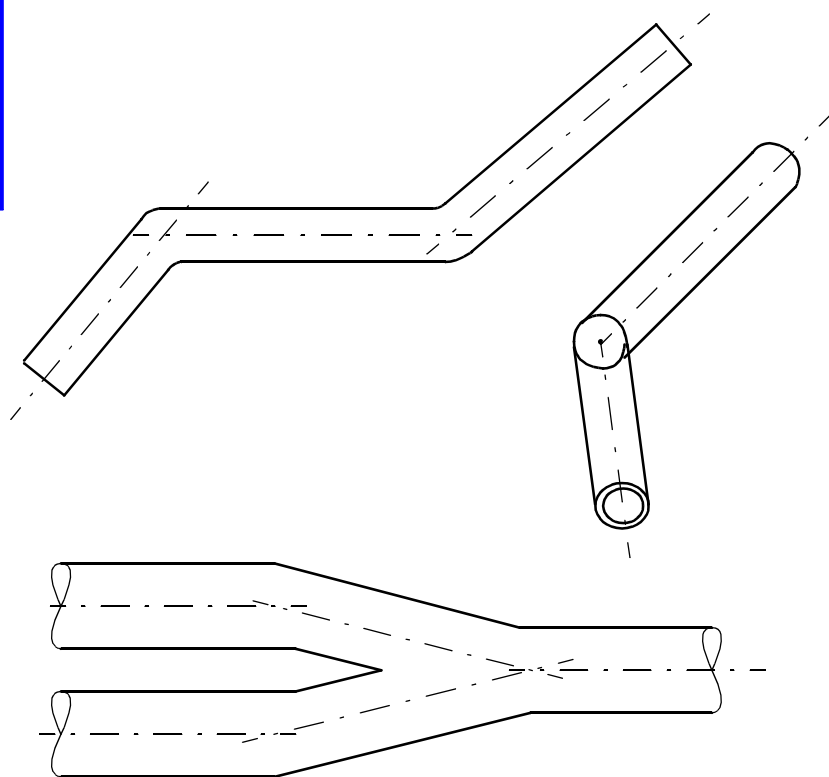


UMESS

Option 12 Pipe Measuring Program for UNIX and LINUX



Operating Instructions



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Carl Zeiss
Corporate Division
Industrielle Meßtechnik
D-73446 Oberkochen

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Preface

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

Principles in this operating manual

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

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

Typographic principles

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

- **bold face**
 - Dialog element on the screen
Example: "... the button <**TERMIN**>"
 - Term
Example: "During calculation the location of a **measuring element in relation to a reference element** is determined."
 - File and directory names
Example: **/home/zeiss/UB**
- *italic*
 - Highlighted text of which the contents are very important
Example: "Click with the *right* mouse button ..."
 - Cross reference
Example: "..., see also ► *"Typographic principles" on Page -3*"
- Courier
Program code, file contents
- **Courier bold face**
Text in dialog windows and records

Signs and symbols

Special signs and symbols are used in this manual.

Symbols for warnings and information



Danger!

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



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.



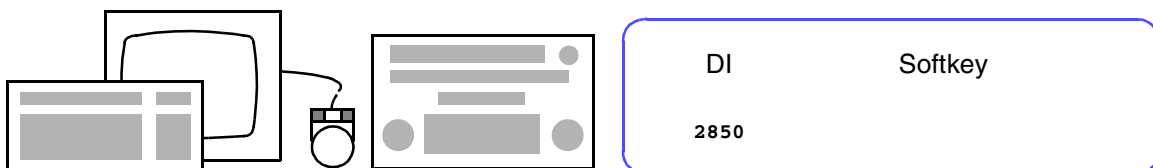
The **Note** symbol is shown next to important text and helpful additional information.

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:



Symbol for softkey

Reference to softkeys in dialogs.

Overview of chapters

This manual describes the function, operation and application possibilities of the UMESS Opt. 12 Pipe Measuring Program.

The following subjects are described:

- *“General” on Page 1-1*
- *“Measuring” on Page 2-1*
- *“Data input and evaluation” on Page 3-1*
- *“Correction of the nominals” on Page 4-1*

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Chapter



General

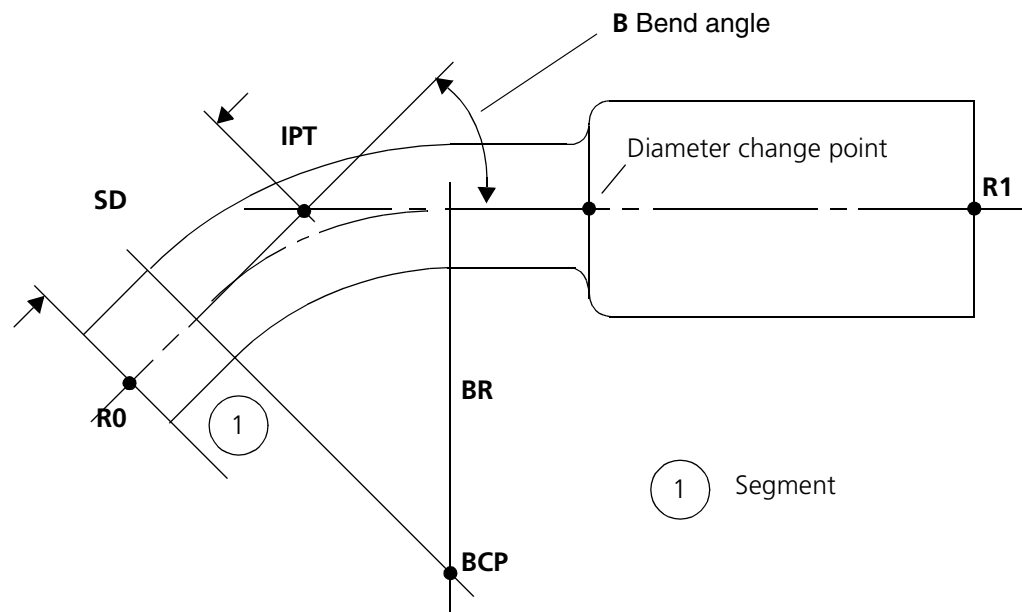
The pipe measuring program is used to measure the diameter and bend data of any bent pipes or round material without an alignment having to be made. Nominals can be entered manually using drawing data or generated by a master part.

The program can be used in manual and in CNC mode.

This chapter contains:

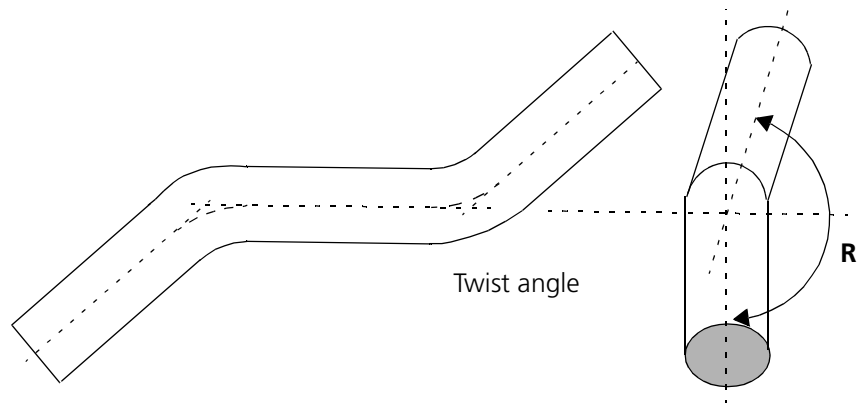
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Explanation of the terms

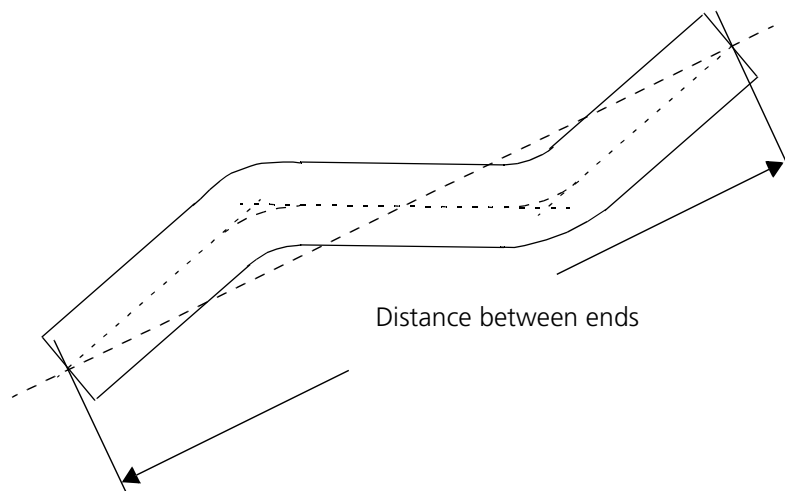


IPT	Pipe intersection points, formed by the intersection of two neighboring cylinder axes.
R0 and R1	Start and end point on the pipe. They are needed for calculating the entire pipe length.
BCP	Center points of the pipe turns (torus segments).
BR	Bend radius
SD	True cylinder lengths formed from the 3D distance of two neighboring pipe intersection points.
B	Bend angle, difference 3D angle between two neighboring pipe axes.

- R** The twist angle is calculated from three consecutive pipe sections: it is obtained by projection of the two outer pipe axes into the plane which is vertical to the center pipe section.



- Dist.btw.ends** 3D distance between the edge points **R0** and **R1**.



- Transport length T** Feed of the pipe between the two individual bend processes.
- LBB and LAB** Remaining length of the pipe before (LBB) and after bending (LAB).
- Bend radius BR** Determines the curve of the pipe in the pipe axis. It is output during the evaluation.
- Stretch factor** Material-specific value which is included in the calculation.
- Saw length** Raw length of the pipe before bending.

Measurement

Only the UMESS elements **POINT**, **INTERSECTION PT** or **CYLINDER** can be used for the measurements.

The start point (**POINT**, **CYLINDER**, **INTERSECTION PT**), cylinder with at least 6 points, change diameter points during the change of diameter, end point, have to be measured.

Evaluation

Call <DI 2800>

The following input masks are activated in succession

- **ROM-Enter address range**
Recall of the previously measured pipe elements in succession.
- **ROM-Enter general pipe data**
Input of the general pipe data.
- **ROM-Enter intersection point data**
Input of the nominals for the pipe intersection points.
- **ROM-Enter segment data**
Input of the nominals for the pipe segments.
- **ROM-Definition of protocol output**
Definition of pipe output.
- **ROM-Specify alignment (Type of deviation calculation)**
Determination of the pipe alignment
- Output of the pipe results on screen or printer.

Chapter

2

Measuring

A pipe which is to be inspected is measured segment by segment using the cylinder N-point program. A mathematical alignment is not necessary.

The pipe start is determined by the sequence of geometric elements **POINT** (edge point 0) and **CYLINDER**, the pipe end is determined by the sequence of geometric elements **CYLINDER** and **POINT** (edge point 1).

Diameter change points are marked by the geometric element **POINT**.

Instead of the **POINT program**, the penetration point **CYLINDER-SURFACE** can be used for the edge points 0 and 1 **<DI 1217>**. Otherwise the pipe measurement may only contain the elements **POINT**, **INTERSECTION POINT** and **CYLINDER**.

Chapter 3

Data input and evaluation

This chapter contains:

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ROM—Specify alignment (Type of deviation calculation)	3-8

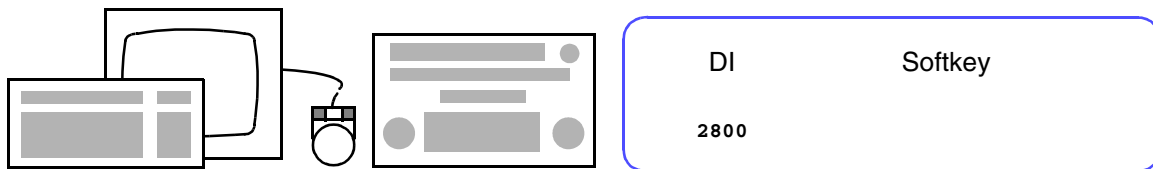
Introduction

Data input and evaluation refer to measured elements which have been gained in normal UMESS mode. Here you must make sure that the address ranges of the elements are arranged consecutively.

After terminating an input mask with **<TERMIN,>** the program branches into the subsequently displayed input mask.

ROM-Enter address range

Function call



Input mask

ROM-Enter address range

from address/name	to address/name	Step width
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	*	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> TERMIN
BACK <input type="text"/> <input type="text"/> <input type="text"/>		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> INFO

Input fields

from address/name

Enter name or address of the first element of a range to be recalled.

to address/name

Enter name or address of the last element of a range to be recalled.

Step width

Distance between the elements required within a range.

NOTE

Elements can be recalled from a maximum of eight ranges.

ROM-Enter general pipe data

After concluding the **ROM-Enter address range** input mask with **<TERMIN,>** the program branches to the following input mask.

ROM-Enter general pipe data

No. of intersection points

Comment on workpiece

Stretch factor

Should the actuals be accepted as nominals?

* YES

NO

*

TERMIN

BACK

INFO

Display/input fields

No. of intersection points	The number of intersection points is determined and displayed by the program using the specified address ranges. They cannot be changed.
Comment on workpiece	Here it is possible to enter a workpiece-related text.
Stretch factor	Material-specific value which is required for the pipe calculation.
Should the actuals be accepted as nominals?	<YES> When generating nominals using a master part. The nominal data are available after the first program run.

ROM–Enter intersection point data

After concluding the **ROM-Enter general pipe data input mask** with **<TERMIN,>** the program branches to the following input mask.

ROM-Enter intersection point

Inters. point No.

Type of inters. pt.

(0 = Edge point; 1 = Pipe intersection point;
2 = Pipe diam.ch.pt.
3 = Diameter change point)

Tolerance sph. rad.

	Nominal	U Tol	L Tol
Inters. point X	0.0000	0.0000	0.0000
Y	0.0000	0.0000	0.0000
Z	0.0000	0.0000	0.0000
Bend. angle BA	0.0000	0.0000	0.0000
Bend. radius BR	0.0000	0.0000	0.0000

* YES

NO

*

TAB NEXT

TERM LIN

TERMIN

BACK

TAB PREV

INFO

Softkeys

TAB NEXT

Selection of data of the next intersection point (the first intersection point has the code number 0).

TAB PREV

Selection of the previous intersection point.

TERM LIN

Transfer of the data of an intersection point.

Display/input fields

Intersection point No.

Display of the intersection point for which data is to be specified

Type of inters. pt.

Specification of the code for the evaluation.

Tolerance sph. rad.

Specification of the tolerance zone for the permissible position of the intersection points according to the best fit.

Intersection point/
Bend. angle/
Bend. radius

Specification of the nominals and tolerances for each intersection point. If the nominals have been specified based on a master part, only the tolerances can be entered here.

ROM-Enter segment data

After concluding the **ROM-Enter intersection point data** input mask with <TERMIN> the program branches to the following input mask.

ROM-Enter segment data			
Segment No.			
	Nominal	U Tol	L Tol
Diameter D	0.0000	0.0000	0.0000
Length SD	0.0000	0.0000	0.0000
Twist angle R	0.0000	0.0000	0.0000
* YES	NO		
		* TAB NEXT	
		TERM LIN	
		TERMIN	
BACK		TAB PREV	
		INFO	

Softkeys

TAB NEXT

Selection of data of the next segment.

TAB PREV

Selection of the previous segment.

TERM LIN

Transfer of the data of a segment.

Display/input fields

Segment No.

Display of the number of the segment for which nominals are to be entered.

Diameter D
Length SD, Twist angle R

The pipe diameter **D** is to be entered with the tolerances. The nominals are calculated for the pipe length **SD** and the twist angle **R**. Only the tolerances can be specified here.

ROM-Definition of protocol output

After concluding the **ROM-Enter segment data** input mask with **<TERMIN>** the program branches to the following input mask.

ROM-Definition of protocol output

Evaluation:

Tolerance inters. pt. evaluation spherical
or cylindrical

Execute edge point correction

Pipe length for first edge point
Pipe length for second edge point

Output:

Pipe intersection points
Bending parameters

* YESNO

*

TERMIN

BACK

INFO

Input fields

Tolerance inters. pt.
evaluation spherical or
cylindrical

The form of the tolerance zone for the intersection points can be selected for the best fit according to all nominals.

Execute edge point
correction

<YES>
If the pipe ends project, the actual edge points are corrected by specifying the pipe lengths for R0 and R1.

Output: Pipe
intersection points/
Bending parameters

Selection of the data to be output in the record.

ROM-Specify alignment (Type of deviation calculation)

After concluding the **ROM-Definition of protocol output** input mask with **<TERMIN,>** the program branches to the following input mask.

ROM-Specify alignment (Type of deviation calculation)			
Current workpiece system from UMESS			
Best fit according to three nominals			
		1st point : No.	
		2nd point : No.	
		3rd point : No.	
Best fit according to all nominals			

* YES	NO		*				TERMIN
BACK							INFO

Input fields

Current workpiece system from UMESS

<YES>

The pipe is not aligned. This variant must be selected if the pipe data is integrated in an existing workpiece.

Best fit according to three nominals

<YES>

If individual pipe sections have large deviations. When aligning the pipe according to three dimensionally stable points, the deviations of the other sections can be judged better.

Best fit according to all nominals

<YES>

This is the standard method of the best fit. Here the actual points are fitted so that their deviation is a minimum to the nominal position. Using the edge point correction, an adulteration of the best fit is avoided if the pipe ends project. Using the specified tolerance cylinder or tolerance sphere, it is checked whether the best fit points lie within the specified tolerance zone.

After concluding this input mask, the results are output in a program run.

Examples for output

Example 1

Output of the pipe section points

```

                                P I P E   E V A L U A T I O N

Remarks      :
Alignment    :  Acc. to all nominals
40          3D FIT      X      .3625
                      Y      -.1593
                      Z      .0000
                SPACE    W      .0000
                PLANE    W      .0071

STRETCH FACTOR      =      1.0000
=====
41      INT PT IPT 0 X      -.3625      .0000      .5000      -.5000      -.3625
                      Y      .1593      .0000      .5000      -.5000      .1593
                      Z      .0000      .0000      .5000      -.5000      .0000
                      B      .0000      .0000      .0000      .0000      .0000
                      BR     .0000      .0000      .0000      .0000      .0000
42      SEGMENT SEG 1 RD  100.1746    100.0000      .5000      -.5000      .1746
                      D      20.0000    20.0000      .2000      -.2000      .0000
                      V      .0000      .0000      .0000      .0000      .0000
43      INT PT IPT 1 X      99.8121    100.0000      .5000      -.5000      -.1879
                      Y      .1635      .0000      .5000      -.5000      .1635
                      Z      .0000      .0000      .5000      -.5000      .0000
                      B      44.9001    45.0000      .5000      -.5000      -.0999
                      BR     50.0000    50.0000      .5000      -.5000      .0000
44      SEGMENT SEG 2 RD  99.8611     98.9949      .5000      -.5000      .8661
                      D      20.3965    20.0000      .2000      -.2000      .3965
                      V      .0000      .0000      .0000      .0000      .0000
45      INT PT IPT 2 X      170.5504    170.0000      .5000      -.5000      .5504
                      Y      -70.3228    -70.0000      .5000      -.5000      -.3228
                      Z      .0000      .0000      .5000      -.5000      .0000
                      B      .0000      .0000      .0000      .0000      .0000
                      BR     .0000      .0000      .0000      .0000      .0000
=====
DIST.BTW.ENDS      184.8755    183.8478      1.0278
=====
BEST FIT IN TOLERANCE SPHERES

Intersec.pt.    Nom/Act. Diff      tR
0              .396      10.0000
1              .249      10.0000
2              .638      10.0000

MEAN DEVIATION =      .4277
=====

```

Example 2

Output of the bend parameters

```

                                P I P E   E V A L U A T I O N

Remarks      :
Alignment    :  Acc. to all nominals
  40         3D FIT      X      .3625
                   Y      -.1593
                   Z      .0000
                SPACE    W      .0000
                PLANE    W      .0071

STRETCH FACTOR      =      1.0000
=====
                                P I P E   B E N D I N G   P A R A M E T E R S
=====
NO      T      R      B      BR      LBB      LAB
START  -117.5542
  1      79.2893      .0000      45.0000      50.0000      117.5542      78.2843
  2      78.2843      .0000      .0000      .0000      .0000      .0000
=====
STRETCH FACTOR      =      1.0000
TOTAL STRETCH      =      .0000
SAW LENGTH      =      196.8435
STRETCHED LENGTH  =      196.8435
DIST.BTW.ENDS    =      183.8478
=====

```

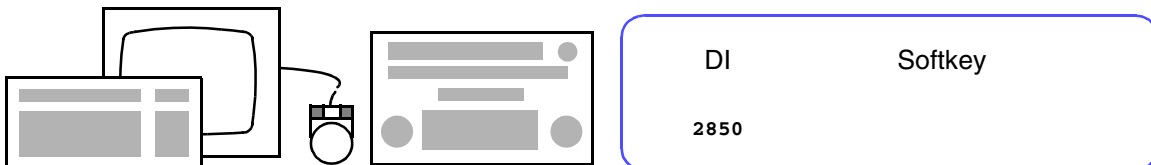

Chapter

4

Correction of the nominals

The nominals can be changed after the first program run. As with the data input, the input masks are run through in succession. In the **ROM-Enter intersection point data** input mask, the entered nominals can be adapted.

Function call



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