

# UMESS

## Option 10 PCM library

SURFACE_XY_DIA.D	
CYLINDER_DIA.D	
LINE_DIA.D	
CIRCLE_DIA.D	
Identification	Value
-----	
RESULT NAME	BO_50
PLANE CODE NUMBER	3
PROBE NO.	1
OUTER=0/INNER=1	1
NV X-COORDINATE	10
NV Y-COORDINATE	20
NV Z-COORDINATE	0
NV D DIAMETER	50
START VALUE I-POS	10
END VALUE I-POS	20
DIST : I-POS/PRB	5
START ANGLE	0
:	:
:	:

## Operating Instructions



This manual must not be circulated or copied, or its contents utilized and disseminated, without our express written permission. Persons misusing this manual are subject to prosecution.

All rights reserved, especially in cases of granting a patent or registering a utility model.

Subject to modifications. All rights pertaining to changes in the measuring machine version, scope of delivery, the software packages and the pertaining documentation reserved.

Carl Zeiss does not grant any warranty on this material and no implied warranties on commercial quality and the suitability for a certain purpose.

Carl Zeiss cannot be held liable for errors included in this document, accidental damage or damage resulting from the provision, function or use of this manual.

All product names are registered trademarks or trademarks of the corresponding proprietors.

**Carl Zeiss**  
Unternehmensbereich  
Industrielle Meßtechnik  
D-73446 Oberkochen

Document type: . . .Operating Instructions  
Version: . . . . .8.x  
Date: . . . . .06/01  
Order No.: . . . . .61212-1110102

# 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 is very important  
Example: "Click with the *right* mouse button ..."
  - Cross reference  
Example: "..., see also ► "Determining the A position" on page 2-3"
- **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.



#### Attention!

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.



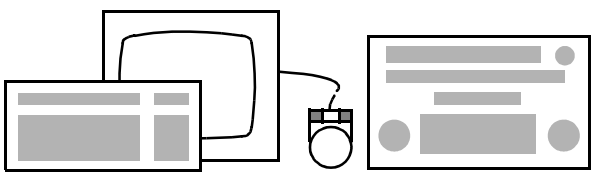
The **Note** symbol is shown next to important text and helpful additional information.

### 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
	<CNC>	<CNC FUNCT>	<CNC>
	<PROG>		<PROG>
1639			<Start>



### Symbol for softkey

Reference to softkeys in dialogs.

# Overview of chapters

This manual describes the function, operation and application possibilities of the measuring program UMESS-UX 10.

The following subjects are described:

- *"General" on page 1-1*
- *"Integrating PCM modules into the CNC program" on page 2-1*
- *"PCM dialogs for the geometric elements" on page 3-1*
- *"PCM dialogs for multi-component elements and special elements" on page 4-1*

## Direct input functions

DI no.	Input abbrev.	Function	Description
1671		Activate PCM run mode	➤ on page 2-2
1663		Set name allocation	➤ on page 2-3
1712	WLVKAT	Read A position	➤ on page 2-3
1639	PROG	Call PROG mode	➤ on page 2-3
1713	WLNWS	Form workpiece coordinate system from control coordinate system	➤ on page 2-4
1079	EXCALL	Select PCM measurement library	➤ on page 2-4
1632	P END	End PROG mode	➤ on page 2-10
1647		PCM generating run	➤ on page 2-13

# Table of contents

<b>Principles in this operating manual</b> .....	<b>3</b>
Typographic principles .....	3
Signs and symbols .....	4
<b>Overview of chapters</b> .....	<b>5</b>
<b>Direct input functions</b> .....	<b>6</b>

## **Chapter 1 General**

<b>General information on PCM measurement modules</b> ...	<b>1-2</b>
<b>Terms</b> .....	<b>1-4</b>
<b>Self-tech programming a CNC run with PCM modules</b> ..	<b>1-5</b>

## **Chapter 2 Integrating PCM modules into the CNC program**

<b>Procedure</b> .....	<b>2-2</b>
Switching on the PCM run mode .....	2-2
Switching on the name allocation .....	2-3
Determining the A position .....	2-3
Calling the PROG mode .....	2-3
Calling the record header .....	2-4
Aligning the workpiece .....	2-4
Selecting the PCM measurement library .....	2-4
Displaying and changing control data catalogs, <CHAN CAT> softkey	2-5
Displaying the catalog of the dialog files, <CATALOG> softkey ..	2-6
Transferring PCM modules to the CNC program .....	2-9
Terminating the self-tech programming .....	2-10
<b>Catalog of PCM measurement modules (calculation modules)</b>	<b>2-12</b>
<b>Run in the CNC program</b> .....	<b>2-13</b>

PCM generating run (DI 1647) .....	2-13
------------------------------------	------

## Chapter 3 PCM dialogs for the geometric elements

General .....	3-2
Dialogs which occur frequently .....	3-4
Dialog for the PCM measurement modules surface XY, surface YZ, surface ZX .....	3-9
Dialog for the line PCM measurement module .....	3-12
Dialog for the scanning line PCM measurement module .....	3-15
Dialog for the cone PCM measurement module .....	3-17
Dialog for the circle PCM measurement module .....	3-22
Dialog for the scanning circle and scanning circle file PCM measurement module .....	3-26
Dialog for the sphere or Sphere_6_Point PCM measurement modules .....	3-29
Dialog for the point PCM measurement module .....	3-33
Dialog for the cylinder and Cylinder_8_Point PCM measurement modules .....	3-35

## Chapter 4 PCM dialogs for multi-component elements and special elements

PCM dialogs for special elements .....	4-2
Dialog for the thread position PCM measurement module .....	4-2
Dialog for the thread gauge PCM measurement module .....	4-5
Dialog for the 3D circle and ring-shaped area PCM measurement module .....	4-9
Dialog for the scanning ring-shaped area PCM measurement module .....	4-13
Dialog for the slot PCM measurement module .....	4-16
Dialog for the bore pattern PCM measurement module .....	4-18
PCM dialogs for combined elements .....	4-21



# Chapter

# 1

## General

---

### **This chapter contains:**

General information on PCM measurement modules . . . . .	1-2
Terms. . . . .	1-4
Self-tech programming a CNC run with PCM modules. . . . .	1-5

## General information on PCM measurement modules

With the PCM measurement modules, you can quickly and simply create control data for geometric elements on the coordinate measuring machine or off-line on an ACE station and link these to complete CNC runs.

With the PCM measurement modules you can measure elements using a large number of probing points which is advantageous for coordinate measuring machines with a trigger probe head (CMM with TPH).

For coordinate measuring machines with measuring probe head (CMM with MPH), you can use the PCM measurement modules with scanning functions.

PCM measurement modules (**PCM = Parameter Control Manager**) consist of parameterized control data which is comprised to measurement modules. The PCM measurement modules are accessories which you can simply include in CNC programs.

The PCM measurement modules are integrated as subprograms into a CNC program. You assign the values for the subprograms via a menu. The control data is created automatically and entered in the current CNC program.

The PCM measurement modules are structured so that you can measure elements in different measurement planes, for example, with the same subprogram. And you can also take different features of the individual elements into consideration. This is possible by the value assignment via PCM dialog files.

Via the dialog files, you make all necessary inputs for the PCM measurement module in question. The applicable measurement routine is then activated automatically by the dialog file (in the background).

The control data of a CNC program contains the strategy for the distribution and number of probings as well as the geometry data (dimension of the workpiece and position in space). You enter this element-specific data during the self-tech programming in a dialog file (table page) which corresponds to the value assignments in the control data.

The value assignment is defined by means of a CNC run which asks for the values via a dialog file. You enter the geometry data of the element to be measured in the dialog file and the probing parameters for the measuring task. If necessary, you can still edit these values later in the CNC program.

A library with various geometric single elements, combined geometric elements and special elements has been created so that usually you do not need to create your own PCM modules.

For each of the individual PCM measurement modules, the PCM library contains a dialog file and separately a file with the relevant measuring routine.

### **UMESS Option 10 PCM measurement module library**

Application of the PCM measurement modules.

### **UMESS Option 09 PCM development system**

Contains the option 10 (application of the PCM measurement modules) and also the extended programming of variants, its own parameterization of control data and creation of its own PCM measurement modules.

# Terms

## Parameters

Variables which are in the control data instead of fixed numbers. These values are assigned numerical values in the CNC run.

## CNC program or workpiece

The actual main program created by self-tech programming using PCM modules.

## PCM dialog file

Input dialog for the corresponding PCM measurement module. The values entered in the dialog (value assignments) are entered in the current CNC program in a CNC run. The PCM dialog files contain preassigned assignments with comments and the call of the respective PCM measurement module with **EXCALL**.

## EXCALL

By means of the **EXCALL** function you can call another CNC program as subprogram within a CNC program (main program) and after the sub program has run, continue in the calling CNC program.

The dialog files call the applicable PCM measurement modules by means of the **EXCALL** function as subprograms.

For more detailed information on the **EXCALL** function, see basic UMESS operating instructions.

## PCM measurement module

Parameterized control data (CNC run) with the travel commands for measuring a geometric element which is called in the CNC program from the dialog file with **EXCALL**.

Dialog files and PCM measurement modules consist of control data lines as does the CNC main program.

A call in the PROG mode assumes that a dialog file and the applicable PCM measurement module are available. Usually, a corresponding dialog file belongs to each PCM measurement module.

# Self-tech programming a CNC run with PCM modules

## Control data catalogs of the PCM library

The control data catalogs for the PCM library are included in the control data administration catalog **<DAW 1630>**:

**Z1 Zeiss cat.  
measurement module  
library**

This catalog only contains the measuring routines of the PCM modules.

**ZA library dialog  
English**

This catalog contains the English dialog files.

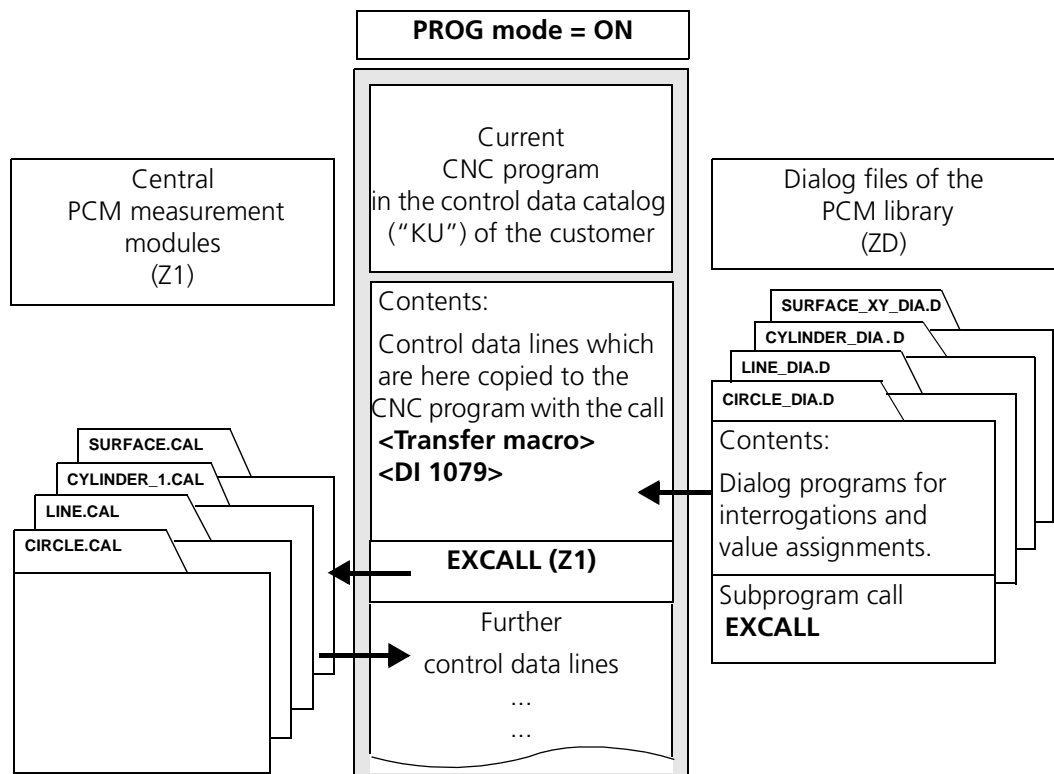
**ZD Messbibliothek  
Dialog Deutsch**

This catalog contains the German dialog files.

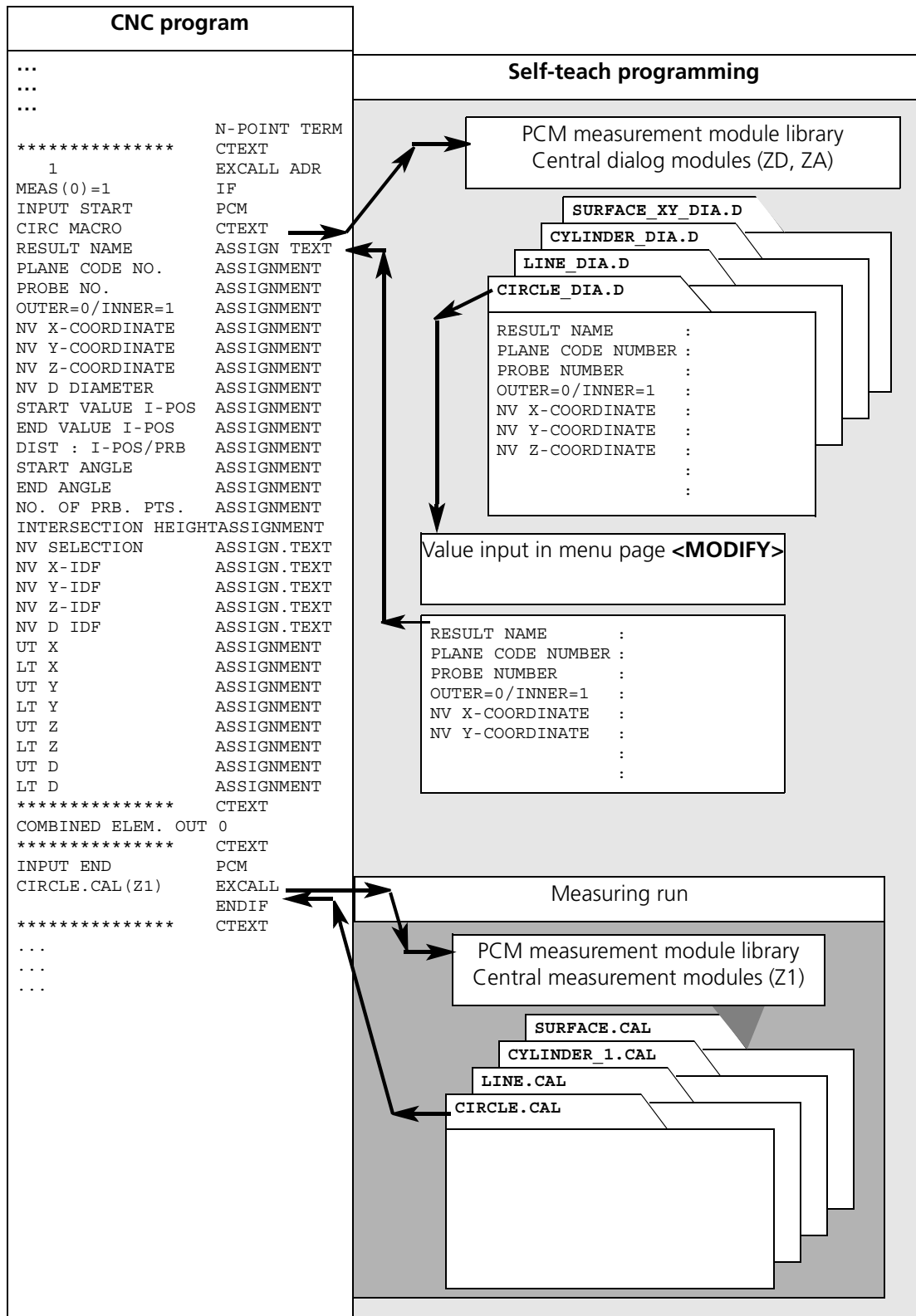
The **Z1 ...** control data catalog must be available in the control data administration catalog.

In order to guide the dialogs to the value assignment, you have to activate a catalog of the dialog files. The **ZA ...** (English) and **ZD ...** (German) dialog files are available for selection, see ► *"Selecting the PCM measurement library"* on page 2-4 for further explanation.

## Diagram: Programming using the PCM library



## Self-teach programming CNC run with PCM modules



# Chapter

# 2

## **Integrating PCM modules into the CNC program**

---

Each of the PCM measurement modules are integrated as a subprogram into the current CNC program by a measuring run.

### **This chapter contains:**

Procedure .....	2-2
Catalog of PCM measurement modules (calculation modules) ..	2-12
Run in the CNC program .....	2-13
PCM generating run (DI 1647) .....	2-13

## Procedure

To integrate PCM modules into a CNC program proceed as follows:

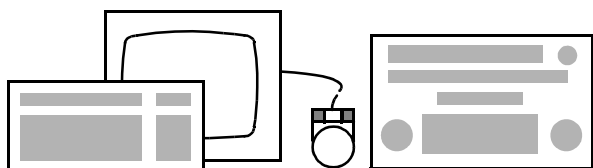
1. ➤ "Switching on the PCM run mode" on page 2-2
2. ➤ "Switching on the name allocation" on page 2-3
3. ➤ "Determining the A position" on page 2-3
4. ➤ "Calling the record header" on page 2-4
5. ➤ "Calling the PROG mode" on page 2-3
6. ➤ "Aligning the workpiece" on page 2-4
7. ➤ "Selecting the PCM measurement library" on page 2-4
8. ➤ "Displaying and changing control data catalogs, <CHAN CAT> softkey" on page 2-5
9. ➤ "Displaying the catalog of the dialog files, <CATALOG> softkey" on page 2-6
10. ➤ "Transferring PCM modules to the CNC program" on page 2-9
11. ➤ "Terminating the self-teach programming" on page 2-10

Before you change to the PROG mode, you have to switch on the PCM run mode and you should also switch on the PCM-EDIT mode.

### Switching on the PCM run mode

In order to be able carry out self-teach programming of the PCM macros in the PROG mode, you have to switch on the PCM run mode.

#### Function call



DI	Softkey	FFK	Menu
	<>	<>	<CNC>
	<>		<PCM>
1671			<PCM Run mode>

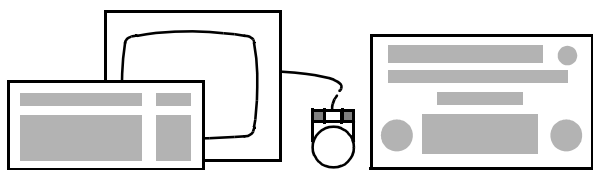


## Switching on the name allocation

If you want to give each of the programmed elements a name, you first have to switch on the name allocation. The respective name is then displayed as the result name in the control data list.

For more information on **Switching on/off the name allocation**, see basic UMESS operating instructions.

### Function call



DI	Softkey	FFK	Menu
	<>	<>	<Record>
	<>		<Mode>
1663			<Name allocation on/off>

## Determining the A position

Determine an A position (this can also be an approx. A position) and save this. Or activate an existing A position by means of **DI 1712**.

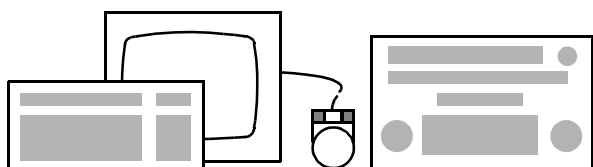
For more information on the mathematical alignment, see basic UMESS operating instructions.

## Calling the PROG mode

Only in the PROG mode it is possible to select, edit and integrate the PCM dialog files into the CNC program. You can start a new workpiece or continue to carry out self-tech programming of an existing CNC run.

For more information on **Starting self-teach programming**, see basic UMESS operating instructions.

### Function call



DI	Softkey	FFK	Menu
	<CNC>	<CNC FUNC1.>	<CNC>
	<PROG>		<PRUG>
1639			<Start>

## Calling the record header

Before self-teach programming you call a record header; for example the standard record header with **DI 1610**.

For more information on the record header, see basic UMESS operating instructions.

## Aligning the workpiece

Align the workpiece and store the new control coordinate system (A position).

### NOTE

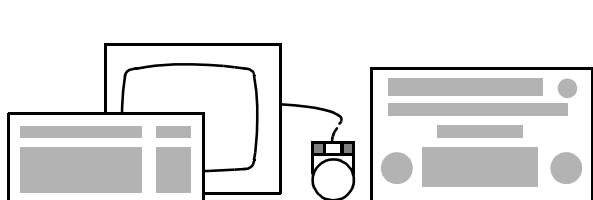
- The travel data, i.e. the position of the element, refers to the control coordinate system (A position).
- With specified nominal-actual comparison for the position, the output deviations refer to the workpiece coordinate system.
- The coordinates of the element to be measured must be entered in the control coordinate system (A position).
- If you want to specify a nominal-actual comparison for a coordinate of the element, you must make sure that the workpiece coordinate system and the control coordinate system (A position) are the same (<DI 1713>).

For more information on the mathematical alignment, see basic UMESS operating instructions.

## Selecting the PCM measurement library

The control data catalog with the PCM dialog files (**ZA Library dialog English**) must be activated.

### Function call



DI	Softkey	FFK	Menu
1079	<> <>	<>	<Elements> <Transfer macro>

## Input mask

CNC adm.: Macro selection		Cat code: Zeiss cat. measurement module library	
<input type="checkbox"/> WP code	<input type="text"/>	Workpiece name	<input type="text"/>
Comment		<input type="text"/>	
* YES	<input type="text"/>	<input type="text"/>	<input type="text"/>
* CHAN CAT		CATALOG	TERMIN
BACK	<input type="text"/>	<input type="text"/>	INFO

## Softkeys

**CHAN CAT**

The control data administration catalog is displayed, ➤ “Displaying and changing control data catalogs, <CHAN CAT> softkey” on page 2-5. You can select the desired control data catalog.

**CATALOG**

The contents of the current control data catalog is displayed, ➤ “Displaying the catalog of the dialog files, <CATALOG> softkey” on page 2-6.

## Displaying and changing control data catalogs, <CHAN CAT> softkey

### Input mask

<input type="checkbox"/> CNC data admin. catalog			
No.	Catalog description	Create	Update
	Z1 Zeiss cat. measurement module library	05.07.2000	05.07.2000
	ZA Library dialog English	05.07.2000	05.07.2000
	ZD Messbibliothek Dialog Deutsch	05.07.2000	05.07.2000
<input type="checkbox"/>			
* YES	NO	<input type="text"/>	<input type="text"/>
* SELECT L		<input type="text"/>	TERMIN
BACK	<input type="text"/>	<input type="text"/>	INFO

Select the desired control data catalog (**ZA Library dialog English**).

### Description of the control data catalogs

\_\_\_ Performance mode catalog

Basic control data catalog

**Z1 Zeiss cat. measurement module library**

This catalog only contains the measuring routines of the PCM modules. The measuring routines of the PCM modules are language neutral.

**ZA Library dialog English**

This catalog contains the English dialog files for the PCM measurement modules.

**ZD Messbibliothek Dialog Deutsch**

This catalog contains the German dialog files for the PCM measurement modules.

### Softkeys

**SELECT L**

Select the line in the catalog: to select the desired control data catalog (**ZA Library dialog English**), enter the number of the relevant line.

**TERMIN**

The selected control data catalog is active. You can display the contents of the active catalog by means of **<CATALOG>**,  
➤ *“Displaying the catalog of the dialog files, <CATALOG> softkey” on page 2-6.*

### Displaying the catalog of the dialog files, **<CATALOG>** softkey

Select, for example, the **ZA Library dialog English** control data catalog in the control data administration catalog.

With **<CATALOG>** you can display the contents of this control data catalog.

## Input mask

CNC adm.: Workpiece catalog		Cat name : Library dialog English	
<input type="checkbox"/> C	WP code <input type="text"/>	Workpiece name <input type="text"/>	Comment <input type="text"/>
Line select.		15	Search criteria <input type="text"/>
Line WP code	Workpiece name		
1	surfxy	SURFACE_XY_DIA.D	
2	surfyz	SURFACE_YZ_DIA.D	
3	surfzx	SURFACE_ZX_DIA.D	
4	sxybasze	SURFACEXY BAS.ZED	
5	sxysubze	SURFACEXY SUB.ZED	
6	syzbasze	SURFACEYZ BAS.ZED	
7	syzsubze	SURFACEYZ SUB.ZED	
8	szxbasze	SURFACEZX BAS.ZED	
9	szxsubze	SURFACEZX SUB.ZED	
10	linebasze	LINE BAS.ZED	
11	line	LINE_DIA.D	
12	linesubze	LINE SUB.ZED	
13	thrgaplug	THREAD_GAGE_PLUG_DIA.D	
14	thrpos	THREAD_POSITION_DIA.D	
15	cone	CONE_DIA.D	
16	conebasze	CONE BAS.ZED	
17	conesubze	CONE SUB.ZED	
18	circle	CIRCLE_DIA.D	
19	circlebasze	CIRCLE BAS.ZED	
20	circlesubze	CIRCLE SUB.ZED	
21	rishabasze	RING_SHAPED_AREA_BAS.ZED	
22	rishaarea	RING_SHAPED_AREA_DIA.D	
23	rishasubze	RING_SHAPED_AREA_SUB.ZED	
24	sphere	SPHERE_DIA.D	
25	shperel6pt	SPHERE_6PT_DIA.D	
26	slot	SLOT_DIA.D	
27	borepatt	BOREPATTERN_DIA.D	
28	nom	nom/act	
29	npt	N POINT TERMIN	
30	gromeas	GRO_MEA.DIA	
31	ptsubze	POINT SUB.ZED	
32	point	POINT_DIA.D	
33	spacecirc	SPACECIRCLE_DIA.D	
34	scircbasze	SPACECIRCLE BAS.ZED	
35	scircsubze	SPACECIRCLE SUB.ZED	
36	s_line	SCANNING LINE_DIA.D	
37	s_linefil	SCANNING LINE_FILE_DIA.D	
38	s_linesub	SCANNING LINE_SUB_ZE	
39	s_circle	SCANNING CIRCLE_DIA.D	
40	s_circle2	SCANNING CIRCLE2_DIA.D	
41	s_circfil	SCANNING CIRCLE_FILE_DIA.D	
42	s_circsub	SCANNING CIRCLE_SUB.ZED	
43	s_rishaarea	SCANNING RING_SHAPED_AREA_DIA.D	
44	s_rishasub	SCANN_RING_SHAPED_AREA_SUB.ZED	
45	torusbasze	TORUS BAS.ZED	
46	cyl8pt	CYLINDER_8PT_DIA.D	
47	cylbasze	CYL BAS.ZED	
48	cylinder	CYLINDER_DIA.D	
49	cylsubze	CYL SUB.ZED	
<input type="text"/>		SELECTWP	INFO WP
<input type="text"/>		* <input type="text"/>	
<input type="text"/>		TERMIN	
BACK	<input type="text"/>	MASK	INFO

Only 10 lines of the catalog can be displayed on the screen.

You can scroll the catalog upwards and downwards by means of the **<↑> + <Shift>** or **<↓> + <Shift>** cursor keys respectively. You can page forward by using the **<Next>** key.

## Explanation of the control data catalog "ZA Library dialog English"

The **ZA Library dialog English** catalog contains the English dialog files of the PCM measurement modules. All dialog files whose name ends with **\_DIA.D** contain dialogs for **individual elements**.

The **ZA Library dialog English** catalog contains dialog files for the following geometric elements: **SURFACE, LINE, CONE, CIRCLE, SHPERE, POINT, TORUS, CYLINDER**. Explanation of the PCM dialogs for the geometric elements, ➤ *"PCM dialogs for the geometric elements" on page 3-1.*

There are extra dialog files on the geometric element surface for the various measuring levels: **SURFACE\_XY\_DIA.D, SURFACE\_YZ\_DIA.D** and **SURFACE\_ZX\_DIA.D**.

The **ZA Library dialog English** catalog also contains dialog files for the following special elements: **THREAD GAUGES, THREAD POSITION, RING SHAPED AREA, SPACE CIRCLE, SLOT, BORE PATTERN, SCANNING\_CIRCLE, SCANNING\_CIRCLE\_FILE**.

Explanation of the PCM dialogs for the special elements, ➤ *"PCM dialogs for special elements" on page 4-2.*

In the PCM library **combined elements** are provided; these dialog files have the extension **.ZED**. For each combined element, two dialog files, one basic file (extension **.BAS.ZED**) and one subfile (extension **SUB.ZED**) are provided. For self-teach programming of a combined element, you first have to call the basic file and then the subfile according to the task. Explanation of the PCM dialogs for the combined elements, ➤ *"PCM dialogs for combined elements" on page 4-21.*

## Input fields and softkeys

### WP code

To select a dialog file, you can enter the relevant workpiece code (for example **flaxy**) of the desired dialog file here.

### Line select.

To position the cursor in a specific line in the catalog or to page in the catalog, you can enter the number of the desired line here.

**SELECTWP**

You can select the dialog file on which the cursor is positioned, i. e. whose line number you may have selected with **Line select.** . The selected dialog file (**WP code, Workpiece name, Comment**) is entered in the input mask.

**INFO WP**

You obtain detailed information on the current (just selected) dialog file, such as creation and modification date, details on who created the file and who has modified it, the internal file name and extent of the file, in a separate screen page.

### MASK

You can look for a desired dialog file in the catalog using text criteria. If you press **<MASK>**, the **CNC adm.: Mask definition** input mask appears. If in this input mask you enter, for example, for WP code **ci\*** and exit the input mask with **<TERMIN>**, then only those dialog files are displayed in the catalog whose workpiece code (**WP code**) starts with **ci**, i.e. all dialog files for the circle measurement.

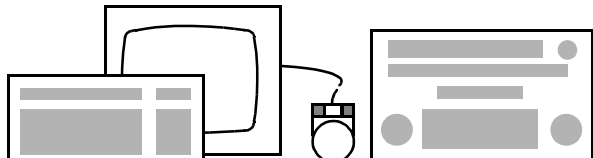
### TERMIN

You reach the **CNC adm.: Macro selection** input mask, the dialog file you have selected from the control data catalog is entered there,   
➤ *"Transferring PCM modules to the CNC program" on page 2-9.*

## Transferring PCM modules to the CNC program

During the self-teach programming (i.e. in PROG mode) you can select the dialog files for the PCM measuring modules and transfer them to the CNC program; you can do this for example by directly entering the WP code in the **CNC adm.: Macro selection** input mask or by selecting the desired dialog file in the relevant catalog (➤ *"Displaying the catalog of the dialog files, <CATALOG> softkey" on page 2-6).*

### Function call



DI	Softkey	FFK	Menu
	<>	<>	<Elements>
1079	<>		<Transfer macro>

CNC adm.: Macro selection      Cat code:    Library dialog English

☒ WP code       Workpiece name

Comment

\* YES NO        \*

BACK

### TERMIN

In the PROG mode of the CNC run the dialog file for the selected PCM macro is opened (workpiece), the following screen page is displayed:

You have to enter all the data necessary for the measurement in the dialog file. The various dialog files are described in the following chapters.

Example

Input mask of the dialog file for the PCM measurement module  
Workpiece name : CIRCLE\_DIA.D

Enter parameters for macroMODIFY

Identification	Value
RESULT NAME	BO_50
PLANE CODE NUMBER	3
PROBE NO	1
OUTER=0/INNER=1	1
NV X-COORDINATE	10
NV Y-COORDINATE	20
NV Z-COORDINATE	0
NV D DIAMETER	50
START VALUE I-POS	10
ENDVALUEI-POS	20
DIST:I-POS/PRB	5
STARTANGLE	0
END ANGLE	360
NO. OF PRB. PTS.	4
INTERSECTION HEIGHT	-10
NV SELECTION	X Y Z D
NV X-IDF	
NV Y-IDF	
NV Z-IDF	
NV D IDF	

MODIFY

\*

TERMIN

BACK

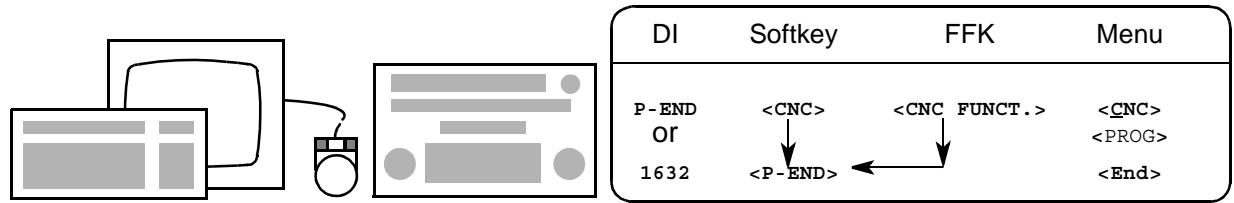
INFO

Explanation of the dialog files ➤ “PCM dialogs for the geometric elements” on page 3-1

Terminating the self-teach programming

To end your programming work, i.e. in order to be able to exit the PROG mode, you have to conclude the self-teach programming. When terminating the self-teach programming, you can save the new or modified programmed lines of the CNC program under the present workpiece name or under a new name.

Function call





For more detailed information, see basic UMESS operating instructions.

## Catalog of PCM measurement modules (calculation modules)

In the **Z1 Zeiss cat. measurement module library** catalog are the files with the calculation and measuring routines of the PCM modules. The calculation and measuring routines of the PCM modules are language neutral. The files with the calculation and measuring routines can be recognized by the identification **.CAL**.

With each CNC run, the geometry and nominal information is again transferred, calculated and executed by the calculation and measuring routines.

If you select the **Z1 Zeiss cat. measurement module library** file in the control data administration catalog, you can display the contents of this file with **<CATALOG>**.

### Input mask

CNC adm.: Workpiece catalog		Cat name : Zeiss cat. measurement module library	
<input type="checkbox"/>	WP code <input type="text" value="26"/>	Workpiece name <input type="text"/>	Comment <input type="text"/>
Line select.		Search criteria <input type="text"/>	
Line	WP code	Workpiece name	
1	bopa_1.cal	BOREPATTERN_1.CAL	
2	bopa_1.cal	BOREPATTERN_1.CAL	
3	circle.cal	CIRCLE.CAL	
4	cone1.cal	CONE_1.CAL	
5	cone2.cal	CONE_2.CAL	
6	cyl1.cal	CYLINDER_1.CAL	
7	cyl2.cal	CYLINDER_2.CAL	
8	cyl8pt.cal	CYLINDER_8PT.CAL	
9	fcf	FOCUS_CONN_ROUTE	
10	line.cal	LINE.CAL	
11	nom	NOM/ACT	
12	npt1	N-POINT_TERM1	
13	gro_c1.cal	GROOVE_CIRCLE_OUTER.CAL	
14	gro_c2.cal	GROOVE_CIRCLE_OUTER.CAL	
15	gro_rs.cal	GRO_RINGSHAPEDAR.CAL	
16	point.cal	POINT.CAL	
17	rshar.cal	RING_SHAPED_AREA.CAL	
18	s_cir2.cal	SCANNING_CIRCL2.CAL	
19	s_circ.cal	SCANNING_CIRCLE.CAL	
20	s_cirf.cal	SCANNING_CIRCLE_FILE.CAL	
21	s_line.cal	SCANNING_LINE.CAL	
22	s_linf.cal	SCANNING_LIN_FIL.CAL	
23	s_ring.cal	SCANN_RING_AREA.CAL	
24	slot	SLOT.CAL	
<input type="text"/>		<input type="text"/> SELECTWP	<input type="text"/> INFO WP * <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> TERMIN
<input type="text"/> BACK		<input type="text"/> MASK	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> INFO

## Run in the CNC program

- Activate the PCM run mode by means of **DI 1671** if this has not already been switched on.
- Start CNC run.

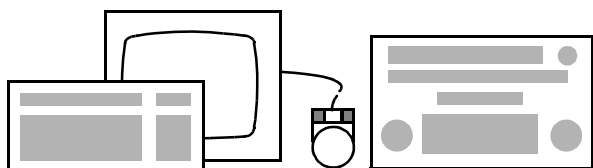
## PCM generating run (DI 1647)

With the PCM generating run, you can generate parameter-free control data in order to transfer PCM runs to program systems not capable of PCM or to coordinate measuring machines with CMS program systems. (PCM-control data cannot yet be converted to CMS; travel path plots are only possible at the moment with generated PCM runs.)

The CNC run created is parameter-free and can be converted to CMS control data.

During the PCM generating run, all parameterized control data lines are converted to parameter-free lines, for this all PCM functions, assignments, loops and branchings are executed and canceled.

### Function call



DI	Softkey	FFK	Menu
	<>	<>	<CNC>
	<>		<PCM>
1647			<PCM generating run>

## 1st input mask

Enter the parameter-free workpiece to be generated.

CNC adm.: PCM - Generating run		Cat code : Converted catalog	
Input of the (parameter-free) workpiece to be generated			
<input checked="" type="checkbox"/> J	Restart	<input type="checkbox"/>	
WP code	<input type="text"/>	Workpiece name	<input type="text"/>
		Comment	<input type="text"/>
* YES	NO	<input type="text"/>	<input type="text"/>
		*	<input type="text"/>
		CATALOG	TERMIN
BACK	<input type="text"/>	<input type="text"/>	<input type="text"/>
			INFO

**TERMIN**

A second input mask follows

## 2nd input mask

Enter the parameterized workpiece to be converted.

CNC adm.: PCM - Generating run		Cat code : Converted catalog	
Input of the (parameterized) workpiece to be converted			
<input checked="" type="checkbox"/> C	WPCode	<input type="text"/>	
		Workpiece name	<input type="text"/>
		Comment	<input type="text"/>
A pos.	<input type="text"/>		
Convert parameter lines		<input type="checkbox"/>	
(NO: only execute EXCALL)			
Execute CNC and calculate results		<input type="checkbox"/>	
Convert masked lines		<input type="checkbox"/>	
* YES	<input type="text"/>	<input type="text"/>	<input type="text"/>
		*	<input type="text"/>
		CATALOG	TERMIN
BACK	<input type="text"/>	<input type="text"/>	<input type="text"/>
			INFO

## Input fields

### Convert parameter lines

– <YES>

Parameterized control data lines are converted to parameter-free control data lines

– <NO>

No conversion of parameterized control data lines, only inclusion of EXCALL calls into the main program.

### Execute CNC and calculate results

– <YES>

Run in CNC mode (CMM travels, output of results in the record).

**Convert masked lines**

- **<NO>**  
CMM does not travel, no result output, however loops, branchings, EXCALL jumps, parameter assignments and PCM functions are executed.
- **<YES>**  
Parameterized lines which are masked are converted to parameter-free lines.
- **<NO>**  
Parameterized lines which are masked are not converted.



# Chapter 3

## PCM dialogs for the geometric elements

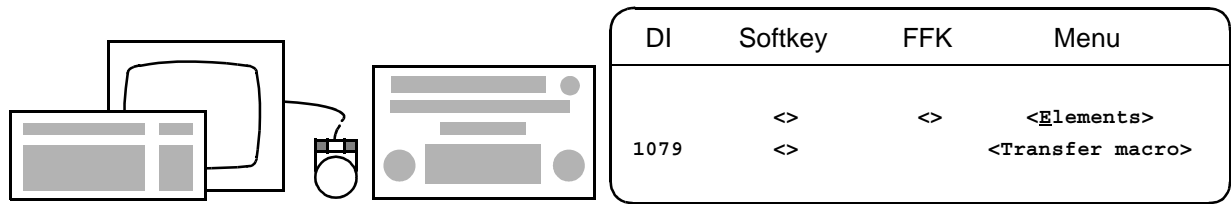
---

### **This chapter contains:**

General . . . . .	3-2
Dialogs which occur frequently . . . . .	3-4
Dialog for the PCM measurement modules surface XY, surface YZ, surface ZX . . . . .	3-9
Dialog for the line PCM measurement module . . . . .	3-12
Dialog for the scanning line PCM measurement module . . . . .	3-15
Dialog for the cone PCM measurement module . . . . .	3-17
Dialog for the circle PCM measurement module . . . . .	3-22
Dialog for the scanning circle and scanning circle file PCM measurement module. . . . .	3-26
Dialog for the sphere or Sphere_6_Point PCM measurement modules 3-29	
Dialog for the point PCM measurement module . . . . .	3-33
Dialog for the cylinder and Cylinder_8_Point PCM measurement modules. . . . .	3-35

# General

## Function call



## Input mask

CNC adm.: Macro selection

Cat code: Library Dialog English

c

WP code

Workpiece name   
Comment

\* YES

NO

BACK

\* 

CHAN CAT

CATALOG

TERMIN

INFO



If you want to call the PCM dialog for another element, you have to click the text in the **WP code** field (here in the example: **cone**) and then by pressing the **<CATALOG>** softkey, the catalog for the dialog files is displayed. In the catalog of the dialog files you can then select the other desired element.

## Softkey



In the PROG mode of the CNC run, the PCM dialog file is opened on the selected PCM macro (workpiece).

The various dialog files are described in the following chapters.



## Example

Input mask of the PCM dialog file for the circle PCM measurement module

Workpiece name : CIRCLE\_DIA.D

Enter parameters for macro		MODIFY	
Identification		Value	
-----		-----	
RESULT NAME		BO_50	
PLANE CODE NUMBER		3	
PROBE NO.		1	
OUTER=0/INNER=1		1	
NV X-COORDINATE		10	
NV Y-COORDINATE		20	
NV Z-COORDINATE		0	
NV D DIAMETER		50	
START VALUE I-POS		10	
END VALUE I-POS		20	
DIST : I-POS/PRB		5	
<div>MODIFY</div>		<div>TERMIN</div>	
<div>BACK</div>		<div>INFO</div>	

16 lines of the dialog file are displayed on the screen.

You can scroll the dialog file up and down by using the **<↑> + <Shift>** or **<↓> + <Shift>** cursor keys.

## Softkeys

### MODIFY

You can change the numerical values and the name. An input field is activated where the cursor is positioned (see input mask). With **<RETURN>** the input field jumps to the next line. When the input field is activated, you can scroll up and down by using the **<↑> + <Shift>** or **<↓> + <Shift>** cursor keys.

### TERMIN

The **CNC run** input mask is displayed again, if you do not stop or cancel the CNC run, the dialog file is integrated in the CNC program as subprogram; the coordinate measuring machine measures the selected element.

### BACK

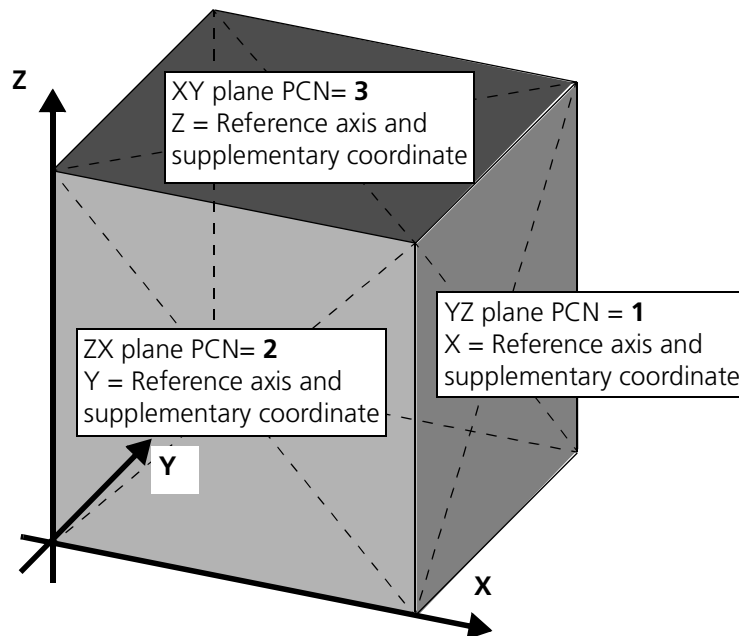
Exit of the dialog file without execution.

## Dialogs which occur frequently

### RESULT NAME

You can give the programmed element a name, maximum 10 characters are possible. The result name appears in the control data list. The result name is also listed in the measurement record. The name allocation must be activated by means of **<DI 1663>**, see basic UMESS operating instructions.

### PLANE CODE NUMBER



### PROBE NO.

Before you call the element to be measured, you have to call the required probe combination and probe configuration, insert or change it. Enter the number of the probe you want to probe with in the dialog page. The probe numbers 1 to 5 are possible.



Changing the probe number manually on the control panel is not taken into consideration, the probing is always carried out with the probe which is entered in the dialog page.

### OUTER=0/INNER=1

With rotationally-symmetrically elements (circle, cylinder, cone) you have to specify whether a shaft (outside probings) or a borehole (inside probings) is concerned. The program automatically defines the probing directions and the travel paths corresponding to the input.

### NM X- Y- Z- COORDINATE A1 A2 PROJ. ANGLE

With the nominal values, you inform the program of the location, size and position of the element to be measured. You can take and enter the X, Y, Z coordinate values and where necessary the diameter D and projected angles A1 and A2 from the design drawing.

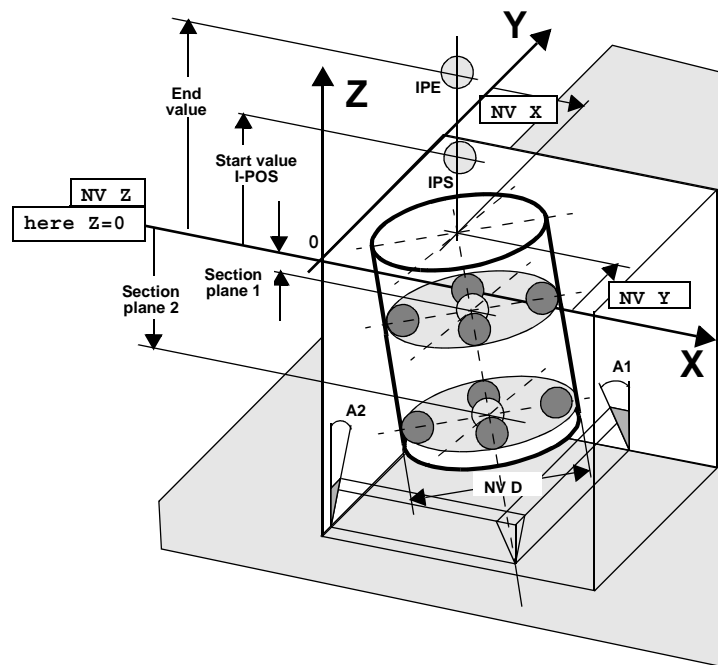
## Reference of the nominal values to the A position or a reference point

### Standard case

All dimensions refer to the A position system:

A nominal coordinate is equal to zero (here in the example  $Z=0$ ).

If the axis of the geometric element only has a slight tilt with reference to the coordinate axes, the start and end value of the intermediate position and the intersection planes refer to the A position.

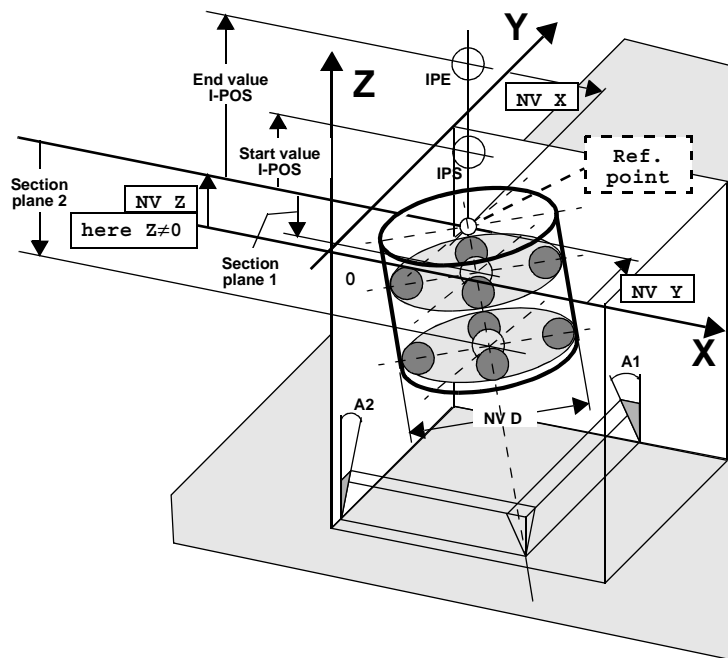


### Pronounced tilt of the geometric element

All nominal coordinates are not equal to zero.

All dimensions refer to a reference point.

As soon as all three nominal coordinates are not equal to zero, you have defined a reference point which lies on the axis of the geometric element (for example on the cylinder axis). All subsequent inputs (start and end value of the intermediate position and the intersection planes) now refer to this reference point and no longer to the A position system.



Make sure you do not enter a displacement twice – once for the nominal and again as intersection plane.

**START VALUE I-POS**  
**END VALUE I-POS**

Enter the intermediate position which is to be travelled to before the probe travels to the intersection plane or after all probings have been carried out.

## NOTE

Reference is the nominal value of the supplementary coordinate, see plane code number.

The other two coordinate values of the start intermediate position result from the nominal values and where necessary the plane code number.

For more information, ➤ "NM X- Y- Z-COORDINATE A1 A2 PROJ. ANGLE" on page 3-4.

**NV SELECTION ...**  
**(X Y Z D A1 A2)**

You can select the nominal values for which a nominal-actual comparison is to be carried out; note: ➤ "Aligning the workpiece" on page 2-4.

**NV X-IDF, NV Y-IDF, NV Z-IDF, NV D IDF, NV A1 IDF, NV A2 IDF**

You can give identifications to the nominal values specified for the nominal-actual comparison with **NV SELECT** (e.g. for a borehole: **B50\_D**);

10 characters are possible, the identifications are also listed in the measurement record.

**UT ... / LT ...**

You must enter an upper (**UT**) and a lower (**LT**) tolerance value for the nominal values which you have specified for **NV SELECT** for the nominal-actual comparison.

**COMBINED ELEM. OUT = 0 / COMBINED ELEM. ON = 1**

– **OUT = 0**

Display that you are programming a single geometric element.

– **ON = 1**

Display that you are programming a combined geometric element.



[This display may not be changed.](#)

**NV A1 PROJ. ANGLE / NV A2 PROJ. ANGLE**

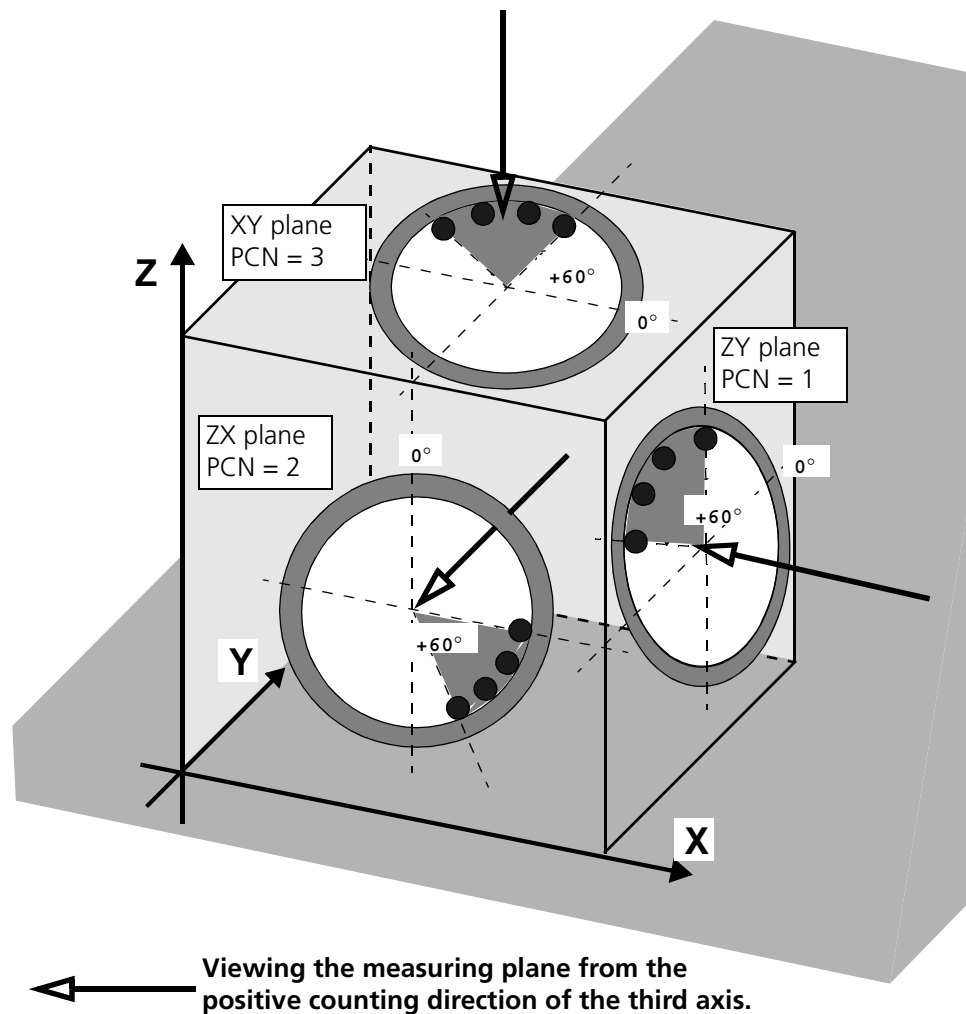
The direction of an axis in the 3D coordinate system is defined by two projected angles (**A1** and **A2**). A projected angle is the angle which results in a workpiece plane when viewing from the third axis. The reference axis is the coordinate axis which is common to both projection planes.

For more detailed information, see basic UMESS operating instructions.

## START ANGLE and END ANGLE

Here as example:

Start angle = 90°, End angle = 150°, NO. OF PRB. PTS. = 4



With **START ANGLE** and **END ANGLE**, you specify the angle range in which a circle, cylinder or cone section is to be measured. You can determine the orientation of the probings with the sign of the angle specification.

## NO. OF PRB. PTS.

Enter the number of probings which are to be carried out in the angle range specified by the **START ANGLE** and **END ANGLE**.

## Dialog for the PCM measurement modules surface XY, surface YZ, surface ZX

**Workpiece name:** SURFACE\_XY\_DIA.D, SURFACE\_YZ\_DIA.D, SURFACE\_ZX\_DIA.D

There is a separate PCM module for the surface measurement for each plane.

### Input mask

as example **SURFACE\_XY\_DIA.D**

Dialog

CNC ADM : Workpiece catalog      Cat name : Measuring library dialog, German

WP code **flaxy**      Workpiece name **Surface\_XY\_DIA.D**  
 Comment **Input surface XY-Ebene**

**I** Line select. **5**      Search criteria

Line	WP code	Workpiece name
1	flaxy	SURFACE_XY_DIA.D
2	flayz	SURFACE_YZ_DIA.D
3	flazx	SURFACE_ZX_DIA.D
4	fxybasze	SURFACEXY BAS.ZED
5	fxybasze	SURFACEXY SUB.ZED
6	fxybasze	SURFACEYZ BAS.ZED
7	fxybasze	SURFACEYZ SUB.ZED
8	fxybasze	SURFACEZX BAS.ZED

SELECTWP   WPINFO   \*   TERMIN  
 BACK   MASK   INFO

**PRB VAR (1=V,0=M)**

With the probing variable you can define whether the surface is to be probed vertically (**1 = V**) i.e. in the normal direction or in the direction of the machine axis (**0 = M**).

### **NV Z NOMINAL**

Position of the surface in space, here in the example: Z axis = space axis.

### **PX PY PZ (REF. POINT ON THE SURFACE)**

Start and end point of the measurement are defined referring to this point, with **START POINT X** and **Y** or **END POINT X** and **Y**.

It is useful if the reference point on the surface is the same as the zero point of the workpiece coordinate system (WCS). You do not necessarily have to be able to probe the reference point, i.e. it may lie outside the material.

### **START POINT X / Y END POINT X / Y**

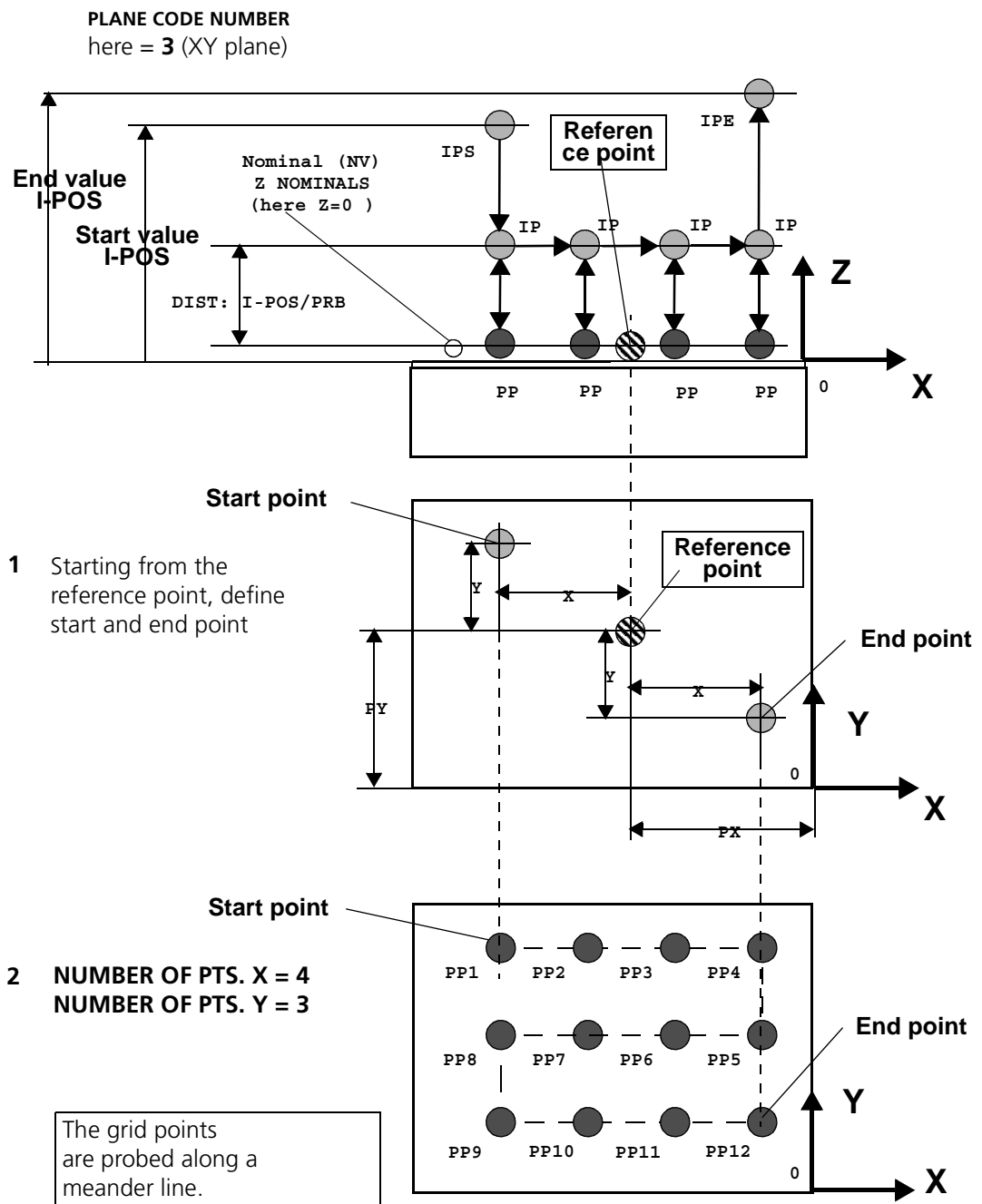
Boundary points of the rectangular surface to be measured (e.g.: left upper corner and right lower corner), at the same time the first or last probing point.

### **NUMBER OF PTS. X / NUMBER OF PTS. Y**

A symmetrical grid is calculated between the start and end point from these two pieces of data. The grid points can be probed along a meander line.



Probing strategy and inputs for the measurement of a surface with 4 x 3 probing points



## Dialog for the line PCM measurement module

**Workpiece name: LINE\_DIA.D**

This PCM module allows you to measure lines which are located anywhere in space.

### Input mask

☐
Enter parameters for macro

Identification	Value
RESULT NAME	
L.DIR. (X=1,Y=2,Z=3)	3
PROBE NO.	1
PRBDIR. (X=1,Y=2,Z=3)	1
PROBING VAR. (1=V,0=M)	1
PX (POINT	0
PY ON	0
PZ LINE	0
PX (POINT	10
PY NOT ON	10
PZ LINE)	10
FIRST HEIGHT	0
LAST HEIGHT	10
NUMBER OF PTS.	3
START VALUE I-POS	20
END VALUE I-POS	20
DIST:I-POS/PRB	5
NV A1	0
NV A2	0
NV SELECTION	X Y Z \$4 \$5
NV X-IDF	
NV Y-IDF	
NV Z-IDF	
NV A1 IDF	
NV A2 IDF	
UT X	.1
LT X	-.1
UT X	.1
LT X	-.1
UT X	.1
LT X	-.1
UT A1	.1
LT A1	-.1
UT A2	.1
LT A2	-.1
COMBINED ELEM. OUT	0

MODIFY

\*

TERMIN

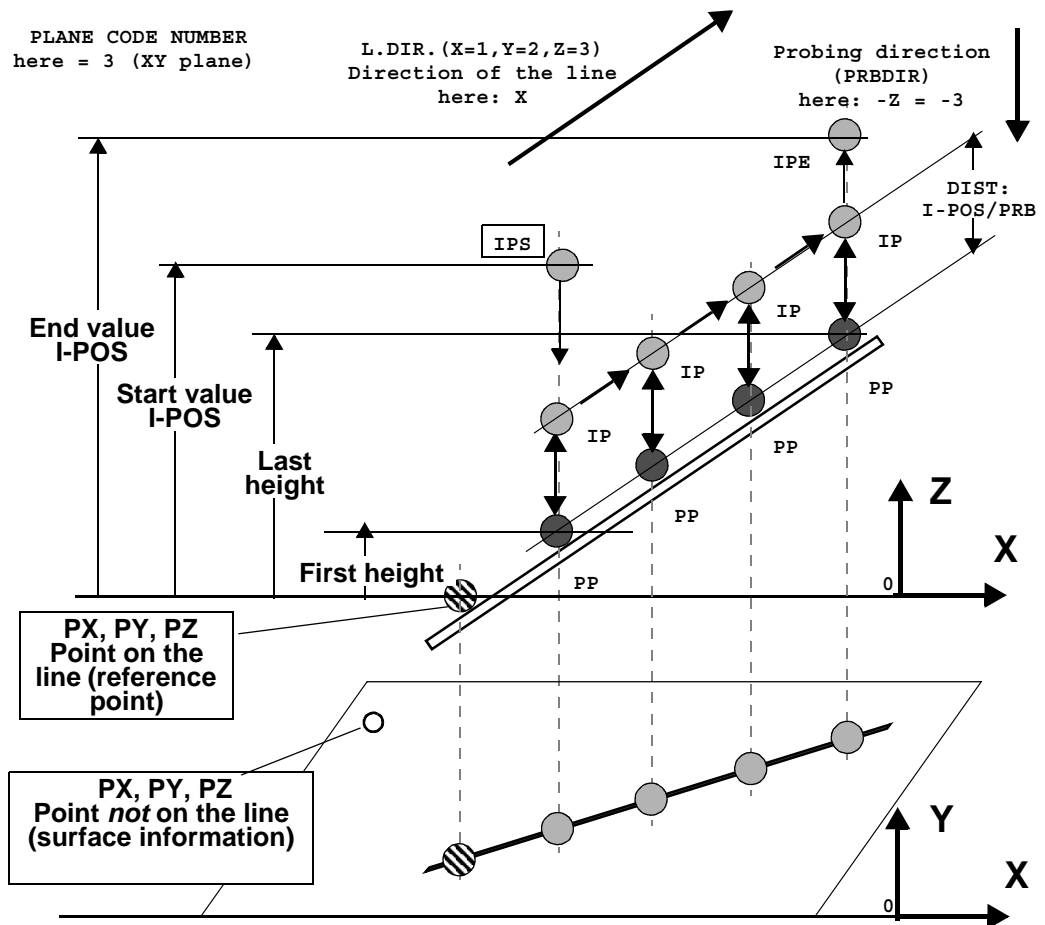
BACK

INFO

Explanation of **RESULT NAME, PROBE NO., START VALUE** and **END VALUE I-POS, DIST: I-POS/PRB, NV A1** and **A2, NV SELECTION, NV ...-IDF, UT** and **LT** ➤ *“Dialogs which occur frequently” on page 3-4*

<b>L.DIR.(X=1,Y=2,Z=3)</b>	Specify the axis direction in which the line is mainly oriented.
<b>PRBDIR.(X=1,Y=2,Z=3)</b>	Direction in which the line is to be probed. The program determines the intermediate positions from this data.
<b>PX PY PZ (POINT ON LINE)</b>	Any point on the line whose coordinates can be taken from the design drawing; reference point for the <b>FIRST HEIGHT</b> and <b>LAST HEIGHT</b> . To simplify matters you can also select the penetration point of the line through the plane. You do not necessarily have to be able to probe the point.
<b>PROBING VAR. (1=V,0=M)</b>	With the probing variable you can define whether the surface is to be probed vertically ( <b>1 = V</b> ), i. e. in the normal direction or in the direction of the machine axis ( <b>0 = M</b> ).
<b>PX PY PZ (POINT NOT ON LINE)</b>	Specify a point which lies on the same surface as the line to be measured, but not on the line. A surface can then be determined from the line plus the one point. The direction of the probe radius correction is derived from the surface information (3D position of the line).
<b>FIRST HEIGHT / LAST HEIGHT</b>	First and last probing point on the line, position data refers to the point <b>PX PY PZ (POINT ON LINE)</b> .
<b>NUMBER OF PTS.</b>	The probing points are automatically distributed evenly on the line between the two probing points <b>FIRST HEIGHT</b> and <b>LAST HEIGHT</b> . The two probing points <b>FIRST HEIGHT</b> and <b>LAST HEIGHT</b> are included in the number of probing points.

## Probing strategy and inputs for the measurement of a line



## Dialog for the scanning line PCM measurement module

Workpiece name: **SCANNING LINE\_DIA.D** or **SCANNING\_LINE\_FILE.DIA**

Lines which are anywhere in space can be measured with scanning using the **SCANNING LINE\_DIA.D** or **SCANNING\_LINE\_FILE.DIA** dialogs.

### Input mask

☐ Enter parameters for macro

Identification	Value
-----	
RESULT NAME	
FILENAME	
L.DIR. (X=1,Y=2,Z=3)	3
PROBE NO.	1
PRBDIR. (X=1,Y=2,Z=3)	1
PX (POINT	0
PY ON	0
PZ LINE	0
PX (POINT	10
PY NOT ON	10
PZ LINE)	10
FIRST HEIGHT	0
LAST HEIGHT	10
START VALUE I-POS	20
END VALUE I-POS	20
SPEED	20
FILTER WAVE LENGTH	0
0.08/0.25/0.8/ ../25/80	
0=FILTER OFF	
STEP SIZE	1
NV A1	0
NV A2	0
NV SELECTION	X Y Z \$4 \$5
NV X-IDF	
NV Y-IDF	
NV Z-IDF	
NV A1 IDF	
NV A2 IDF	
UT X	.1
LT X	-.1
UT X	.1
LT Y	-.1
UT X	.1
LT Z	-.1
UT A1	.1
LT A1	-.1
UT A2	.1
LT A2	-.1
COMBINED ELEM. OUT	0

This line is **only** available in the dialog for PCM measurement module **SCANNING\_LINE\_FILE.DIA**

This line is **not** available in the dialog for PCM measurement module **SCANNING\_LINE\_FILE.DIA**

MODIFY

\*

TERMIN

BACK

INFO

Explanation of **RESULT NAME**, **PROBE NO.**, **START VALUE** and **END VALUE I-POS**, **NV A1** and **A2**, **NV SELECTION**, **NV ...-IDF**, **UT** and **LT** ► *“Dialogs which occur frequently” on page 3-4*

Explanation of **L.DIR.(X=1,Y=2,Z=3)**, and **PRBDIR.(X=1,Y=2,Z=3)**, and **PX PY PZ (POINT ON LINE)**, and **PX PY PZ (POINT NOT ON LINE)** and **FIRST HEIGHT/LAST HEIGHT** ► *“Dialog for the line PCM measurement module” on page 3-12*

### FILENAME

Only for **SCANNING\_LINE\_FILE.DIA**: Specify the name of the file in which the measured points are to be stored.

### SPEED

Enter the scanning speed in mm/s (minimum 0.01 mm/s).

### FILTER WAVE LENGTH 0.08/0.25/0.8/ ..../25/80 0=FILTER OFF

Using a filter you can separate the waviness profile from influences of the surface roughness.

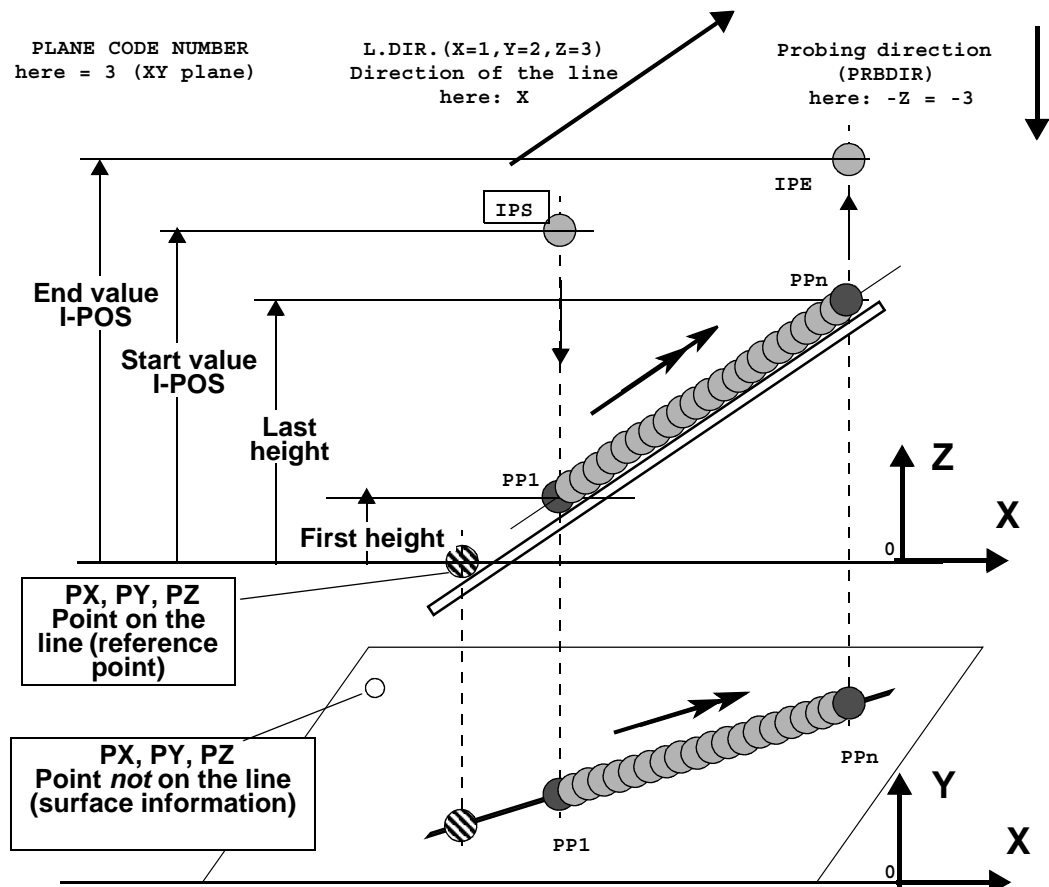
For the filter wave length, you can select between the values **0.8** or **2.5** and their power of ten. You have to select the smallest filter wave length so that 3 points can be recorded, the largest wave length corresponding to the half of the path scanned; for more information, see basic UMESS operating instructions.

A comparison of the measurement results assumes that the same filter wave length has been used for the evaluation.

### STEP SIZE

Enter the distance between two points each of which is to be transferred as measured values. If you enter zero, the smallest step size possible is taken.

Probing strategy and inputs for scanning a line



## Dialog for the cone PCM measurement module

Workpiece name: CONE\_DIA.D

This PCM module allows you to measure cones which are located anywhere in space.

## Input maskN



Enter parameters for macro

Identification	Value
-----	
RESULT NAME	
PLANE CODE NUMBER	3
PROBE NO.	1
OUTER=0/INNER=1	1
NV X-COORDINATE	0
NV Y-COORDINATE	0
NV Z-COORDINATE	0
NV D DIAMETER	200
NV A1 PROJ. ANGL.	0
NV A2 PROJ. ANGL.	0
START VALUE I-POS	25
END VALUE I-POS	30
DIST : I-POS/PRB	10
CONE ANGLE	60
START ANGLE	0
END ANGLE	360
NO. OF PRB. PTS.	4
NO. OF INTERSECT.	3
INTERS. (0=REG/1=IRR)	1
1. INTERSECTION	-11
2. INTERSECTION	-22
3. INTERSECTION	-31
4. INTERSECTION	0
5. INTERSECTION	0
6. INTERSECTION	0
7. INTERSECTION	0
8. INTERSECTION	0
9. INTERSECTION	0
10. INTERSECTION	0
NV SELECTION	XYZD \$4\$5\$6
NV X-IDF	
NV Y-IDF	
NV Z-IDF	
NV D IDF	
NV A1 IDF	
NV A2 IDF	
NV AC IDF	
UT X	.1
LT X	-.1
UT Y	.1
LT Y	-.1
UT Z	.1
LT Z	-.1
UT D	.05
LT D	-.05
UT A1	.02
LT A1	-.02
UT A2	.02»
LT A2	-.02
UT AC	.02
LT AC	-.02
COMBINED ELEM. OUT	0

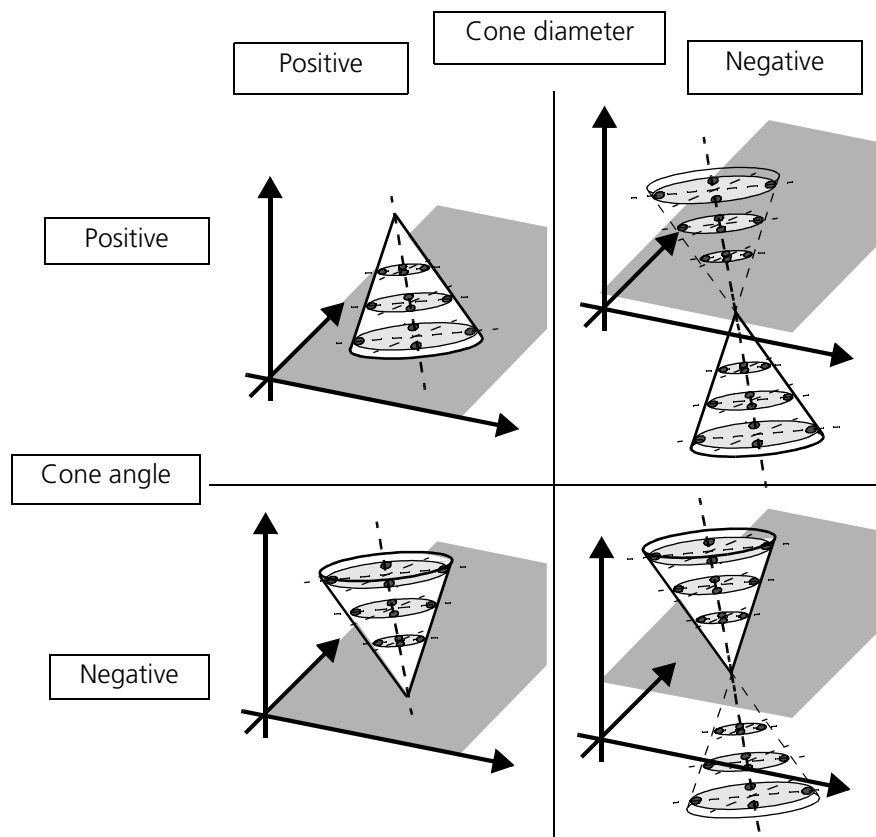
MODIFY				*				TERMIN
BACK								INFO



Explanation of **RESULT NAME**, **PLANE CODE NUMBER**, **PROBE NO.**, **NV X- Y- Z- COORDINATE**, **NV A1** and **A2 PROJ. ANGL.**, **START VALUE** and **END VALUE I-POS**, **DIST: I-POS/PRB**, **START** and **END ANGLE**, **NO. OF PRB. PTS.**, **NV SELECTION**, **NV...-IDF**, **UT** and **LT** ► "Dialogs which occur frequently" on page 3-4

## NV D DIAMETER and CONE ANGLE

Sign rule for cone diameter and angle:



## START ANGLE END ANGLE NO. OF PRB. PTS. NO. OF INTERSECT.

With **START ANGLE** and **END ANGLE**, you define the angle range in which all intersection planes are to be probed with the specified number of probing points.

Specify the number of intersection planes in which you want to probe the cone. A maximum of 10 irregularly distributed sections are possible.

**INTERS. (0=REG/1=IRR)**

Specify whether the sections are to be distributed regularly or irregularly on the cone.

– **0 = REG**

If the sections are to be distributed regularly, you have to enter the value for the first intersection plane for **1. INTERSECTION** and the regular distance between the subsequent intersection planes for **2. INTERSECTION**.

– **1 = IRR**

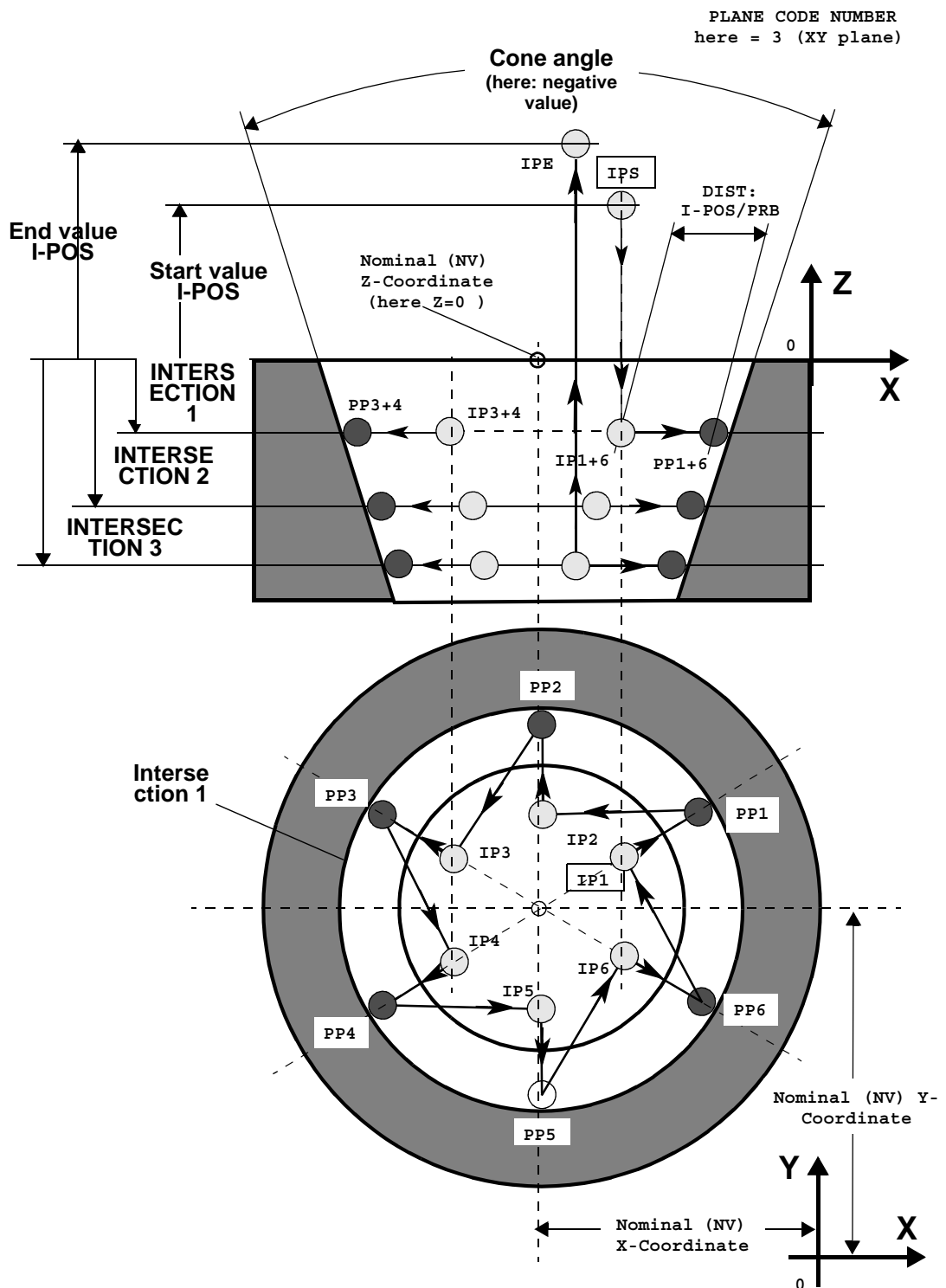
If the sections are to be distributed irregularly, you have to enter each intersection plane (**1. INTERSECTION 2. INTERSECTION ...** etc. up to max. **10. INTERSECTION**) individually. A maximum of 10 irregular intersection planes is possible.

**INTERSECTION**

Does the intersection plane refer to the A position or a reference point?

Explanation ► “NM X- Y- Z-COORDINATE A1 A2 PROJ. ANGLE” on page 3-4

Probing strategy for the measurement of an inner cone with 3, 5 or more probing points per intersection plane



## Dialog for the circle PCM measurement module

**Workpiece name:** CIRCLE\_DIA.D

The PCM measurement modules **CIRCLE\_...** allow you to measure the inner and outer circles which are located in a plane of the coordinate system.

You can measure the circles in any angle range with any number of probings (min. 3).

### Input mask

Enter parameters for macro		MODIFY	
Identification	Value		
RESULT NAME	BO_50		
PLANE CODE NUMBER	3		
PROBE NO.	1		
OUTER=0/INNER=1	1		
NV X-COORDINATE	10		
NV Y-COORDINATE	20		
NV Z-COORDINATE	0		
NV D DIAMETER	50		
START VALUE I-POS	10		
END VALUE I-POS	20		
DIST : I-POS/PRB	5		
START ANGLE	0		
END ANGLE	360		
NO. OF PRB. PTS.	4		
INTERSECTION HEIGHT	20		
NV SELECTION	X Y Z D		
NV X-IDF			
NV Y-IDF			
NV Z-IDF			
NV D IDF			
UT X	.1		
LT X	-.1		
UT Y	.1		
LT Y	-.1		
UT Z	.1		
LT Z	-.1		
UT D	.05		
LT D	-.05		
COMBINED ELEM. OUT	0		

MODIFY

BACK

\*

TERMIN

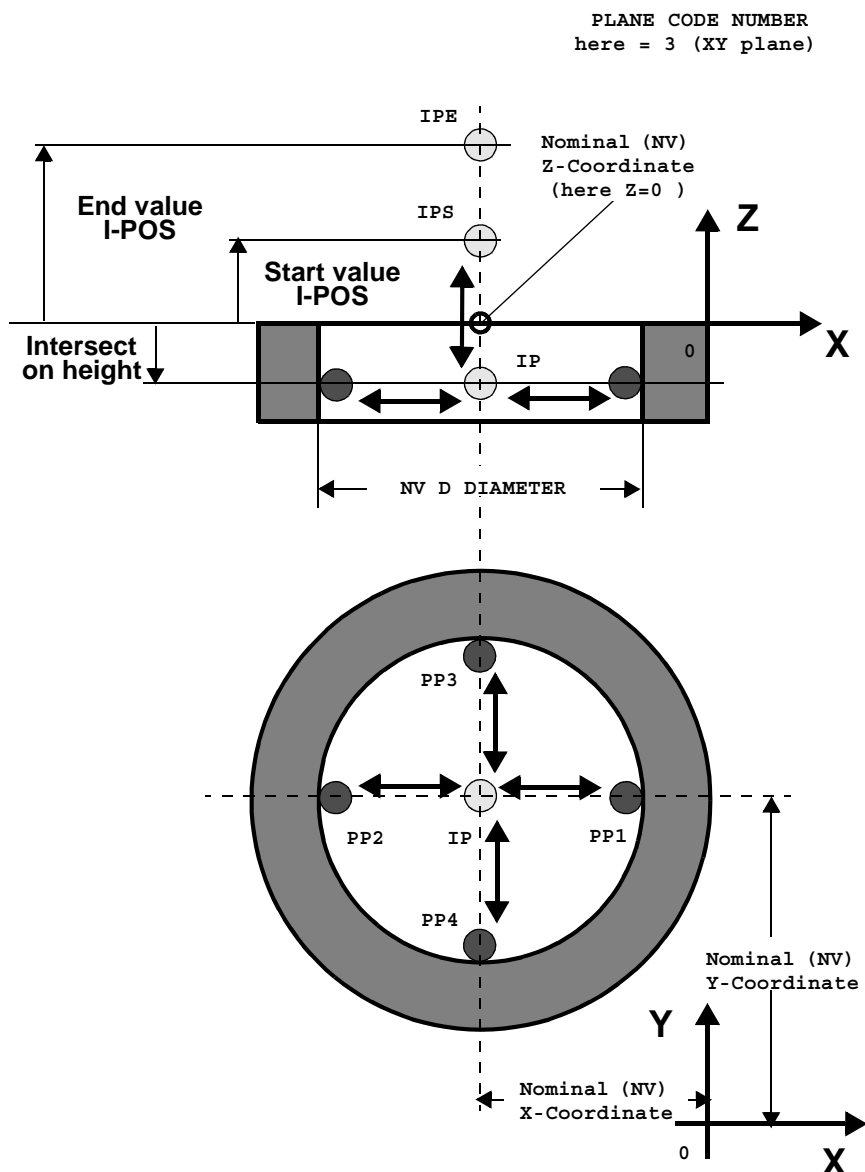
INFO

Explanation of **RESULT NAME**, **PLANE CODE NUMBER**, **PROBE NO.**, **NV X- Y- Z- COORDINATE**, **START VALUE** and **END VALUE I-POS**, **DIST: I-POS/PRB**, **START** and **END ANGLE**; **NO. OF PRB. PTS.**, **NV SELECTION**, **NV ...-IDF**, **UT** and **LT** ➤ "Dialogs which occur frequently" on page 3-4

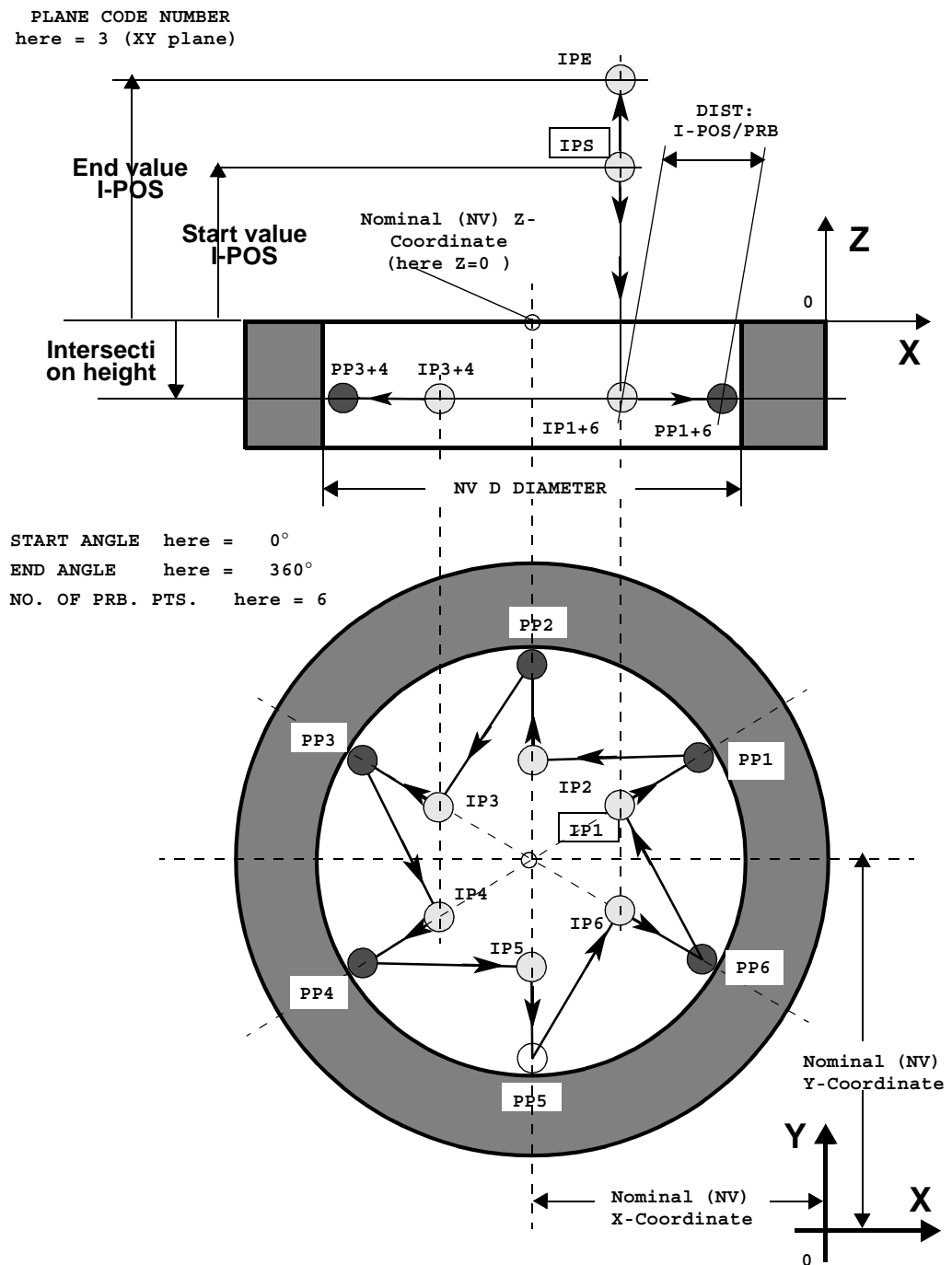
## INTERSECTION HEIGHT

Does the intersection height refer to the A position or a reference point? Explanation ► "NM X- Y- Z-COORDINATE A1 A2 PROJ. ANGLE" on page 3-4

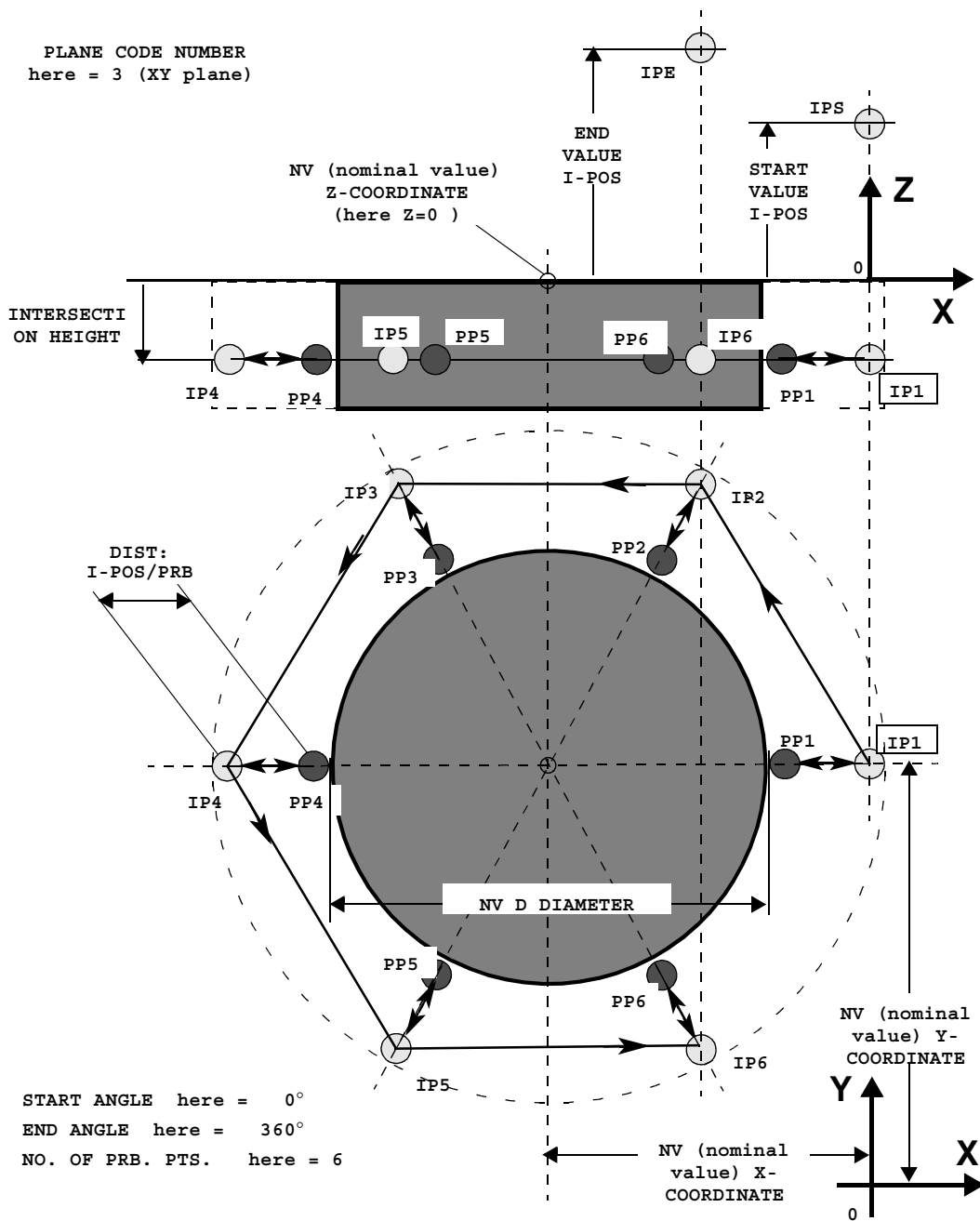
Probing strategy for the measurement of an inner circle with 4 probing points (standard circle)



Probing strategy for the measurement of an inner circle with 3, 5 or more probing points



Probing strategy for the measurement of an outer circle



## Dialog for the scanning circle and scanning circle file PCM measurement module

Workpiece name: **SCANNING\_CIRCLE\_DIA.D** or **SCANNING\_CIRCLE\_FILE\_DIA.D**

Using the **SCANNING\_CIRCLE\_FILE\_DIA.D** dialog you can store the measured points in a named file and evaluate them (e. g. **FILTER**) or to evaluate several circles together.

### Input mask

☐ Enter parameters for macro
 MODIFY

Identification	Value
<b>RESULT NAME</b>	
<b>FILENAME</b>	
PLANE CODE NUMBER	3
PROBE NO.	1
OUTER=0/INNER=1	1
CENTER POINT X	0
CENTER POINT Y	0
CENTER POINT Z	0
DIAMETER	10
START VALUE I-POS	0
END VALUE I-POS	0
START ANGLE(+/-)	0
START ANGLE(+/-)	360
SPEED	8
STEP SIZE	1
<b>NV SELECTION</b>	<b>X Y Z D</b>
NV X-IDF	
NV Y-IDF	
NV Z-IDF	
NV D IDF	
UT X	.1
LT X	-.1
UT Y	.1
LT Y	-.1
UT Z	.1
LT Z	-.1
UT D	.05
LT D	-.05
COMBINED ELEM. OUT	0

MODIFY    \*     TERMIN

BACK        INFO

This line is **only** available in the dialog for PCM measurement module **SCANNING\_CIRCLE\_FILE.DIA**

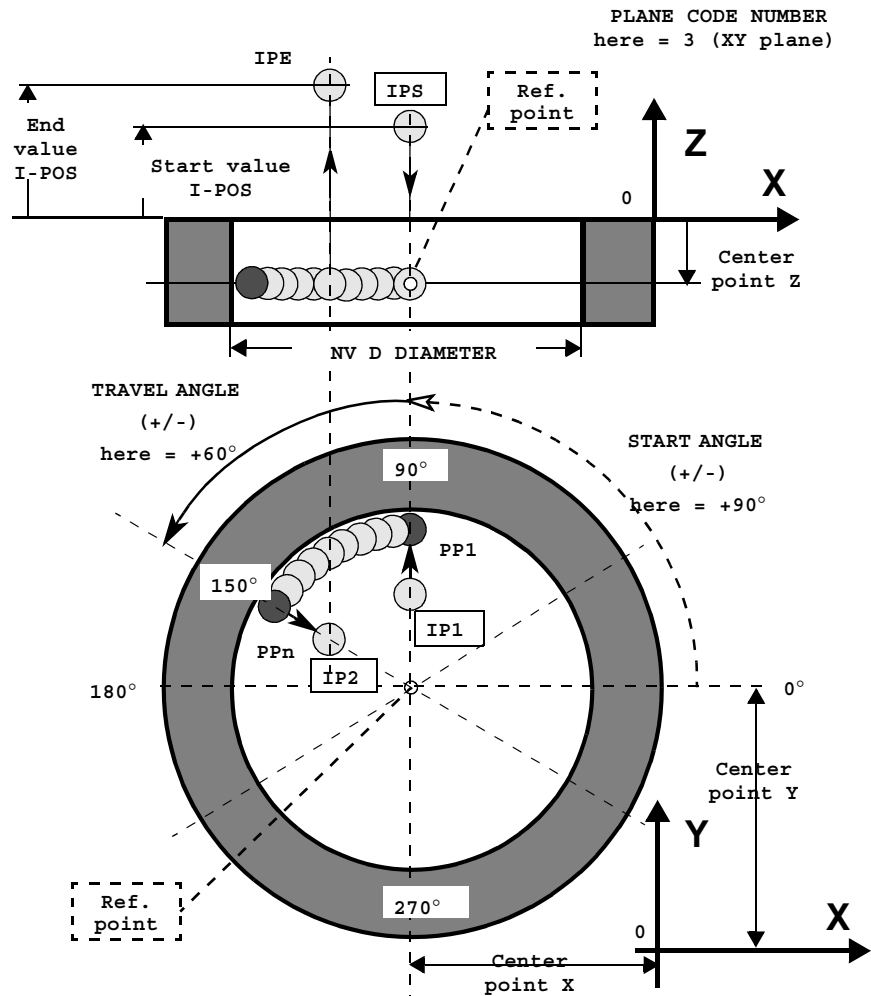
This line is **not** available in the dialog for PCM measurement module **SCANNING\_CIRCLE\_FILE.DIA.D**

Explanation of **RESULT NAME**, **PLANE CODE NUMBER**, **PROBE NO.**, **OUTER=0/INNER=1**, **NV X- Y- Z- COORDINATE**, **NV A1** and **A2 PROJ. ANGL.**, **START VALUE** and **END VALUE I-POS**, **DIST: I-POS/PRB**, **START** and **END ANGLE**, **NO. OF PRB. PTS.**, **NV SELECTION**, **NV...-IDF**, **UT** and **LT** ➤ "Dialogs which occur frequently" on page 3-4



<b>CENTER POINT X / Y / Z</b>	Corresponds to <b>NV X- Y- Z-COORDINATE</b> , ► <i>“Dialogs which occur frequently” on page 3-4, figure Reference of the nominal values to the A position or to a reference point.</i>
<b>FILENAME</b>	Only for <b>SCANNING_CIRCLE_FILE.DIA.D</b> : Specify the name of the file in which the measured points are to be stored.
<b>START ANGLE(+/-) and TRAVEL ANGLE(+/-)</b>	<p>As <b>START ANGLE</b> specify the position where the scanning is to start, starting from the 0° mark (► <i>“Dialogs which occur frequently” on page 3-4, figure: START and END ANGLE</i>).</p> <p>As <b>TRAVEL ANGLE</b> specify the distance (angle range) which is to be scanned starting from the position defined by the start angle. You can enter positive or negative angle values.</p>
<b>NOTE</b>	If the geometric conditions allow, it is advisable to scan a somewhat larger area than is actually necessary. If, for example, you are scanning a full circle with a travel angle of 370°, you travel past the start position at a constant scanning speed. With the subsequent circle evaluation, you can then delete the measured points from the first 5° and the last 5° of the scanned travel angle.
<b>SPEED</b>	Enter the scanning speed in mm/s (minimum 0.01 mm/s).
<b>STEP SIZE</b>	Enter the distance between two points each of which is to be transferred as measured values. If you enter zero, the smallest step size possible is taken.

### Scanning a circle



## Dialog for the sphere or Sphere\_6\_Point PCM measurement modules

**Workpiece name: SPHERE\_6PT\_DIA.D or SPHERE\_DIA.D**

The PCM measurement modules **SPHERE\_...** allow you to measure outer spheres which are located anywhere in space.

– **SPHERE\_6PT\_DIA.D**

is the dialog for standard sphere measurement with 6 probings.

– **SPHERE\_DIA.D**

is the dialog for any sphere measurement with at least 4 probings. With this dialog you can also measure spherical calottes and spherical segments.

### Input mask

☐ Enter parameters for macro
 MODIFY

Identification	Value	
-----		
RESULT NAME		
DIR. OF SHAFT	3	
PROBE NO.	1	
NV X-COORDINATE	0	
NV Y-COORDINATE	0	
NV Z-COORDINATE	0	
NV D DIAMETER	30	
NV A1 PROJ. ANGL.	0	
NV A2 PROJ. ANGL.	0	
NV SELECTION	X Y Z D	
NV X-IDF		
NV Y-IDF		
NV Z-IDF		
NV D IDF		
START VALUE I-POS	10	
END VALUE I-POS	10	
DIST : I-POS/PRB	5	
ANGLE FOR INTERS. 1	90	<div> <div></div> <div></div> </div>
START ANGLE	0	
END ANGLE	360	
NO. OF PRB. PTS.	2	
ANGLE FOR INTERS. 2	0	
START ANGLE	0	
END ANGLE	360	
NO. OF PRB. PTS.	4	
UT X	.1	
LT X	-.1	
UT Y	.1	
LT Y	-.1	
UT Z	.1	
LT Z	-.1	
UT D	.05	
LT D	-.05	

MODIFY

\*

TERMIN

BACK

INFO

This line is **not** available in the dialog for PCM measurement module **Sphere\_6\_Point**

Explanation of **RESULT NAME**, **PROBE NO.**, **NV X- Y- Z- COORDINATE** , **NV A1** and **A2 PROJ. ANGL.**, **START VALUE** and **END VALUE I-POS**, **DIST: I-POS/PRB**, **START** and **END ANGLE**; **NO. OF PRB. PTS.**, **NV SELECTION**, **NV ...-IDF**, **UT** and **LT** ➤ *“Dialogs which occur frequently” on page 3-4*

**DIR. OF SHAFT**

Plane towards which the probe points, enter plane code number.

**ANGLE FOR INTERS.**  
**1/ANGLE FOR INTERS. 2**

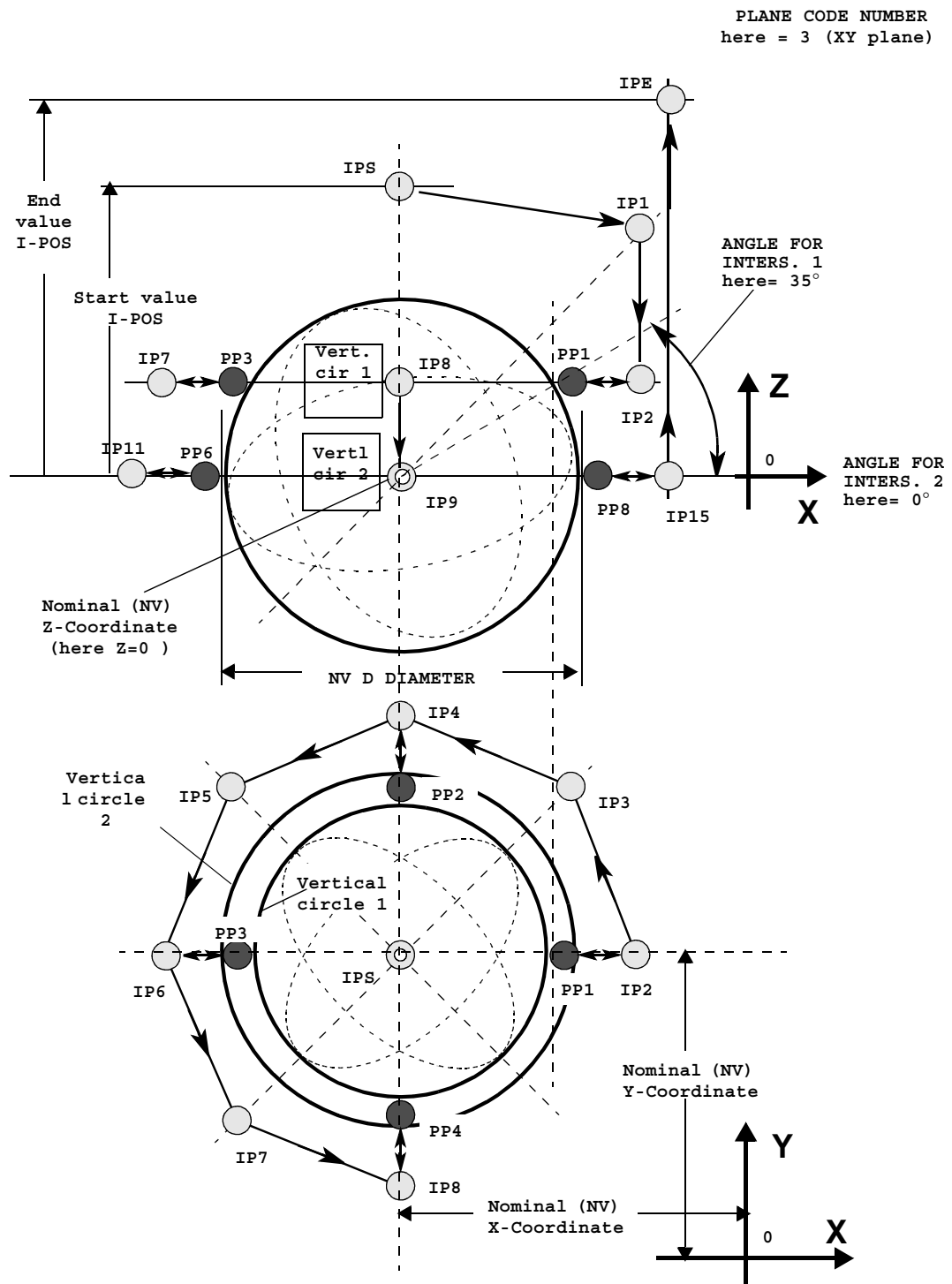
You can also measure the sphere in any two vertical circles. You enter the position of the vertical circles as angle, in the range from 0° (equator) to 90° (pole).

**START ANGLE**  
**END ANGLE**  
**NO. OF PRB. PTS.**

With **START ANGLE** and **END ANGLE** you specify the angle range in which the desired number of probings is to be made in each of the two vertical circles (**NO. OF PRB. PTS.**). For a sphere measurement, at least 4 probings are required.



Probing strategy for the measurement of a sphere in 2 vertical circles  
(with PCM module **SPHERE\_DIA.D**)



# Dialog for the point PCM measurement module

Workpiece name: POINT\_DIA.D

The POINT\_DIA.D dialog allows you to measure single points which are located anywhere in space.

## Input mask

☐ Enter parameters for macro
 MODIFY

Identification	Value
-----	
RESULT NAME	
PLANE CODE NUMBER	3
PROBE NO.	1
NV X-COORDINATE	0
NV Y-COORDINATE	0
NV Z-COORDINATE	0
NV A1 PROJ. ANGL.	0
NV A2 PROJ. ANGL.	0
START VALUE I-POS	10
END VALUE I-POS	20
NV SELECTION	X Y Z
NV X-IDF	
NV Y-IDF	
NV Z-IDF	
UT X	.1
LT X	-.1
UT Y	.1
LT Y	-.1
UT Z	.1
LT Z	-.1
COMBINED ELEM. OUT	0

MODIFY

\*

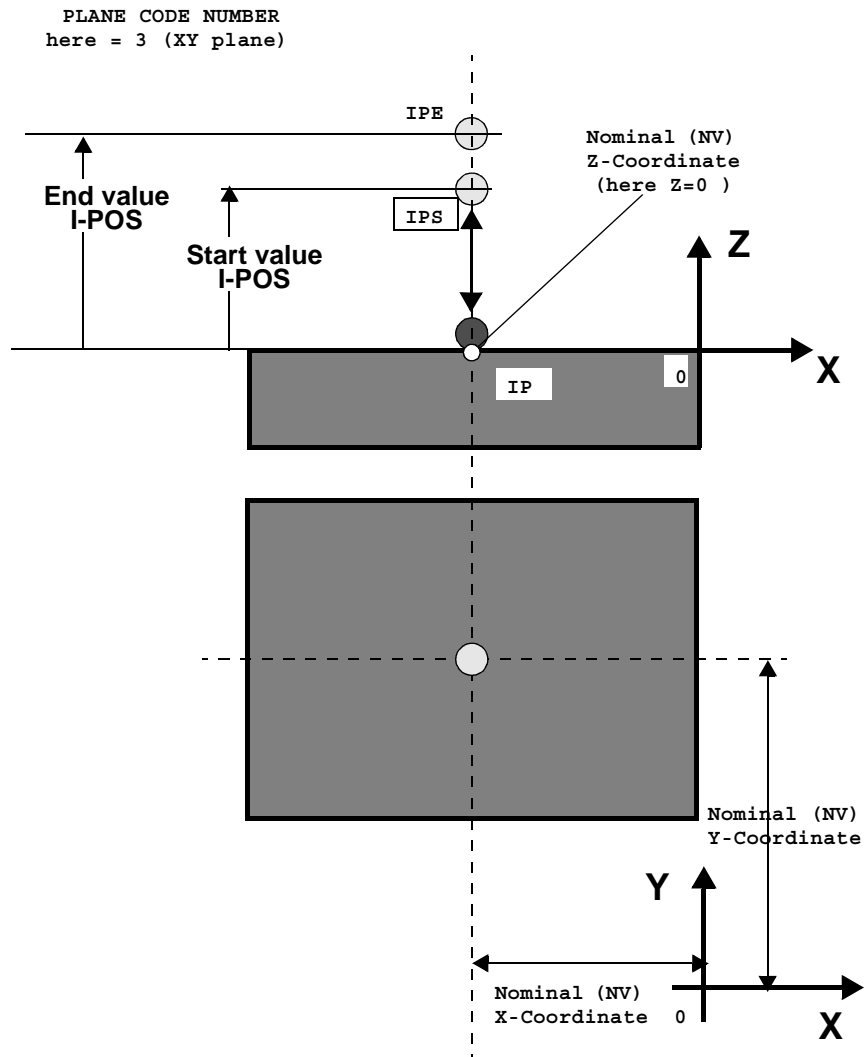
TERMIN

BACK

INFO

Explanation of **RESULT NAME**, **PLANE CODE NUMBER**, **PROBE NO.**, **NV X- Y- Z- COORDINATE**, **NV A1** and **A2 PROJ. ANGL.**, **START VALUE** and **END VALUE I-POS**, **NO. OF PRB. PTS.**, **NV SELECTION**, **NV...-IDF**, **UT** and **LT** ➤ “Dialogs which occur frequently” on page 3-4

Probing strategy for the measurement of point in space





## Dialog for the cylinder and Cylinder\_8\_Point PCM measurement modules

**Workpiece name:** CYLINDER\_8PT\_DIA.D or CYLINDER\_DIA.D

The PCM measurement modules **CYLINDER\_...** allow you to measure inner and outer cylinders which are located anywhere in space.

- **CYLINDER\_8PT\_DIA.D**  
is the dialog for standard cylinder measurement with 8 probings in two intersection planes.
- **CYLINDER\_DIA.D**  
is the dialog for any cylinder measurement in any angle range with any number of probings (min. 3) in a maximum of 10 distributed intersection planes.

## Input mask

☐ Enter parameters for macro
 MODIFY

Identification	Value
-----	
RESULT NAME	
PLANE CODE NUMBER	3
PROBE NO.	1
OUTER=0/INNER=1	1
NV X-COORDINATE	0
NV Y-COORDINATE	0
NV Z-COORDINATE	0
NV D DIAMETER	46
NV A1 PROJ. ANGL.	0
NV A2 PROJ. ANGL.	0
START VALUE I-POS	-10
END VALUE I-POS	-20
DIST : I-POS/PRB	5
START ANGLE	0
END ANGLE	360
NO. OF PRB. PTS.	4
NO. OF INTERSECT.	2
INTERS. (0=REG, 1=IRR)	0
1. INTERSECTION	7
2. INTERSECTION	5
3. INTERSECTION	0
4. INTERSECTION	0
5. INTERSECTION	0
6. INTERSECTION	0
7. INTERSECTION	0
8. INTERSECTION	0
9. INTERSECTION	0
10. INTERSECTION	0
NV SELECTION	XYZD \$4 \$5
NV X-IDF	
NV Y-IDF	
NV Z-IDF	
NV D IDF	
NV A1 IDF	
NV A2 IDF	
UT X	.1
LT X	-.1
UT Y	.1
LT Y	-.1
UT Z	.1
LT Z	-.1
UT D	.05
LT D	-.05
UT A1	.02
LT A1	-.02
UT A2	.02
LT A2	-.02
COMBINED ELEM. OUT	0

MODIFY

\*

TERMIN

BACK

INFO

This line is **not** available in the dialog for PCM measurement module **Cylinder\_8\_Point**

Explanation of **RESULT NAME**, **PLANE CODE NUMBER**, **PROBE NO.**, **NV X- Y- Z- COORDINATE**, **NV A1** and **A2 PROJ. ANGL.**, **START VALUE** and **END VALUE I-POS**, **DIST: I-POS/PRB**, **NV SELECTION**, **NV...-IDF**, **UT** and **LT** ➤ "Dialogs which occur frequently" on page 3-4

**START ANGLE**  
**END ANGLE**  
**NO. OF PRB. PTS.**

With **START ANGLE** and **END ANGLE** you define the angle range in which all intersection planes are to be probed with the specified number of probing points.

**NO. OF INTERSECT.**

Specify the number of intersection planes in which you want to probe the cone. A maximum of 10 irregularly distributed sections are possible.

**INTERS. (0=REG/1=IRR)**

Specify whether the sections are to be distributed regularly or irregularly on the cylinder.

– **0=REG**

The sections are to be distributed evenly, you have to enter the value for the first intersection plane for

**1. INTERSECTION** and the regular distance between the subsequent intersection planes for **2. INTERSECTION**.

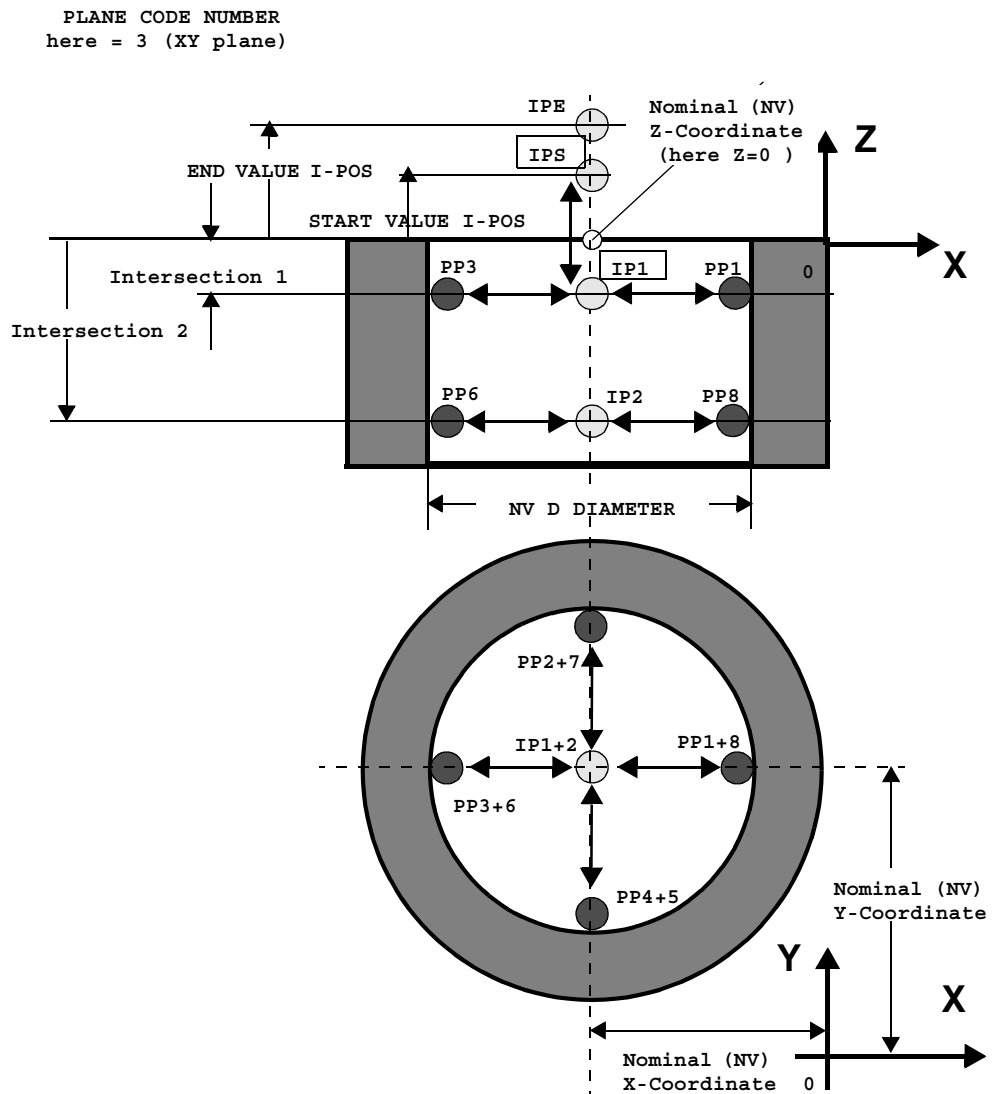
– **1=IRR**

If the sections are to be distributed irregularly, you have to enter each intersection plane (**1. INTERSECTION 2. INTERSECTION ...** etc. up to max. **10. INTERSECTION**) individually. A maximum of 10 irregular intersection planes is possible.

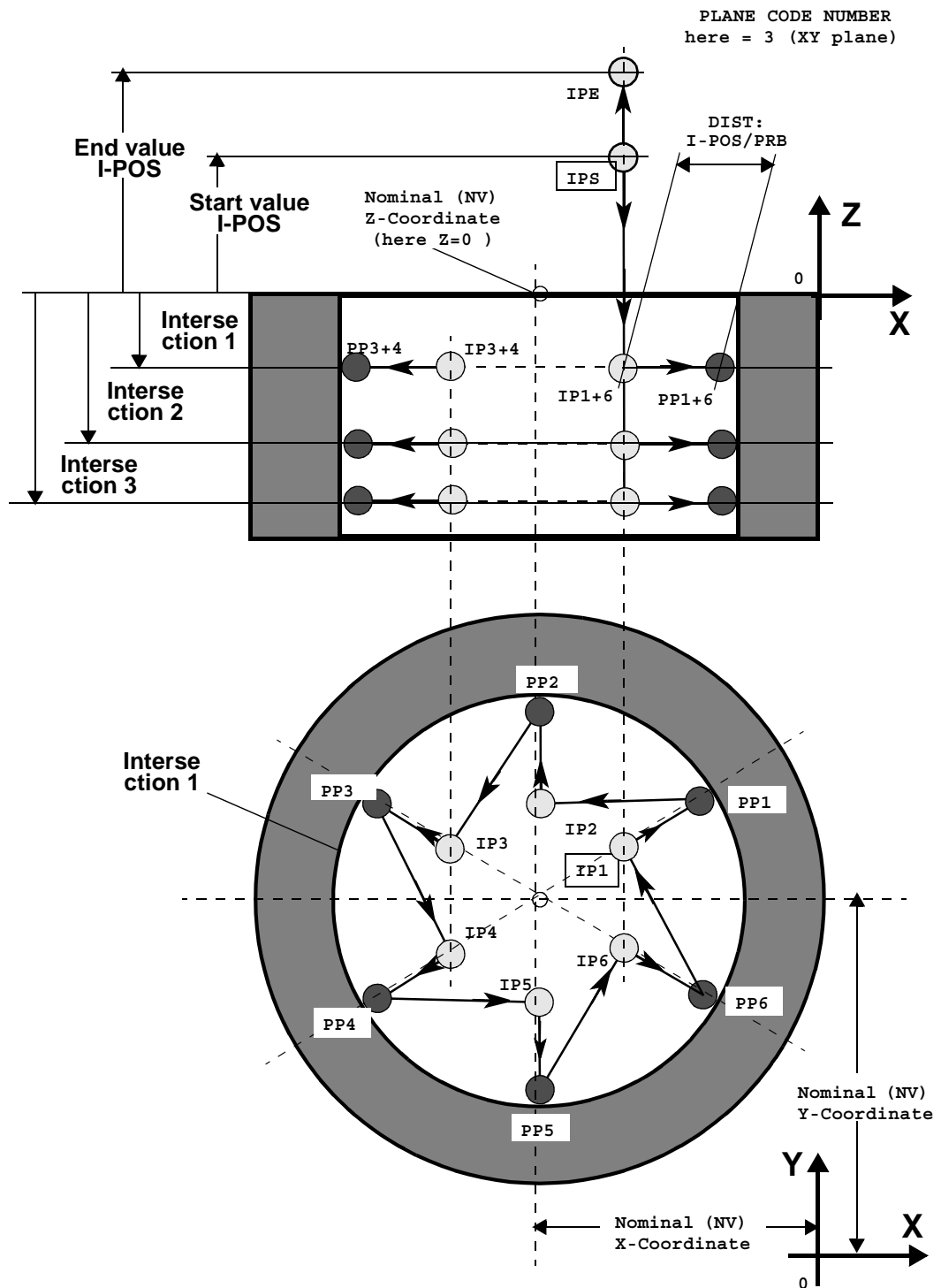
**INTERSECTION**

Does the dimension of the intersection plane refer to the A position or a reference point? Explanation ► "NM X- Y- Z-COORDINATE A1 A2 PROJ. ANGLE" on page 3-4

Probing strategy for the measurement of an inner cylinder with  
8 probing points (standard cylinder, i.e. with dialog  
**CYLINDER\_8PT\_DIA.D**)



Probing strategy for the measurement of an inner cylinder with 3, 5 or more probing points per intersection plane





# Chapter

# 4

## PCM dialogs for multi-component elements and special elements

---

### **This chapter contains:**

PCM dialogs for special elements . . . . .	4-2
PCM dialogs for combined elements . . . . .	4-21

## PCM dialogs for special elements

### Dialog for the thread position PCM measurement module

**Workpiece name:** THREAD POSITION\_DIA.D

This PCM module allows you to measure the position of threads simply and economically. It is assumed that the thread axis is vertical to the plane in question.

The thread is probed with a circle measurement whereby the thread pitch is taken into consideration, i.e. the probing points lie on a helix with the pitch of the thread. It does not matter whether you start with the first probing with the crest or side of the thread. Use the probe clusters with the largest probe spheres possible.

#### Input mask

☐ Enter parameters for macro
 MODIFY

Identification	Value
-----	
RESULT NAME	
PLANE CODE NUMBER	3
PROBE NO.	1
NV X-COORDINATE	10
NV Y-COORDINATE	20
NV Z-COORDINATE	0
NV D DIAMETER	50
THREAD PITCH	2
THR. (0=LE,1=RI)	1
THR. (0=OU,1=IN)	1
START VALUE I-POS	20
END VALUE I-POS	20
DIST: I-POS/PRB	3
INTERSECTION HEIGHT	5
NV SELECTION	X Y Z
NV X-IDF	
NV Y-IDF	
NV Z-IDF	
UT X	.1
LT X	-.1
UT Y	.1
LT Y	-.1
UT Z	.1
LT Z	-.1
NO. OF PRB. PTS.	4
START ANGLE	0
END ANGLE	360

MODIFY

\*

TERMIN

BACK

INFO



Explanation of **RESULT NAME, PLANE CODE NUMBER, PROBE NO., NV X- Y- Z- COORDINATE, START VALUE and END VALUE I-POS, START and END ANGLE, NO. OF PRB. PTS., NV SELECTION, NV...-IDF, UT and LT** ➤ *"Dialogs which occur frequently" on page 3-4*

**NV D DIAMETER  
THREAD PITCH**

Specify the nominal diameter and the nominal pitch of the thread.

**THR. (0=LE,1=RI)**

Specify the direction of rotation of the thread, 0 = left-hand thread, 1 = right-hand thread.

**THR. (0=OU,1=IN)**

Specify whether you want to measure a screw (**0 = OU**) or a nut (**1 = IN**).

**DIST: I-POS/PRB**

Specify the respective distance between the intermediate position and the probing point.

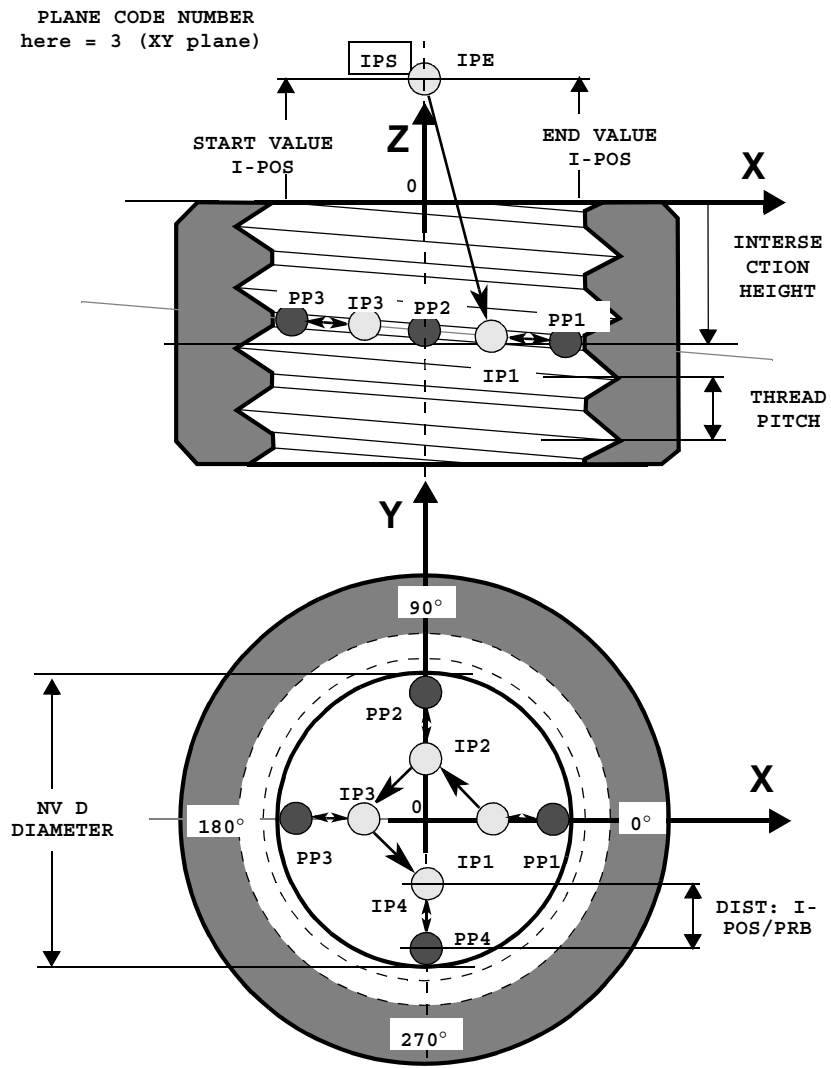
**INTERSECTION HEIGHT**

Specify the position (height) at which the measurement should start, starting from the plane in which the thread is located.

**NO. OF PRB. PTS.**

You should probe in at least four points.

Determine thread position with four-point measurement:



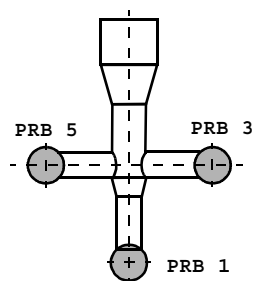
## Dialog for the thread gauge PCM measurement module

**Workpiece name:** THREAD GAUGE\_DIA.D

This PCM module allows you to measure ISO thread gauges according to DIN 13. You can check the effective diameter and the thread pitch for gauges for bolt and nut threads, i. e. with ring gauges and plug gauges.

### Special probe for thread measurement:

Special probe clusters with three probes are used for the thread measurement. The probe diameter is selected corresponding to the thread pitch:



Pitch P <mm>	Probe diameter <mm>
0.50	0.30
0.80 ; 1.00	0.50
1.25 ; 1.50 ; 1.75	0.80
2.00 ; 2.50	1.35
3.00 ; 3.50	1.80
4.00 ; 4.50	2.30

### Aligning the thread gauge (A position)

Clamp the thread gauge so that the thread axis is parallel to a coordinate axis (Z axis) and that there is enough space for the special probe at the end (under) the thread gauge. The space for the special probe is needed as you have to determine the control coordinate system (A position) with the help of shaft probings for the thread gauge.

You determine the control coordinate system by first measuring a surface on the thread gauge with probe no. 1 and then measure a four-point circle with shaft probings. For thread gauge rings with a diameter under 10 mm, the position of the missing coordinate axis is defined by the cone of the probe shaft instead of the circle measurement.

### Input mask

☐ Enter parameters for macro
 MODIFY

Identification	Value
-----	
RING GAUGE=1/PLUG GAUGE=0 1	
FLANK ANGLE	60
THREAD PITCH	3
ADJUST. FACTOR THR.	1
EFFECTIVE DIAM.	49.991
EFF. D. TOL +/-	0
PITCH TOL +/-	0
NO. OF THREADS	3
INSERT DEPTH PRB.	-42
PROBE SHAFT DIA./2	5.5
I-POS BEFORE MEAS.	10
NV SELECTION	XYZ D \$4 \$5

MODIFY

BACK

\*

TERMIN

INFO

**RING GAUGE=1/  
PLUG GAUGE= 0**

Inner/outer code, important for the automatic definition of the probing directions and probing paths.

**FLANK ANGLE**

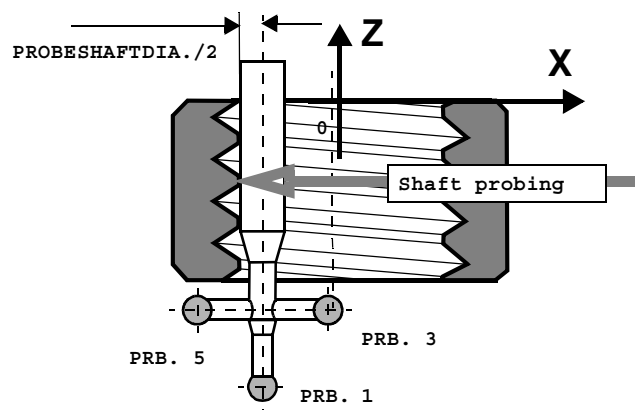
taken from specification sheet, angle between neighbouring flanks in the axis section, see fig. in ► *"Measuring the thread pitch" on page 4-9.*

**THREAD PITCH**

taken from the specifications, distance along the flank diameter line between neighbouring flanks in the same direction of the same thread.

<b>ADJUST. FACTOR THR.</b>	For the pitch measurement, the position of the first probing is defined by the number of threads, by which the adjustment is made in the direction of the thread axis. One thread pitch is usually specified as the adjustment factor as default, see fig. in ► <i>"Measuring the thread pitch"</i> on page 4-9.
<b>EFFECTIVE DIAM.</b>	taken from specification sheet, diameter of the imaginary cylinder located coaxially to the thread and of which any surface line cuts the thread profile so that the sections formed by the screw thread undercut and thread tooth are the same.
<b>EFF. D. TOL +/-</b>	Tolerance of the effective diameter, taken from specification sheet.
<b>PITCH TOL +/-</b>	Tolerance of the thread pitch, taken from specification sheet.
<b>NO. OF THREADS</b>	Tolerance of threads, taken from specification sheet.
<b>INSERT DEPTH PRB.</b>	To determine the A position of the thread gauge, the probe shaft is used for probing in the thread. To do so, the probe must be inserted far enough down in the thread.
<b>PROBESHAFTDIA./2</b>	To determine the A position of the thread gauge, the probe shaft is used for probing in the thread. Enter half the shaft diameter.

Shaft probing with the thread gauge:



## Measuring the effective diameter

When measuring the effective diameter, the thread gauge is first aligned exactly (exact A position), then the thread flank must be found with the probe.

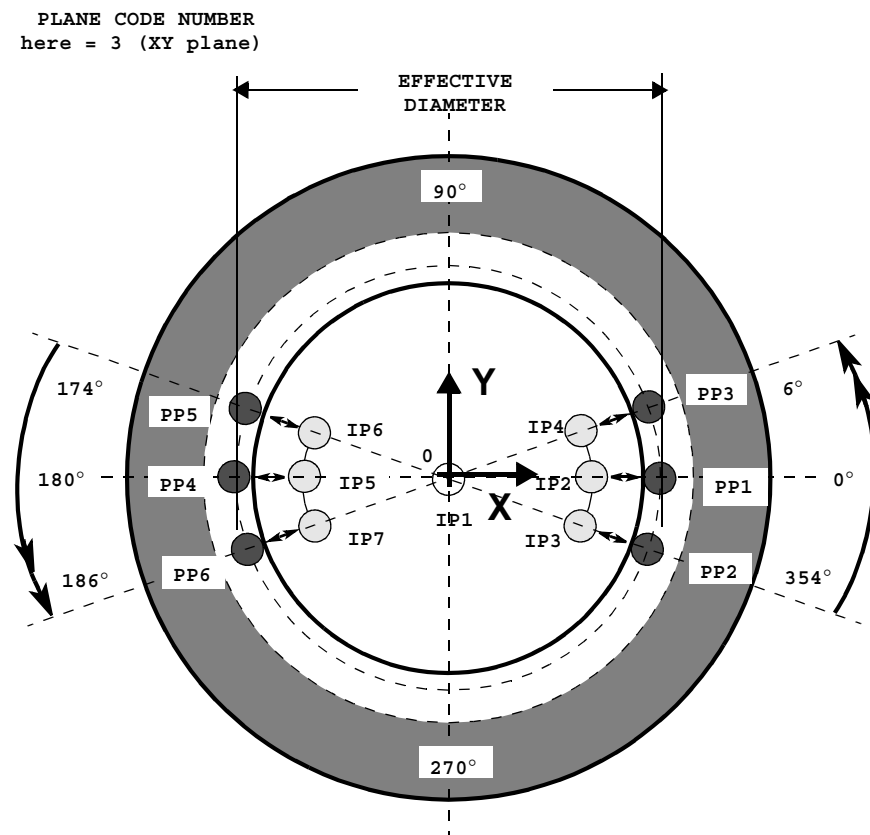
The thread flank is looked for by means of self-centering probing: The thread is probed using self-centering probing and the measured value is compared with the nominal core diameter, then the probe travels in the direction of the thread axis and again probes with self-centering. With this second self-centering probing, the probe finds the flank of the thread (the tooth flank may already have been found with the first probing).

With the self-centering probing, the probe is clamped in a coordinate direction, the measuring force is applied in the second coordinate direction and the probe can move freely in the third coordinate direction so that it can glide along a thread flank until it has centered between the two thread flanks.

The flank diameter is calculated from 6 probings (two circle measurements each with three points), see figure. With each of the two circle measurements, a circle segment of  $\pm 6^\circ$  is measured each with three points referring to the center point.

Both circle segments lie opposite to one another. If the first circle segment has been measured, the opposite circle segment is measured displaced half a thread pitch in the direction of the thread axis.

Measuring a diameter composed of 2 circle segments:

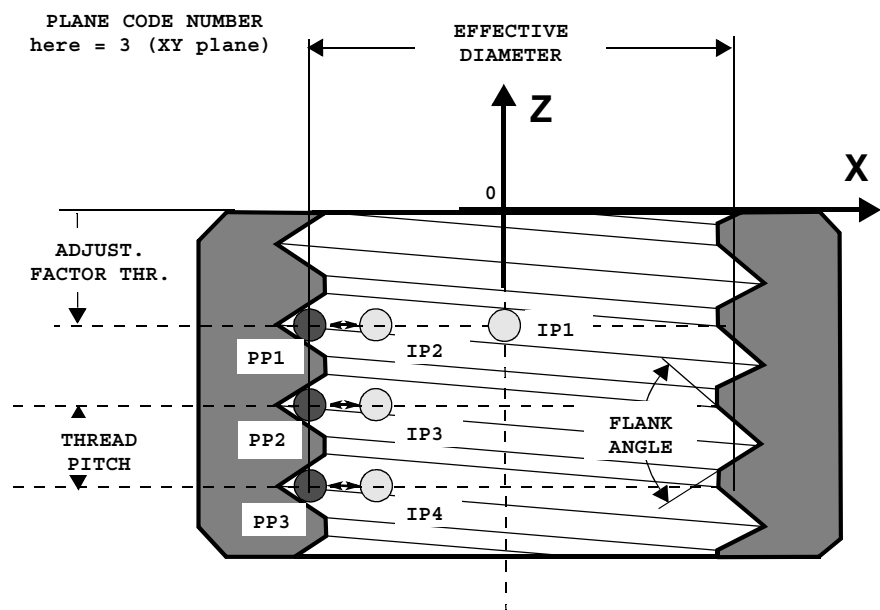


## Measuring the thread pitch

You can measure the thread pitch using several individual probings. The distance in the direction of the thread axis is evaluated.

The number of threads to be checked depends on the thickness of the thread gauge.

Probing in the thread flank for the pitch measurement:



## Dialog for the 3D circle and ring-shaped area PCM measurement module

**Workpiece name:** SPACE CIRCLE\_DIA\_D or RING\_SHAPED\_AREA\_DIA.D

### SPACE CIRCLE\_DIA\_D

is the dialog for measuring circles which are located anywhere in space.

(Compare: **CIRCLE\_DIA.D** is the dialog for measuring circles which lie in a plane of the coordinate system ► "Dialog for the circle PCM measurement module" on page 3-22).

### RING\_SHAPED\_AREA\_DIA.D

is the dialog for measuring surfaces with circular boundaries which can lie anywhere in space, e.g. surfaces of shouldered shafts and boreholes.

The dialogs for 3D circle and ring-shaped area have the same structure.

## Input mask

Enter parameters for macro		MODIFY	
Identification	Value		
-----			
RESULT NAME			
PLANE CODE NUMBER	3		
PROBE NO.	1		
OUTER=0/INNER=1	1		
NV X-COORDINATE	0		
NV Y-COORDINATE	0		
NV Z-COORDINATE	0		
NV D DIAMETER	46		
NV A1 PROJ. ANGL.	0		
NV A2 PROJ. ANGL.	0		
START VALUE I-POS	-10		
END VALUE I-POS	-20		
DIST : I-POS/PRB	5		
START ANGLE	0		
END ANGLE	360		
NO. OF PRB. PTS.	4		
NV SELECTION	XYZ \$4\$5		
NV X-IDF			
NV Y-IDF			
NV Z-IDF			
NV A1 IDF			
NV A2 IDF			
UT X	.1		
LT X	-.1		
UT Y	.1		
LT Y	-.1		
UT Z	.1		
LT Z	-.1		
UT A1	.02		
LT A1	-.02		
UT A2	.02		
LT A2	-.02		
COMBINED ELEM. OUT	0		
MODIFY		*	TERMIN
BACK			INFO

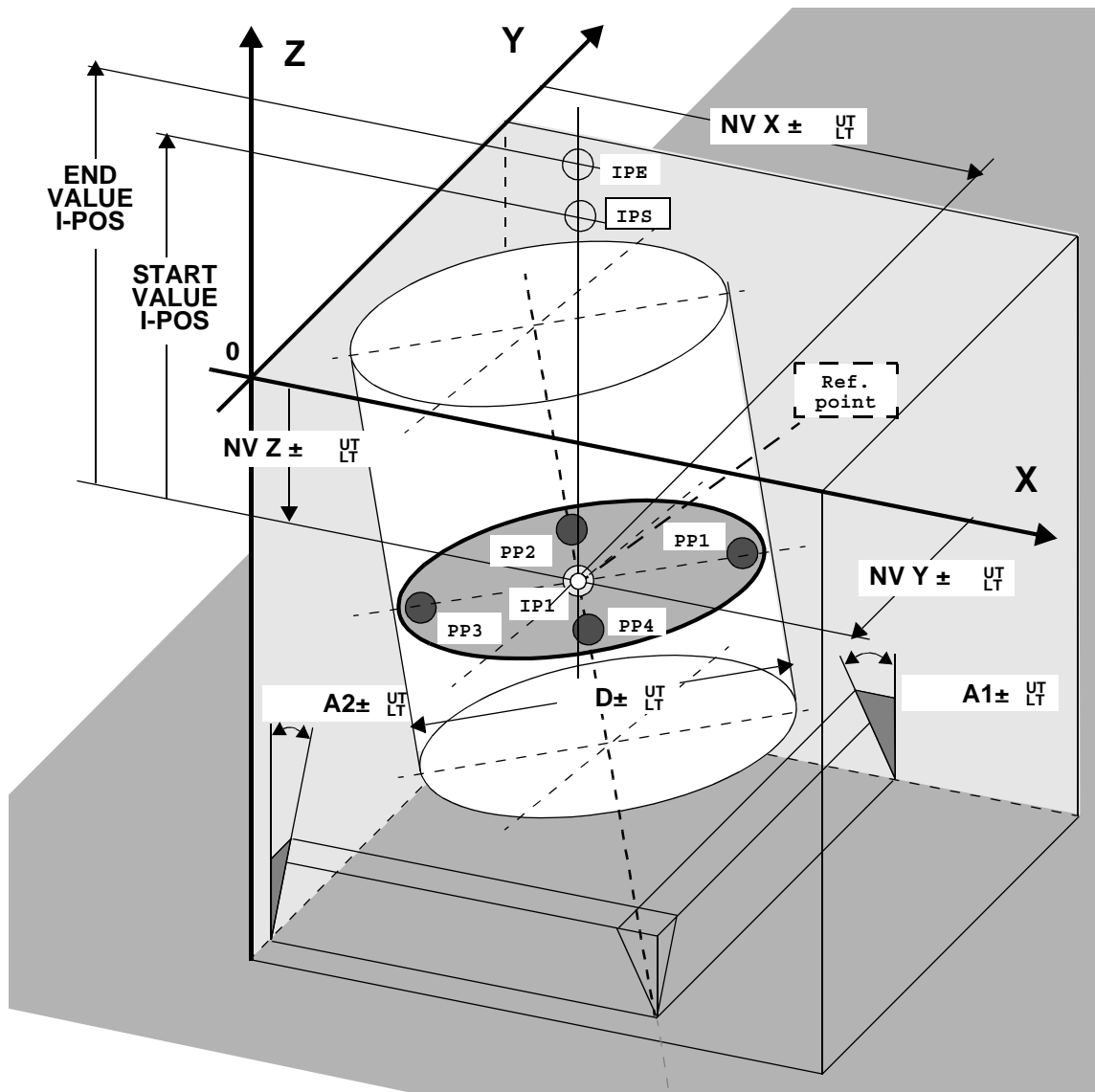
Explanation of **RESULT NAME**, **PLANE CODE NUMBER**, **PROBE NO.**, **NV X- Y- Z- COORDINATE**, **NV A1-** and **A2 PROJ. ANGL.**, **START VALUE** and **END VALUE I-POS**, **DIST: I-POS/PRB**, **START** and **END ANGLE**, **NO. OF PRB. PTS.**, **NV SELECTION**, **NV...-IDF**, **UT** and **LT** ➤ "Dialogs which occur frequently" on page 3-4

**OUTER=0/INNER=1**

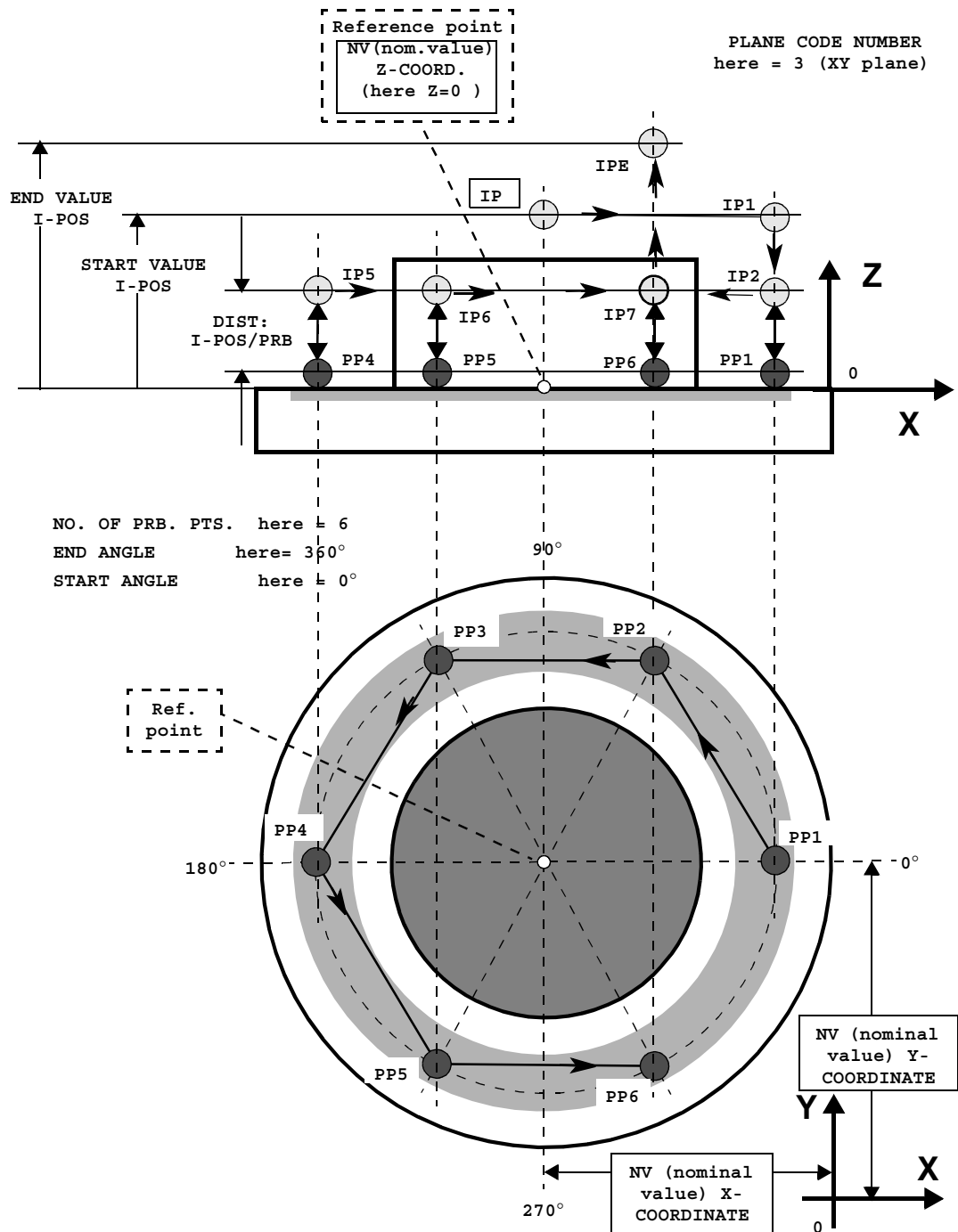
- With 3D circle:  
Specify whether shaft or borehole.
- With ring-shaped area:  
Specify whether the ring-shaped area is outside on the workpiece or in a borehole; the program then defines the travel paths and intermediate positions.



Measuring a 3D circle with 4 probings:



Probing strategy for the measurement of a ring-shaped area



## Dialog for the scanning ring-shaped area PCM measurement module

**Workpiece name: SANNING\_RING-SHAPED AREA**

Area with circular boundary which can lie anywhere in space, e. g. faces of shouldered shafts and boreholes can be measured using scanning with the **SANNING\_RING-SHAPED AREA** dialog.

### Input mask

Enter parameters for macro		MODIFY	
Identification	Value		
-----			
RESULT NAME			
PLANE CODE NUMBER	3		
PROBE NO.	1		
OUTER=0/INNER=1	1		
NV X-COORDINATE	0		
NV Y-COORDINATE	0		
NV Z-COORDINATE	0		
NV D DIAMETER	46		
NV A1 PROJ. ANGL.	0		
NV A2 PROJ. ANGL.	0		
START VALUE I-POS	-10		
END VALUE I-POS	-20		
START ANGLE	0		
TRAVEL ANGLE	360		
SPEED	20		
FILTER WAVE LENGTH	0		
0.08/0.25/0.8/ ../25/80			
0=FILTER OFF			
STEP SIZE	1		
NV SELECTION	XYZ \$4 \$5		
NV X-IDF			
NV Y-IDF			
NV Z-IDF			
NV A1 IDF			
NV A2 IDF			
UT X	.1		
LT X	-.1		
UT Y	.1		
LT Y	-.1		
UT Z	.1		
LT Z	-.1		
UT A1	.02		
LT A1	-.02		
UT A2	.02		
LT A2	-.02		
COMBINED ELEM. OUT	0		
MODIFY		*	TERMIN
BACK			INFO

Explanation of **RESULT NAME**, **PLANE CODE NUMBER**, **PROBE NO.**, **NV X- Y- Z- COORDINATE**, **NV A1** and **A2 PROJ. ANGL.**, **START VALUE** and **END VALUE I-POS**, **NV SELECTION**, **NV ...-IDF**, **UT** and **LT** ➤ "Dialogs which occur frequently" on page 3-4

## OUTER=0/INNER=1

Specify whether the ring-shaped area is outside on the workpiece or in a borehole; the program then defines the travel paths and intermediate positions.

## START ANGLE (+/-) and TRAVEL ANGLE (+/-)

As **START ANGLE** specify the position where the scanning is to start, starting from the 0° mark (► *“Dialogs which occur frequently” on page 3-4, figure: **START and END ANGLE***).

As **TRAVEL ANGLE** specify the distance (angle range) which is to be scanned starting from the position defined by the start angle. You can enter positive or negative angle values.

## NOTE

If the geometric conditions allow, it is advisable to scan a somewhat larger area than is actually necessary. If, for example, you are scanning a full circle with a travel angle of 370°, you travel past the start position at a constant scanning speed. With the subsequent circle evaluation, you can then delete the measured points from the first 5° and the last 5° of the scanned travel angle.

## SPEED

Enter the scanning speed in mm/s (minimum 0.01 mm/s).

## FILTER WAVE LENGTH 0.08/0.25/0.8/ ../25/80 0=FILTER OFF

Using a filter you can separate the waviness profile from influences of the surface roughness.

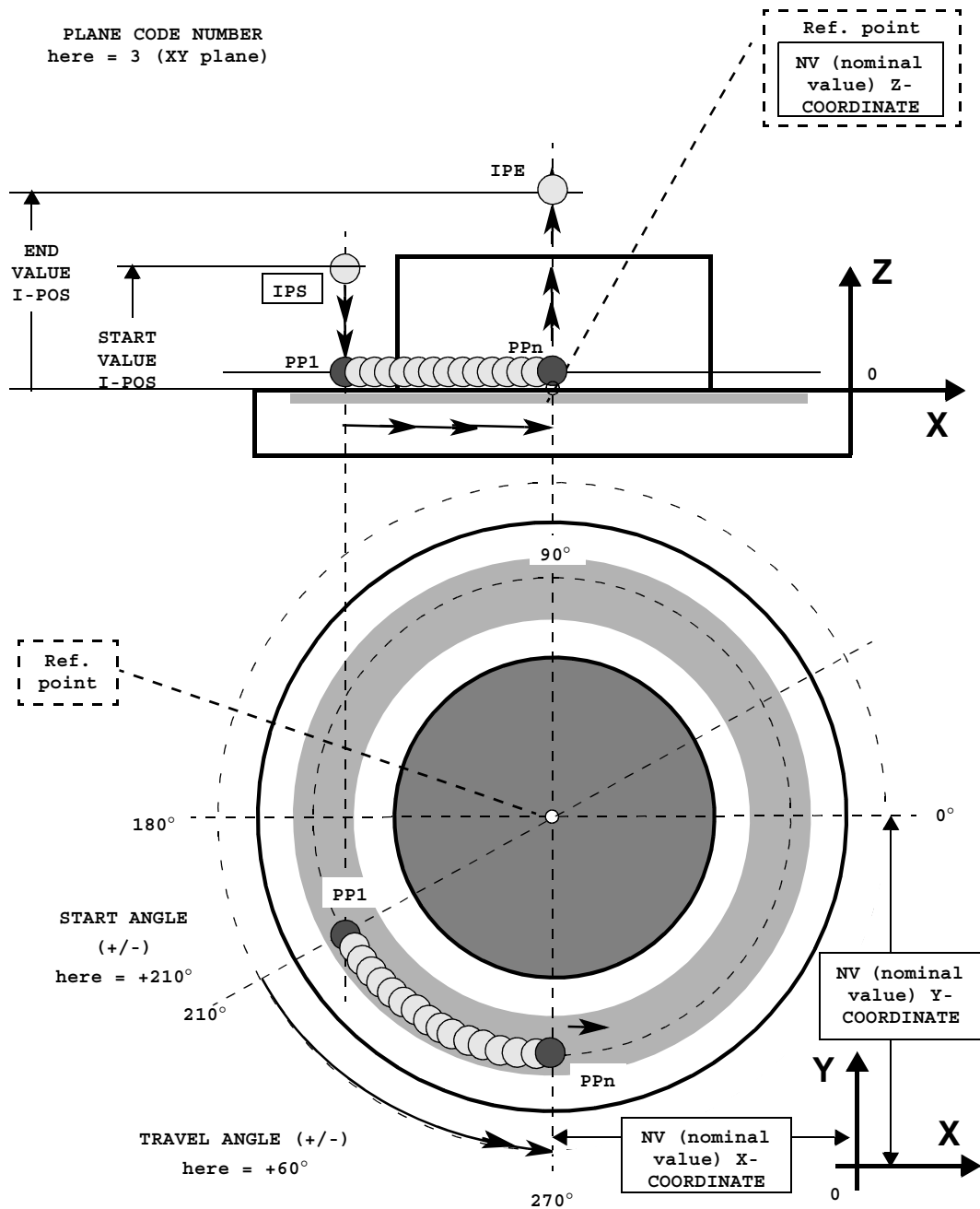
For the filter wave length, you can select between the values **0.8** or **2.5** and their power of ten. You have to select the smallest filter wave length so that 3 points can be recorded, the largest wave length corresponding to the half of the path scanned; for more information, see basic UMESS operating instructions.

A comparison of the measurement results assumes that the same filter wave length has been used for the evaluation.

## STEP SIZE

Enter the distance between two points each of which is to be transferred as measured values. If you enter zero, the smallest step size possible is taken.

## Probing strategy for the scanning of a ring-shaped area



## Dialog for the slot PCM measurement module

Workpiece name: **SLOT\_DIA.D**

The **slot** PCM module allows you to measure the feather key grooves according to DIN 6885 groove form N1 or punched out slots.

You can measure slots which lie in a specific plane (plane code number), 3D skew position cannot be taken into consideration.

### Input mask

Enter parameters for macro		MODIFY	
Identification	Value		
-----			
PLANE CODE NUMBER	3		
PROBE NO.	1		
NV X-COORDINATE	0		
NV Y-COORDINATE	0		
NV Z-COORDINATE	0		
NV WIDTH	10		
NV LENGTH	50		
NO. OF INTERSECT.	3		
ANGLE	0		
START VALUE I-POS	20		
END VALUE I-POS	20		
DIST : I-POS/PRB	4		
INSERT DEPTH	-4		
NV SELECTION	X Y Z D		
NV X-IDF			
NV Y-IDF			
NV Z-IDF			
NV D IDF			
UT X	.1		
LT X	-.1		
UT Y	.1		
LT Y	-.1		
UT Z	.1		
LT Z	-.1		
UT L	.1		
LT L	-.1		
UT W	.05		
LT W	-.05		

MODIFY				*				TERMIN
BACK								INFO

Explanation of **PLANE CODE NUMBER**, **PROBE NO.**, **NV X- Y- Z- COORDINATE**, **START VALUE** and **END VALUE I-POS**, **DIST : I-POS/PRB**, **NV SELECTION**, **NV ...-IDF**, **UT** and **LT** ➤ "Dialogs which occur frequently" on page 3-4

**NV WIDTH and  
NV LENGTH**

Enter the nominal dimensions of the slot. The length of the slot is the distance of the circle center points of circle 1 and circle 2, see figure.

**NO. OF INTERSECT.**

Enter the desired number of intersections for the measurement of the slot width, in which a distance measurement is to be executed. The intersections are distributed evenly between circle 1 and circle 2 automatically.

**ANGLE**

Enter the position of the slot in the plane in question by specifying the angle of the slot length to a coordinate axis.

**INSERT DEPTH**

Specify how deep the probing is to be made in the slot.

Does the dimension of the insertion depth refer to the A position or a reference point? Explanation ► "NM X- Y- Z-COORDINATE A1 A2 PROJ. ANGLE" on page 3-4.

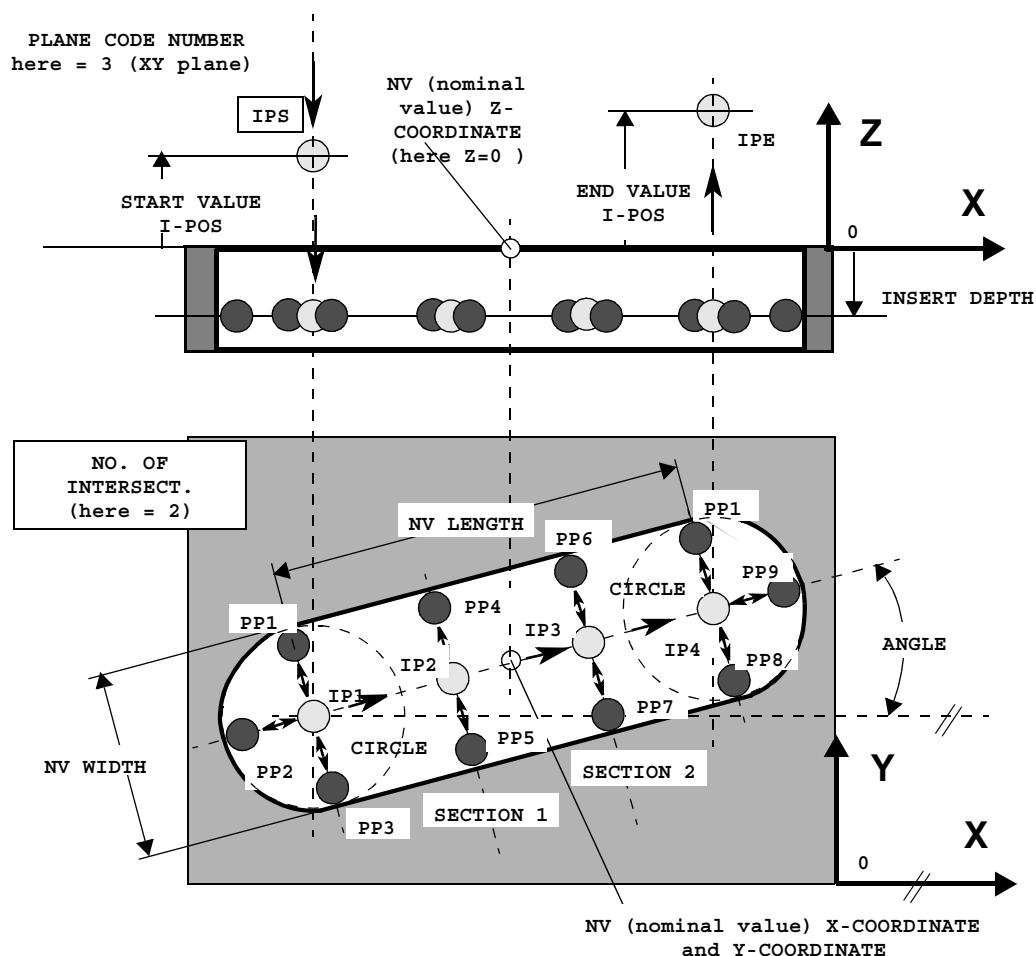
**Probing strategy for the measurement of a slot**

First circle 1 is measured.

Then the width (distance) is measured in each section.

Circle 2 is then measured.

The distance between circle 1 and circle 2 is the length of the slot.



## Dialog for the bore pattern PCM measurement module

Workpiece name: **BOREPATTERN\_DIA.D**

The **BORE PATTERN ...** PCM measurement module allows you to measure bore patterns which consist of several bores evenly arranged on a divided circle.

All the boreholes of a bore pattern must have the same diameter and they must all lie in the same plane (projected angles are equal to zero). Each borehole is measured with four probings (standard circle).

### Input mask

Enter parameters for macro		MODIFY	
Identification	Value		
-----			
RESULT NAME			
PLANE CODE NUMBER	3		
PROBE NO.	1		
X-COORD./INSERT. D.	0		
Y-COORD./INSERT. D.	0		
Z-COORD./INSERT. D.	-5		
D BORE DIAMETER.	10		
NV SELECTION	X Y Z D		
NV X-IDF			
NV Y-IDF			
NV Z-IDF			
NV D IDF			
PITCH CIRCLE DIA.	100		
START ANGLE	0		
ANGULAR PITCH	90		
END ANGLE	360		
START VALUE I-POS	10		
END VALUE I-POS	10		
UT X	.1		
LT X	-.1		
UT Y	.1		
LT Y	-.1		
UT Z	.1		
LT Z	-.1		
UT D	.05		
LT D	-.05		

MODIFY				*				TERMIN
BACK								INFO

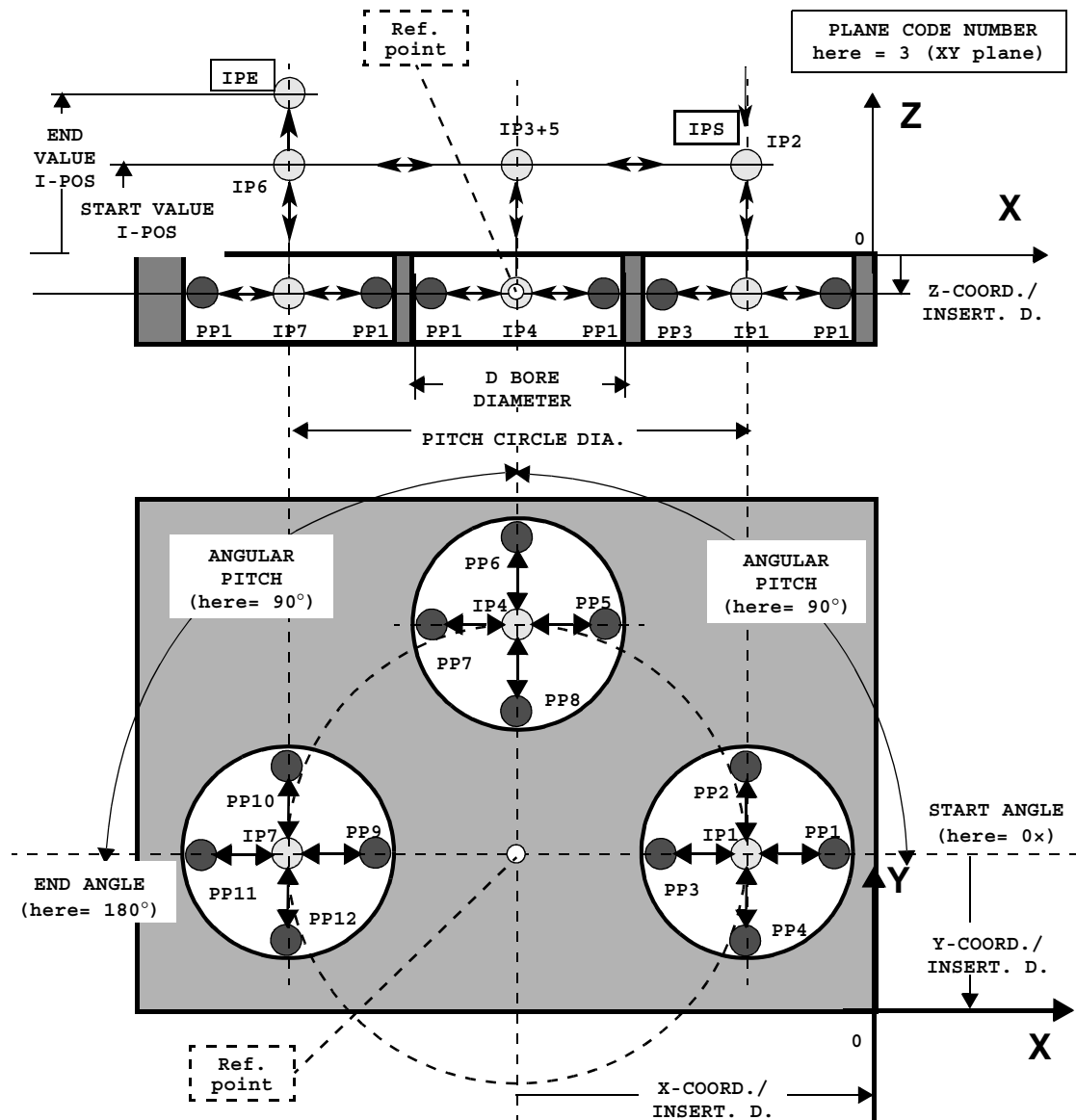
Explanation of **RESULT NAME**, **PLANCE CODE NUMBER**, **PROBE NO.**, **X- Y- Z- COORD./INSERT. D.**, **START VALUE** and **END VALUE I-POS**, **START** and **END ANGLE**, **NV SELECTION**, **NV...-IDF**, **UT** and **LT** ➤ "Dialogs which occur frequently" on page 3-4

Enter the technical data of the bore pattern: a common borehole diameter for all bores, the pitch circle diameter and the angular pitch.

**D BORE DIAMETER**  
**PITCH CIRCLE DIA.**  
**ANGULAR PITCH**

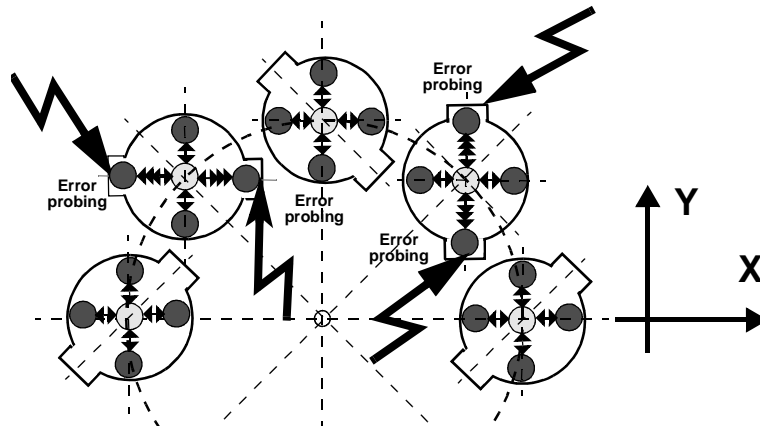


Probing strategy for the measurement of a bolthole circle



**NOTE**

As probings are made parallel to the workpiece axis, error probings may be made, for example, with slotted boreholes.



## PCM dialogs for combined elements

Combined elements are geometric elements which are made up of several individual elements.

For example, an area can be made up of several individual areas or lines or a cone can be made up of several lines and circles.

The following combined geometric elements can be measured with the PCM library:

Surface	Line	Cone	Circle
Ring-shaped area	3D circle	Torus	Cylinder

You can form these combined elements from the following individual elements:

Surface	Line	Cone	Ring-shaped area
Circle	3D circle	Points	Cylinder

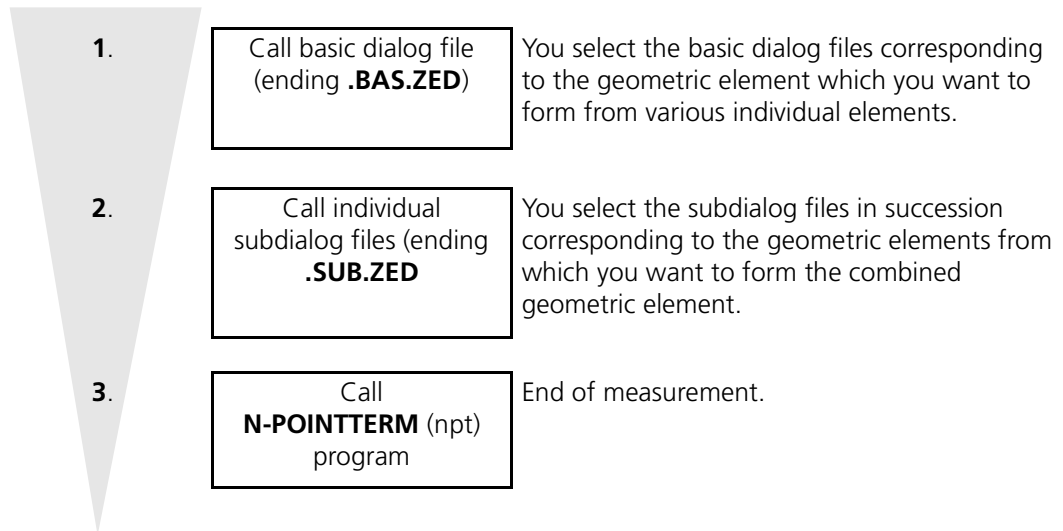
The dialog files for combined elements are identified by the ending **.ZED**.

There are two dialog files for combined elements, a basic dialog file (ending **.BAS.ZED**) and a subdialog file (ending **.SUB.ZED**).

During self-teach programming of a combined element, you always first call the basic dialog file for the geometric element you want to combine. You then call the subdialog files corresponding to the individual elements out of which you want to form the geometric element.

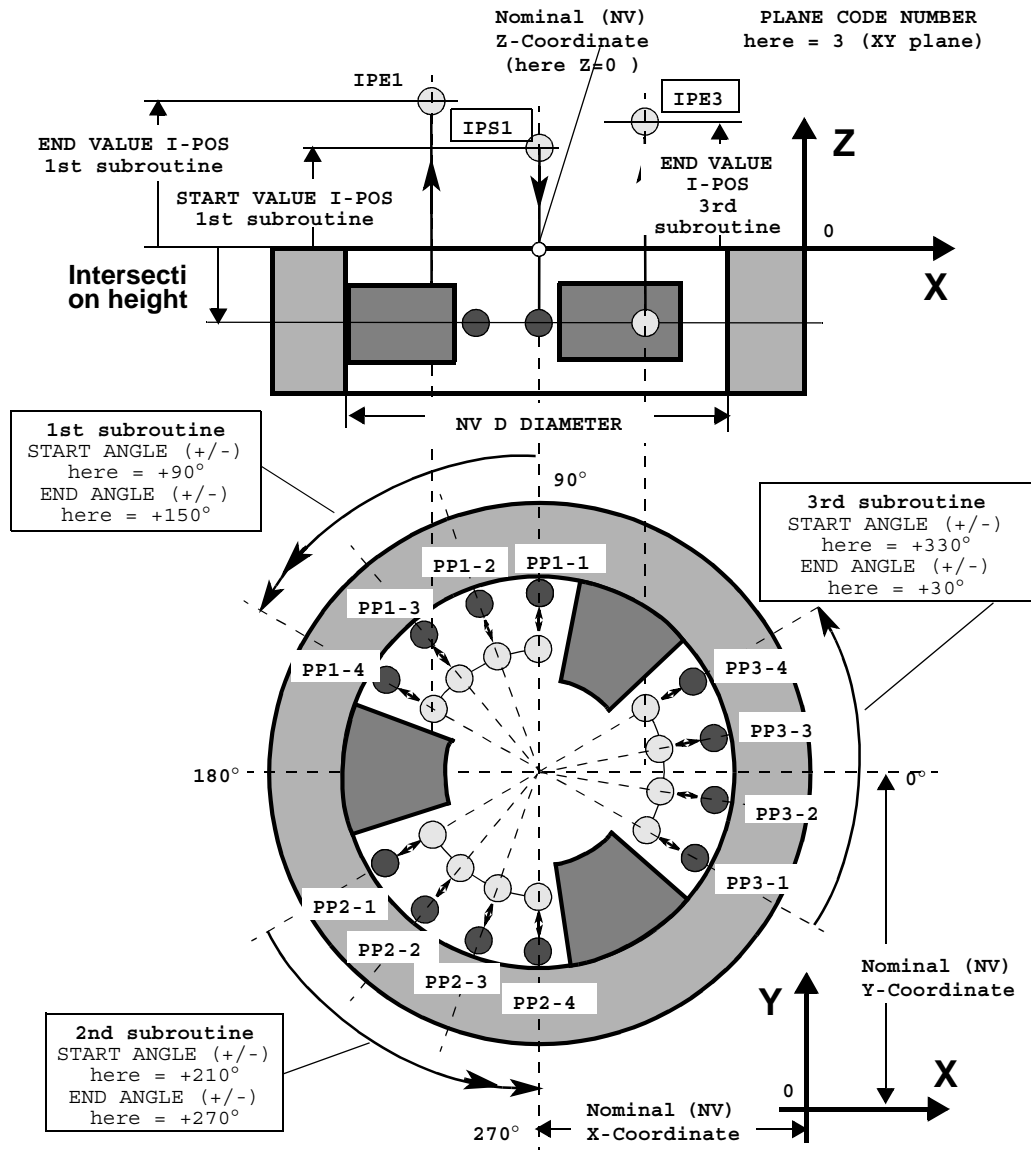
The various dialog files are called in succession and processed so that the individual travel paths can be added.

### Measuring a combined geometric element



**Example**

Circle measurement made up of three circle segments



### Procedure

1. Call basic dialog file for the combined element "circle" **CIRCLE\_BAS.ZED**, enter values and end with **<TERMIN>**.
2. Call subdialog file "circle" **CIRCLE\_SUB.ZED** for the 1st circle segment (1st subroutine), enter values and execute measurement of the 1st circle segment with **<TERMIN>**.
3. Call subdialog file "circle" **CIRCLE\_SUB.ZED** for the 2nd circle segment (2nd subroutine), enter values and execute measurement of the 2nd circle segment with **<TERMIN>**.
4. Call subdialog file "circle" **CIRCLE\_SUB.ZED** for the 3rd circle segment (3rd subroutine), enter values and execute measurement of the 3rd circle segment with **<TERMIN>**.
5. End circle measurement with **N-POINTTERM** (npt).

In the example, a circle is to be made up of individual elements, to do this the basic dialog file for the combined element "circle" must be called:

**Workpiece name: CIRCLE\_BAS.ZED**

### Input mask

Enter parameters for macro		MODIFY	
Identification	Value		
RESULT NAME	BO_50		
PLANE CODE NUMBER	3		
NV X-COORDINATE	10		
NV Y-COORDINATE	20		
NV Z-COORDINATE	0		
NV D DIAMETER	50		
NOM/ACT (0=N/1=Y)			
NV SELECTION	X Y Z D		
NV X-IDF			
NV Y-IDF			
NV Z-IDF			
NV D IDF			
UT X	.1		
LT X	-.1		
UT Y	.1		
LT Y	-.1		
UT Z	.1		
LT Z	-.1		
UT D	.05		
LT D	-.05		
COMBINED ELEM. CIRCLE	1		

MODIFY

BACK

\*

TERMIN

INFO

Explanation of **RESULT NAME, PLANE CODE NUMBER, NV X- Y- Z- COORDINATE, NV SELECTION, NV ...-IDF, UT and LT**  
 ➤ "Dialogs which occur frequently" on page 3-4

**NOM/ACT (0=N/1=Y)**

Specify whether a nominal-actual comparison should be made.

**COMBINED ELEM.**

Message that the combined mode "circle" is activated, the program waits for subsequent subprograms corresponding to the individual geometric elements out of which the circle is to be formed.

**CIRCLE 1**

In the example, the circle is to be made up of three individual elements, these three individual elements are three circle segments; to do this a subdialog file "circle" has to be called for each individual element:

**Workpiece name: CIRCLE\_SUB.ZED**

### Input mask

Enter parameters for macro		MODIFY	
Identification	Value		
PLANE CODE NUMBER	3		
PROBE NO.	1		
OUTER=0/INNER=1	1		
NV X-COORDINATE	10		
NV Y-COORDINATE	20		
NV Z-COORDINATE	0		
NV D DIAMETER	50		
START VALUE I-POS	20		
END VALUE I-POS	30		
DIST : I-POS/PRB	5		
START ANGLE	90		
END ANGLE	150		
NO. OF PRB. PTS.	4		
INTERSECTION HEIGHT	-20		
COMBINED ELEM. CIRCLE	1		
MODIFY		*	TERMIN
BACK			INFO

Explanation of **PLANE CODE NUMBER, PROBE NO., NV X- Y- Z- COORDINATE, START VALUE and END VALUE I-POS, DIST : I-POS/PRB, START and END ANGLE, NO. OF PRB. PTS., INTERSECTION HEIGHT,** ➤ "Dialogs which occur frequently" on page 3-4

Corresponding to the example, the subdialog file "circle" has to be called in succession for each of the three circle segments, the start and end angle have to be entered for each segment and the measurement has to be started each time with **<TERMIN>**.

Once the third circle segment has been measured, the circle measurement and calculation of the combined element are concluded with **N-POINTTERM** (npt).



# Index

## Symbols

<CATALOG> 2-5  
<CHAN CAT> 2-5  
<INFO WP> 2-8  
<MASK> 2-9  
<MODIFY> 3-3  
<SELECTWP> 2-8  
<Transfer macro> 2-4, 3-2  
\_\_\_ Performance mode catalog 2-6

## A

ADJUST. FACTOR THR. 4-7  
Aligning the thread gauge 4-6  
Aligning the workpiece 2-4  
ANGLE 4-17  
ANGLE FOR INTERS. 1/ANGLE FOR  
INTER. 2 3-30  
ANGULAR PITCH 4-19

## B

BAS.ZED 4-21  
Basic dialog file 4-21  
BORE DIAMETER 4-19  
BOREPATTERN\_DIA.D 4-18

## C

Calculation modules 2-12  
Calling the PROG mode 2-3  
Calling the record header 2-4  
Catalog of the PCM measurement  
modules 2-12  
CENTER POINT X / Y / Z 3-27  
Central dialog modules 1-6  
Central measurement modules 1-6  
Central PCM measurement modules 1-5  
CIRCLE\_DIA.D 3-22  
CNC data admin. catalog 2-5  
CNC program or workpiece 1-4  
COMBINED ELEM. CIRCLE 1 4-25  
COMBINED ELEM. OUT = 0 / COMBINED  
ELEM. ON = 1 3-7  
Combined element "circle" 4-24  
combined elements 2-8  
Combined geometric elements 4-21  
CONE ANGLE 3-19  
CONE\_DIA.D 3-17  
Convert masked lines 2-15  
Convert parameter lines 2-14

CYLINDER\_8PT\_DIA.D 3-35  
CYLINDER\_DIA.D 3-35

## D

Determining the A position 2-3  
DI 1610 2-4  
DI 1647 2-13  
DI 1671 2-13  
DI 1712 2-3  
DI 1713 2-4  
Dialog file 1-2  
Dialog for the 3D circle and ring-shaped  
area PCM measurement module 4-9  
Dialog for the bore pattern PCM  
measurement module 4-18  
Dialog for the circle PCM measurement  
module 3-22  
Dialog for the cone PCM measurement  
module 3-17  
Dialog for the cylinder and  
cylinder\_8\_point PCM measurement  
modules 3-35  
Dialog for the line PCM measurement  
module 3-12  
Dialog for the point PCM measurement  
module 3-33  
Dialog for the scanning circle and  
scanning circle file PCM  
measurement module 3-26  
Dialog for the scanning line PCM  
measurement module 3-15  
Dialog for the scanning ring-shaped area  
PCM measurement module 4-13  
Dialog for the slot PCM measurement  
module 4-16  
Dialog for the sphere or sphere\_6\_Point  
PCM measurement modules 3-29  
Dialog for the surface PCM measurement  
modules 3-9  
Dialog for the thread gauge PCM  
measurement module 4-5  
Dialog for the thread position PCM  
measurement module 4-2  
Dialogs which occur frequently 3-4  
Dimensions refer to a reference point 3-5  
Dimensions refer to the A position  
system 3-5  
DIR. OF SHAFT 3-30  
Displaying and changing control data  
catalogs 2-5

Displaying the catalog of the dialog files 2-6  
DIST: I-POS/PRB 4-3

## E

EFF. D. TOL +/- 4-7  
EFFECTIVE DIAM. 4-7  
Effective diameter 4-5  
element-specific data 1-2  
END ANGLE 3-8, 3-19  
END VALUE I-POS 3-6  
EXCALL 1-4  
Execute CNC and calculate results 2-14

## F

Feather key grooves 4-16  
FILENAME 3-16, 3-27  
FILTER WAVE LENGTH 3-16, 4-14  
FIRST HEIGHT 3-13  
FIRST HEIGHT / LAST HEIGHT 3-13  
FLANK ANGLE 4-6

## G

Generating run 2-13  
Geometry data 1-2

## I

individual elements 2-8  
Inner circle 3-24  
Inner cylinder 3-38, 3-39  
INSERT DEPTH 4-17  
INSERT DEPTH PRB. 4-7  
INTERS. (0=REG/1=IRR) 3-20, 3-37  
INTERSECTION 3-20, 3-37  
INTERSECTION HEIGHT 3-23, 4-3

## L

L.DIR.(X=1,Y=2,Z=3) 3-13  
LAST HEIGHT 3-13  
LENGTH 4-16  
Line select. 2-8  
LINE\_DIA.D 3-12

## M

Main program 1-4  
Measure ISO thread gauges according to DIN 13 4-5  
Measure single points 3-33  
Measure the position of threads 4-2  
Measurement of a bolthole circle 4-19  
Measurement of a line 3-14  
Measurement of a ring-shaped area 4-12  
Measurement of a slot 4-17

Measurement of a surface 3-11  
Measurement of an inner cone 3-21  
Measuring a 3D circle 4-11  
Measuring the effective diameter 4-7  
Measuring the thread pitch 4-9

## N

NM X- Y- Z-COORDINATE A1 A2 PROJ.  
ANGLE 3-4  
NO. OF INTERSECT. 3-19, 3-37, 4-17  
NO. OF POINTS 3-13  
NO. OF PRB. PTS. 3-8, 3-19, 4-3  
NO. OF THREADS 4-7  
NOM/ACT (0=N/1=Y) 4-25  
N-POINTTERM 4-24, 4-26  
npt 4-26  
NUMBER OF PTS. X / NUMBER OF PTS. Y 3-10  
Nut 4-3  
NV A1 PROJ. ANGLE / NV A2 PROJ. ANGLE 3-7  
NV D DIAMETER 4-3  
NV SELECTION ... (X Y Z D A1 A2) 3-6  
NV X-IDF, NV Y-IDF, NV Z-IDF, NV D IDF, NV A1 IDF, NV A2 IDF 3-7  
NV Z NOMINAL 3-10

## O

Outer circle 3-25  
Outer spheres 3-29  
OUTER=0/INNER=1 3-4, 4-10, 4-14

## P

Parameter Control Manager 1-2  
parameter-free 2-13  
Parameters 1-4  
PCM development system 1-3  
PCM dialog file 1-4  
PCM dialogs for combined elements 4-21  
PCM dialogs for special elements 4-2  
PCM generating run 2-13  
PCM measurement module 1-4  
PCM measurement module library 1-3  
PITCH CIRCLE DIA. 4-19  
Pitch measurement 4-9  
PITCH TOL +/- 4-7  
PLANE CODE NUMBER 3-4  
Point 3-34  
POINT\_DIA.D 3-33  
PRB VAR (1=V,0=M) 3-9, 3-13  
PRBDIR.(X=1,Y=2,Z=3) 3-13  
PROBE NO. 3-4  
Probe shaft 4-7  
PROBE SHAFT DIA./2 4-7

program systems not capable of PCM 2-13  
 Pronounced tilt of the geometric element 3-5  
 PX PY PZ (POINT NOT ON LINE) 3-13  
 PX PY PZ (POINT ON LINE) 3-13  
 PX PY PZ (REF. POINT ON THE SURFACE) 3-10

## R

Reference of the nominal values 3-5  
 RESULT NAME 3-4  
 RING GAUGE=1/PLUG GAUGE=0 4-6  
 RING\_SHAPED\_AREA\_DIA.D 4-9  
 Run in the CNC program 2-13

## S

SANNING\_RING-SHAPED AREA 4-13  
 Scanning a circle 3-28  
 Scanning a line 3-17  
 SCANNING\_LINE\_DIA.D 3-15  
 Scanning of a ring-shaped area 4-15  
 SCANNING\_CIRCLE\_DIA.D 3-26  
 SCANNING\_CIRCLE\_FILE\_DIA.D 3-26  
 SCANNING\_LINE\_FILE.DIA 3-15  
 Screw 4-3  
 Selecting the PCM measurement library 2-4  
 Shaft or borehole 4-10  
 SLOT\_DIA.D 4-16  
 SPACE\_CIRCLE\_DIA.D 4-9  
 Special elements 2-8  
 Special probe clusters with three probes 4-5  
 Special probe for thread measurement 4-5  
 SPEED 3-16, 3-27, 4-14  
 Sphere in 2 vertical circles 3-32  
 SPHERE\_6PT\_DIA.D 3-29  
 SPHERE\_DIA.D 3-29  
 Spherical calottes 3-29  
 Spherical segments 3-29  
 Standard circle 3-23  
 Standard cylinder 3-38  
 Standard sphere measurement with 6 probings 3-29  
 START ANGLE 3-8, 3-19  
 START ANGLE END ANGLE NO. OF PRB. PTS. 3-37  
 START ANGLE(+/-) 3-27, 4-14  
 START POINT X / Y END POINT X / Y 3-10  
 START VALUE I-POS 3-6  
 STEP SIZE 3-16, 3-27, 4-14  
 SUB.ZED 4-21

Subdialog file 4-21  
 SURFACE\_XY\_DIA.D 3-9  
 SURFACE\_YZ\_DIA.D 3-9  
 SURFACE\_ZX\_DIA.D 3-9  
 Switching on the name allocation 2-3  
 Switching on the PCM run mode 2-2

## T

Terminating the self-teach programming 2-10  
 THR. (0=LE,1=RI) 4-3  
 THR. (0=OU,1=IN) 1 4-3  
 THREAD GAUGE\_DIA.D 4-5  
 THREAD PITCH 4-3, 4-6  
 Thread pitch 4-5  
 Thread position with four-point measurement 4-4  
 THREAD\_POSITION\_DIA.D 4-2  
 Transferring PCM modules to the CNC program 2-9  
 TRAVEL ANGLE 4-14  
 TRAVEL ANGLE(+/-) 3-27, 4-14

## U

UMESS UX Option UX 09 1-3  
 UMESS UX Option UX 10 1-3  
 UT ... / LT ... 3-7

## V

Variables 1-4  
 Variant programming 1-3

## W

WIDTH 4-16  
 WP code 2-8

## Z

Z1 Zeiss cat. measurement module library 1-5, 2-6, 2-12  
 ZA Library dialog English 2-6, 2-8  
 ZA library dialog English 1-5  
 ZD Measurement library dialog German 1-5  
 ZD Messbibliothek Dialog Deutsch 2-6

