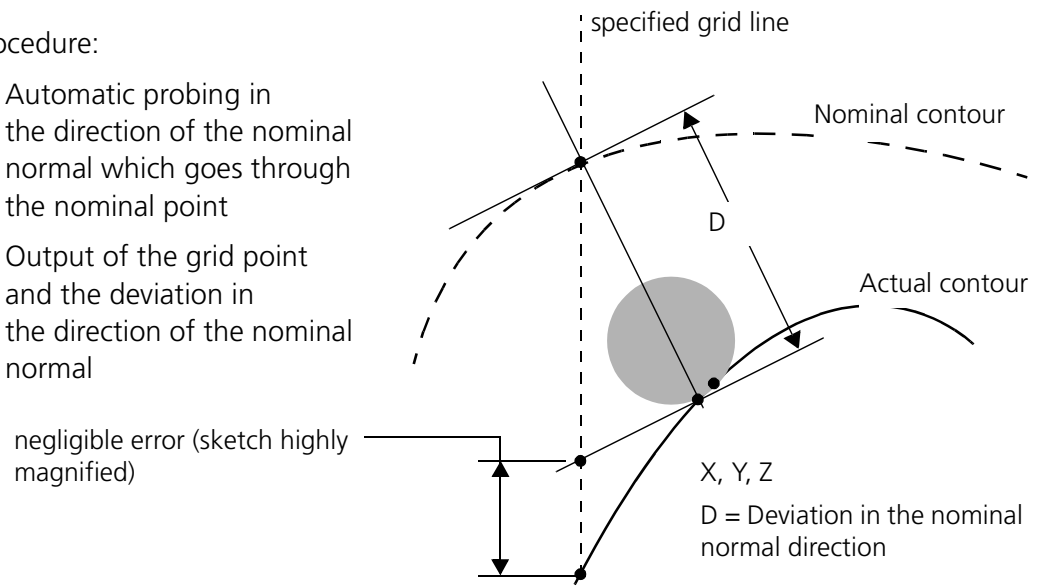
- Automatic probing in the nominal point in the direction of the specified grid line (1)
- Automatic determination of the actual normal
- Automatic probing in the direction of the actual normal, repetition of the autom. determination of the actual normal
- Automatic probing in the direction of the actual normal, output of the actual grid point and the deviation in the direction of the actual normal (2)



## (3) Nominal normal known, nominal coordinates known

Procedure:

- Automatic probing in the direction of the nominal normal which goes through the nominal point
- Output of the grid point and the deviation in the direction of the nominal normal

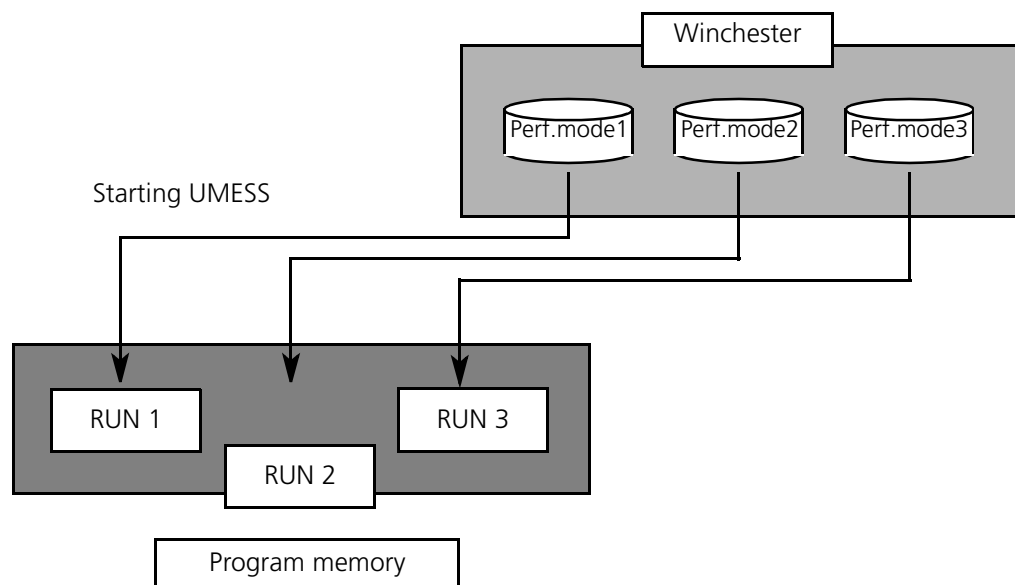


# Chapter 3

## Administration of the space point-modes

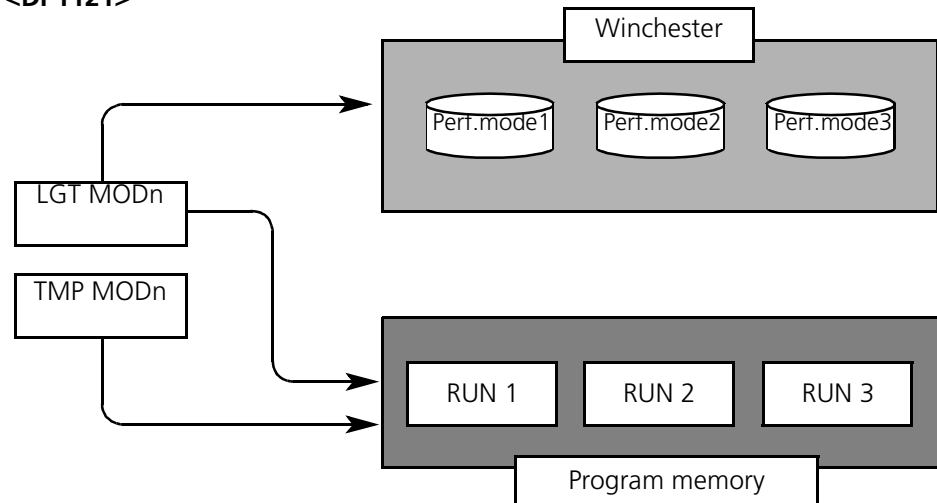
The parameters for three different space point measuring runs are stored on the Winchester, the so-called **Performance modes**.

When starting UMESS these performance modes are copied to the program memory and are then available with the space point measurement as **RUN 1** to **3**:



With the space point mode input **<DI 1121,>** the current runs in the program memory as well as the performance modes on the Winchester can be changed. With the softkeys **<TMP MODn>** only the corresponding runs in the program memory are changed, with the softkeys **<LGT MODn>** the performance modes on the Winchester as well.

**<DI 1121>**





# Chapter

# 4

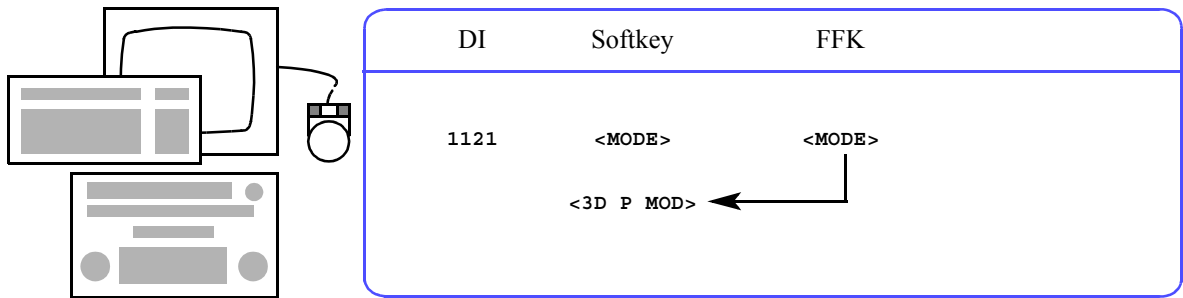
## Mode input (DI 1121)

---

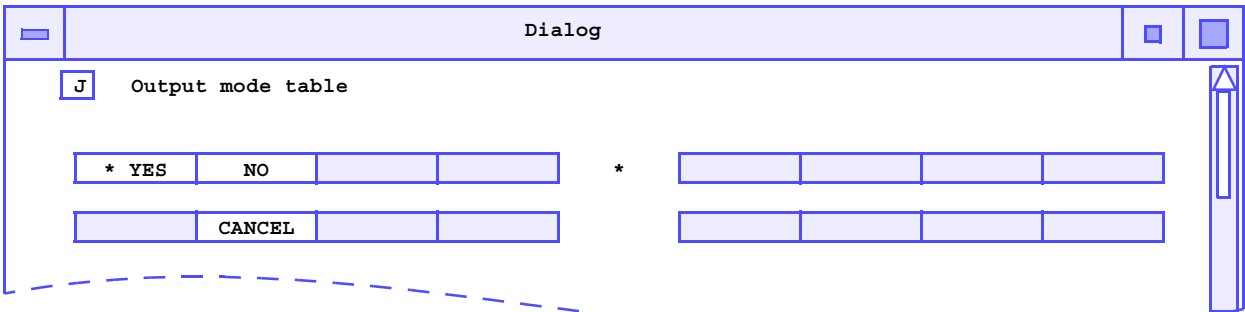
This function enables:

- the listing of runs 1 to 3 which are currently stored in the program memory
- modification of the runs stored in the program memory
- modification of the performance modes stored on the Winchester.

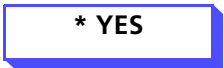
Function call



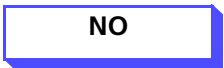
The following inquiry appears after the function call:



Softkey



The parameters of the runs stored in the program memory are output on the **Space point mode - List** screen page. The list can be output on the printer with the **PRINTER** softkey, see screen page overleaf. The **Space point mode - Input** input mask is opened with **<TERMIN>**.



The **Space point mode - Input** input mask is opened, see input mask overleaf.

Space point mode - List				RUN 1	RUN 2	RUN 3
Current run				*	*	*
Point determination	- Measure					
Point input	- manual measurement					
	- Max. iteration number	....	0	....	0	....
Input	- Normals NX,NY,NZ					
	- Angle W1,W2					
Determination of normals with-CNC		....		....		....
Output in- grid point coordinates			*		*	
	- space point coordinates					
Arc radius			0.1000		0.1000	
Start angle			0.00		0.00	
Position after measurement						
Norm. vec. dist.			0.0000		0.0000	
Workpiece dist.			0.0000		0.0000	
Clearance plane			0.0000		0.0000	
			PRINTER	*		TERMIN
						INFO

**TERMIN**

You call the **Space point mode - Input** input mask.

PRINTER

You output the list on the printer

## Space point mode - Input input mask

Space point mode - Input

J

Point definition

-Measure

- Input

Normals NX,NY,NZ

- Preset by manual measurement

Angle A1,A2

- Max. number of iterations

0

Normal determination with

- CNC

Outputing grid point coordinates

\*

- Space point coord.

Arc radius

0.1000

Start angle

0

Position after measurement

- Norm. vec. distance

- Workpiece axis distance

- Clearance plane

\* YES

NO

MOD INFO

\*

TMP MOD1

TMP MOD2

TMP MOD3

BACK

PRE MENU

LGT MOD1

LGT MOD2

LGT MOD3

INFO

## Explanation of the softkeys

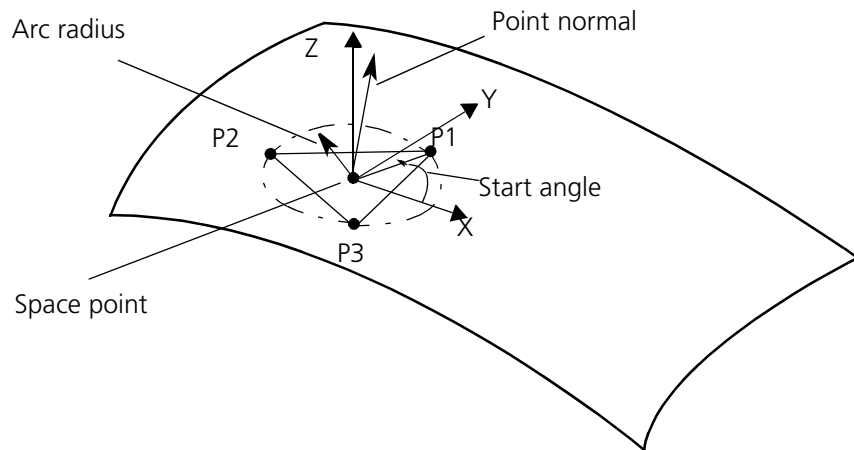
* YES / NO	To select the required input fields.
MOD INFO	The parameters of the runs currently stored in the program memory are output on the screen (see dialog).
TMP MODn	The current screen contents are stored in the program memory under the corresponding number as <b>RUN n</b> .
LGT MODn	The current screen contents are stored under the corresponding number as <b>RUN n</b> in the program memory <b>and</b> as performance mode n on the Winchester.
BACK	Screen page concluded and return to the UMESS main menu.
PRE MENU	Return to the UMESS main menu.
INFO	Screen information on the input field currently selected.

## Explanation of the input fields

<b>Point definition</b>	<p>The program <b>&lt;DI 1120&gt;</b> requires the direction of the surface normal in the space point for the space point measurement.</p> <p>The following options can be selected:</p>
<b>Measure</b>	<p>The nominal normal is unknown. <b>&lt;DI 1120&gt;</b> should automatically obtain the information required for the normal direction by an automatic iteration measurement (standard case).</p>
<b>Preset by manual measurement</b>	<p>The nominal coordinates are unknown They are specified by probing the test piece.</p>
<b>max. number of iterations</b>	<p>(relevant with measurement = *): Maximum number of iterations with the automatic calibration of the normal direction, for explanation see <b>Arc radius</b>.</p>
<b>Input</b>	<p>Information on the normal direction by screen input. The data required originates from the design drawing for example, or has already been determined by a measurement. Two input variants are available:</p>
<b>Normal NX, NY, NZ</b>	<p>Normal direction should be entered in vector form: NX, NY, NZ are those components of the normal vector which are projected onto the respective axes of the workpiece coordinate system.</p>
<b>Angle A1, A2</b>	<p>The direction of the normal should be entered with the projected angles A1, A2.</p>
<b>Normal determination with CNC</b>	<p><b>&lt;YES&gt;</b> In the CNC run the normal direction for each space point is determined by measurement.</p> <p><b>&lt;NO&gt;</b> In the CNC run the normal direction of the learn programmed workpiece is used (point determination by measurement prerequisite).</p>
<b>Output in</b>	<p>The result of the space point measurement can be output in space point or in grid point coordinates. Select the required output form with <b>&lt;YES&gt;/&lt;NO&gt;</b>.</p>

### Arc radius/ Start angle

(Only with normal determination by measurement.) **<DI 1120>** uses the values entered here for the following iteration method for normal calibration:



**<DI 1120>** probes three points about the entered space point at an interval of 120° at the distance entered with the arc radius and calculates the normal of this surface element. The nominal point is probed with this auxiliary normal and a new normal determined again with three probings.

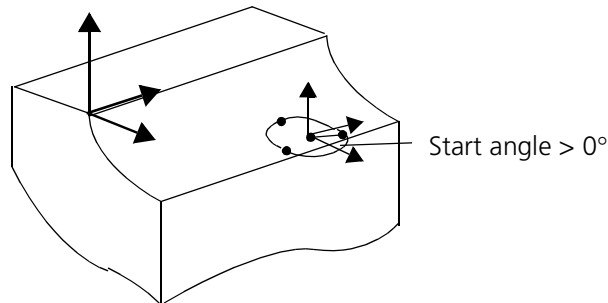
If the difference between both normals does not exceed a limit value, the space point is determined. Otherwise this iteration is repeated corresponding to the repetition factor entered with **the max. No. of iterations**.

For defining the start angle:

Prb. direction	PLCN	Start angle counts from
+X, -X	1	+Y anticlockwise
+Y, -Y	2	+Z (mathematically positive);
+Z, -Z	3	with start angle = 0 the 1st auxiliary point lies on the axis

## Application example

The space point is very near to an edge.



Start angle and arc radius can also be influenced with **<DI 1661>** (machine parameters).

### Position after measurement

After the space point measurement **<DI 1120>** automatically backs away. Direction and length of the backaway path must be defined here or with **<DI 1661>**. Selection criterion can be, for example, the position of the space points if a collision-free backaway is only guaranteed in the normal direction or only in the direction of the workpiece coordinate system.

The following 3 backaway methods can be chosen; only one of these can be activated at a time (i.e. value input only possible in one field):

#### Norm. vec. dist.

The probe is backed away in the direction of the normal with the backaway distance entered.

#### Workpiece axis dist.

Backaway takes place in the direction of the workpiece coordinate system counter to the last probing direction with the backaway distance entered.

#### Clearance plane

Backaway takes place in the direction of the workpiece coordinate system on the clearance plane. This lies perpendicular to the last probing direction at the distance specified above/below the workpiece zero point (take care with signs).

## Application example

For the clearance plane, a value is entered which is larger than the maximum expanse of the workpiece in the backaway direction. After the probe has been reversed, the next probing point can be travelled to in the clearance plane without risk of collision caused by the workpiece.

The screen page is concluded with **<PRE MENU>** or with **<BACK>** (see softkeys for explanation).





# Chapter

# 5

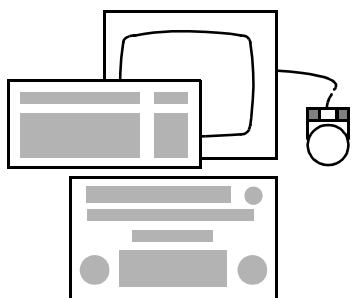
## Space point measurement run (DI 1120)

If this function is called, a space point measurement run can be started with parameters defined with **<DI 1121>**.

### NOTE

Before the function call, the probe must be positioned approximately in the probing or normal direction before the space point to be measured.

### Function call



DI	Softkey	FFK	Menu
1220	<GEO.ELEM>	<GEOM. ELEMENT>	<Element>
	<SPACE PT>	←	<Car body> <Space point>

The following softkey menu appears after the function call:

Please select function								
* YES	NO			*	RUN 1	RUN 2	RUN 3	TERMIN
BACK								INFO

You have to specify with the softkey the parameters with which the space point measurement is to be carried out:

### Softkeys

**RUNn**

The parameters currently stored in the program memory under **RUNn** are used for the space point measurement.

**TERMIN**

The same parameters are used as for the last call of **<DI 1120>** (simplification of operation).

**BACK**

Cancellation of the space point measurement and return to the previous menu.

The following dialog subsequently appears:


<b>PROBE NO = 1</b>	<b>PRB. DIRECTION = - Z</b>	(1, 5)
---------------------	-----------------------------	--------

<b>NOM. POINT</b>		
<b>X = 0.0000 mm</b>	<b>Y = 0.0000 mm</b>	<b>Z=0.0000 mm</b>

<b>NOMINAL NORMAL</b>		
<b>NX = 0.0000</b>	<b>NY = 0.0000</b>	<b>NZ = 0.0000</b>

<b>ANGLE</b>		
<b>A1 = 0.0000</b>	<b>A2 = 0.0000</b>	<b>PRB. DIRECTION = - Z</b>

- 1 Specify the probe number and probing direction.
- 2 Specify the nominal coordinates of the space point in workpiece coordinates. If the contour is unknown, the point can be determined e.g. by probing with supplementary coordinates (**<XYZY>**). The measurement run starts if the run selected has made provision for the definition of the normal direction by measurement.

- 
- 3 Inquiry only appears if the run selected has made provision for the input of the normal direction as vector. You only have to enter the X, Y and Z components of a vector of the normal direction. The program takes over the standardization.
  - 4 Inquiry only appears if the run selected has made provision for the input of the normal direction as projected angle.
  - 5 The individual input fields are confirmed with **<Return>**. All data offered is accepted with **<TERMIN>**. If nominals exist, these are offered as default, otherwise the data is always used from the last call of **<DI 1120>**.



# Chapter 6

## Edge point (DI 1220)

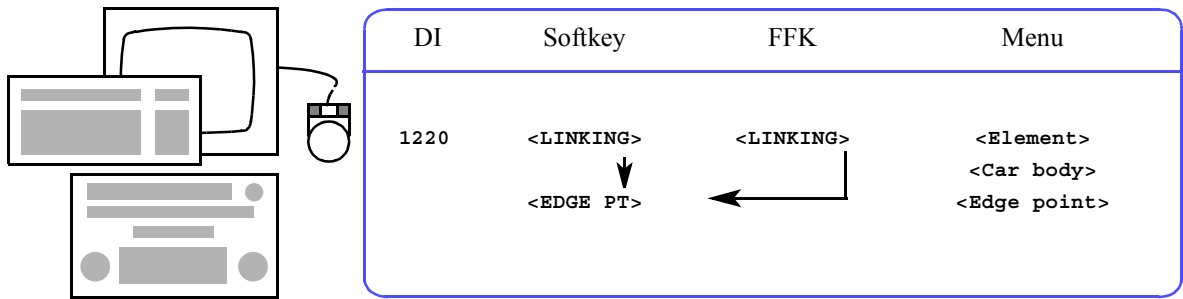
---

If a plane intersects two surfaces which are not parallel, two intersection lines appear which meet at a so-called edge point.

**<DI 1220>** calculates such edge points which cannot normally be probed with the help of the normal directions of the surfaces.

All edge points arising from the parallel displacement of the intersection plane lie on the edge line. If both surfaces are even, their intersection line is identical to the edge line.

Function call



The following screen page appears after the function call:

EDGE PT

C

Element 1

RPKT 5

Element 2

RPKT 7

Result

UMRPKT 1

\*

TERMIN

BACK

INFO

Procedure

Enter the names or the addresses of the space point from which the edge point is to be calculated in the input fields **Element 1** and **Element 2**.

Enter the name which is to receive the results in the **Result** field.

Conclude screen page with **<TERMIN>**.

NOTE

- It is not necessary to differentiate between element 1 and element 2.
- If the name allocation is not activated, the screen page does not appear. The last two elements in the record are used.

Then the following screen page appears:

Edge point - value input

PLANE CODE NO.=  INTERS. HEIGHT =  GRID DIM.=

### Explanation of the input fields

#### PLANE CODE NO.

Enter the plane code number of the intersection plane and confirm with **<Return>** (YZ = 1; XZ = 2; XY = 3). The computer offers the plane calculated from the space points.

#### INTERSECTION HEIGHT

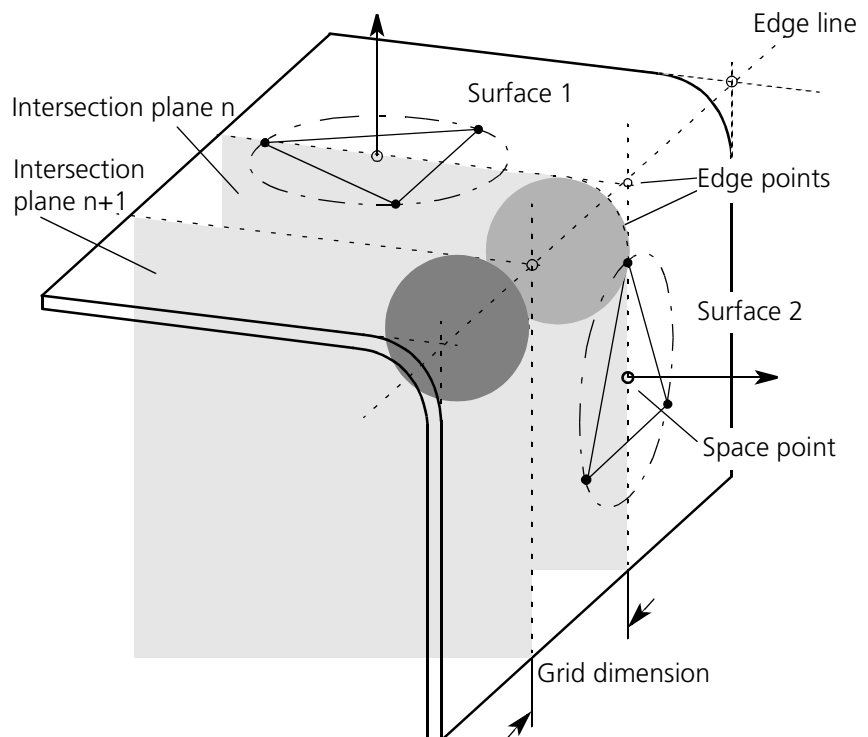
Enter the distance of the intersection plane from the zero plane of the workpiece coordinate system and confirm with **<Return>**.

#### GRID DIM.

With continuous edge point measurement, a uniform intersection plane distance can be given as grid dimension. The dimension entered here is added to the previous intersection height with the next call of **<DI 1220>** and offered in the **INTERS HEIGHT** field as default.

#### <BASIC MEN>

Return to the UMESS basic menu.



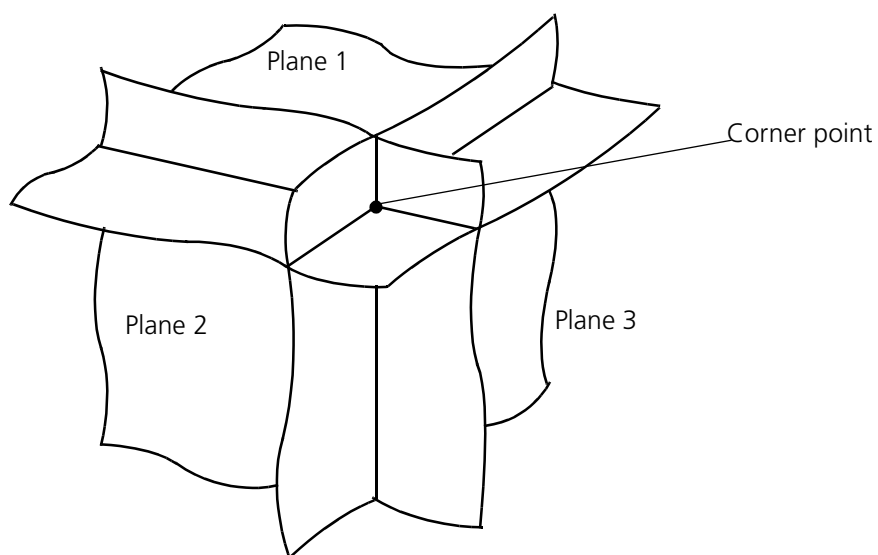




# Chapter

## Corner point (DI 1216)

Three planes not parallel to one another intersect at one point, the so-called corner point.

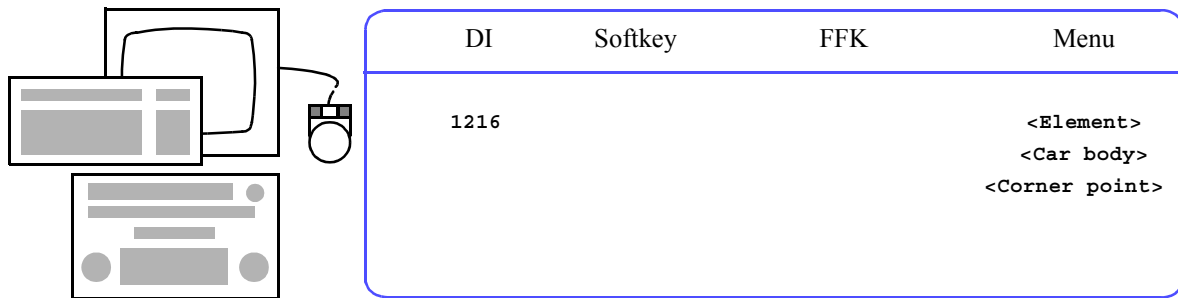


The **<DI 1216>** function calculates this corner point from three previously measured planes.

A plane can be specified by the following elements:

**SURFACE**  
**SPACE POINT**  
**EDGE POINT**

### Function call



The following screen page appears after the function call:

Corner point						
<input type="checkbox"/> C	Element 1	<input type="text" value="SURF_5"/>	Element 2	<input type="text" value="EDGEPT_1"/>	Result	<input type="text" value="3DPT_3"/>
	Result	<input type="text" value="CORNPT_1"/>				
		*				
				<input type="text" value="TERMIN"/>		
<input type="text" value="BACK"/>				<input type="text" value="INFO"/>		

### Procedure

- Enter the names or addresses of the elements which define the planes (surface, space point or edge point) in the Element 1, 2 and 3 input fields.
- Enter the name which is to receive the results in the Result field.
- Terminate screen page with **<TERMIN>**.

### NOTE

- The sequence of the individual planes is irrelevant.
- If the name allocation is not activated, the three last elements in the measuring record are used. The screen page does not appear.

# Chapter 8

## **Parabola edge point (DI 1173)**

---

With the parabola edge point program function, you can calculate an intersection point, the parabola edge point, from the measurement of two parabolas.

An equalization polynomial of the 2nd degree is calculated from the measured points for each parabola and then the intersection point is calculated from the two equalization polynomials.

### Procedure

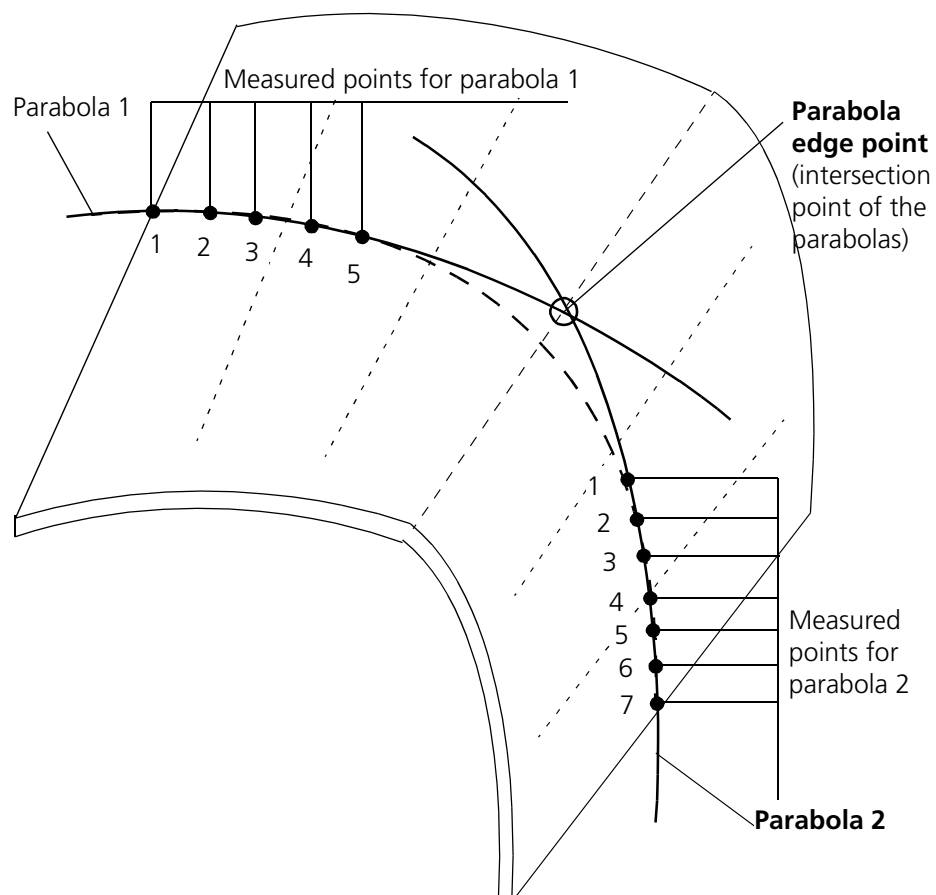
To determine both parabolas, you can probe manually, measure single points or scan. Always first measure parabola No. 1 and then parabola No. 2 and please keep to the following orientation during measurement:

#### NOTE

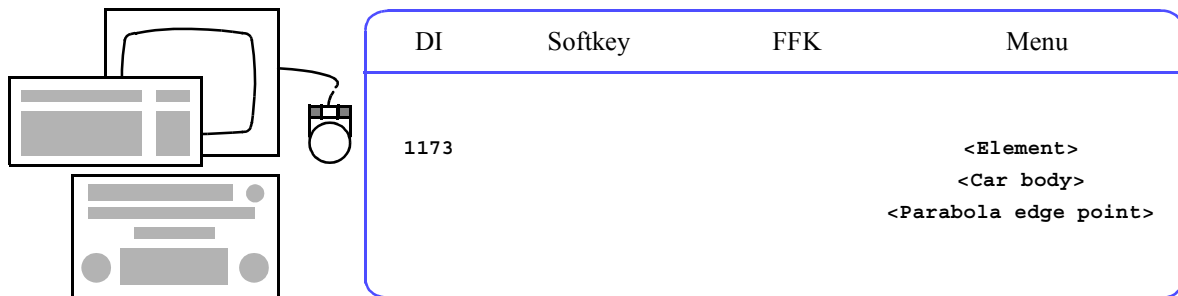
Parabola No. 1 is measured in the direction towards the intersection point expected. Parabola No. 2 is measured away from the intersection point expected.

The number of points for parabola No. 1 and parabola No. 2 do not have to be the same. Once the second parabola has been measured, the parabola edge point is calculated straightaway.

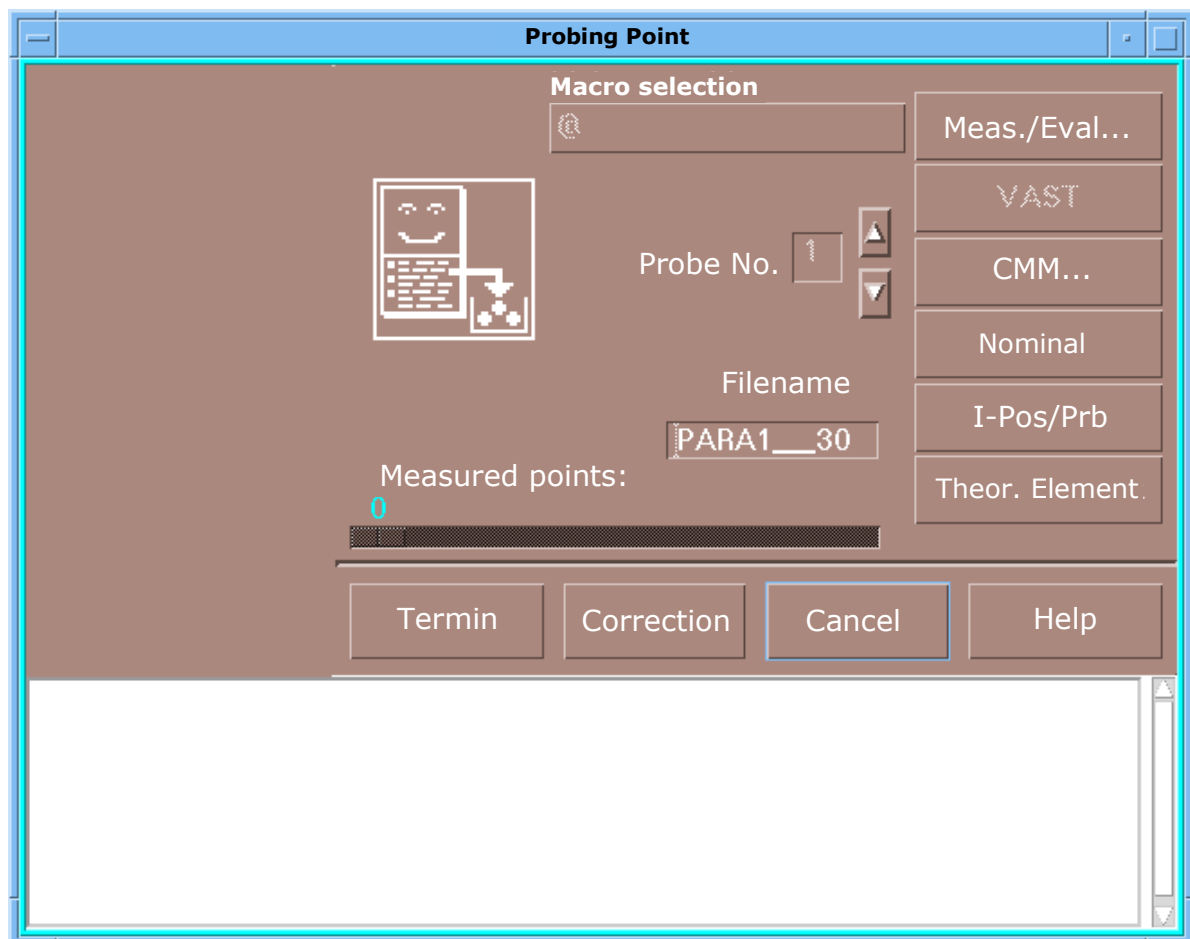
### Defining the parabola edge point



## Function call

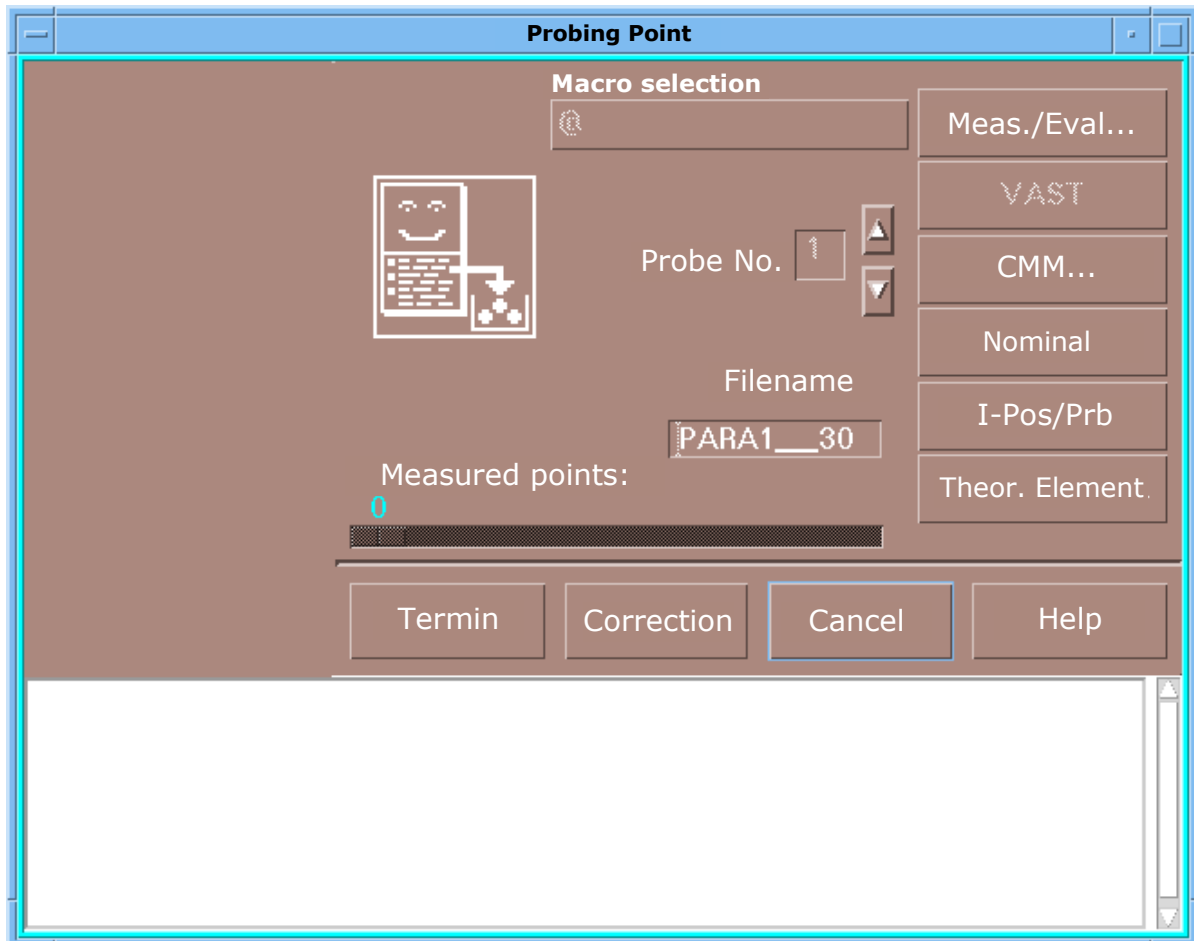


The following screen page appears after the function call:



<TERMIN>

You terminate the measurement of parabola No. 1, the screen page for measuring parabola No. 2 follows directly.



<TERMIN>

You terminate the measurement of parabola No. 2, the intersection point of both parabolas, the parabola edge point, is then calculated.

The softkey assignment in the **Parabola edge point** screen pages corresponds to that of the **Geometric elements**, for further information see UMESS Operating Instructions.

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