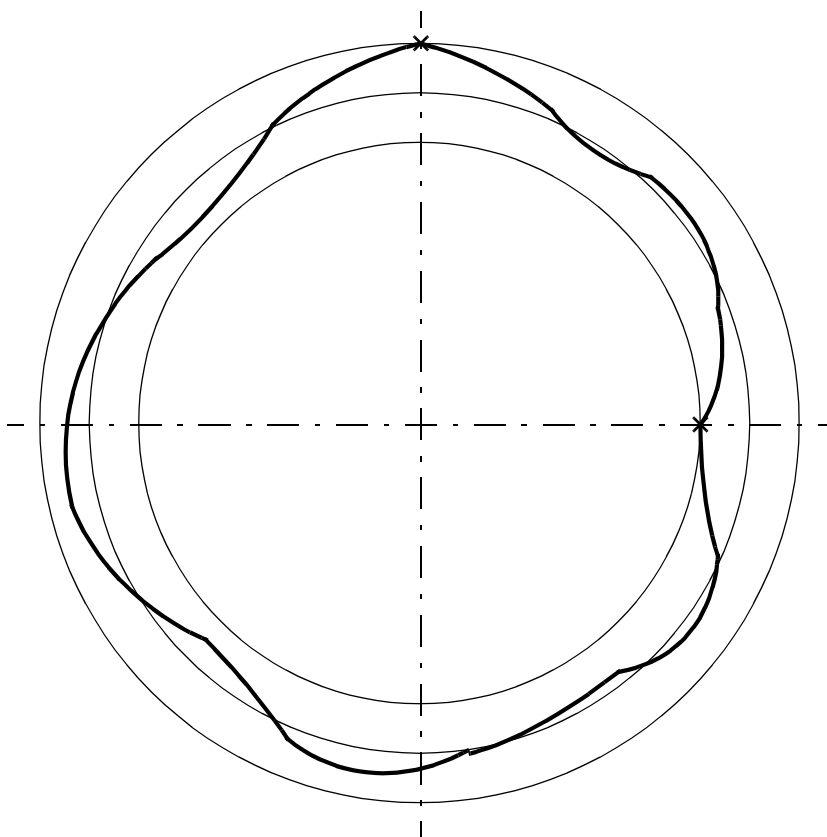


UMESS

Option 2 Extended form and position inspection



Operating Instructions



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Preface

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

Principles in this operating manual

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

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

Typographic principles

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

- **bold face**
 - Dialog element on the screen
Example: "... the button <**TERMIN**>"
 - Term
Example: "During calculation, the location of a **measuring element** in relation to a **reference element** is determined."
 - File and directory names
Example: **/home/zeiss/UB**
- *italic*
 - Highlighted text of which the contents is very important
Example: "Click with the *right* mouse button ..."
 - Cross reference
Example: "..., see also ► *"Roundness plot" on page 2-9*"
- 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.



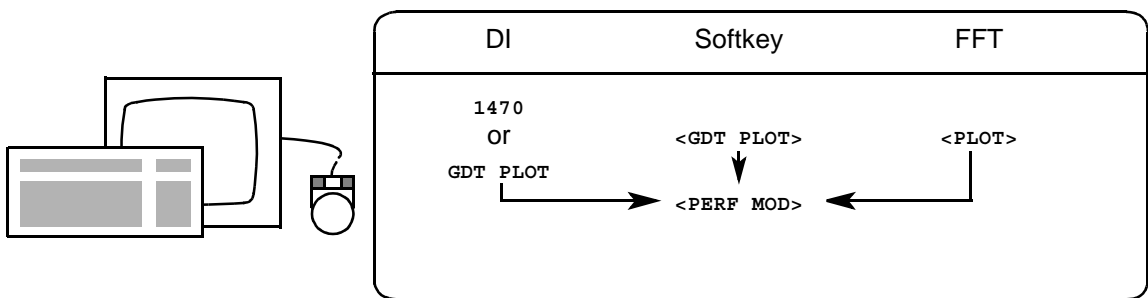
The **Note** symbol is shown next to important text and helpful additional information.

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 measuring program UMESS Opt.2.

The following subjects are described:

- *"Mode setting for graphics output devices" on page 1-1*
- *"Graphic evaluation of form deviations" on page 2-1*
- *"GDT plot performance modes" on page 3-1*
- *"2D Bore pattern best fit" on page 4-1*

Direct input functions

| DI no. | Input abbrev. | Function | Description |
|--------|---------------|--|--------------------------|
| 1625 | | Mode setting for graphics output devices | ➤ Page 1-2 |
| 1470 | | GDT plot request Setting of GDT plot performance mode | ➤ Page 2-3 ➤ Page 3-3 |
| 1461 | | Request for fast plot | ➤ Page 2-7 |
| 1652 | | Paper change | ➤ Page 2-2 |
| 1159 | | Fit bore pattern | ➤ Page 4-4 |

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| | |
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Chapter

1

Mode setting for graphics output devices

This chapter contains:

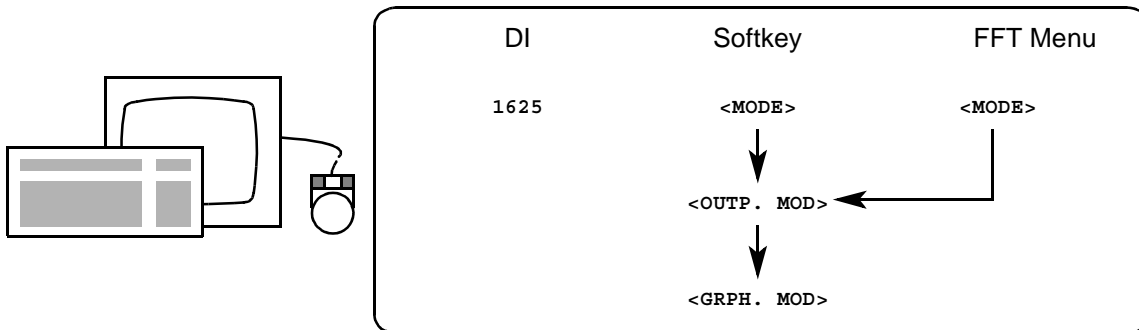
| | |
|--|------|
| Function call (DI 1625) | 1-2 |
| Listing the graphics output mode (LIST) | 1-4 |
| Configuration of a graphics output (CONFIG). | 1-5 |
| Activating/deactivating plot output device/plot format | 1-9 |
| Checking operational readiness/ initializing the plot output device (INIT) | 1-12 |

Function call (DI 1625)

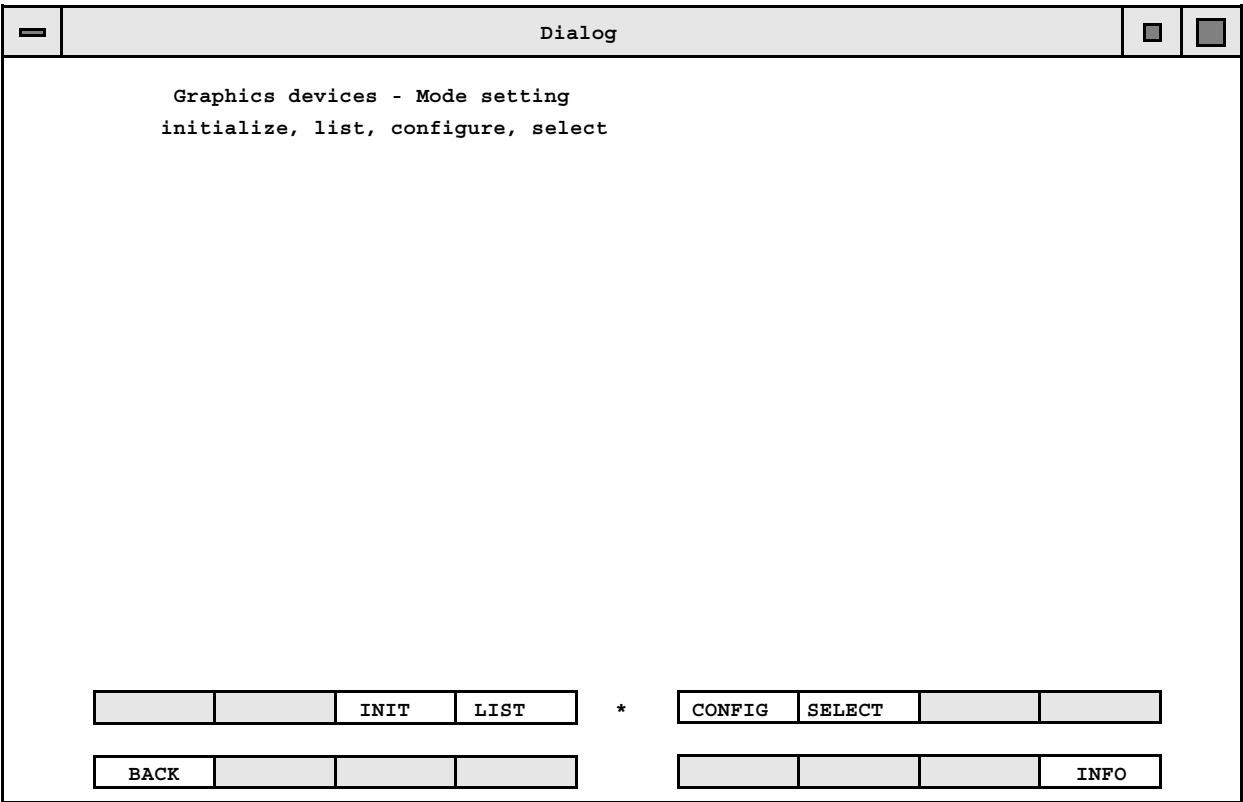
<DI 1625> must be called to

- Activate or switch off plot output device(s),
- Set or modify plot formats,
- Initialize plot output devices
- List current settings

The current setting, your graphics output mode, remains unchanged. It remains valid for every plot requested until you set a new mode with < DI 1625>.



Dialog window



Softkeys



Used to initialize activated devices (▶ *“Checking operational readiness/ initializing the plot output device (INIT)” on page 1-12*).



Used to list current graphics output mode (▶ *“Listing the graphics output mode (LIST)” on page 1-4*).



Used to change graphics output mode (e.g. entering other plot formats, ▶ *“Configuration of a graphics output (CONFIG)” on page 1-5*).



Used to select output device(s)/format(s) or switching off the output device/format no longer required (▶ *“Activating/deactivating plot output device/plot format” on page 1-9*).



Used to return to current menu, current setting becomes/remains effective.



Used to list further information.

Listing the graphics output mode (LIST)

This softkey lists the current graphics output mode on the given output device (printer, monitor).

Example of output:

| No. | ACT | LU | WSP program name | Xmin | Xmax | Ymin | Ymax |
|-----|-----|----|------------------|------|-------|------|-------|
| 1 | * | 1 | GRAPHICS WINDOW | 0.0 | 340.0 | 0.0 | 270.0 |
| 2 | | 2 | GRAPHICS | 0.0 | 380.0 | 0.0 | 280.0 |
| 3 | | 3 | LASERJETIII | 0.0 | 265.0 | 0.0 | 195.0 |
| 4 | | 4 | PLOTTER1_A4 | 0.0 | 270.0 | 0.0 | 190.0 |
| 5 | | 5 | PLOTTER1_A4 | 0.0 | 270.0 | 0.0 | 190.0 |
| 6 | | 6 | PLOTTER2_A4 | 0.0 | 270.0 | 0.0 | 190.0 |
| 7 | | 7 | PLOTTER2_A3 | 0.0 | 395.0 | 0.0 | 270.0 |
| 8 | | 8 | PLOTTER2_L_A3 | 0.0 | 550.0 | 0.0 | 395.0 |

Interpretation

No.

Current device or format number.

ACT

Specifies which device or format is activated (activate-deactivate with **< SELECT >** *"Activating/deactivating plot output device/plot format" on page 1-9*). The graphics window of the screen shown in the example is activated.

NOTE

If several output devices are activated simultaneously, a plot corresponding to the parameters takes place only on the device with the lowest number. See information in **>** *"Activating/deactivating plot output device/plot format" on page 1-9*.

LU

Internal code number

WSP program name

Name of device/format; for explanation see **>** *"Configuration of a graphics output (CONFIG)" on page 1-5*.

Xmin,Ymin,Xmax,Ymax

Size of device field in millimeters where you can position the plot; for explanation, see **>** *"Configuration of a graphics output (CONFIG)" on page 1-5*.

Function call

LIST

> *"Function call (DI 1625)" on page 1-2, <LIST> softkey.*

Configuration of a graphics output (CONFIG)

This function is used to set/change the graphics output mode.

Application examples

- Change of plotter format.
- Definition of several formats for a plotter which can be selected as required.

NOTE

This function allows only editing of parameters. You must use **< SELECT >** to switch a device or format on/off.

Function call

CONFIG

► "Function call (DI 1625)" on page 1-2, **<CONFIG>** softkey.

Dialog window

| Dialog | | | | | | | |
|-----------------------------------|---|----|------------------|------|-------|------|-------|
| Configuration of graphics devices | | | | | | | |
| Device No | ? | LU | WSP program name | Xmin | Xmax | Ymin | Ymax |
| 1 | * | 1 | GRAPHICS WINDOW | 0.0 | 340.0 | 0.0 | 270.0 |
| 2 | | 2 | RECORD GRAPHICS | 0.0 | 380.0 | 0.0 | 280.0 |
| 3 | | 3 | LASERJETIII | 0.0 | 265.0 | 0.0 | 195.0 |
| 4 | | 4 | PLOTTER1_A4 | 0.0 | 270.0 | 0.0 | 190.0 |
| 5 | | 5 | PLOTTER1_A3 | 0.0 | 395.0 | 0.0 | 270.0 |
| 6 | | 6 | PLOTTER2_A4 | 0.0 | 270.0 | 0.0 | 190.0 |
| 7 | | 7 | PLOTTER2_A3 | 0.0 | 395.0 | 0.0 | 270.0 |
| 8 | | 8 | PLOTTER2_L_A3 | 0.0 | 550.0 | 0.0 | 395.0 |

| | | | | | | | | |
|-------|----------|--|--|---|--|--|--|--------|
| * YES | NO | | | * | | | | TERMIN |
| BACK | PRE MENU | | | | | | | INFO |

Softkeys

YES

Column ?: Select current line to change entries (* is entered in the ? column).

In the other columns: Acceptance of value displayed in highlighted field.

NO

Column ?: Cursor jumps to next line, any * entered is deleted.

In the other columns: Not activated.

TERMIN

Closes dialog window, implements changes entered and returns to dialog window for setting modes of graphics output devices.

BACK

Returns to dialog window for setting modes of graphics output devices without implementing changes.

INFO

More information.

Input fields

*

Enter an * behind the device number to be changed (enter with **<* YES>** or type in).

LU

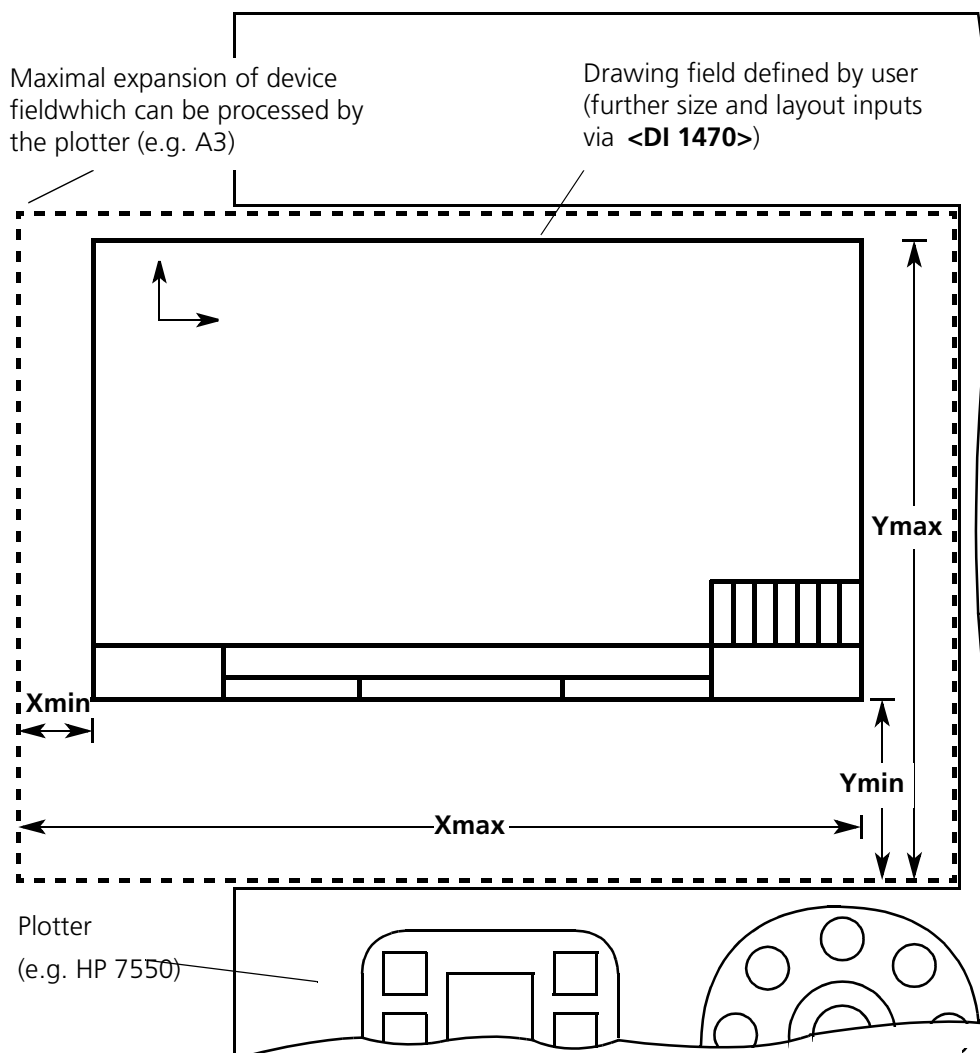
Not an input field, only display of codes set by the manufacturer.
Do not modify!

WSP program name

If you want, you can change the device/format names predefined by the manufacturer. Example in illustrated dialog box: Under nos. 4 and 5, two formats have been defined for plotter 1 which you can activate as required with **<SELECT>**.

Xmin, Ymin, Xmax,
Ymax

Used to define size and expansion of device field (fig. on next page).
You can position the plot within this device field (► *"Explanation of terms for GDT plot performance mode" on page 3-29*).



NOTE

- The maximum formats permissible for $X_{max} \times Y_{max}$ on the HP 7550 plotter are:
 - DIN A 3: 395.0 mm x 270.0 mm;
 - DIN A 4: 270.0 mm x 190.0 mm.
- Normally $X_{min}, Y_{min} = 0$. For special applications, you may set $X_{min}, Y_{min} > 0$. In this case, use a performance mode with **DEVICE FIELD FROM SYSTEM DATA = *** (set in **PLOT FORMAT**, > "Plot format" on page 3-6, dialog window).
- If a graphics output device occurs several times in an input mask, you can define and store as many formats as required for this device. Of course you can then activate only one of these formats with <SELECT>.

Operation

Use the cursor keys \vee and \wedge or **<Return>** or **<NO>** to select the line (device no.) to be changed. Activate device format required with **<YES>** (if * appears in the column?, your entry can be typed in). Only the line selected with * can be edited.

The program then offers the remaining fields of the selected line for acceptance/editing. Do not change the LU column. Confirm each input with **<Return>**, select individual fields with the \vee and \wedge cursor keys. After stepping through all fields, the cursor jumps to the ? column of the next device no., where a new device no. can be selected.

Close the dialog box: With **<TERMIN>** you activate the changes you have made or with **<BACK>** you retain the previous status.

Activating/deactivating plot output device/plot format

This softkey is used to switch plot output devices or plot formats on/off. Each plot requested appears on the device(s) or in the format(s) last activated with **< SELECT >**.

Application examples

- Selection from various previously entered and fixed plot formats.
- Selection of various output devices connected (e.g. plotter, printer, or graphics window) in order to e.g. check a plot on the screen or printer before plotting it.
- Simultaneous output of a plot on various output units (e.g. monitor or plotter).

NOTE

If several output devices are activated simultaneously, a plot corresponding to the parameters takes place only on the device with the lowest number. On the other devices the plot is enlarged/reduced in all details (e.g. type), regardless of the parameters defined.

If a plot is to be executed in different sizes complying with the parameters, first activate the corresponding device with **<SELECT>**; then restart the plotting process.

Function call

SELECT

➤ "Function call (DI 1625)" on page 1-2, **<SELECT>** softkey.

Dialog window

| Configuration of graphics devices | | | | | | | |
|-----------------------------------|---|----|------------------|------|-------|------|-------|
| Device No. | ? | LU | WSP program name | Xmin | Xmax | Ymin | Ymax |
| 1 | * | 1 | GRAPHICS WINDOW | 0.0 | 340.0 | 0.0 | 270.0 |
| 2 | | 2 | RECORD GRAPHICS | 0.0 | 380.0 | 0.0 | 280.0 |
| 3 | | 3 | LASERJETIII | 0.0 | 265.0 | 0.0 | 195.0 |
| 4 | | 4 | PLOTTER1_A4 | 0.0 | 270.0 | 0.0 | 190.0 |
| 5 | | 5 | PLOTTER1_A3 | 0.0 | 395.0 | 0.0 | 270.0 |
| 6 | | 6 | PLOTTER2_A4 | 0.0 | 270.0 | 0.0 | 190.0 |
| 7 | | 7 | PLOTTER2_A3 | 0.0 | 395.0 | 0.0 | 270.0 |
| 8 | | 8 | PLOTTER2_L_A3 | 0.0 | 550.0 | 0.0 | 395.0 |

| | | | | | | | | |
|-------|----------|--|--|---|--|--|--|--------|
| * YES | NO | | | * | | | | TERMIN |
| BACK | PRE MENU | | | | | | | INFO |

Softkeys

* YES

Used to activate the device/format marked by the cursor (an * is entered in the ACT column). Then move the cursor to the next line.

NO

Used to deactivate or reject the device/format (if an * was entered, it must be deleted). Then move the cursor to the next line.

TERMIN

Used to close the dialog window and accept all entries and then return to the **Graphics devices - Mode setting** dialog window.

BACK

Used to return to the **Graphics devices - Mode setting** dialog window without accepting the changes entered.

INFO

More information.

ACT

Input fields

- Enter for the device/format to be activated (by selecting **<* YES>** or typing in the entry).
- Delete for the device/format to be deactivated (by selecting **<* NO>**).

The remaining columns are used only for information. For editing use **Configuration of graphics devices** ➤ *“Configuration of a graphics output (CONFIG)” on page 1-5.*

Operation

Use the cursor keys \downarrow and \uparrow or **<Return>** or **<NO>** to select the line (device no.) to be changed. Activate the desired device/format with **<YES>**. Deactivate device/format no longer required with **< NO>** (* is deactivated in ACT column).

Close the dialog box: By pressing **<TERMIN>** to accept altered device selection. **<BACK>** to retain the previous status.

Checking operational readiness/ initializing the plot output device (INIT)

UMESS normally initializes the output device selected automatically.
<INIT> informs you of the initialization status prior to a plot output or after an unsuccessful plot attempt.

Application examples

- To check operational readiness of activated plot devices following initial connection, copying of new software, and/or longer periods of disuse.
- To determine the causes of a fault following an unsuccessful plot attempt (status message, fault no.).

If an error message appears, correct the fault and repeat initialization.

Function call

INIT

➤ "Function call (DI 1625)" on page 1-2, <INIT> softkey.

Chapter

2

Graphic evaluation of form deviations

You can plot, i.e. graphically display, the form deviation of a geometric element (e.g. a circle) after it has been measured.

This chapter contains:

| | |
|--|------|
| How to plot | 2-2 |
| Requesting GDT plots | 2-3 |
| Roundness plot | 2-9 |
| Straightness plot with plane tolerance | 2-12 |
| Straightness plot with cylindrical tolerance | 2-14 |
| Flatness plot. | 2-16 |
| Cylindricity plot | 2-18 |
| Plot form | 2-20 |
| Linear plot from circle segment measurements (<CIRCSEG>) . . . | 2-21 |

How to plot

- Scan the element of interest or perform individual probings. When using individual probings, keep the measuring direction selected during the measurement, as the plot connects the probing points with lines in the order they occur.
- If necessary, activate the plot output device(s) with **<DI 1625>** and/or define the plot format(s) (➤ *“Mode setting for graphics output devices” on page 1-1*).
- If the existing or supplied GDT plot performance modes are not suitable: define another plot performance mode (➤ *“General and procedure” on page 3-2*).
- Request plot (➤ *“Requesting GDT plots” on page 2-3*).

NOTE

You can always plot only the last element measured. Recall of or reference to previous addresses is not possible.

- Paper change is not performed automatically after a GDT plot. This function must be activated explicitly by means of **<DI 1652>**. If the plot is output to a plotter page, the plot only appears after this DI.

Examples for GDT plots: ➤ *“Creating/changing performance modes” on page 3-4*.

Requesting GDT plots

GDT plot

There are two ways to request GDT plots:

With **<DI 1470>** you can request GDT plots for which additional inputs appropriate for the given geometric element can be made, [▶ “Requesting GDT plots \(DI 1470\)” on page 2-3.](#)

Fast plot

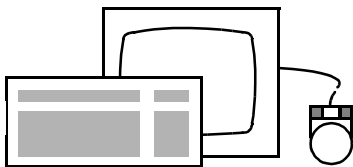
Using **<DI 1461>** you can request GDT plots which will then be executed immediately without additional inputs, [▶ “Requesting fast plots \(DI 1461\)” on page 2-7.](#)

Requesting GDT plots (DI 1470)

After measuring a geometric element, you can request the corresponding GDT plot and the forms. There is a special menu page for each geometric element in which inputs have to be made.

With this function you can also edit and administer plot performance modes, [▶ “GDT plot performance modes” on page 3-1.](#)

Prerequisites for plotting and general procedure, [▶ “How to plot” on page 2-2.](#)



| DI | Softkey | FFK |
|------------------------|------------|--------|
| 1470 OR GDT PLOT | <GDT PLOT> | <PLOT> |

NOTE

With **<DI 1470>** the graphics are output on the screen. The graphics will be output on your plotter or graphics-capable printer only if you call up “paper change” command **<DI 1652>**.

Dialog window

GDT plot
Select task

| | | | | | | | | |
|----------|----------|-----------|----------|---|---------|----------|----------|--------|
| CONTACTP | | ROUNDNESS | STR PLAN | * | STR CYL | FLATNESS | CYLINDER | TERMIN |
| BACK | PERF MOD | FORM | | | CIRCSEG | A-LINEAR | | INFO |

Softkeys

- | | |
|------------------|--|
| ROUNDNESS | Starts roundness plot, (▶ <i>"Roundness plot" on page 2-9</i>). |
| STR PLAN | Starts straightness plot with tolerance set by two parallel planes, (▶ <i>"Straightness plot with plane tolerance" on page 2-12</i>). |
| STR CYL | Starts straightness plot with cylindrical tolerance zone, (▶ <i>"Straightness plot with cylindrical tolerance" on page 2-14</i>). |
| FLATNESS | Starts flatness plot, (▶ <i>"Flatness plot" on page 2-16</i>). |
| CYLINDER | Starts cylindricity plot, (▶ <i>"Cylindricity plot" on page 2-18</i>). |
| TERMIN | Used to return to previous menu. |
| BACK | |

| | |
|-----------------|---|
| PERF MOD | Used to enter, edit and administer GDT plot performance modes, (➤ <i>"Main menu GDT plot performance mode"</i> on page 3-4). |
| FORM | Calls up plot form without entering results, e.g. as print format for form, (➤ <i>"Plot form"</i> on page 2-20). |
| CIRCSEG | Linear plot from circle segment measurements (< CIRCSEG >, < DI 1114 >), ➤ <i>"Linear plot from circle segment measurements (<CIRCSEG>)"</i> on page 2-21. |
| CONTACTP | Used to fit plot for circle in curve, < DI 1168 >. |
| A-LINEAR | General linear plot, < DI 1470 >. |

Example

Linear plot of the radial minimum and maximum values of <**DI 1190**>
 Call up <**DI 1470**> softkey <**A-LINEAR**>
 Then, the page **Linear plot: Radii measurement** appears.

| | | | | | | | | | | | |
|--------------------------------|--|----|--|--------|--|----------|--|--|--|--------|--|
| Dialog | | | | | | | | | | | |
| Linear plot: Radii measurement | | | | | | | | | | | |
| Performance mode name | | | | CZ_RAD | | Comments | | | | | |
| With form ? | | | | * | | | | | | | |
| Designation | | | | | | | | | | | |
| Nominal dimension | | | | 0.0000 | | | | | | | |
| upper tolerance | | | | 0.0000 | | | | | | | |
| lower tolerance | | | | 0.0000 | | | | | | | |
| Dispersion classes | | | | 8 | | | | | | | |
| Magnification | | | | 2000 | | | | | | | |
| YES | | NO | | | | * | | | | TERMIN | |
| BACK | | | | | | | | | | INFO | |

Then, enter the addresses to be plotted in page **Recall several elements**.

Dialog

Recall several elements

from address/name

1

to address/name

28

step size

1

1

1

1

1

1

1

1

1

*

TERMIN

BACK

INFO

The symbol to be plotted is entered in page **Select symbol**.

Dialog

Calculate minimum

Result name

MIN_1

Minimum of

x values

y values

z values

D values

D2 values

A1 values

A2 values

Ac values

YES

NO

*

TERMIN

BACK

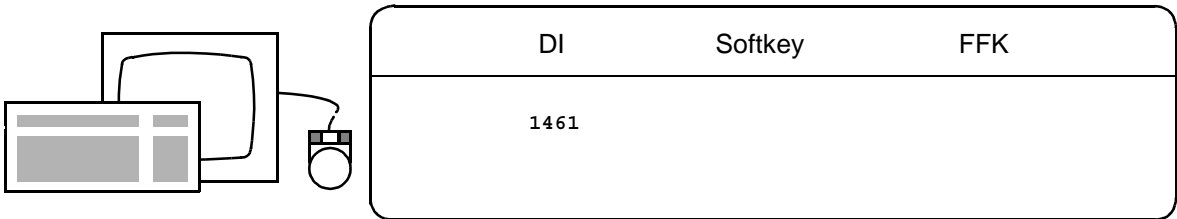
INFO

Output on plotter or graphics-capable printer

To plot the graphics with your plotter or print them with your graphics-capable printer, first execute <DI 1470> and then DI 1652 for <paper change>.

Requesting fast plots (DI 1461)

After measuring a geometric element, you can request the corresponding GDT plot as fast plot. Following the function call, the fast plot will be executed immediately, i.e. no further inputs are required.



The type of fast plot depends on the geometric element:

| | |
|-----------------|--|
| Circle | Roundness plot |
| Line | Straightness plot with plane 2D tolerance zone |
| Surface | Flatness plot |
| Cylinder | Cylindricity plot |
| Cone | Cylindricity plot |

For certain input values, the general preassignments for the screen pages are used:

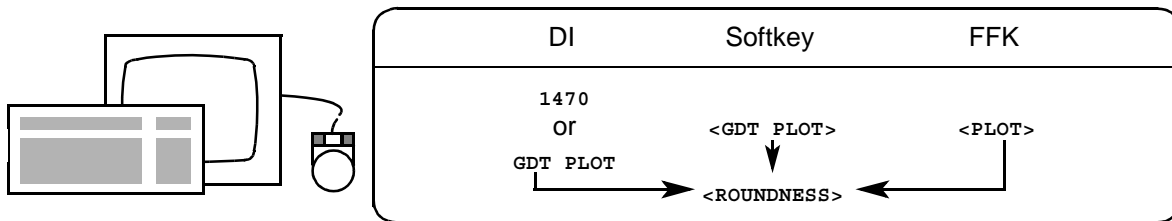
| | |
|------------------------------|--|
| Performance mode name | The performance mode name last used for the given geometric element is used. |
| With form | Yes |
| Identification | None |
| Nom. tolerance | Corresponds to current actual tolerance |
| Dispersion class | 8 |

Special preassignment for

| | |
|---|--|
| Straightness plot | Straightness plane tolerance zone |
| Tolerance plane during measurement | In probing direction |
| Tolerance plane for recall | In X for XY plane In Y for YZ plane |
| Flatness plot | Output of all points: Yes No. of grids: 2 |
| Cylindricity plot | No. of surface lines: 6 |

Roundness plot

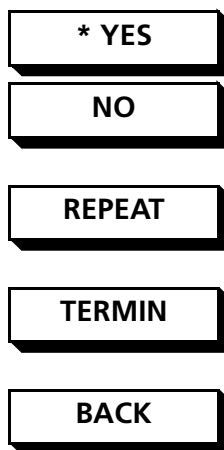
Request for a graphic roundness evaluation on the current plot output device(s). The element measured last must allow such an evaluation (e. g. <CIRCLE>). ➤ "Plot parameters for roundness" on page 3-25.



Dialog window

| Dialog | | | | | | | | | |
|---|--|---------|--|---|--|--|--|--|--|
| PERF M. NAME | | CZ_RUND | | COMMENT | | | | | |
| WITH FORM | | ? * | | | | | | | |
| ELEMENT ADDRESS | | 78 | | | | | | | |
| IDENTIFICATION | | | | | | | | | |
| T-NOM | | 0.1000 | | | | | | | |
| DISPERSION CLASSES | | 4 | | | | | | | |
| MAGNIFICATION | | 1876 | | | | | | | |
| <div> <div>* YES</div> <div>NO</div> <div></div> <div></div> </div> | | | | <div> <div>*</div> <div></div> <div></div> <div>REPEAT</div> <div>TERMIN</div> </div> | | | | | |
| <div> <div>BACK</div> <div></div> <div></div> <div></div> </div> | | | | <div> <div></div> <div></div> <div></div> <div>INFO</div> </div> | | | | | |

Softkeys



Acceptance/refusal of YES/NO field currently highlighted (<YES> = input of *).

Cancels or "undoes" changes (resets inputs to their original status).

Closes dialog window and saves changes, executes plot and returns program control to previous menu.

Cancellation followed by return to **GDT PLOT** dialog window.

Input fields

PERF M. NAME

Enter appropriate performance mode supplied (➤ *"Performance modes supplied" on page 3-3*) or one of your own plot performance standards, (➤ *"Main menu GDT plot performance mode" on page 3-4*).

COMMENT

Not an input field, only display of the comment entered when the performance mode was created.

WITH FORM

- <YES>
Form still must be created.
- <NO>
Form rejected, e.g. because you are using preprinted forms to save time.

ELEMENT ADDRESS

Only the points of the element measured last can be plotted. Its address is the default value. This address yields a plot of the form deviations. You can also plot the points in reference to another element and then obtain e.g. a concentricity plot.

IDENTIFICATION

You can assign a name to the result (max. 6 characters long) which then will appear on the plot.

T-NOM

Enter nominal value for tolerance. The corresponding tolerance zone will then be plotted after which the actual value of the form deviation will be offered.

You can deactivate the tolerance zone plot via T-NOM. If you do not want to have the tolerance zone plotted for the roundness plot, (➤ *"Roundness plot" on page 2-9*), the straightness plot with plane tolerance (➤ *"Straightness plot with plane tolerance" on page 2-12*) or the cylindricity plot, (➤ *"Cylindricity plot" on page 2-18*) you must enter a negative numeric value under T-NOM. A minus sign (-) will then be entered in brackets under T-NOM on the plot.

DISPERSION CLASSES

Specify the number of dispersion classes for the frequency diagram (max. 10). This diagram assigns one of these classes to each probing point between MIN and MAX. Since the frequency diagram makes little sense with only a few points, it should be suppressed in such cases by entering **0**.

MAGNIFICATION

In most cases you should show the deviations magnified.

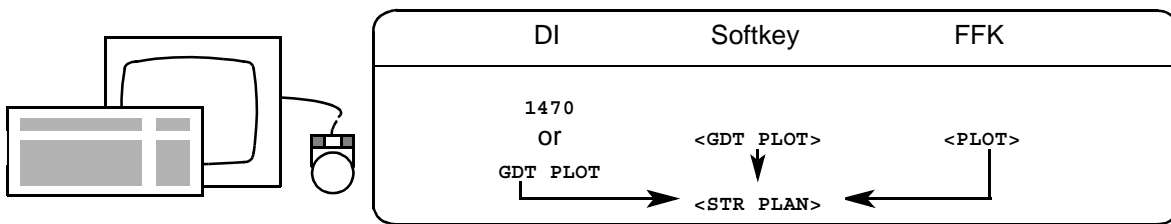
Operation

The program highlights the field where an input is expected. Enter data and accept with **<Return>**. Accept or reject YES/NO fields with **<YES>**, **<NO>** (**<YES>** = input of *). Individual fields can be selected with the \vee and \wedge cursor keys. **<TERMIN>** starts the output on the current output device(s).

Straightness plot with plane tolerance

Request for a graphic straightness evaluation on the current plot output device(s), tolerance input with two parallel planes. The element measured last must allow such an evaluation (<LINE>).

Example: ➤ "Plot parameters for straightness with plane tolerance" on page 3-16.



Dialog window

| Dialog | | | |
|--------------------|----------|-------------------|--|
| PERF M.NAME | CZ_GER_E | COMMENT | |
| WITH FORM | ? * | | |
| TOL. PLANE | ? * | PRB DIRECTION ? * | |
| MEASUREMENT | | TANGENTIAL ? | |
| RECALL | ? | X DIRECTION ? | |
| | | Y DIRECTION ? | |
| ELEMENT ADDRESS | 78 | | |
| IDENTIFICATION | | | |
| T-NOM | 0.1000 | | |
| DISPERSION CLASSES | 4 | | |
| MAGNIFICATION | 1478 | | |
| * YES NO | | * REPEAT TERMIN | |
| BACK | | INFO | |

Softkeys

As for ► *“Roundness plot” on page 2-9.*

Operation

As for ► *“Roundness plot” on page 2-9.*

Input fields

PERF M. NAME

As for ► *“Roundness plot” on page 2-9.*

WITH FORM

As for ► *“Roundness plot” on page 2-9.*

**TOLERANCE PLANE
Measurement**

Measured line (scanned line or line from probings)
You can display the deviation of the measured element in the probing direction (**PRB DIRECTION = ***) or tangentially (**TANGENTIAL = ***).

**TOLERANCE PLANE
RECALL**

Line from recalled points.
You can display the element deviations in the directions indicated.

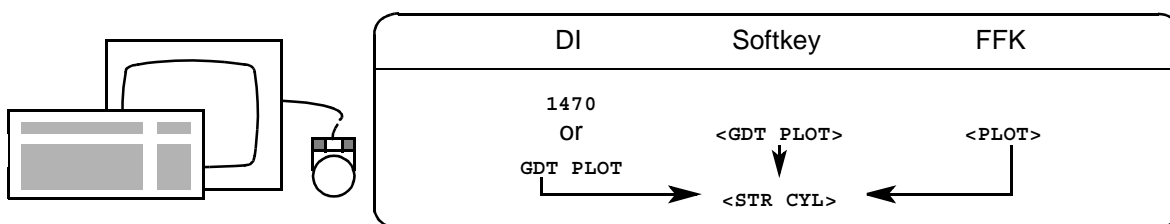
**ELEMENT ADDRESS,
IDENTIFICATION,
T-NOM, DISPERSION
CLASSES,
MAGNIFICATION**

As for ► *“Roundness plot” on page 2-9.*

Straightness plot with cylindrical tolerance

Request for a graphic straightness evaluation with cylindrical tolerance zone on the current plot output device(s). The element measured last must allow such an evaluation (<LINE>). Example:

► "Plot parameters for straightness with tolerance cylinder" on page 3-18.



Dialog window

| Dialog | | | |
|-------------------------------------|----------|-----------------|--|
| GDT PLOT: STRAIGHTNESS CYLINDRICITY | | | |
| PERF M. NAME | CZ GER Z | COMMENT | |
| WITH FORM | ? * | | |
| ELEMENT ADDRESS | 78 | | |
| IDENTIFICATION | | | |
| T-NOM | 0.1000 | | |
| DISPERSION CLASSES | 4 | | |
| MAGNIFICATION | 2082 | | |
| NO. OF TOL. CIRCLES | 9 | | |
| OUTPUT ALL POINTS? | | | |
| * YES NO | | * REPEAT TERMIN | |
| BACK | | INFO | |

Softkeys

As for ► *“Roundness plot” on page 2-9.*

Operation

As for ► *“Roundness plot” on page 2-9.*

Input fields

As for ► *“Roundness plot” on page 2-9.*

PERF M. NAME,
WITH FORM, ELEMENT
ADDRESS,
IDENTIFICATION,
T-NOM, DISPERSION
CLASSES,
MAGNIFICATION

NO. OF TOL. CIRCLES

These circles symbolize the tolerance zone graphically. The value from the performance mode is offered.

OUTPUT ALL POINTS

– **<YES>**

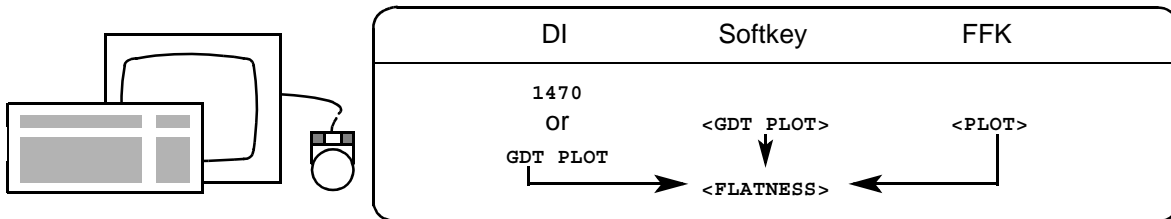
The plot draws all points in turn and connects them to each other.

– **<NO>**

The points are grouped in classes, whereby the number of classes corresponds to the number of tolerance circles. The mean deviation is plotted on each tolerance circle.

Flatness plot

Request for a graphic flatness evaluation on the current plot output device(s). The element measured last must allow such an evaluation (e.g. **<SURFACE>**). Example: ➤ "Plot parameters for flatness" on page 3-21.



Dialog window

| Dialog | | | |
|--------------------|---------|-----------------|--|
| GDT PLOT: FLATNESS | | | |
| PERF M.NAME | CZ_EBEN | COMMENT | |
| WITH FORM | * | | |
| OUTPUT ALL POINTS? | * | | |
| NUMBER OF GRIDS | 2 | | |
| ELEMENT ADDRESS | 78 | | |
| IDENTIFICATION | | | |
| T-NOM | 0.1000 | | |
| DISPERSION CLASSES | 4 | | |
| MAGNIFICATION | 1888 | | |
| * YES NO | | * REPEAT TERMIN | |
| BACK | | INFO | |

Softkeys

As for ► *“Roundness plot” on page 2-9.*

Operation

As for ► *“Roundness plot” on page 2-9.*

Input fields

As for ► *“Roundness plot” on page 2-9.*

**PERF M. NAME, WITH
FORM**

OUTPUT ALL POINTS

– **<YES>**

The plot draws all points in turn and connects them to each other. The start and end points of each scanning path are marked by perpendiculars. Depending on the number of points, the perpendicular is also drawn for other points.

– **<NO>**

Display of the deviations per grid field (cf. **NUMBER OF GRIDS**). The plot adds the deviations in the probing direction for all points within a grid field and plots them as perpendiculars in the lower corner of the field. The perpendiculars of adjacent fields are connected by lines.

**NUMBER OF GRIDS
(grid lines)**

The plot displays the surface on which the probing points are distributed as a rhombus. As an interpretation aid, a grid network can be drawn over this. You have to specify its density here, cf. fig. in ► *“Plot parameters for flatness” on page 3-21.* In this example, the **NUMBER OF GRIDS** (grid lines) = 8. The input limits are 2 and 15.

**ELEMENT ADDRESS,
IDENTIFICATION,
T-NOM, DISPERSION
CLASSES,
MAGNIFICATION**

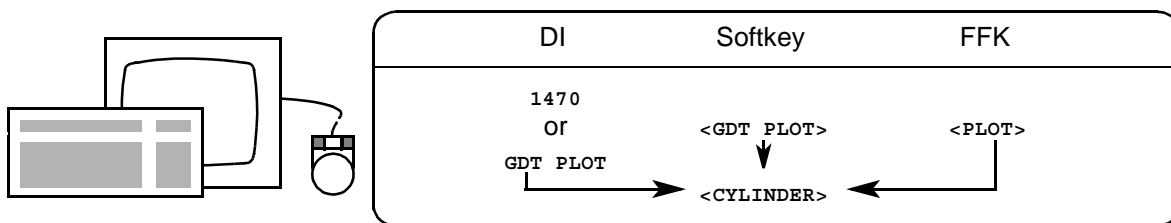
As for ► *“Roundness plot” on page 2-9.*

Cylindricity plot

Request for a graphic cylindricity evaluation on the current plot output device(s). The element measured last must allow such an evaluation (<CYLINDER>). Example: ➤ “Plot parameters for cylindricity” on page 3-23.

NOTE

When measuring cylindricity, the measured points can only be recorded in the scanning mode of measurement or using the **intersection cylinder** function (<DI 1126>).



Dialog window

| Dialog | | | | | | | | | |
|-----------------------------|--|--------|--|---------|--|--|--|---------------|--|
| GDT PLOT: Cylindricity plot | | | | | | | | | |
| PERF M. NAME | | CZ ZYL | | COMMENT | | | | | |
| WITH FORM | | ? * | | | | | | | |
| NO. OF SURFACE LINES | | 7 | | | | | | | |
| ELEMENT ADDRESS | | 78 | | | | | | | |
| IDENTIFICATION | | | | | | | | | |
| T-NOM | | 0.1000 | | | | | | | |
| DISPERSION CLASSES | | 4 | | | | | | | |
| MAGNIFICATION | | 1888 | | | | | | | |
| * YES | | NO | | | | | | * | |
| BACK | | | | | | | | REPEAT TERMIN | |
| | | | | | | | | INFO | |

Softkeys

As for ► *“Roundness plot” on page 2-9.*

Operation

As for ► *“Roundness plot” on page 2-9.*

Input fields

**PERF M. NAME, WITH
FORM**

As for ► *“Roundness plot” on page 2-9.*

NO. OF SURFACE LINES

Enter the number of surface lines required (max. 4).

**ELEMENT ADDRESS,
IDENTIFICATION,
T-NOM, DISPERSION
CLASSES,
MAGNIFICATION**

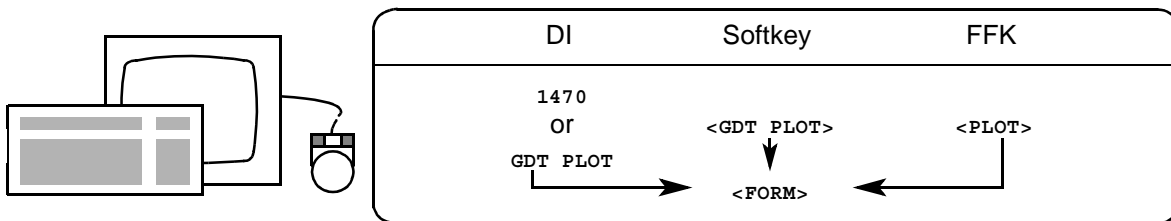
As for ► *“Roundness plot” on page 2-9.*

Plot form

Request for the form used for a graphic form evaluation on the current plot output device(s).

Application: E.g. used to produce a large number of finished plot forms (via offset printing or on a copier). Advantage: The time required for plotting is reduced if the form does not have to be plotted each time as well.

Secondary application: If you create a new plot performance mode, you can use this function to quickly check the position and size of the drawing field.



Dialog window

| PERF M. NAME | CZ_ZYL | COMMENT |
|--------------|--------|---------|
| | | |

Softkeys

As for ► "Roundness plot" on page 2-9.

Operation

As for ► "Roundness plot" on page 2-9.

Input fields

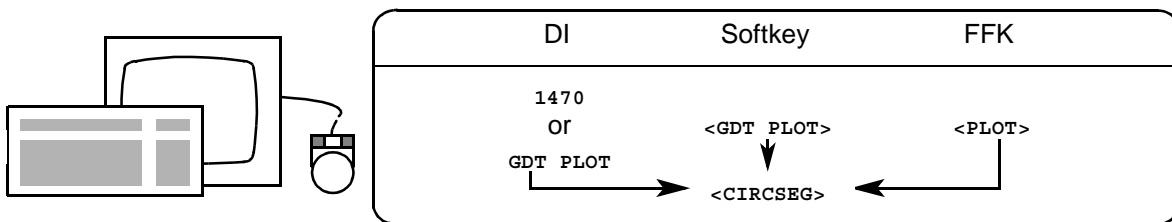
PERF M. NAME,
COMMENT

As for ► "Roundness plot" on page 2-9.

Linear plot from circle segment measurements (<CIRCSEG>)

Prerequisite

With <DI 1114> a circle segment and the individual CIRCSEG results must be output (<DI 1114> **Measuring a circle segment**, see UMESS basic operating instructions). All CIRCSEG results output are plotted.



Dialog window

| Dialog | | | | | | | | | |
|--------------------------------|--|--------|--|---------|--|--|--|----------|--|
| LINEAR PLOT: RADII MEASUREMENT | | | | | | | | | |
| PERF M. NAME | | CZ_RAD | | COMMENT | | | | | |
| WITH FORM | | ? * | | | | | | | |
| IDENTIFICATION | | | | | | | | | |
| NOMINAL | | | | | | | | | |
| UPPER TOLERANCE | | | | | | | | | |
| LOWER TOLERANCE | | | | | | | | | |
| DISPERSION CLASSES | | | | | | | | | |
| MAGNIFICATION | | | | | | | | | |
| * YES | | NO | | | | | | * TERMIN | |
| BACK | | | | | | | | INFO | |

Input fields

| | |
|---|--|
| PERF M. NAME | Performance mode supplied: CZ_RAD |
| COMMENT | This is not an input field, but only a display of the comment entered during creation of the performance mode. |
| WITH FORM | <ul style="list-style-type: none">– <YES> Create form.– <NO> Omit form. |
| IDENTIFICATION | You can assign a name to the result for identification purposes which will then appear on the plot. |
| NOMINAL, UPPER TOLERANCE, LOWER TOLERANCE | If a nominal dimension was specified for radius R of the circle segment, this radius along with the upper and lower tolerance is offered as the preassignment (default setting). |
| DISPERSION CLASSES | Specify the number of dispersion classes for the frequency diagram. |
| MAGNIFICATION | In most cases you should show the deviations magnified. If the scale does not accord with the plot, this is of special significance. |

NOTE

If a nominal dimension has already been entered for R for the circle segment and all preassignments were accepted, the function can also be initiated by means of **<DI 1461> (fast plot)**. In this case, no inputs will be prompted, i.e. plotting will be started immediately.

Chapter

3

GDT plot performance modes

This chapter contains:

| | |
|--|------|
| General and procedure | 3-2 |
| Performance modes supplied | 3-3 |
| Creating/changing performance modes | 3-4 |
| Explanation of terms for GDT plot performance mode | 3-29 |

General and procedure

GDT plot performance modes combine the specifications according to which a plot is generated on the plot output device. E.g. the performance mode defines the dimension and arrangement of the plot on the page, the size and arrangement of the individual elements plotted (heading, record header, etc.), character size and color.

When requesting a plot, you must specify the performance mode according to which the plot is to be created (► *"Graphic evaluation of form deviations" on page 2-1*).

We supply a suitable performance mode for each type of form deviation possible (► *"Performance modes supplied" on page 3-3*). This means that you only need to define another performance mode if you have special requirements. The values predesignated for the performance modes we supply have been entered in the dialog windows in chapter 3 wherever possible and appropriate.

Always start definition of the performance mode with **<DI 1470>**, softkey **<PERF MOD>** (► *"How to plot" on page 2-2*). From here, the program branches to the different dialog windows.

Performance modes supplied

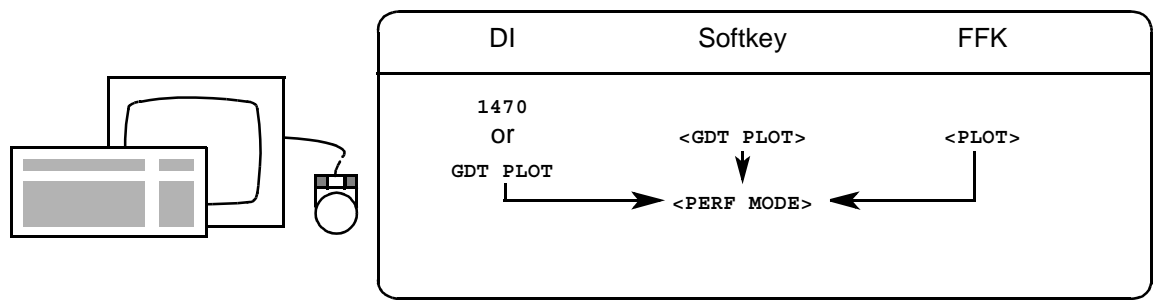
The following GDT plot performance modes are provided by the manufacturer.

| | |
|------------------------------------|-----------------|
| Roundness | CZ_RUND |
| Straightness plane tolerance | CZ_GER_E |
| Straightness cylindrical tolerance | CZ_GER_Z |
| Flatness | CZ_EBEN |
| Cylindricity | CZ_ZYL |
| Bore pattern | CZ_LOBI |
| Linear plot | CZ_RAD |

Creating/changing performance modes

Main menu GDT plot performance mode

To define, edit or administer plot output specifications, you must first open the **GDT plot: Performance mode input and admin** dialog window.



Dialog window

Dialog

GDT plot: Performance mode input and admin

Perf m. name

Comment

Perf mode input

Input: Format

Nom/act data

Flatness

Bore pattern

Char. size/pen no.

Straight. flat tol

Cylindricity

Labels

Straight. cyl tol

Roundness

Output

Screen

Catalog

Printer

Perf. mode data

Delete

Copy

to

* YES

NO

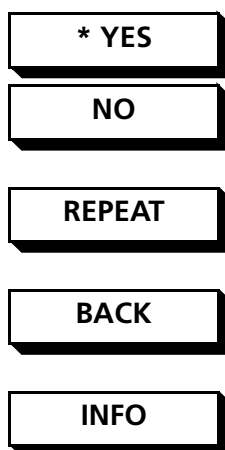
BACK

*

REPEAT

INFO

Softkeys



Used to accept/reject YES/NO field (<YES> = input of *).

Used to check inputs.

Used to return to previous menu.

More information.

Input fields

Perf m. name

Enter identification with up to 8 characters. You can administer the performance mode and request its execution during plots under performance mode name.

Comment

The performance mode can be described here to help the user (field may also remain blank).

Perf mode input

- <YES>
Used to create or edit performance mode, jump to input field.
- <NO>
Used to delete or copy performance mode, jump to delete.

Input

Select the parameters you want to change with <YES>, <NO>.

| | |
|-----------------------|--|
| Format | ➤ "Plot format" on page 3-6 |
| Char. size/pen no. | ➤ "Character size/pen numbers" on page 3-8) |
| Labels | ➤ "Display fields for labels" on page 3-10) |
| Nom/act data | ➤ "Display fields for nominal/actual data and extreme values" on page 3-13 |
| Straightness flat tol | ➤ "Plot parameters for straightness with plane tolerance" on page 3-16 |
| Straightness cyl tol | ➤ "Plot parameters for straightness with tolerance cylinder" on page 3-18 |
| Flatness | ➤ "Plot parameters for flatness" on page 3-21 |
| Cylindricity | ➤ "Plot parameters for cylindricity" on page 3-23 |
| Roundness | ➤ "Plot parameters for roundness" on page 3-25 |
| Bore pattern | ➤ "Plot parameters for bore pattern" on page 3-27 |

In order to completely define a performance mode, you must enter details on:

- Format, char. size/pen no., labels and nom/act data
- as well as on straightness flat tol/straightness cyl tol, flatness/cylindricity or roundness/bore pattern (depending on what this performance mode is to plot).

Output

Function cannot be selected at the present time.

Delete

– <YES>

Used to delete performance mode entered. The dialog window will then reappear.

– <NO>

Jump to copy.

Copy

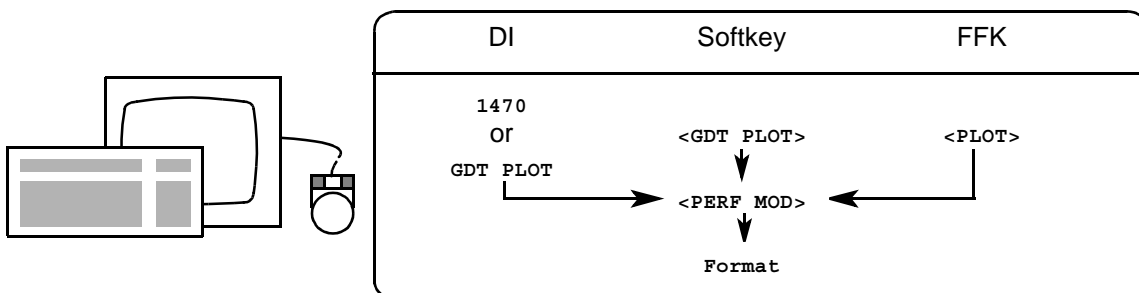
Copy performance mode and save copy under a new name; e.g. to create a new performance mode from the original by changing several parameters. The dialog window then reappears.

Operation

The program highlights the field where an input is expected. Enter data and accept with **<Return>**. Accept or reject YES/NO fields with **<YES>**, **<NO>** (**<YES>** = input of *). Selection of **<YES>** opens an additional dialog window. Individual fields can be selected with the **↓** and **↑** cursor keys. Conclude entry with **<BACK>**.

Plot format

The size and position of the plot must be defined in the **PLOT FORMAT** dialog window.



Dialog window

| Dialog | | | | | |
|-------------------------------|---|--------------|----------|--------|--------|
| PLOT FORMAT | | P. mode name | | | |
| DRAWING FIELD | | FIELD SIZE | | | |
| | | X | Y | | |
| FRAME | | 380.0000 | 280.0000 | | |
| DEVICE ADJUSTMENT | | | | | |
| DEVICE FIELD FROM SYSTEM DATA | ? | * | | | |
| DEVICE FIELD AS DEFAULT | ? | | | | |
| POSITION DRAWING FIELD | | FROM | X | Y | |
| REDUCE DRAWING FIELD | ? | 1 | 0.0000 | 0.0000 | |
| MAXIMUM FIELD SIZE | | | | | |
| DEVICE FIELD | | NORMAL ? | * | | |
| | | ROTATED ? | | | |
| * YES | | NO | | * | |
| | | | | REPEAT | TERMIN |
| BACK | | | | | INFO |

Softkeys

As for ➤ “Main menu GDT plot performance mode” on page 3-4.

Input fields

FRAME FIELD SIZE

Enter frame size (definition ➤ “Device field, frame, drawing field, display field” on page 3-29). The input values influence the scale (➤ “Scaling factor” on page 3-31). The performance modes supplied (➤ “Performance modes supplied” on page 3-3) designate: X = 380, Y = 280.

DEVICE FIELD FROM SYSTEM DATA

Position drawing field in device field (➤ “Device field, frame, drawing field, display field” on page 3-29):

– <YES>

Automatic process with optimum fit of drawing field in device field. To make sure that the plot is not distorted, a margin may be left on the right or at the top.

– <NO>

Jump to **DEVICE FIELD AS DEFAULT**.

DEVICE FIELD AS
DEFAULT

- **<YES>**
For absolute positioning of the drawing field in the device field (➤ *“Field positioning” on page 3-32*). Enter the reference point of the drawing field first, and then the coordinates for the device field (in mm).
If the drawing field no longer fits completely into the device field because the values are too large, the plot will be corrected correspondingly. If **FIELD REF = 1** and **COORDINATES X=0, Y=0**, the drawing field corresponds to the device field.
- **<NO>**
Jump to **DEVICE FIELD FROM SYSTEM DATA**.

REDUCE DRAWING
FIELD

- **<YES>**
You can reduce the drawing field by entering corresponding values. The input values are subject to the scaling (➤ *“Scaling factor” on page 3-31*).
- **<NO>**
The drawing field becomes identical with the frame. Its dimensions correspond to the values in mm entered for **FRAME**.
Jump to **DEVICE FIELD**.

DEVICE FIELD NORMAL,
ROTATED

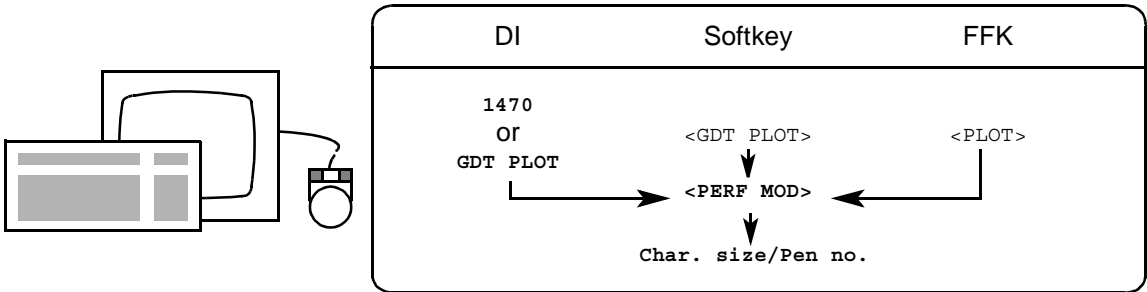
ROTATED has not yet been implemented.

Operation

As for ➤ *“Main menu GDT plot performance mode” on page 3-4*.

Character size/pen numbers

In the dialog window **GDT PLOT: CHARACTER SIZE/PEN NUMBER** you can select the character sizes and (via the pen number) the color.



Dialog window

| GDT PLOT: CHARACTER SIZE/PEN NUMBER | | | |
|-------------------------------------|------------|----------------|---------|
| | PEN NUMBER | CHARACTER SIZE | |
| | | MAXIMUM | MINIMUM |
| FORM AND IDENTIFICATIONS | 1 | 4.0000 | 3.0000 |
| RECORD HEADER | 1 | 3.0000 | 3.0000 |
| NUMERICAL VALUES | 3 | 3.0000 | 3.0000 |
| HEADING | 1 | 8.0000 | 5.0000 |
| TOLERANCE BAND | 4 | | |
| DEVIATIONS (GRAPHIC) | 2 | | |
| REFERENCE LINE | 3 | | |

| | | | | | | | | |
|------|--|--|--|---|--|--|--------|--------|
| | | | | * | | | REPEAT | TERMIN |
| BACK | | | | | | | | INFO |

Softkeys

As for ► “Main menu GDT plot performance mode” on page 3-4.

Input fields

PEN NUMBER

Enables color assignment:

| Pen number | Screen (graphics window) | Plotter |
|------------|--------------------------|---|
| 1 | black | Color corresponding to the current assembly with different colored pens |
| 2 | green | |
| 3 | red | |
| 4 | blue | |
| 5 | yellow | |
| 6 | orange | |
| 7 | magenta (dark red) | |
| 8 | cyan (turquoise) | |

CHARACTER SIZE

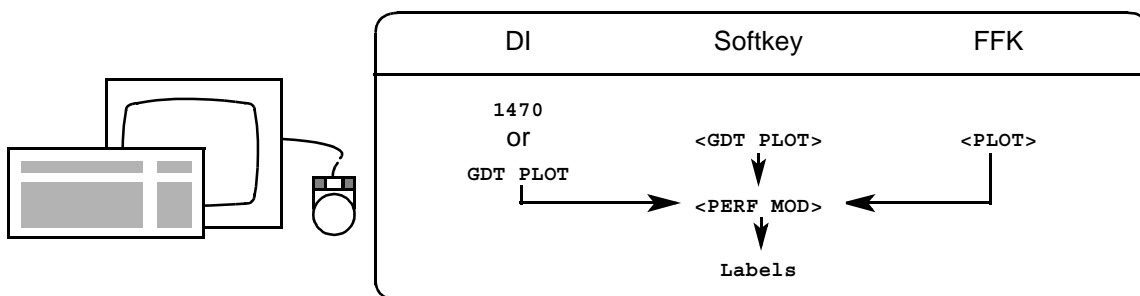
The program always tries to use the character size entered for **MAXIMUM**. If this character size does not fit the field specified, the character size is reduced to the dimension required, but only to the size entered for **MINIMUM**.

Operation

As for ► “Main menu GDT plot performance mode” on page 3-4.

Display fields for labels

In the dialog window **GDT PLOT: LABELS** you can select the display fields to appear in the plot (heading, diagram for dispersion classes, plane indicator, scale, symbol, measured data) and define their size and arrangement.



Dialog window

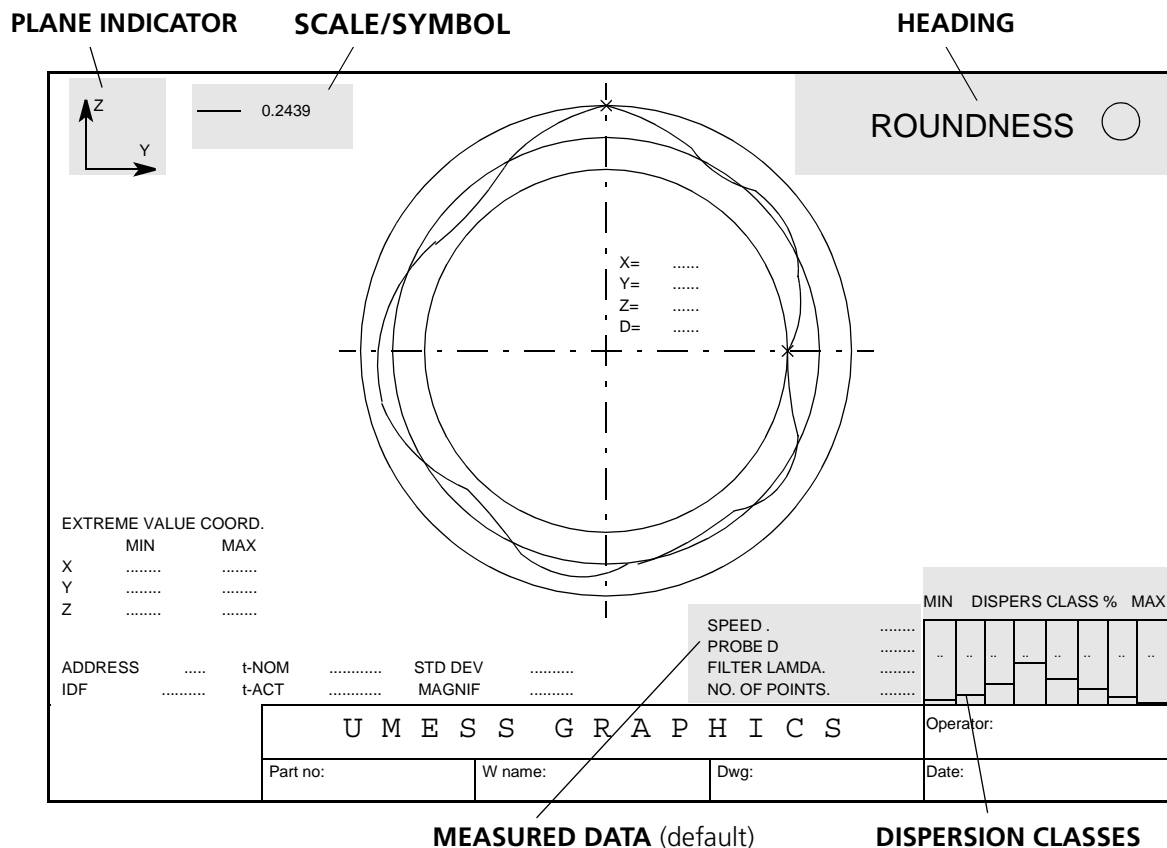
| Dialog | | | | | | | | | |
|--------------------------|------------|---|-----------|---------|-------------|---|----------|----------|--------|
| GDT PLOT: LABELS | | | | | | | | | |
| | FIELD SIZE | | FIELD REF | | COORDINATES | | | | |
| | X | Y | FROM | TO | X | Y | | | |
| RECORD HEADER | | | | | | | | | |
| CONNECT TO FRAME | | | | | | | | | |
| DISPERSION CLASSES | ? | * | 90.0000 | 40.0000 | 3 | | 380.0000 | 20.0000 | |
| CONNECT TO RECORD HEADER | | | | | | | | | |
| HEADING | ? | * | 100.0000 | 18.0000 | 5 | | 360.0000 | 270.0000 | |
| PLANE INDICATOR | ? | * | 30.0000 | 30.0000 | | | 35.0000 | 240.0000 | |
| SCALE/SYMBOL | ? | * | 40.0000 | 15.0000 | 1 | | 85.0000 | 255.0000 | |
| MEASURED DATA | ? | * | 90.0000 | 40.0000 | 1 | | 285.0000 | 20.0000 | |
| NO OF LINES/COLUMNS | | | 4 | / | 1 | | | | |
| PROBE SPHERE DIAMETER | | | 2 | / | 1 | | | | |
| SCANNING SPEED | | | 3 | / | 1 | | | | |
| NO. OF POINTS | | | 4 | / | 1 | | | | |
| (*=EXTREME VALUES) | | | | / | | | | | |
| LAMBDA FILTER | | | 1 | / | 1 | | | | |
| * YES | | | NO | | | | | | |
| | | | | | | | REPEAT | | TERMIN |
| BACK | | | | | | | | | INFO |

Softkeys

As for ► "Main menu GDT plot performance mode" on page 3-4.

Input fields

Explanation of input fields (for the example roundness plot):



RECORD HEADER

Currently not activated.

DISPERSION CLASSES

The dispersion classes document the distribution of the probing points between **MIN** and **MAX** (► *“Requesting GDT plots” on page 2-3*).

HEADING

The heading names the type of form deviation.

PLANE INDICATOR

Plot of output plane; please note that the plane indicator has only one reference point (► *"Field positioning"* on page 3-32).

SCALE/SYMBOL

Scale for the plot output and symbol for the type of form deviation.

MEASURED DATA

The measured data include the scanning speed (**SPEED**), the probe sphere diameter (**PROBE D**), the filter used during calculation of the element (**FILTER LAMDA**) and the number of measuring points (**NO. OF POINTS**) as default settings. You may also select output of the extreme values (marked by *).

NOOFLINES/COLUMNS

The example from the dialog window requires the plot of the MEASURED DATA in a one-column table with 4 lines, cf. plot on previous page. For more examples: ➤ “Display fields for nominal/actual data and extreme values” on page 3-13.

PROBE SPHERE
DIAMETER,
SCANNING SPEED, NO.
OF POINTS,
(*=EXTREME VALUES),
LAMBDA FILTER

Specify for each of the above the line/column of the table in which the information should appear. If no input is made, the corresponding value will not be plotted.

FIELD SIZE

Enter the dimensions for each display field. The input values are subject to the scaling (➤ “Scaling factor” on page 3-31).

FIELD REF

To position a display field, you must enter its reference points in the FROM column (➤ “Field positioning” on page 3-32).

For the **DISPERSION CLASSES** you must decide between absolute and relative positioning. Enter a “**blank**” (space bar) in the **FROM** column for the positioning type not required.

For relative positioning, enter the reference point of the field to which you want to connect the display field in the **TO** column.

COORDINATES

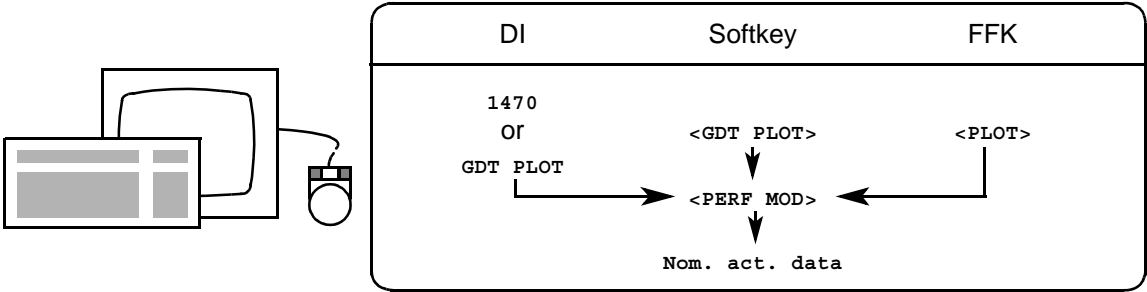
Enter the coordinates of the drawing field to which you want to make the connection. The input values are subject to the scaling (➤ “Scaling factor” on page 3-31). No input is required for relative positioning.

Operation

As for ➤ “Main menu GDT plot performance mode” on page 3-4.

Display fields for nominal/actual data and extreme values

In the dialog window **GDT PLOT: DESIGNATION NOM-ACT DATA** you specify whether the fields for nominal/actual data and extreme values should appear in the plot and define their size and arrangement.



Dialog window

| Dialog | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----|---|------------|---------|-----------|----|-------------|---------|--|-------|----|--|--|---|--|--|--------|--------|------|--|--|--|--|--|--|--|------|
| GDT PLOT: DESIGNATION NOM-ACT DATA | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | FIELD SIZE | | FIELD REF | | COORDINATES | | | | | | | | | | | | | | | | | | | | |
| | | | X | Y | FROM | TO | X | Y | | | | | | | | | | | | | | | | | | | |
| NOM / ACT DATA | ? | * | 300.0000 | 10.0000 | 1 | | 0.0000 | 20.0000 | | | | | | | | | | | | | | | | | | | |
| CONNECT TO FRAME | ? | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CONNECT TO RECORD HEADER | ? | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NO OF LINES/COLUMNS | | | 1 | 6 | | | | | | | | | | | | | | | | | | | | | | | |
| POSITION ADDRESS | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| IDENTIFICATION | | | 1 | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| REFERENCE ADDRESS | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T-NOM | | | 1 | 3 | | | | | | | | | | | | | | | | | | | | | | | |
| T-ACT | | | 1 | 4 | | | | | | | | | | | | | | | | | | | | | | | |
| STANDARD DEVIATION | | | 1 | 5 | | | | | | | | | | | | | | | | | | | | | | | |
| MAGNIFIC. | | | 1 | 6 | | | | | | | | | | | | | | | | | | | | | | | |
| EXTREME VALUES | ? | * | 70.0000 | 50.0000 | 1 | | 10.0000 | 40.0000 | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <tr> <td>* YES</td> <td>NO</td> <td></td> <td></td> <td>*</td> <td></td> <td></td> <td>REPEAT</td> <td>TERMIN</td> </tr> <tr> <td>BACK</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>INFO</td> </tr> </table> | | | | | | | | | | * YES | NO | | | * | | | REPEAT | TERMIN | BACK | | | | | | | | INFO |
| * YES | NO | | | * | | | REPEAT | TERMIN | | | | | | | | | | | | | | | | | | | |
| BACK | | | | | | | | INFO | | | | | | | | | | | | | | | | | | | |

Softkeys

As for ► "Main menu GDT plot performance mode" on page 3-4.

Input fields

NOM/ACT DATA, EXTREME VALUES

EXTREME VALUES

EXTREME VALUE COORD.
MIN MAX
X
Y
Z

NOM/ACT DATA

ADDRESS t-NOM
IDF t-ACT
STD DEV
MAGNIF

SPEED
PROBE D
FILTER LAMDA
NO. OF POINTS

| MIN | DISPERSION % | MAX |
|-----|--------------|-----|
| .. | .. | .. |
| .. | .. | .. |
| .. | .. | .. |
| .. | .. | .. |
| .. | .. | .. |
| .. | .. | .. |

UMESS GRAPHICS

Part no: W name: Dwg: Operator:
Date:

Cf. above figure. Enter dimensions of display field, input values are subject to scaling (► *“Scaling factor” on page 3-31*). Absolute or relative positioning is possible, see ► *“Display fields for labels” on page 3-10*.

NOOFLINES/COLUMNS

The 6 pieces of information listed are available. The output is performed in tabular form, i.e. in lines and columns. Entry in the dialog window shown below requires a table with one line and 6 columns:

| | | | | | |
|---------|-----|-------|-------|---------|--------|
| 1/1 | 1/2 | 1/3 | 1/4 | 1/5 | 1/6 |
| ADDRESS | IDF | t-NOM | t-ACT | STD DEV | MAGNIF |

The plot section shown above contains a table with 2 lines and 3 columns:

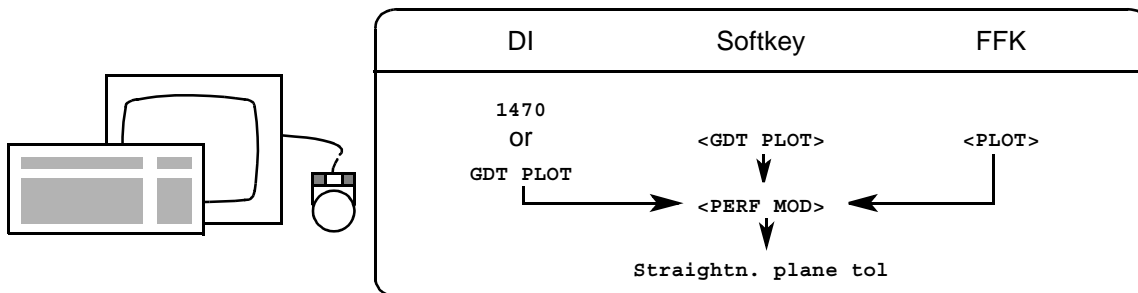
| | | |
|-----|-----|-----|
| 1/1 | 1/2 | 1/3 |
| 2/1 | 2/2 | 2/3 |

Operation

As for ► *“Main menu GDT plot performance mode” on page 3-4*.

Plot parameters for straightness with plane tolerance

Input of parameters for straightness plot with a tolerance zone of two parallel planes.

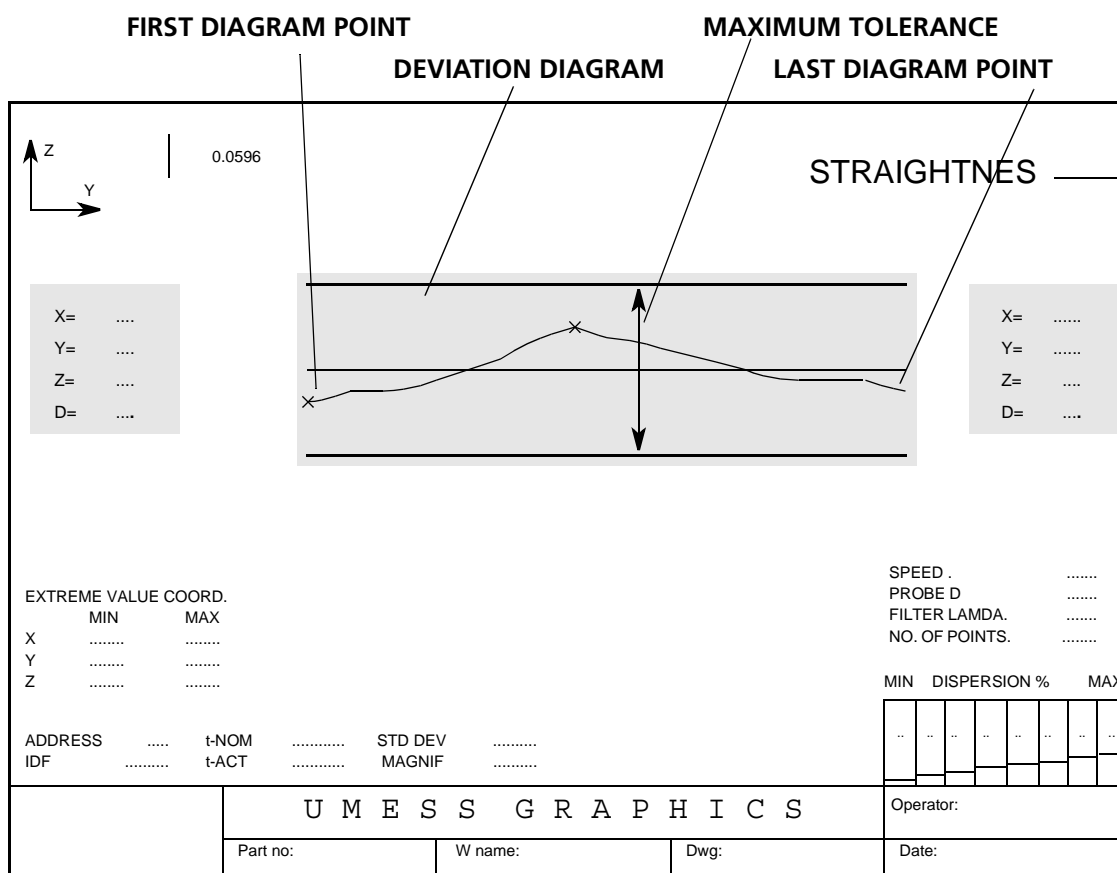


Dialog window

| Dialog | | | | | | | |
|--|------------|----------|-----------|-----------------|-------------|----------|--|
| GDT PLOT: PLOT PARAMETERS STRAIGHTNESS PLANE TOLERANCE | | | | | | | |
| | FIELD SIZE | | FIELD REF | | COORDINATES | | |
| | X | Y | FROM | TO | X | Y | |
| DEVIATION DIAGRAM | 250.0000 | 120.0000 | 1 | | 50.0000 | 110.0000 | |
| MAXIMUM TOLERANCE WIDTH | 100.0000 | | | | | | |
| FIRST DIAGRAM POINT | 3* | | | | | | |
| POSITION COORDINATES | 30.0000 | 30.0000 | 1 | | 10.0000 | 150.0000 | |
| CONNECT TO DIAGRAM | | | | | | | |
| LAST DIAGRAM POINT | 3* | | | | | | |
| POSITION COORDINATES | 30.0000 | 30.0000 | 3 | | 370.0000 | 150.0000 | |
| CONNECT TO DIAGRAM | | | | | | | |
| * YES NO | | | | * REPEAT TERMIN | | | |
| BACK | | | | INFO | | | |

Softkeys

As for ► “Main menu GDT plot performance mode” on page 3-4.



FIELD SIZE

Enter the dimensions of the current display field. The input values are subject to the scaling (► “Scaling factor” on page 3-31).

FIELD REF

To position a display field, you have to enter its reference point in the **FROM** column (► “Field positioning” on page 3-32).

You have to decide between absolute and relative positioning for the **FIRST DIAGRAM POINT** and **LAST DIAGRAM POINT**. Enter a “blank” (space bar) in the **FROM** column for the type of positioning not required.

For relative positioning, enter the reference point of the deviation diagram to which you want to connect the display field in the **TO** column.

COORDINATES

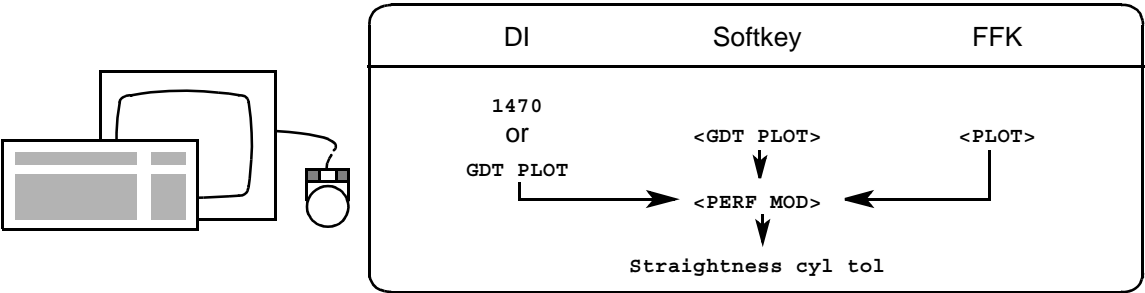
Enter the coordinates of the drawing field where you want to position. The input values are subject to the scaling (► “Scaling factor” on page 3-31). No input is required for relative positioning.

Operation

As for ► “Main menu GDT plot performance mode” on page 3-4.

Plot parameters for straightness with tolerance cylinder

Input of parameters for straightness plot with cylindrical tolerance zone.



Softkeys

As for ► “Main menu GDT plot performance mode” on page 3-4.

Dialog window

| Dialog | | | | | | | | | |
|---|--|------------|----------|-----------|----|-------------|----------|--------|--|
| GDT PLOT: PLOT PARAMETERS STRAIGHTNESS TOLERANCE CYLINDER | | | | | | | | | |
| | | FIELD SIZE | | FIELD REF | | COORDINATES | | | |
| | | X | Y | FROM | TO | X | Y | | |
| DEVIATION DIAGRAM FIELD | | 250.0000 | 120.0000 | 1 | | 70.0000 | 110.0000 | | |
| REF. LINE: START POINT | | X | 80.0000 | | | END POINT X | 300.0000 | | |
| | | Y | 130.0000 | | | Y | 210.0000 | | |
| MAXIMUM TOL. DIAMETER | | 40.0000 | | | | | | | |
| MAXIMUM NUMBER OF TOL. CIRCLES | | 10 | | | | | | | |
| FIRST DIAGRAM POINT | | ? | * | | | | | | |
| POSITION COORDINATES | | 30.0000 | 30.0000 | 1 | | 10.0000 | 110.0000 | | |
| CONNECT TO DIAGRAM | | | | | | | | | |
| LAST DIAGRAM POINT | | ? | * | | | | | | |
| POSITION COORDINATES | | 30.0000 | 30.0000 | 3 | | 370.0000 | 200.0000 | | |
| CONNECT TO DIAGRAM | | | | | | | | | |
| * YES NO | | | | * | | REPEAT | | TERMIN | |
| BACK | | | | | | | | INFO | |

Input fields

FIRST DIAGRAM POINT **DEVIATION DIAGRAM FIELD** **REFERENCE LINE: END POINT**

REF. LINE: START POINT **MAXIMUM TOL. DIAMETER** **LAST DIAGRAM POINT**

STRAIGHTNES

X=
Y=
Z=

X=
Y=
Z=

EXTREME VALUE COORD.
MIN MAX
X
Y
Z

SPEED
PROBE D
FILTER LAMDA.
NO. OF POINTS.

MIN DISPERSION % MAX
..

ADDRESS t-NOM STD DEV
IDF t-ACT MAGNIF

U M E S S G R A P H I C S

Operator:

Part no: W name: Dwg: Date:

FIELD SIZE

Enter the dimensions for the respective display field. The input values are subject to the scaling (► *"Scaling factor" on page 3-31*).

FIELD REF

To position a display field, you must enter its reference points in the FROM column (► *"Field positioning" on page 3-32*).

You have to decide between absolute and relative positioning for the **FIRST DIAGRAM POINT** and **LAST DIAGRAM POINT**. Enter a **"blank"** (space bar) in the **FROM** column for the type of positioning not required.

For relative positioning, enter the reference point of the deviation diagram to which you want to connect the display field in the **TO** column.

COORDINATES

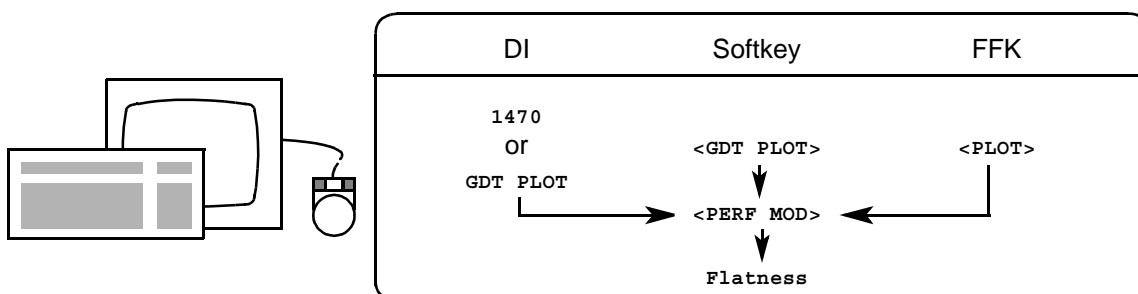
Enter the coordinates of the drawing field where you want to position. The input values are subject to the scaling (► *"Scaling factor" on page 3-31*). No input is required for relative positioning.

Operation

As for ► “Main menu GDT plot performance mode” on page 3-4.

Plot parameters for flatness

Input of parameters for flatness plot.



Dialog window

| Dialog | | | | | | | | | |
|------------------------------------|--|------------|----------|-----------|----|-------------|----------|--------|--------|
| GDT PLOT: PLOT PARAMETERS FLATNESS | | | | | | | | | |
| | | FIELD SIZE | | FIELD REF | | COORDINATES | | | |
| | | X | Y | FROM | TO | X | Y | | |
| DEVIATION DIAGRAM FIELD | | 280.0000 | 170.0000 | 6 | | 190.0000 | 270.0000 | | |
| LEFT CORNER POINT | | | | | | 55.0000 | 185.0000 | | |
| RIGHT CORNER POINT | | | | | | 325.0000 | | | |
| FIRST CORNER POINT | | ? | * | | | | | | |
| POSITION COORDINATES | | | 30.0000 | 30.0000 | 2 | 200.0000 | 55.0000 | | |
| SECOND CORNER POINT | | ? | * | | | | | | |
| POSITION COORDINATES | | | 30.0000 | 30.0000 | 4 | 365.0000 | 140.0000 | | |
| THIRD CORNER POINT | | ? | * | | | | | | |
| POSITION COORDINATES | | | 30.0000 | 30.0000 | 2 | 200.0000 | 240.0000 | | |
| FOURTH CORNER POINT | | ? | * | | | | | | |
| POSITION COORDINATES | | | 30.0000 | 30.0000 | 8 | 15.0000 | 140.0000 | | |
| * YES | | NO | | | * | | | REPEAT | TERMIN |
| BACK | | | | | | | | | INFO |

Softkeys

As for ► “Main menu GDT plot performance mode” on page 3-4.

Input fields

Diagram illustrating the input fields for the GDT plot performance mode, showing a 3D surface plot and various data entry fields.

Input Fields:

- FOURTH CORNER POINT**
- FIRST CORNER POINT**
- THIRD CORNER POINT**
- DEVIATION DIAGRAM FIELD**
- THIRD CORNER POINT**
- SECOND CORNER POINT**
- FLATNESS**

Coordinate Fields:

X=
Y=
Z=

EXTREME VALUE COORD.

| | MIN | MAX |
|---|-------|-------|
| X | | |
| Y | | |
| Z | | |

ADDRESS **t-NOM** **STD DEV**
IDF **t-ACT** **MAGNIF**

U M E S S G R A P H I C S

Operator:

Part no: **W name:** **Dwg:** **Date:**

MIN **DISPERSION %** **MAX**

First Corner Point

FIELD SIZE

Enter the dimensions for the respective display field. The input values are subject to the scaling (► *"Scaling factor"* on page 3-31).

FIELD REF

To position a display field, you have to enter its reference point in the **FROM** column (► *"Field positioning"* on page 3-32).

COORDINATES

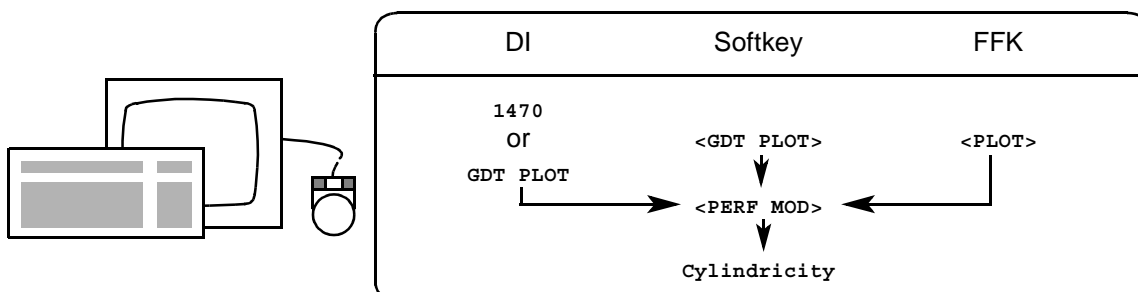
Enter the coordinates of the drawing field where you want to position. The input values are subject to the scaling (► *"Scaling factor"* on page 3-31).

Operation

As for ► *"Main menu GDT plot performance mode"* on page 3-4.

Plot parameters for cylindricity

Input of parameters for cylindricity plot.



Dialog window

| Dialog | | | | | | | |
|---|--|------------|----------|---|--|-------------|----------|
| GDT PLOT: PLOT PARAMETERS CYLINDRICITY | | | | | | | |
| | | FIELD SIZE | | FIELD REF | | COORDINATES | |
| | | X | Y | FROM TO | | X | Y |
| ROUNDNESS DEVIATION | | | | | | | |
| FIRST CIRCLE | | 80.0000 | 80.0000 | 1 | | 40.0000 | 100.0000 |
| CENTER POINT OF LAST CIRCLE | | | | | | 120.0000 | 220.0000 |
| REFERENCE CIRCLE DIAMETER | | 60 | | | | | |
| SURFACE LINES | | 190.0000 | 120.0000 | 4 | | 375.0000 | 160.0000 |
| INCLINATION AS CIRC. DEV ? | | * | | | | | |
| MAXIMUM TOLERANCE WIDTH | | 14 | | | | | |
| <div> <div>* YES</div> <div>NO</div> <div></div> <div></div> </div> | | | | <div> <div>*</div> <div></div> <div></div> <div>REPEAT</div> <div>TERMIN</div> </div> | | | |
| <div> <div>BACK</div> <div></div> <div></div> <div></div> </div> | | | | <div> <div></div> <div></div> <div></div> <div>INFO</div> </div> | | | |

Softkeys

As for ► "Main menu GDT plot performance mode" on page 3-4.

Input fields

| UMESS GRAPHICS | | | | | | | | | | MIN | DISPERSION % | MAX |
|----------------|-------|-------|-------|---------|-------|--------------|-------|---------------|-------|-----|--------------|-----|
| ADDRESS | ..... | t-NOM | ..... | STD DEV | ..... | SPEED | ..... | PROBE D | ..... | .. | .. | .. |
| IDF | ..... | t-ACT | ..... | MAGNIF | ..... | FILTER LAMDA | ..... | NO. OF POINTS | ..... | .. | .. | .. |
| Operator: | | | | | | | | | | | | |
| Part no: | | | | W name: | | | Dwg: | | Date: | | | |

FIELD SIZE

Enter the dimensions for the respective display field. The input values are subject to the scaling (► *“Scaling factor”* on page 3-31).

FIELD REF

To position a display field, you have to enter its reference point in the **FROM** column (► *“Field positioning”* on page 3-32).

COORDINATES

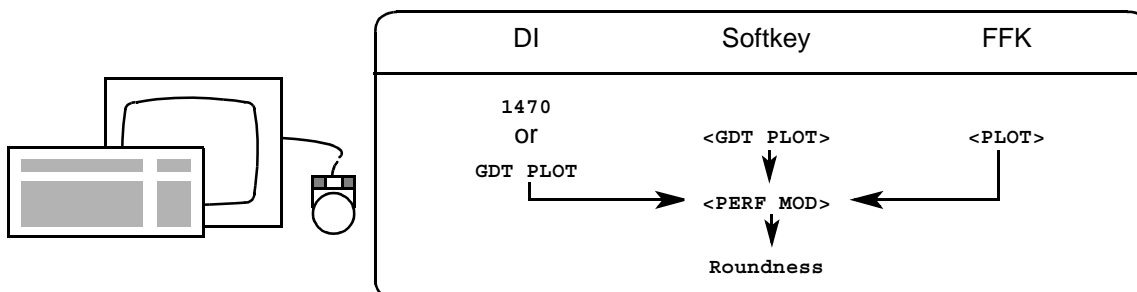
Enter the coordinates of the drawing field where you want to position. The input values are subject to the scaling (► *“Scaling factor”* on page 3-31).

Operation

As for ► *“Main menu GDT plot performance mode”* on page 3-4.

Plot parameters for roundness

Input of parameters for roundness plot.



Dialog window

| Dialog | | | | | | | | | |
|-------------------------------------|--|------------|----------|-----------|---------|-------------|----------|----------|----------|
| GDT PLOT: PLOT PARAMETERS ROUNDNESS | | | | | | | | | |
| | | FIELD SIZE | | FIELD REF | | COORDINATES | | | |
| | | X | Y | FROM | TO | X | Y | | |
| DEVIATION DIAGRAM | | 200.0000 | 200.0000 | 9 | | 190.0000 | 150.0000 | | |
| REFERENCE CIRCLE DIAMETER | | 150.0000 | | | | | | | |
| MAXIMUM TOLERANCE WIDTH | | 40.0000 | | | | | | | |
| CIRCLE DATA | | ? | * | 40.0000 | 25.0000 | 1 | | 193.0000 | 150.0000 |
| CONNECT TO DIAGRAM | | | | | | | | | |
| OUTPUT | | | | | | | | | |
| X COORDINATE | | ? | * | | | | | | |
| Y COORDINATE | | ? | * | | | | | | |
| Z COORDINATE | | ? | * | | | | | | |
| DIAMETER | | ? | * | | | | | | |
| * YES | | NO | | | * | | | REPEAT | TERMIN |
| BACK | | | | | | | | | INFO |

Softkeys

As for ► "Main menu GDT plot performance mode" on page 3-4.

Input fields

| DEVIATION DIAGRAM | | REFERENCE CIRCLE DIAMETER | | CIRCLE DATA | | MAXIMUM TOLERANCE WIDTH | | ROUNDNESS | |
|--|--|--|--|---|--|--|--|---|--|
| | | | | | | | | | |
| EXTREME VALUE COORD. MIN MAX X Y Z | | X= Y= Z= D= | | SPEED PROBE D FILTER LAMDA. NO. OF POINTS. | | MIN DISPERSION % MAX | | ADDRESS t-NOM STD DEV IDF t-ACT MAGNIF | |
| U M E S S G R A P H I C S | | | | | | | | | |
| Part no: | | | | W name: | | Dwg: | | Operator: | |
| Date: | | | | Date: | | Date: | | Date: | |

FIELD SIZE

Enter the dimensions for the respective display field. The input values are subject to the scaling (► *"Scaling factor" on page 3-31*).

FIELD REF

To position a display field, you have to enter its reference point in the **FROM** column (► *"Field positioning" on page 3-32*).

For **CIRCLE DATA** you must decide between absolute and relative positioning. Enter a **"blank"** (space bar) in the **FROM** column for the type of positioning not required.

For relative positioning, enter the reference point of the deviation diagram to which you want to connect the display field in the **TO** column.

COORDINATES

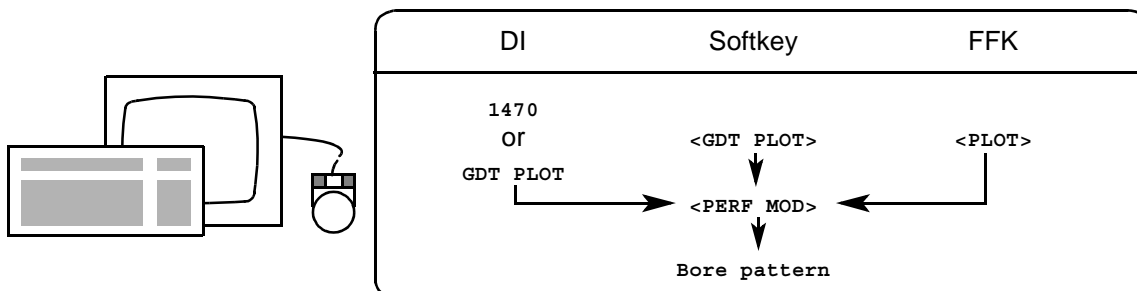
Enter the coordinates of the drawing field where you want to position. The input values are subject to the scaling (► *"Scaling factor" on page 3-31*). No input is required for relative positioning.

Operation

As for ► *"Main menu GDT plot performance mode" on page 3-4*.

Plot parameters for bore pattern

Input of parameters for bore pattern plot (► “Bore pattern plot” on page 4-17)



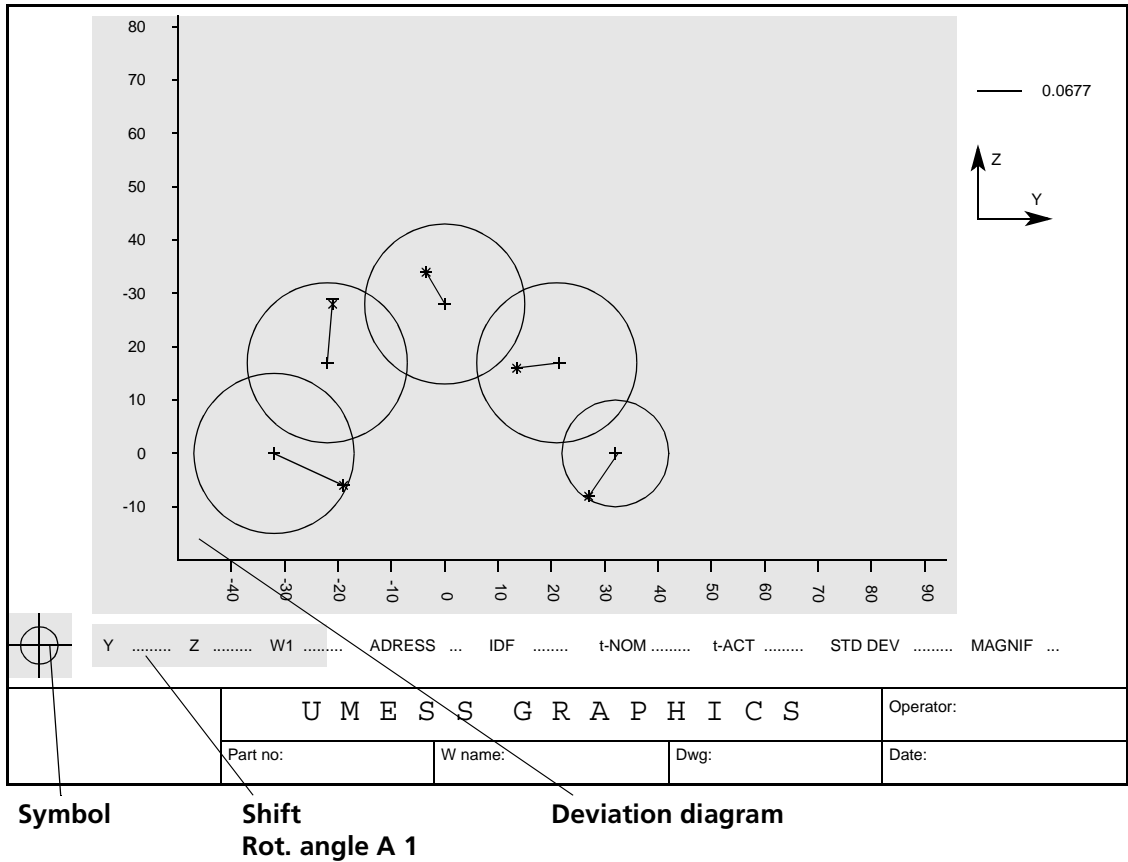
Dialog window

| Dialog | | | | | | | | | |
|--------------------------|--|--------------------|----------|------------|--|------------------|---------|--------|--|
| Plot parameters bore pat | | | | | | | | | |
| | | Field size | | Field ref. | | Coordinates | | | |
| | | X | Y | | | X | Y | | |
| Deviation diagram | | 360.0000 | 230.0000 | 1 | | 0.0000 | 40.0000 | | |
| Best fit data | | * 180.0000 10.0000 | | 3 | | 180.0000 30.0000 | | | |
| Number lines/columns | | 1 | / 4 | | | | | | |
| Position symbol | | 1 | / 1 | | | | | | |
| Shift X | | 1 | / 2 | | | | | | |
| Shift Y | | 1 | / 3 | | | | | | |
| Rot. angle A 1 | | 1 | / 4 | | | | | | |
| * YES | | NO | | * | | REPEAT | | TERMIN | |
| BACK | | | | | | | | INFO | |

Softkeys

As for ► “Main menu GDT plot performance mode” on page 3-4.

Input fields



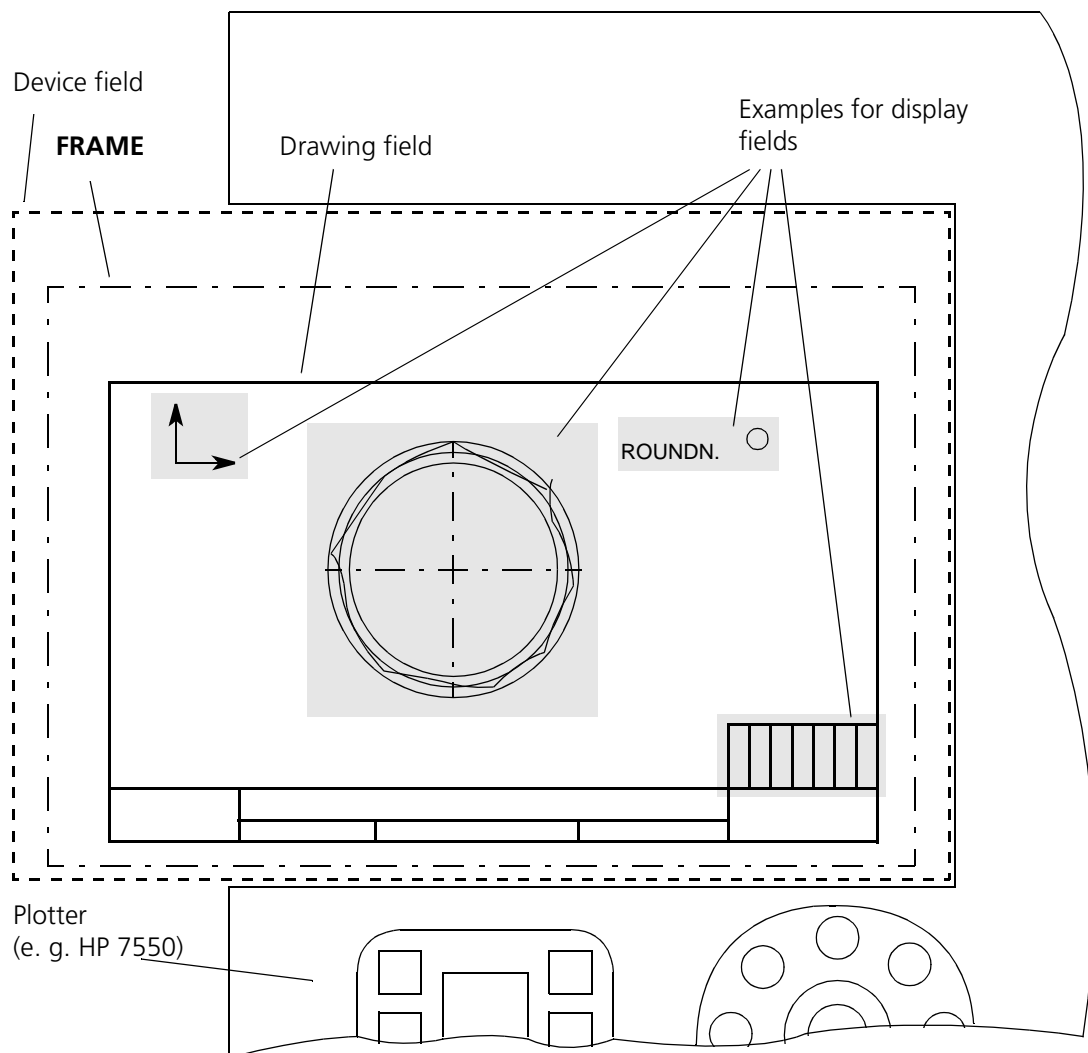
- Field size** Enter the dimensions for the respective display field. The input values are subject to the scaling (▶ *“Scaling factor” on page 3-31*).
- Field ref.** To position a display field, you must enter its reference point here (▶ *“Field positioning” on page 3-32*).
- Coordinates** Enter the coordinates of the drawing field where you want to position. The input values are subject to the scaling (▶ *“Scaling factor” on page 3-31*).

Operation

As for ▶ *“Main menu GDT plot performance mode” on page 3-4*.

Explanation of terms for GDT plot performance mode

Device field, frame, drawing field, display field

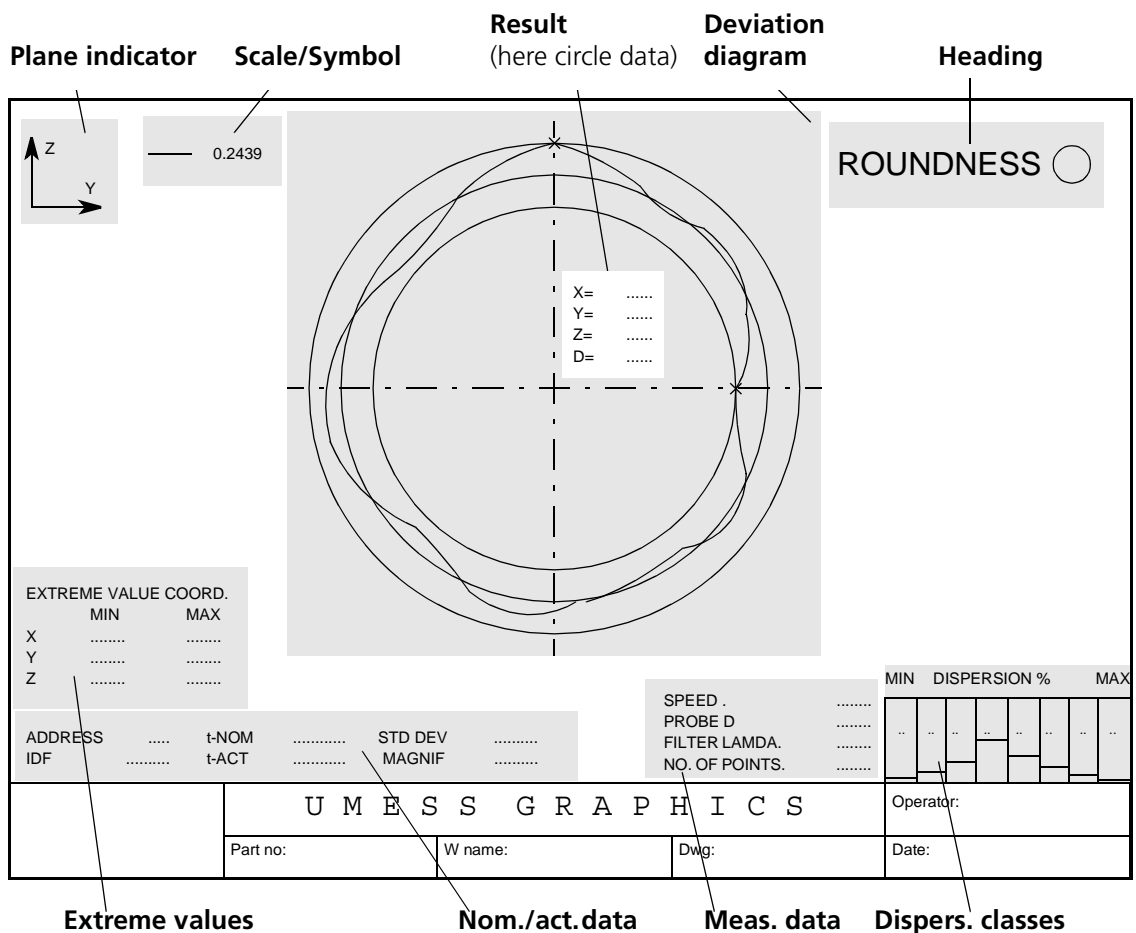


A plot comprises the following elements:

- Device field: Defined with **<DI 1625>**, **<CONFIG>**, Xmax, Ymax according to the paper format used or the working area of the plotter (► *“Configuration of a graphics output (CONFIG)” on page 1-5*). Inputs must be made in mm, e.g. paper format A 4: 270 mm x 190 mm; paper format A 3: 395 mm x 270 mm.

- Frame: Defined in the **PLOT FORMAT** dialog window, **DRAWING FIELD FRAME** input field (➤ “Plot format” on page 3-6).
The frame is an invisible reference size used to calculate the scaling factors (➤ “Scaling factor” on page 3-31).
- Drawing field(s): Defined in the **PLOT FORMAT** dialog window, **DEVICE ADJUSTMENT** input fields (➤ “Plot format” on page 3-6).
The actual plot is performed within the drawing field (e.g. requested via <ROUNDESS>), and limited by the boundary line. Its dimensions are determined by the scaling factor (➤ “Scaling factor” on page 3-31).
- Display field(s): ➤ “Display fields” on page 3-30.

Display fields

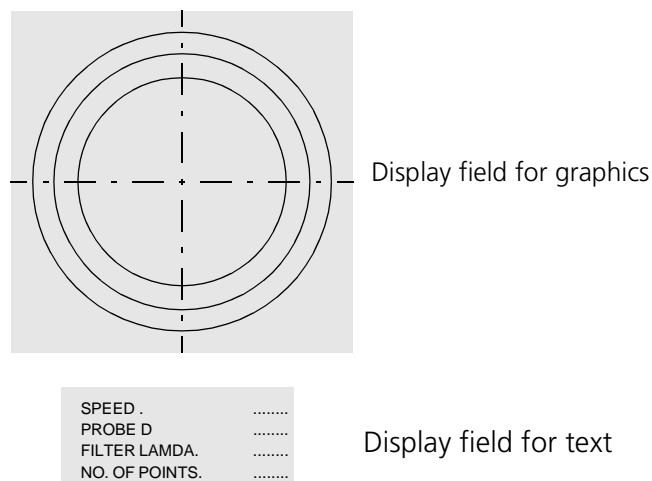


A plot can contain the following display fields (shown on a roundness plot):

Display fields must be defined in the

- **GDT PLOT: LABELS** (► “Display fields for labels” on page 3-10),
- **GDT PLOT: DESIGNATION NOM-ACT DATA** (► “Display fields for nominal/actual data and extreme values” on page 3-13),
- **GDT PLOT: PLOT PARAMETERS** (► “Plot parameters for straightness with plane tolerance” on page 3-16 to ► “Plot parameters for bore pattern” on page 3-27) dialog windows.

Their position within the drawing field and their dimensions are subject to the scaling (► “Scaling factor” on page 3-31).



A distinction is made between display fields for graphics and display fields for text:

In the display fields for text (e.g. dispersion classes), the texts are left-justified, and the numbers are right-justified. If a field size is too large or too small, the texts and numbers will then be spaced too far apart or too close together. In this case, you must adapt the field size(s) accordingly.

See note on character size in ► “Character size/pen numbers” on page 3-8.

Scaling factor

The X and Y input values for the dimensions of the drawing field (**PLOT FORMAT** dialog window) and for the position data and dimensions of the display fields (**GDT PLOT: LABELS**, **GDT PLOT: DESIGNATION NOM-ACT DATA**, **GDT PLOT: PLOT PARAMETERS** ...dialog windows) are scaled.

To obtain the values of these drawing or display fields in mm, the input values for FRAME must be multiplied by the scaling factor. This factor is calculated from the **X** or **Y** values you have entered in the **PLOT FORMAT** dialog window for **DRAWING FIELD FRAME** and **DRAWING FIELD MAXIMUM FIELD SIZE**.

Calculation: **XDRAWING FIELD/XFRAME** and **YDRAWING FIELD/YFRAME** are compared with each other. The smaller of the two values is the scaling factor.

If **REDUCE DRAWING FIELD = NO** then **XDRAWING FIELD = XFRAME**, **YDRAWING FIELD = YFRAME**, i.e. the scaling factor = 1. In this case, the boundary line of the plot lies on the frame, i.e. the frame and the drawing field are identical.

| FRAME | | REDUCE DRAWING FIELD | | | | |
|-------|-----|----------------------|-----|----|-----------------|---|
| | | YES | | NO | Scaling factor | Dimensions of drawing field (in mm x mm) *) |
| X | Y | X | Y | | | |
| 380 | 280 | 200 | 160 | | 200/380 = 0,526 | 200 x 147 |
| 270 | 190 | | | X | 1 | 270 x 190 |

*) If the device field is smaller, the drawing field will be adapted accordingly.

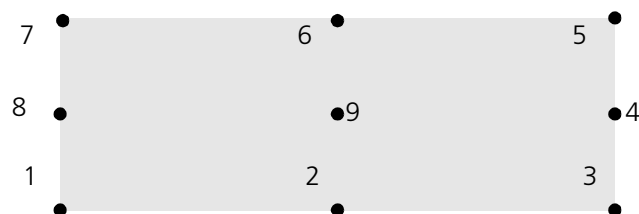
For the display fields proceed in the same manner with the **X** and **Y** input values for **FIELD SIZE** and **COORDINATES**.

NOTE

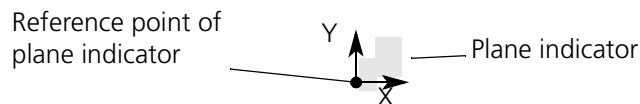
For input in millimeters, the scaling factor should be 1 and the device field (in mm) should be the drawing field.

Field positioning

Each field has the following reference grid regardless of its type, form and size:



The numbers mark the reference grid points. Exception: The plane indicator has only one reference point:



The reference grid points are used for positioning drawing and display fields. The position input for the drawing field is made in the **PLOT FORMAT** dialog window (► *“Plot format” on page 3-6*), for display fields in the

GDT PLOT: LABELS (► *“Display fields for labels” on page 3-10*),

GDT PLOT: DESIGNATION NOM-ACT DATA (► *“Display fields for nominal/actual data and extreme values” on page 3-13*),

GDT PLOT: PLOT PARAMETERS (► *“Plot parameters for straightness with plane tolerance” on page 3-16* to ► *“Plot parameters for bore pattern” on page 3-27*) dialog windows.

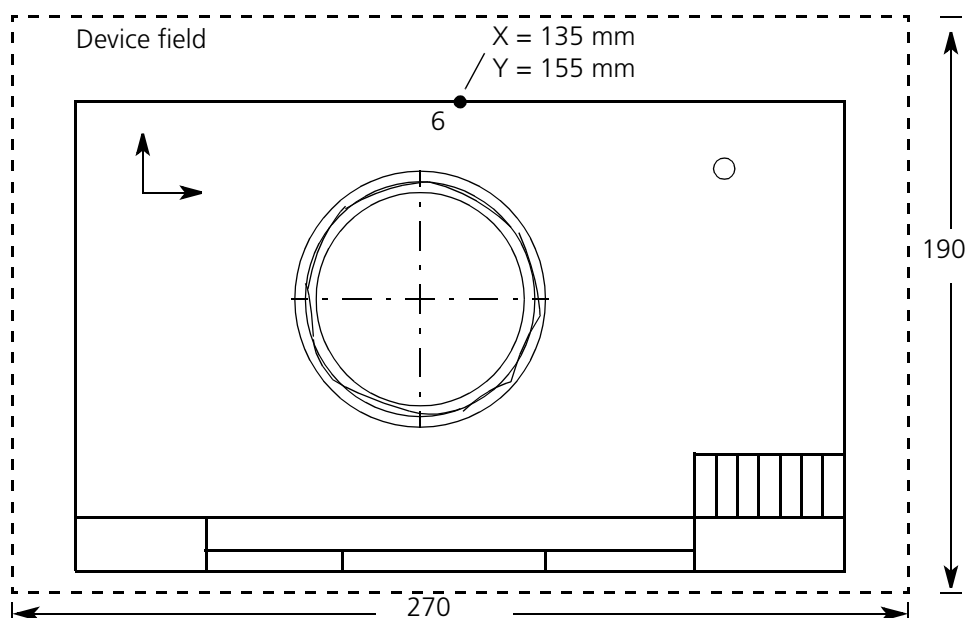
Absolute and relative positioning

A distinction is made between two positioning techniques, i.e. absolute and relative positioning.

Absolute positioning

You position a reference grid point of the subordinate field in the coordinates of the higher level field.

Example 1



Extract from **PLOT FORMAT** dialog window:

Dialog

DRAWING FIELD

FIELD SIZE

X

Y

FRAME

270.0000

190.0000

DEVICE ADJUSTMENT

DEVICE FIELD FROM SYSTEM DATA

?

☐

DEVICE FIELD AS DEFAULT

?

☒

FIELD RED

COORDINATES

FROM

X

Y

6

135.0000

155.0000

POSITION DRAWING FIELD

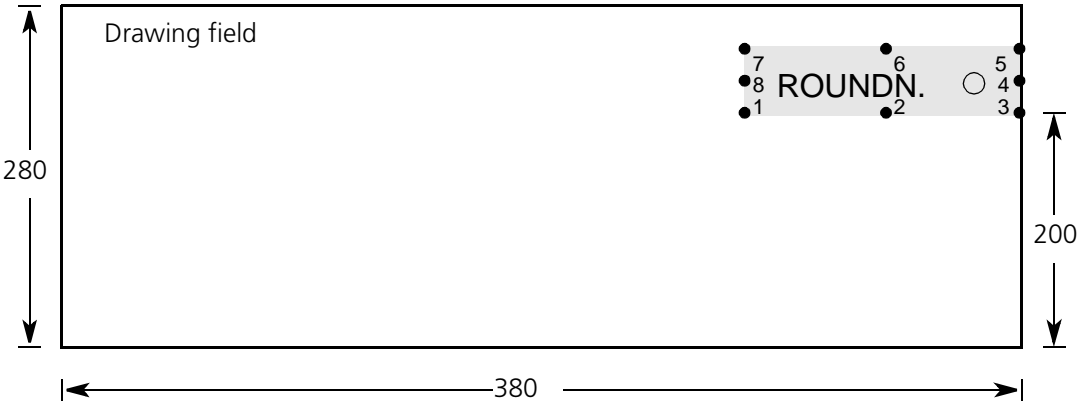
REDUCE DRAWING FIELD

?

☐

Example 2

Position grid point 3 of the **HEADING** display field in coordinates X = 380 and Y = 200 of the (possibly limited) drawing field:



Extract from the **GDT PLOT: LABELS** dialog window:

Dialog

GDT PLOT: LABELS

| | FIELD SIZE | | FIELD REF | | COORDINATES | |
|--------------------------|--------------------------|----------------------|--------------------------|--------------------------|----------------------|----------------------|
| | X | Y | FROM | TO | X | Y |
| RECORD HEADER | <input type="checkbox"/> | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> | <input type="text"/> |
| CONNECT TO FRAME | <input type="checkbox"/> | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> | <input type="text"/> |
| DISPERSION CLASSES | <input type="checkbox"/> | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> | <input type="text"/> |
| CONNECT TO RECORD HEADER | <input type="checkbox"/> | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> | <input type="text"/> |
| HEADING | <input type="checkbox"/> | <input type="text"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="text"/> | <input type="text"/> |

NOTE

Position inputs for display fields are subject to scaling (► “Scaling factor” on page 3-31).

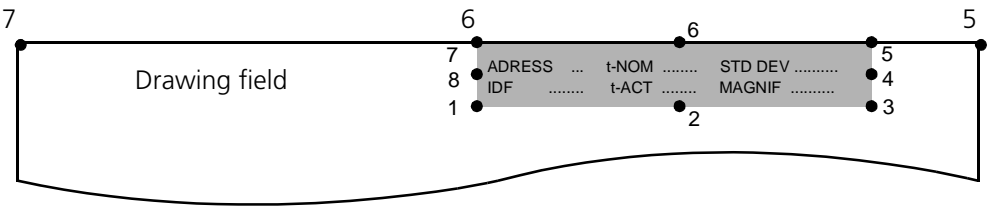
Relative positioning

You fasten the reference grid point of a display field to the reference grid point of another display field or the drawing field.

Example

Position grid point 7 of the **NOM/ACT**

DATA display field in grid point 6 of the (possibly restricted) drawing field.



Extract from the **GDT PLOT: DESIGNATION NOM-ACT DATA** dialog window.

Dialog

GDT PLOT: DESIGNATION NOM-ACT DATA

| | | FIELD SIZE | | FIELD REF | | COORDINATES | |
|--------------------------|-----|------------|---------|-----------|----|-------------|---|
| | | X | Y | FROM | TO | X | Y |
| NOM / ACT DATA | ? * | 300.0000 | 10.0000 | | | | |
| CONNECT TO FRAME | ? * | | | 7 | 6 | | |
| CONNECT TO RECORD HEADER | ? | | | | | | |

Chapter

4

2D Bore pattern best fit

This chapter contains:

| | |
|---|------|
| Overview and procedure | 4-2 |
| Best fit of bore patterns | 4-4 |
| Interpretation of results | 4-16 |
| Control data list and notes on special applications | 4-21 |

Overview and procedure

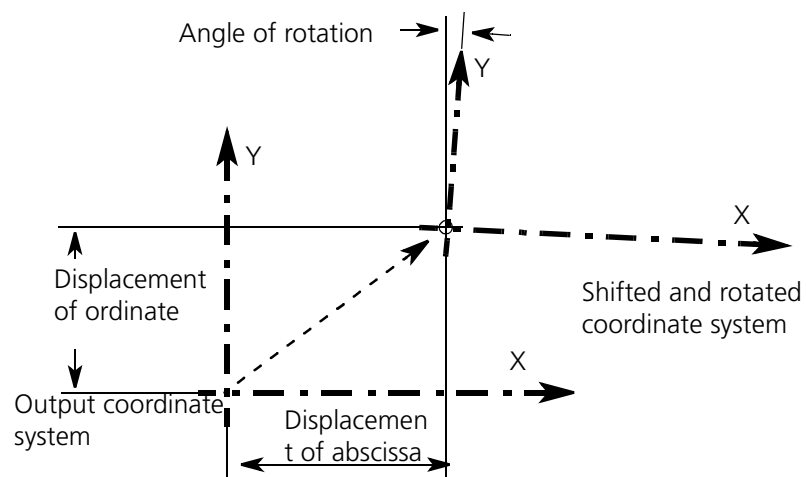
With the 2D bore pattern best fit you can check the position tolerances of any bore pattern and change the workpiece coordinate system by the best fit parameters (2D-Fit).

Several methods are available for a best fit. The best fit can be made by shift and/or rotation (select both for an optimal best fit).

You can then check the position tolerances by magnifying (zooming) the tolerance ranges (MMC).

The bore pattern best fit record (example ➤ *“Record output” on page 4-16*) supplies the following result:

- Displacement of ordinate, displacement of abscissa and angle of bore pattern rotation as best fit parameters.
- The workpiece coordinate system changed by the best fit parameters: Rotated by the rotation angle, the zero point is displaced by the displacement values.



- The individual elements (bores) of the bore pattern, recalled into the modified coordinate system, with their position tolerances checked.

All results appear under their own address and can be used for the nominal-actual comparison, recall, coordinate transformation, etc.

You can also plot the best fit result (➤ *“Bore pattern plot” on page 4-17*).

Procedure for bore pattern best fit

- Measure the bores which should be taken into consideration; any addresses may be used, i.e. they need not be taken from the

current coordinate system. The sense of rotation must be taken into account.

- If you want to plot the bore pattern best fit: Select/Set the plot output device/plot format with **<DI 1625>**. If necessary, create your own bore pattern performance mode.
- If you require a nominal-actual comparison for the displacement of ordinate and abscissa and /or rotation angle, then enter nominal dimensions.
- (For bore patterns) Enter **<DI 1159>** and fill out the **Bore pattern: Nom-act input** dialog window (➤ *“Function call and data input <DI 1159>” on page 4-4*). See pertaining notes for other elements/element groups.
- If you want to plot the result: Press the **<PLOT>** softkey to change to the **Bore pattern best fit plot output** dialog window (➤ *“Requesting the bore pattern plot” on page 4-9*). From there, you can return to the dialog window: Bore pattern: Nom-act input.
- Quit the **Bore pattern: Nom-act input** dialog window with **<TERMIN>** to change to the **Bore pattern best fit** dialog window and continue your input there (➤ *“Best fit” on page 4-12*). Press **<TERMIN>** to request the best fit result.
- If desired, press **<RECALL>** to install the coordinate system changed by the best fit values (for more information, see ➤ *“Record output” on page 4-16*).

NOTE

<DI 1159> is a collective function request for bore patterns. If you want to execute a best fit of other elements or element groups, proceed as described in ➤ *“Control data list and notes on special applications” on page 4-21*.

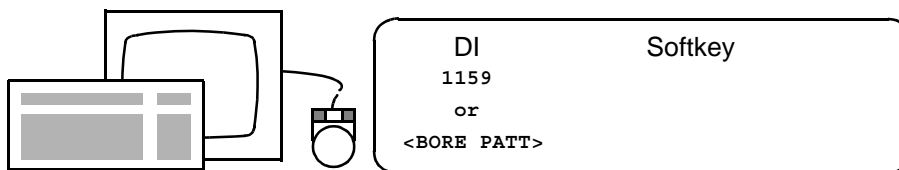
Graphic output is executed following paper change with **<DI 1652>** .

Best fit of bore patterns

Function call and data input <DI 1159>

Preparations and procedure: ➤ "Overview and procedure" on page 4-2. Two subsequent dialog windows followed by a third window for the bore pattern plot must be filled in.

The input must be started by using the following function call.



Dialog window

| Dialog | | | | | | | | | | |
|------------------------------------|----|--------|--------------------------|------------|--------|-------------------------------------|----------|--------|-------------|------|
| Bore pattern: Nom-act input | | | | | | | | | | |
| Best fit of ADR/Name | | | | | to | | | | Step | |
| Best fit of ADR/Name | | | CIRCLE 1 | | to | | CIRCLE 4 | | Step | |
| Rot. reg. arrangement ? | | | <input type="checkbox"/> | | Radius | | 0.0000 | | Start angle | |
| Specify GDT POS | | | d | | M | | A | | M | |
| ADR/Name of meas. element | | | 0 | | Ref. A | | Ref. B | | M | |
| ? | | Symbol | IDF | Nominal | | UTOL | | LTOL | | NORM |
| * | X | | | 0.0000 | | | | | | |
| * | Y | | | 0.0000 | | | | | | |
| | D | | | 0.0000 | | 0.0000 | | 0.0000 | | |
| * | tX | | | 0.0000 | | | | | | |
| * | tY | | | 0.0000 | | | | | | |
| Table input: Conclude TAB TERM | | | | | | | | | | |
| Display/change: TAB NEXT, TAB PREV | | | | | | | | | | |
| * YES NO | | | | CARTES | | * TAB NEXT TAB TERM TERM LIN TERMIN | | | | |
| BACK | | | | PLOT POLAR | | TAB PREV SYMM INFO | | | | |

The last entries made are stored as the default values in the dialog window.

Softkeys

*** YES**

Used to affirm/reject a yes/no query.

NO

CARTES

Switches symbols (X, Y \leftrightarrow R, W) for nominal value inputs in cartesian or polar coordinates.

POLAR

TAB NEXT

Cf. notes on input fields "Best fit of ADR/Name and ADR/Name of meas. element".

TAB PREV

TAB TERM

TERM LIN

Used to quit input line with displayed data without stepping through each field.

TERMIN

Used to quit current dialog window and open **Bore pattern best fit** window, ➤ "Best fit" on page 4-12.

BACK

Return to calling menu.

PLOT

Opens the **Bore pattern best fit plot output** window if you want to plot the bore pattern best fit (➤ "Requesting the bore pattern plot" on page 4-9). You can change to this dialog box at any time. After you quit it with <TERMIN> or <BACK>, the Nom/act value input page appears again with the data last entered.

Input fields

The last entries made are stored as the default values in the dialog window.

If the new input is identical with the last actual value address, the nominal values will be assigned the values last entered. If the actual value address is changed, the nominal values will be rounded off. The measuring direction must be taken into account during measurement.

Best fit of ADR/Name ... to ... step

Specify the addresses of the bores to be fitted. For consecutive bores or bores arranged at regular intervals, enter the start address, end address and step size (address block). For a single address, enter the same value for "Best fit of ADR/Name" and "to". The elements to be best fit do not have to be located in the current coordinate system.

The input is always made in the lower line. If you enter an address block, the data will jump to the line above. The lower line is then free for input of another address block.

In this way you can create a table with a maximum of 10 lines (10 address blocks). The dialog window always shows only two lines of this table. You can scroll inside the table by using the **<TAB NEXT>** and **<TAB PREV>** softkeys.

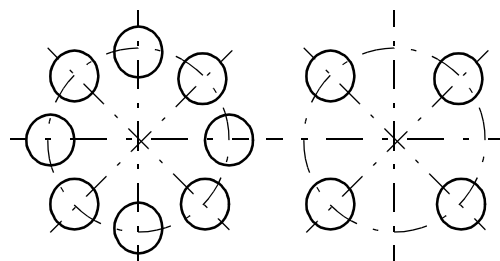
Relative addresses and/or a descending order of addresses are allowed (in latter case, enter step size with "-" sign).

With full-circle bore patterns you should enter the bores in the order of their arrangement. In this case, the program will subsequently support you by generating the nominal dimensions, cf. information and example for rot. reg. arrangement.

Once you have entered all addresses, you must press the **<TAB TERM>** softkey to reach the next input field.

Rot. reg. arrangement, radius, start angle

If you best fit a full-circle bore pattern (360°) with uniform graduation, you should mark (i.e. select) rot. reg. arrangement. Examples for such bore patterns:

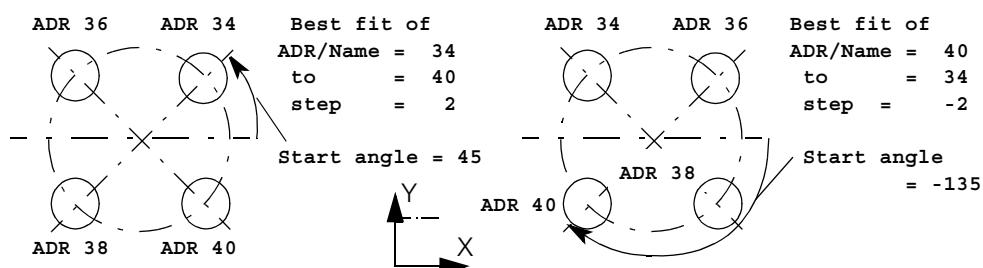


In this case, the program prompts input of the radius and start angle and offers correctly generated data starting with the input field ADR/Name of meas. element.

Prerequisites

- You have entered the elements of the full-circle bore pattern in the order they occur.
- The bore pattern lies concentrically to the zero point of the workpiece coordinate system.

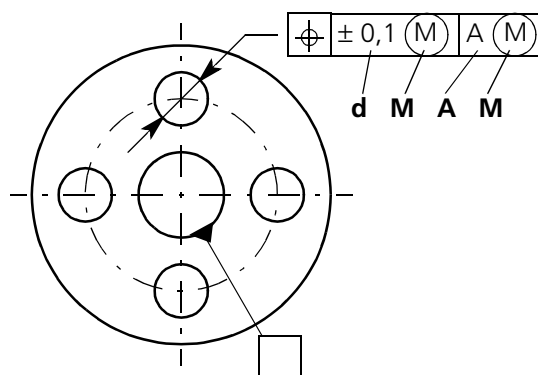
- “Start angle” refers to the first of these elements (mathematically positive, counter-clockwise). Example for bore pattern in the XY plane with view from positive direction of the third axis:



If you do not mark (select) rot. reg. arrangement, the program will individually prompt input of the nominal values for each address.

Specify GDT POS d M A M B M

Mark as shown in your drawing:



- d = YES:** Circular tolerance zone of the measured element.
- d = NO:** Square-shaped tolerance zone of the measured element.
- A = YES:** Measured element refers to a reference element.
- A = NO:** Measured element refers to a zero point.
- d M = YES:** Tolerance extended by difference between maximum material size and actual size of measured element.
- A M = YES:** Tolerance extended by difference between maximum material size and actual size of reference element.

ADR/Name of meas. element, Symbol, IDF, Nominal, UTOL, LTOL, NORM

Now, you must enter the nominal values/tolerances for each bore pattern address. If you have marked "rot. reg. arrangement", the program will generate addresses and nominal values which you can then either accept or overwrite; see note below.

Accept the default address. The program then expects successive input or confirmation of the parameters displayed in the "Symbol" column. It automatically assigns the correct values to this column, depending on the plane of your bore pattern and the parameters specified by the **GDT POS** input. If you have selected the MMC principle for **GDT POS** (M = YES), the program will here prompt input of the nominal diameter and the tolerances of the individual addresses. Without MMC, only the input of position tolerance **t** will be prompted. Make input exactly as for **<DI 1452>** (nominal values). The IDF column can be left blank.

Once all parameters have been entered, the next measured element will appear under "ADR/Name of meas. element" for acceptance or overwriting. The individual nominal values/tolerances must then be entered or confirmed in succession.

Here again, the program writes the data to a table in which you can scroll with **<TAB NEXT>**, **<TAB PREV>**, cf. "Best fit of ADR/Name".

NOTE

For faster input/confirmation:

- Accept the currently displayed address and data with **<TERM LIN>** (i.e. one line of the table) or
- Accept all addresses, nominal values and tolerances with **<TAB TERM>**, i.e. the complete table, without having to step through it line-by-line.

However, the last possibility requires:

- that the position tolerance is the same for all elements and
- that you have observed all of the rules for entering full-circle bore patterns, i.e. correctly generated the program, cf. notes on "Rot. reg. arrangement".

ADR/Name of reference A, ADR/Name of reference B

The reference element will be requested only if **A=*** and you have entered/confirmed the tolerances for all measured elements. Names or relative addresses may be entered. The reference element does not have to be located in the current coordinate system. If **A=*** and **M=*** (tolerance extension of reference element), the nominal values and tolerances of the reference element must then be entered. Follow same procedure as for "ADR/Name of reference element".

Operation

Enter or confirm all of the values prompted in succession. The program will guide you through the dialog window. If you want to plot, you can press the **<PLOT>** softkey at any time to open the **Bore pattern best fit/plot output** dialog window, ▶ *"Requesting the bore pattern plot" on page 4-9*. From there you can return to the dialog window, which you can quit with **<TERMIN>** after performing all entries. Continue ▶ *"Best fit" on page 4-12*.

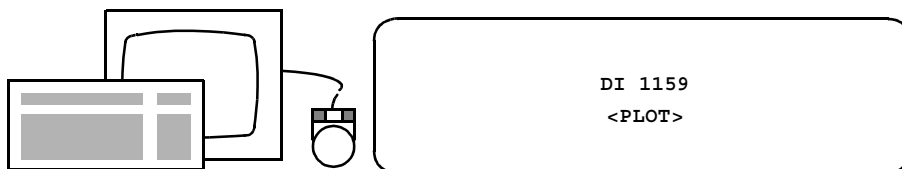
Requesting the bore pattern plot

If required, you can plot your bore pattern best fit. To do so, you must call the "Bore pattern best fit plot output" dialog window.

Please note that this window can be called up only from the "Bore pattern: Nom-act input" dialog window, to which you will then return afterward. The plot will be output on the current plot output device; select beforehand with **<DI 1625>**, if necessary.

Example and explanations of the bore pattern plot ▶ *"Bore pattern plot" on page 4-17*.

Graphic output is executed following paper change with **<DI 1652>**.



Dialog window

Dialog

Bore pattern best fit plot output

P. mode name

CZ LOBI

Comment

With form

*

Magnification

100

Identific.

123456

Output from

0.00

% tolerance utilization

Plot name/address for each element

*

or plot identification

All elements with the same pen number

*

Pen number

1

or assign with table

From elem.

to

Step

1

Pen number

1

From elem.

CIRCLE 1

to

CIRCLE 4

Step

1

Pen number

1

* YES

NO

*

TAB NEXT

TAB TERM

TERMIN

BACK

FORM PERF

MOD

TAB PREV

INFO

Softkeys

* YES

NO

Used to affirm/reject a yes/no query.

TERMIN

Used to close dialog window and return to the **Bore pattern: Nom-act input** dialog window, ►“Function call and data input <DI 1159>” on page 4-4.

BACK

Used to cancel a plot request and return to the **Bore pattern: Nom-act input** dialog window.

TAB NEXT

Cf. notes on input field **From elem.**

TAB PREV

TAB TERM

FORM

Used to start plot form (►“Plot form” on page 2-20).

PERF MOD

Opens dialog window for defining plot performance modes (► *“Main menu GDT plot performance mode” on page 3-4*).

INFO

More information.

Input fields

**P. mode name,
Comment,
With form,
Identification**

As for GDT plot, ► *“Roundness plot” on page 2-9*. The performance mode supplied for bore patterns is called **CZ_LOBI**.

Magnification

As for GDT plot, ► *“Roundness plot” on page 2-9*; however, the program does not offer a suitable value, i.e. you must key it in yourself.

**Output from %
tolerance utilization**

Plot is output starting with the tolerance utilization entered here (in %).

**Plot name/address for
each element or plot
identification**

If desired, you can label the individual bore pattern bores with their name, address or identification (td, tx, ty).

**All elements with the
same pen number**

Unicolor plot.

or assign with table

Multicolor plot.

Pen number

After All elements with the same pen number = **YES**, select color via pen number.

**From element,
to step,
Pen number**

If you have selected All elements with the same pen number = **No**, you can now select the individual colors via the pen numbers; color assignement as for ► *“Character size/pen numbers” on page 3-8*. The program writes the data to a table which you can scroll through or close with the softkeys **<TAB PREV>**, **<TAB NEXT>**, **<TAB TERM>**, cf. **Bore pattern: Nom-act input** dialog window, ► *“Function call and data input <DI 1159>” on page 4-4*

Operation

Enter the required plot parameters.

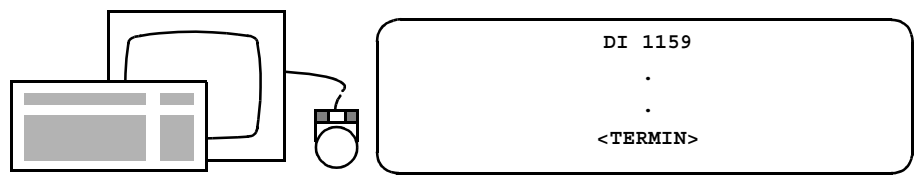
After pressing **<TERMIN>** or **<BACK>**, the program returns to the **Bore pattern: Nom-act input** dialog window, ► *“Function call and data input <DI 1159>” on page 4-4*.

The plot is created only after you close the **Bore pattern best fit** dialog window (► *“Best fit” on page 4-12*).

Graphic output is executed following paper change with **<DI 1652>**.

Best fit

After the **Bore pattern: Nom-act input** dialog window has been closed with <TERMIN>, the program automatically continues with the **Bore pattern best fit** dialog window, where the best fit conditions are defined.



Alternative function call: ▶ “Control data list and notes on special applications” on page 4-21.

Dialog window

Dialog

Bore pattern best fit

Bore patt. name: LOBI_1

Best fit method: Gauss

or

Chebyshev

or

L1 best fit

or

Tol. consideration

or gauge simulation

* Weighting with 1/Tolerance

Best fit mode: Rotate * Shift *

Nominal file: SOLWEP_07

* YES NO

*

TERMIN

BACK

INFO

Softkeys

*** YES**

Used to affirm/reject a yes/no query.

NO

TERMIN

Used to close the dialog window and output the result on the printer (> "Record output" on page 4-16) and (if selected) on the plotter (> "Bore pattern plot" on page 4-17) or in the corresponding screen windows.

BACK

Used to return to the **Bore pattern: Nom-act input** dialog window.

Input fields

Bore patt. name

The name entered here appears in the record and the plot if you have activated name allocation with **<DI 1663>**.

Best fit method

Gauss

Sum of the error squares, i.e. outliers have a certain influence on the result.

Gauss and Weighting with 1/Tolerance:

As for Gauss,
only each element is weighted w. the factor $\frac{1}{\text{toleranz}}$

Chebyshev

Largest error amount = minimum, i.e. outliers determine the result.

L1 best fit

Sum of error amounts = minimum, i.e. outliers have no influence on the result.

Tolerance consideration (only with round tol. zone):

- Largest error minus $\frac{t_D}{2}$ = minimum
- If bore pat. is in tolerance, then: error minus $\frac{t_D}{2} < 0$

In case of tolerance consideration, the measured elements with MML and the references with MMC cause a tolerance extension prior to the best fit. The references are not considered for the best fit.

Gauge simulation (only with round tol. zone)

In case of gauge simulation, a tolerance extension is only calculated if the measured elements have MMC.

Reference A is the center of rotation for the rotation, reference B defines the admissible zone for a rotation and shift. Reference B has always MMC! The truth table for the best fit shows how to set the rotation and translation for the gauge simulation in the input dialog.

The following number of measured elements is admissible:

- no reference: 2 to 200 measured elements: in case of one measured element: **<DI 1407>** has to be used.
- one reference: 1 to 199 measured elements
- two references: 1 to 198 measured elements

NOTE

- MMC is only considered for tolerance consideration and gauge simulation.
- Reference B is only considered for gauge simulation. It is not considered for all other best fit functions.

| | | One circular reference element | |
|---------------------------------------|--------------|--------------------------------|------------|
| | no reference | A without MMC | A with MMC |
| Measured elements with or without MMC | 1 | 1 without translation | 1 |

| | Two circular reference elements | | | |
|---------------------------------------|---------------------------------|--------------------------|-----------------------------|-----------------------------|
| | A without MMC B without MMZ | A with MMC B with MMC | A with MMC B without MMZ | A without MMC B with MMC |
| Measured elements with or without MMC | 0 | 1 | --- | 1 without translation |

Explanations

0 = no best fit

1 = best fit with translation and rotation

--- = not used

Best fit mode

Shift

The record outputs two coordinates under the bore pattern address which correspond to the sliding displacement values of the best fit in the ordinate and abscissa directions, ➤ *“Overview and procedure” on page 4-2*.

Rotate

The record outputs the angle of rotation with A1 under the bore pattern address (displacement of ordinate, displacement of abscissa, ➤ *“Overview and procedure” on page 4-2*).

You have the option of selecting both modes, one or none at all. For an optimum best fit, select Rotate=* and Shift=*, ➤ *“Function call and data input <DI 1159>” on page 4-4*. If you make no selection, the record will document the actual and nominal status without best fit data.

Nominal file

Display of the standard nominal files, no editing possible. If you need another file, please enter this afterwards in the corresponding control data line with the control data editor (➤ *“Control data list and notes on special applications” on page 4-21*).

Operation

Enter the data required and determine the best fit method. After you press **<TERMIN>**, the best fit results are output on the printer (➤ *“Record output” on page 4-16*) and (if selected) on the plotter (➤ *“Bore pattern plot” on page 4-17*) or in the corresponding screen windows.

Interpretation of results

Record output

```

=====
ADR|REC|TASK|IDF|SY|ACTUAL|NOMINAL|U.TOL|L.TOL|DEV|EXC
=====
383      CIRCLE I      X      24.9992
                        Y      24.9925
                        D      10.0043

384      CIRCLE I      X       5.0044
                        Y      25.0014
                        D      10.0029

385      CIRCLE I      X       5.0005
                        Y       4.9975
                        D       9.9960

Best fit method:  Gauss
Best fit mode Shift in XY
Best fit mode Rotate about  Z

Bore pattern calculation Start
386      * 2D-FIT      X      -.0012
                        Y       .0002
                        A1     -.0067
                        Y/X
3P S/MIN/MAX          .0042          (3)   .0024          (1)   .0054

387      ROTATE PLANE  A      -.0067  ABOUT MACHINE AXIS Z

388      ZEROP        X      -.0012
                        Y       .0002

389 383! CIRCLE I      X      24.9975
                        Y      24.9952
                        D      10.0043

390      GDT POS      X      24.9975  25.0000          -.0025
                        Y      24.9952  25.0000          -.0048
                        td       .0107    .1000   .2043          +

                        (M)      D1     10.0043  10.0000   .1000  -.1000          +

                        .
                        .
                        .

393 385! CIRCLE I      X       5.0011
                        Y       4.9979
                        D       9.9960

394      GDT POS      X       5.0011  5.0000          .0011
                        Y       4.9979  5.0000          -.0021
                        td       .0047    .1000   .1960          +

                        (M)      D1     9.9960  10.0000   .1000  -.1000  -.0040  -

395 382 *COORD. SYSTEM AS FOR ADR.  382

Bore pattern calculation End

```


Explanation of example

- Address 383 to 385: Measure the bores of the bore pattern to be best fit as circles.
- The results of the bore pattern calculation are stated between the two subheadings "Bore pattern calculation Start" and "Bore pattern calculation End", introduced by notes on the best fit method corresponding to your entries in the dialog windows of **<DI 1159>**.
- Address 386 records the displacement of abscissa, displacement of ordinate and rotation angle, i.e. the values by which the coordinate system is changed (➤ *"Overview and procedure" on page 4-2*).
- Addresses 387 and 388 document the best fit coordinate system.
- The remaining addresses up to 394 contain the bores of the bore pattern recalled into the best fit coordinate system and the position deviations.
- Address 395: Immediately before "Bore pattern calculation End", the old coordinate system, valid until **<DI 1159>** was called up, will be automatically recalled. If you want to continue working in the coordinate system altered by the best fit values, you must recall the corresponding address (in this example 388).

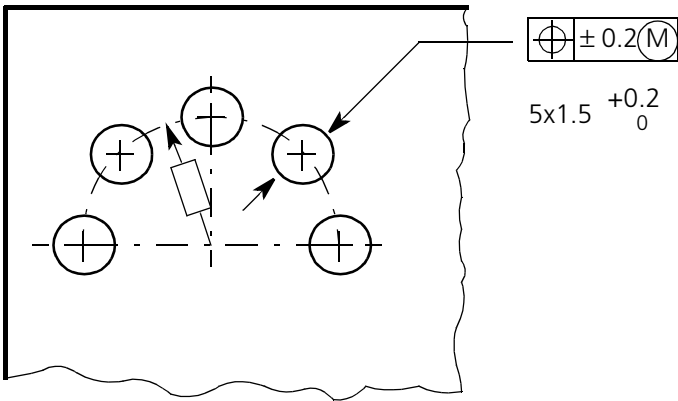
Bore pattern plot

Preparations for plotting

➤ *"Overview and procedure" on page 4-2*

The plot compares the nominal position of the bores (including the tolerance zone) with its actual position. It shows the nominal position of the bore with its tolerance so that all tolerance fields are visible. The deviations measured are plotted as the actual position. The shift and rotational values appear in the **Y**, **Z**, **X** and **A** fields.

Measurement example

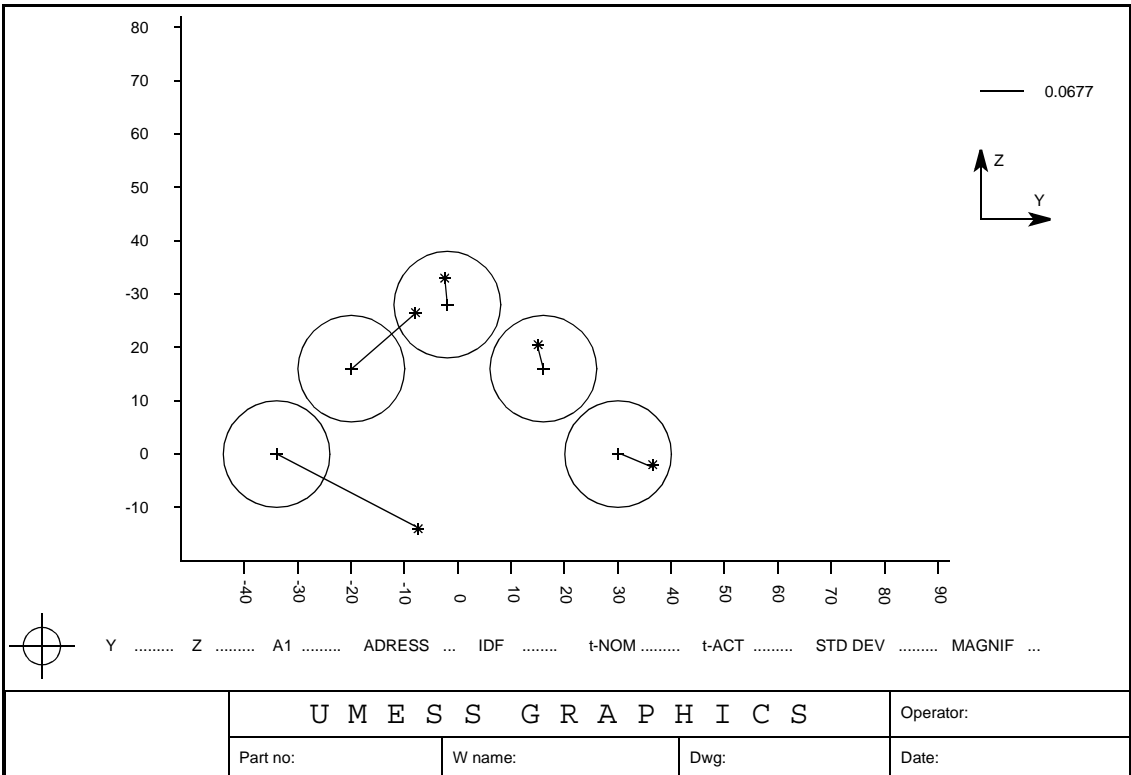


In this example, the evaluation takes place with three different options:

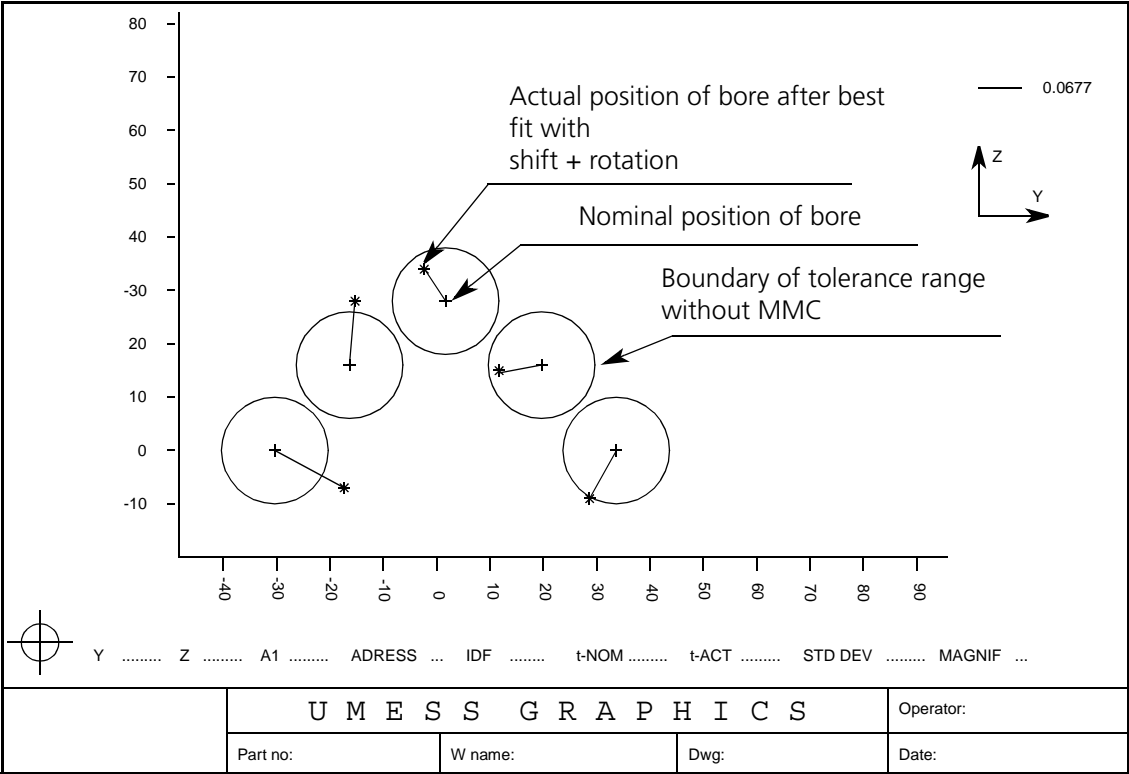
- with rotation,
- with rotation and shift,
- with rotation, shift and MMC.

The following three plots show the corresponding evaluation.

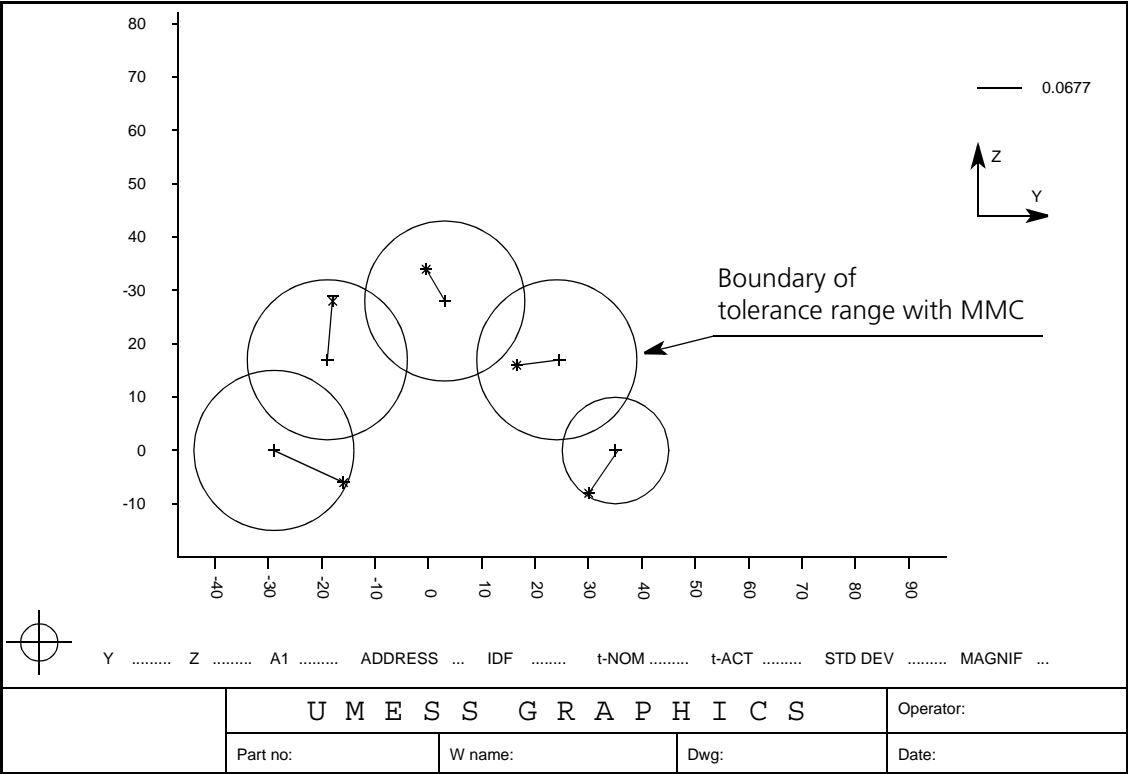
Rotate



Rotation and shift



Rotation, shift and MMC



Control data list and notes on special applications

<DI 1159> generates the following control data list (here with the example from ➤ *“Record output” on page 4-16*):

| No. | X | Y | Z | Function | SC2 | AC1 | PCN | CCN | ADR |
|--------|----------------|---------------|----------|--------------|-----|-------|------|------|-----|
| Dialog | | | | | | | | | |
| 1013 | | | | CIRCLE | 0 | 0 | 1104 | 1410 | |
| 1014 | 39.9901 | 50.0001 | 50.0001 | I-POS | 0 | 11110 | 0 | 1101 | |
| 1022 | 39.9901 | 50.0001 | 50.0001 | I-POS | 0 | 11110 | 0 | 1101 | |
| 1023 | | | | N POINT TERM | 1 | 0 | 1191 | 1420 | 383 |
| 1035 | | | | CIRCLE | 0 | 0 | 1104 | 1410 | |
| 1036 | 39.9901 | 39.9901 | -40.0020 | I-POS | 0 | 11110 | 0 | 1101 | |
| 1044 | 39.9901 | 39.9901 | -40.0020 | I-POS | 0 | 11110 | 0 | 1101 | |
| 1045 | | | | N POINT TERM | 1 | 0 | 1191 | 1420 | 385 |
| 1046 | | | | BORE P.START | 0 | 0 | 1159 | 0 | |
| 1047 | | | | GDT BFIT STA | 0 | 2 | 1480 | 0 | |
| 1048 | 0 | PKTSOLWEP_10U | | LDL NOMVFIL | 0 | 0 | 9919 | 0 | |
| 1049 | 0 | 0 | 0 | NOM VAL BFIT | 0 | 2 | 1484 | 0 | |
| 1050 | 3 | | | PARAM | | 2 | 0 | 9981 | 0 |
| 1051 | 300.00000 | | | PARAM | | 61 | 0 | 9981 | 0 |
| 1052 | 200.00000 | | | PARAM | | 62 | 0 | 9981 | 0 |
| 1053 | x_kreis_1 | | | PARAM TXT | | 26 | 0 | 9982 | 0 |
| 1054 | y_kreis_1 | | | PARAM TXT | | 27 | 0 | 9982 | 0 |
| 1055 | 0.01000 | | | PARAM | | 51 | 0 | 9981 | 0 |
| 1056 | 0.01000 | | | PARAM | | 52 | 0 | 9981 | 0 |
| 1057 | tx_kreis_1 | | | PARAM TXT | | 16 | 0 | 9982 | 0 |
| 1058 | ty_kreis_1 | | | PARAM TXT | | 17 | 0 | 9982 | 0 |
| 1059 | 3 | | | PARAM | | 3 | 0 | 9981 | 0 |
| 1060 | | | | GDT END | 0 | 0 | 9983 | 0 | |
| 1061 | 0 | 0 | 0 | NOM VAL BFIT | 0 | 2 | 1484 | 0 | |
| 1062 | 3 | | | PARAM | | 2 | 0 | 9981 | 0 |
| 1063 | 200.00000 | | | PARAM | | 61 | 0 | 9981 | 0 |
| 1064 | 300.00000 | | | PARAM | | 62 | 0 | 9981 | 0 |
| 1065 | x_kreis_2 | | | PARAM TXT | | 26 | 0 | 9982 | 0 |
| 1066 | y_kreis_1 | | | PARAM TXT | | 27 | 0 | 9982 | 0 |
| 1067 | 0.01000 | | | PARAM | | 51 | 0 | 9981 | 0 |
| 1068 | 0.01000 | | | PARAM | | 52 | 0 | 9981 | 0 |
| 1069 | tx_kreis_2 | | | PARAM TXT | | 16 | 0 | 9982 | 0 |
| 1070 | ty_kreis_2 | | | PARAM TXT | | 17 | 0 | 9982 | 0 |
| 1071 | 4 | | | PARAM | | 3 | 0 | 9981 | 0 |
| 1072 | | | | GDT END | 0 | 0 | 9983 | 0 | |
| 1073 | | | | GDT BFIT END | 0 | 0 | 1481 | 0 | |
| 1074 | | | | POINT FILE | 0 | 0 | 1100 | 1410 | |
| 1075 | 383 | 385 | 1 EN | RECALL M ADR | 0 | 1 | 1302 | 0 | |
| 1076 | 0 | PKTISTWEP_10U | | FILE TERMIN | 0 | 1 | 1192 | 430 | |
| 1077 | | | | BORE PATT | 0 | 0 | 1160 | 1410 | |
| 1078 | 0 | PKTISTWEP_10U | | RECALL FILE | 0 | 1 | 1305 | 0 | |
| 1079 | | | | PT RECALL | 3 | 5 | 1192 | 430 | 386 |
| 1080 | 1 XY | | | TRANS BEFIT | 0 | 0 | 9911 | 0 | |
| 1081 | 1 Z | | | ROTAT BEFIT | 0 | 0 | 9911 | 0 | |
| 1082 | 2.0000 | | | BFIT PARAM | 0 | 0 | 9911 | 0 | |
| 1083 | 0 | PKTSOLWEP_10U | | LDL NOMVFIL | 0 | 0 | 9919 | 0 | |
| 1084 | 3 | 0.0067 | | TR PLANE | 0 | 1 | 1702 | 1640 | 387 |
| 1085 | | | | ZERO POINT | 0 | 0 | 1701 | 1640 | 388 |
| 1086 | 383 | JA | | RECALL 1 ADR | 0 | 1 | 1301 | 0 | 389 |
| 1087 | | | | GDT EVAL STA | 0 | 0 | 1474 | 0 | |
| 1088 | 0 | 0 | 0 | GDT POSITION | 0 | 2 | 1407 | 0 | 390 |
| 1089 | | | | GDT END | 0 | 0 | 9983 | 0 | |
| 1090 | 385 | JA | | RECALL 1 ADR | 0 | 1 | 1301 | 393 | |
| 1091 | 0 | 0 | 0 | GDT POSITION | 0 | 2 | 1407 | 394 | |
| 1092 | | | | GDT END | 0 | 0 | 9983 | 0 | |
| 1093 | 4 | 1 999 \$1 | 0.0000 | BESTFIT PLOT | 0 | 5 | 1471 | 0 | |
| 1094 | STAFPCZ_LOBI_U | | | DL GDT PLOT | 0 | 0 | 0 | 9911 | 0 |
| 1095 | 0 | 0 | 1 | DL PEN NO | 0 | 0 | 9911 | 0 | |
| 1096 | 7 | PKTISTWEP_10U | | DL ACTVFILE | 0 | 0 | 9911 | 0 | |
| 1097 | PLOTT | 0.0000 | 100 | LDL GDT PLOT | 0 | 0 | 9919 | 0 | |
| 1098 | | | | GDT EVAL END | 0 | 0 | 1475 | 0 | |
| 1099 | 382 | | | RECALL WPSYS | 0 | 1 | 1301 | 1640 | 395 |
| 1100 | | | | BORE P. TERM | 0 | 0 | 1161 | 0 | |

<DI 1159> is a collective function call comprising individual modules which exist in UMESS as separate functions with their own function request commands. Only the control data lines highlighted in gray apply specifically to <DI 1159>. All other control data lines can be generated by the following operating sequence.

The bore pattern best fit was extended by the best fit method gauge simulation. A second reference (reference B) can be entered in the screen for the nominal values. The procedure for entering the nominal value for reference B is the same as for reference A: If reference B with MMC is selected, the nominal values for reference B are prompted later.

All references for the bore pattern best fit are circular. All non-circular references have to be considered by the user by means of other UMESS functions.

Example

A bore pattern has the three references A, B, C. References B and C are circular, reference A is a workpiece edge. An alignment, e.g. rotate plane, is carried out by means of reference A. For the bore pattern best fit, references B and C are entered as references A and B.

Influence of the circular references on the evaluation

Tolerance consideration: In case of the best fit method **tolerance consideration**, the measured elements with MML and the references with MMC cause a tolerance extension prior to the best fit. The references are not considered for the best fit.

You can also use this sequence to perform best fits of individual elements and special element groups.

| DI or softkey | Function | Control data line in example | Example |
|--|--|------------------------------|---|
| 1104 | CIRCLE | 1013 to 1045 | Measure elements to be best fitted (or recall) |
| 1480* | GDT BFIT STA GDT POSITION GDT POSITION GDT BFIT END | 1047 to 1048 | Open nominal file |
| 1407 | | 1049 to 1060 | For the elements to be best fitted |
| 1407 | | 1061 to 1072 | For the elements to be best fitted |
| 1481 | | 1073 | Close nominal file |
| 1100* | POINT FILE RECALL M ADR FILE TERMIN | 1074 | Open actual file (point file) |
| <RECALL> | | 1075 | Recall of elements to be best fitted into point file |
| <TERMIN> | | 1076 | Close actual value file |
| 1160 <TERMIN> <FILEEVAL> <TERMIN> | BORE PATT. | 1077 to 1083 | Input starts with dialog window Bore pattern best fit , ➤ "Best fit" on page 4-12 |
| 1702 | ROTATE PLANE | 1084 | Rotation angle for the coordinate system changed by the best fit values, ➤ "Overview and procedure" on page 4-2 |
| 1701 | ZEROPOINT | 1085 | Displacement for the coordinate system displaced by the best fit values, ➤ "Overview and procedure" on page 4-2 |
| 1301 | RECALL 1 ADR | 1086 | Recall of the first element into the changed coordinate system |
| 1474 | GDT EVAL STA | 1087 | Start higher-order GDT evaluation |
| 1407 | GDT POSITION | 1088 to 1089 | Position check in new coordinate system |
| 1301 1407 | RECALL 1 ADR GDT POSITION | 1090 to 1092 | Recall and position check for each element to be best fitted |
| (1471) | BEST FIT PLOT | 1093 to 1097 | Function call not possible; generate control data lines in usual way, e.g. with editor or <DI 1159> |
| 1475 | GDT EVAL END | 1098 | Terminate higher-order GDT evaluation |
| 1301 | RECALL WSSYS | 1099 | Recall of old coordinate system (if it is required instead of best fit system) |

* The order of nominal value and actual value acquisition may also be reversed (steps in brackets).

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