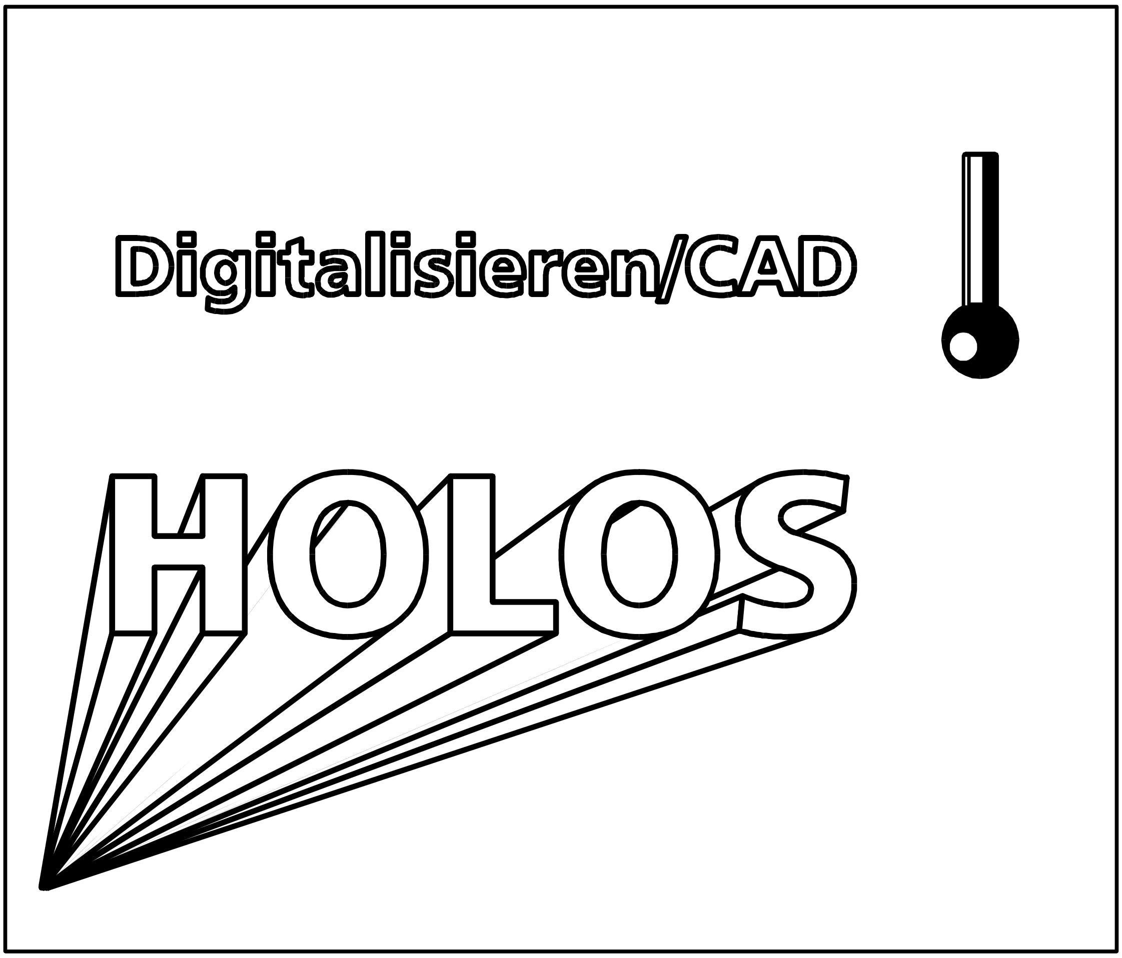
Digitizing/CAD-NT/UX



Instruction Manual

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1 General Information

Program functions for digitizing free form surfaces and CAD functions are available as additional options to HOLOS.

They are integrated under the designations “Digitizing” and “CAD” into the menu, from which they are then called up.

Using the **Digitizing functions** you can digitize free form surfaces and generate surface descriptions from the acquired data.

The program functions required are, on the one hand, the digitizing functions in CADLINK, and on the other hand, the functions within the “Digitizing” menu in HOLOS.

The **CAD functions** are used to generate surfaces, curves, points or elements of regular geometry.

About this operating manual

This operating manual describes the “Digitizing/CAD” program functions in the versions for Windows NT and for UNIX.

Screen masks are shown in the NT version as a rule.

Functions which generally or for the described function only apply for one of the two versions are marked as follows:

- (NT) for Windows NT
- (UX) for UNIX

The chapters and sections are divided into

- general information about commands and
- step-by-step operating instructions

The following symbols are used for describing the operating sequences:

Necessary action

Result of an action

Computer message

Other symbols are:

< ... > for calling up commands

[R] for letters on the keyboard, e.g. hotkeys

denotes cross references to other chapters or sections.

2 Digitizing

The prerequisite for generating curves and surfaces is manual probing of points on the workpiece surface. The interface between HOLOS and the coordinate measuring machine is CADLINK, an option of the measuring software.

The CADLINK communication module in the UMESS measuring software offers three options for digitizing models, which are used to define free form curves and free form surfaces in HOLOS:

- Digit grid
- Digit curve
- Digit point

With manual measuring machines, these functions are not available in the measuring software itself. In this case, you must define in HOLOS how probed points are further processed.

⇘ To do this, click on the <Manual point probing> function in the <Manual> menu and activate the <Digitization point> option.

The functions described below relate to the UMESS-UX, UMESS 300 and UMESS 1000 measuring software.

The digitization points are further processed in HOLOS in conjunction with all other measuring software packages.

2.1 Grid

The <DIGIT GRID> function defines a point grid which is used directly in HOLOS for calculation (= approximation) of a surface. In order to define the point grid, enter the number of points required in both the U and V parameter directions.

You must probe at least two points in each parameter direction. If there is curvature present within the surface, increase the number of probing points in order to include the information from these curvature changes in the first calculation of the surface. However, keep the number of grid points as small as possible! You can then collect sufficient information about a surface using the digitization functions in HOLOS.

Probing sequence and surface orientation

You can probe the grid points either in a meandering fashion or linearly.

The sequence of the probing points determines the parameter directions of the surface. The direction from the first to the second grid point defines the direction of the V parameter of the free form surface. The direction from the first to the next grid line defines the direction of the U parameter.

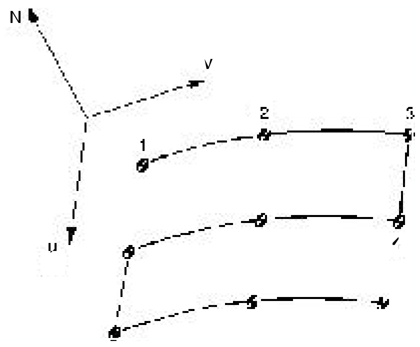


Figure 2-1

As different functions assume that surfaces are oriented in the same way, when digitizing you should ensure that the surface orientations are identical.

If these conventions are not observed, during the interactive construction of curves and surfaces, this can lead to a surface which does not lie on the actual workpiece surface. Reason: The probe radius is corrected in the wrong direction, as the surface normal is incorrectly defined.

When digitizing a grid, the probing vector is taken into account in the first probing point, i.e. if the parameter directions U and V are incorrectly defined, this can be automatically corrected by the system.

Polynomial degree

The polynomial degree of the calculated surfaces is dependent on the number of probed points in the respective parameter direction. It is always one less than the number of probed points, up to a maximum limit. You can enter the maximum polynomial degree using the <Parameters - Digitizing> function.

🕮 See HOLOS Operating Manual Chap. 12.13

2.2 Curves

The <DIGIT CURVE> function is used to manually probe the points on a curve which are directly used in HOLOS for calculation (= approximation) of a free form curve. Curves can be digitized with the scanning procedure in the UMESS 1000 and UMESS UX measuring software.

In order to define curves, you must probe at least two curve points. You can probe more points as required, in order to obtain information about the curvature changes in the curve.

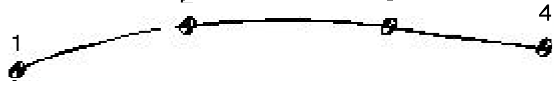


Figure 2-2

Probing sequence and orientation of the curve

The sequence of the probed points defines the orientation of a curve. The orientation of a curve determines the orientation of the surface generated with curves.
The orientation of the curve can be modified in HOLOS at any time.

see HOLOS Operating Manual, Chap. 9.10

Polynomial degree

The polynomial degree of a curve is dependent on the number of curve points. It is always one less than the number of probed points, up to a maximum limit. You can enter the maximum polynomial degree using the <Parameters - Digitizing> function.

In HOLOS you can further process curves to generate free form surfaces using the <Curve -> Surface> function.

2.3 Points

The <DIGIT POINTS> function is used to collect any quantity of points.
These points are displayed and managed in HOLOS as “Digitization points”.

Digitization points can be used to generate curves in a graphically interactive way or to define areas for area scanning.

In the UMESS 1000 and UMESS UX measuring software, scanned points can also be generated on a scanning line.

Various functions are available in HOLOS for managing digitization points and scanning lines. These functions are explained in the following chapters.

3 Digitizing with HOLOS-NT

The <Digitizing> function divides into numerous subfunctions.

Functions for interactively generating curves and surfaces on the screen:

- Points → Curve
- Line → Curve
- Lines → Surface
- Grid → Surface
- Curves → Surface

The following functions are also available:

• Surface digitizing	For re-digitizing an existing surface
• Scanning area	For scanning with a probe or laser
• Scanning surface	For scanning with a probe or laser
• Digitization point	For data management

3.1 Curves from points

Using the <Points -> Curve> function you can generate curves from individual digitization points or from CAD points which have been transferred from the CAD system via the CAD file for the model. The digitization points are obtained via CADLINK by means of manual probing.
The curve is generated interactively on the screen by clicking on the points with the mouse.

The points for calculating a curve must be clicked on in ascending order. The sequence of the points is displayed in the graphic window by a point number. The sequence of the points determines the orientation of the curve.

> ***NOTE***
>
> The digitization points are only graphically displayed if their visibility has been activated in the <Display> function of the graphics menu bar.
> 🕮 see HOLOS Operating Manual chap. 3.1

Operation:

- Click on the <Points -> Curve> function.
- "Select: point" appears in the status line.
- Click on the first curve point.
- A window opens with the coordinates of the point and further functions.

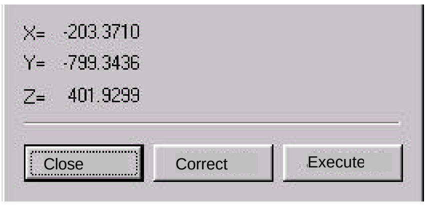


Figure 3-1

- Click on further points of a curve in ascending order.
- Start calculation of the curve with <Execute>.
- The curve is calculated.

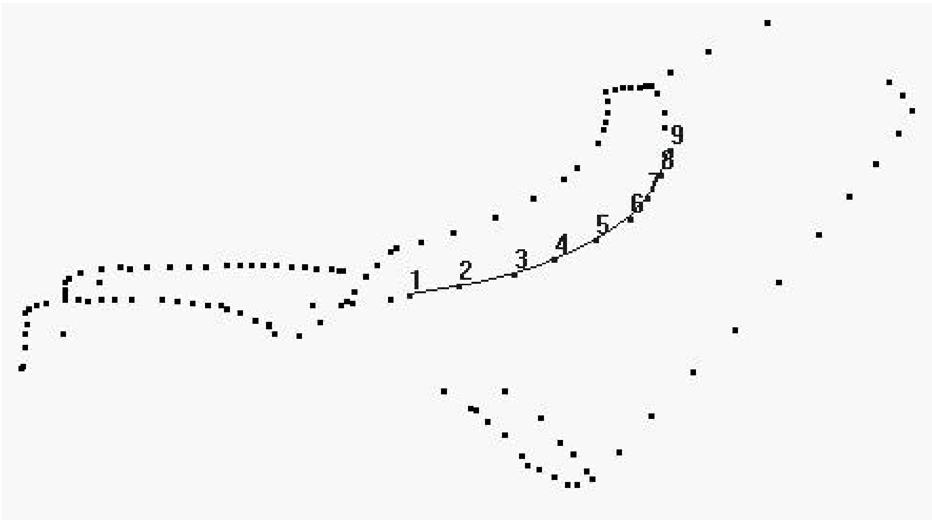


Figure 3-2

- When you have generated all curves, close the window.
- Using <Correct> you can undo the selection of a point in descending order.

3.2 Curves from lines

Using the <Line -> Curve> function you can generate curves from segments of scanning lines. The UMESS 1000 or UMESS UX measuring software must be available to produce scanning lines. The curves are generated interactively on the screen by clicking with the mouse on the start and end point of a line segment .
To calculate a curve, simply click on the start and end point. All points included in the line will then be taken into account. Each new mouse click on a line moves the end point. The sequence of the points is displayed in the graphic window by a point number. The sequence of the points determines the orientation of the curve!

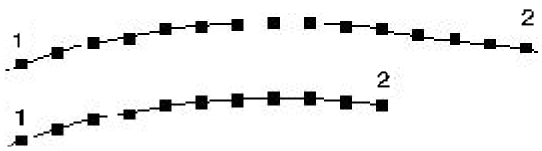


Figure 3-3

> ***NOTE***
>
> The lines are only graphically displayed if their visibility has been activated in the <Display>function of the graphics menu bar.
> see HOLOS Operating Manual Chap. 3.1

Operation:

Click on the <Line> - <Curve> function.

"Select: point" appears in the status line.

Click on the start point.

A window opens with the coordinates of the point and further functions.

Click on the end point. Start calculation of the curve with <Execute>

3.3 Surfaces from lines

Using the <Lines-> Surface> function you can generate surfaces from complete scanning lines. The surfaces can be segmented (= divided into patches). The UMESS 1000 or UMESS UX measuring software must be available to produce scanning lines. The surfaces are generated interactively on the screen by clicking on the scanning lines in ascending order before starting the function.

Before the surface is calculated you must enter the degree of continuity, the polynomial degree and the segmentation in a dialog window.

see HOLOS Operating Manual, Glossary

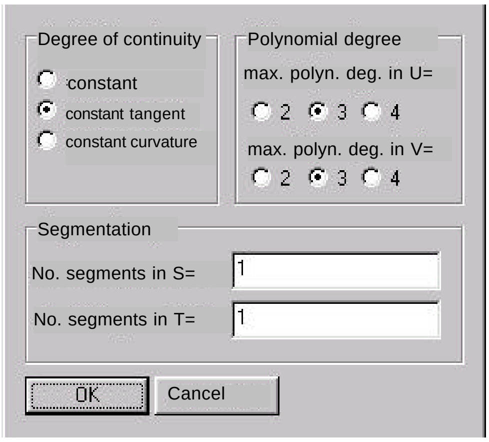


Figure 3-4

When the surface is generated, the standard deviation and the maximum deviation of the line points from the newly generated surface are displayed in the status line.

Operation:

First of all, define the group of scanning lines to be used with the <Scanning lines><Select> function in the <Digitizing><data> menu.

Then click on the <Lines -> Surfaces> function.

A window opens for entering the polynomial degree, continuity and segmentation.

Enter the parameters and accept the values with <OK>.

The surface is generated.

3.4 Surfaces from measuring runs

You can calculate surfaces from measuring runs with the <Grid -> Surface> function.

Prerequisite

The measuring runs must be defined as grids or rasters and have already been measured.

Grid and raster points have different effects:

Grid: The surface is recalculated and saved under the same name.

Raster: A new raster is calculated and saved under a new name.

Operation:

Click on the <Grid -> Surface> function.

A window opens for selecting all measuring runs for the current model.

Select the measuring run and confirm with <OK>.

The surface is calculated.

3.5 Surfaces from curves

Using the <Curve -> Surface> function, you can generate surfaces from curves. The curves can be directly digitized or they can have been generated using one of the above functions.

There are two functions for generating surfaces from curves:

- Lofting
- Boundary curves

3.5.1 Lofting

During lofting, the surface is generated from a group of parallel curves.

You can use at least two but a maximum of 40 curves. You must select the curves in ascending order.

Orientation of the generated surface

The orientation of the first selected curve defines the direction for the V parameter of the surface.

The direction from the first to the second curve defines the direction for the U parameter. The surface normal then corresponds to the direction of the third axis of a right-rotating coordinate system over U and V.

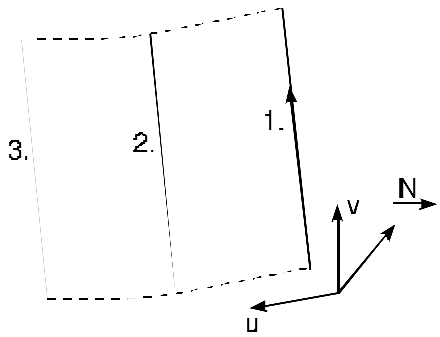


Figure 3-5

You can display the orientation of the curves using the setting in the <Display> function in the graphics menu bar. You can rotate the orientation with the <Rotate orientation> function in the <Objects> menu.

> ***NOTE***
>
> You must observe the instructions on surface orientation! If the surface normal is pointing in the wrong direction, then the surface will not lie on the actual surface of the workpiece, as the probe radius is corrected in the wrong direction.

Operation

- First of all define a group of curves with the <Define group> function. Click on the curves in ascending order!
- Click on the <Curves -> Surface> function and then on <Lofting>.
- The surface is calculated immediately.

3.5.2 Boundary curves

With the <Boundary curves> function, the surface is generated from four curves which define the boundary.

Orientation of the generated surface

TIP: Select the curves in a circular direction (but this is not compulsory)!

The orientation of the first selected curve defines the direction for the V parameter of the surface. The direction from the first to the last curve defines the direction for the U parameter. The surface normal then corresponds to the direction of the third axis of a right-rotating coordinate system over U and V.

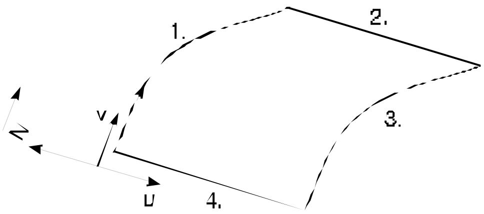


Figure 3-6

NOTE

You must observe the instructions on surface orientation! If the surface normal is pointing in the wrong direction, the surface will not lie on the actual surface of the workpiece, as the probe radius is corrected in the wrong direction.

Operation:

- First define a group of curves with the <Define group> function. Click on the curves in a circular direction!
- Click on the <Curves -> Surface> function and then on <Boundary curves>.
- The surface is calculated immediately.

3.6 Digitize surface

The surfaces produced from the above functions may still be very rough. The accuracy of a surface description is increased by collecting more probing information.

The <Digitize surface> function comprises two steps:
- A grid which is probed in the CNC run is laid over each of the selected surfaces.
- The surfaces are then recalculated.

Define the number of grid points in a dialog window.
see HOLOS Operating Manual, Chap.7.1.1

However, there is a minimum number of grid points which the program uses if you specify too few points. These depend on the defined polynomial degree of the surface:
Polynomial degree + 2. This can result in more points being probed than you have specified. The maximum polynomial degree is set with the <Digitize> parameter function.

> ***NOTE***
>
> For operation in CNC mode: each grid is processed using a meandering path.

Operation:

First of all, define a group of surfaces with the <Define group> function.

Click on the <Digitize surface> function.

A window opens for entering the grid points.

Enter the grid points and accept the values with <OK>.

The measuring procedure is started immediately. The surfaces are then recalculated.

3.7 Scanning area

This function is used to define digitization areas and calculate scanning lines (not available with manual measuring machines or UMESS 300).

3.7.1 Define, save and read area

Operation:

Select the <Digitize>-<scanning area> function.

A dialog window opens for entering further parameters.

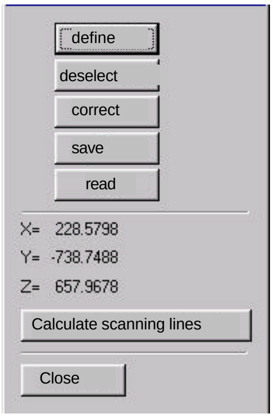


Figure 3-7

define

The area to be scanned is defined by its boundary points. You can generate any boundaries for the area to be defined. The only prerequisite is that the area can be projected into a defined plane. The normal in this plane defines the subsequent probing direction for probing/backaway in the start/end points of the scanning lines.

To define boundary points, you can use CAD points, digitized points, points on form directrices or points on scanning lines. The boundary points are applied as soon as this function has been selected.

The polygon of the boundary points is displayed graphically on the screen, and the respective coordinates of the last selected point are output in the center of the window as X, Y, and Z-value.

You can delete the displayed point (i.e. the last selected point) from the boundary polygon using the correction key in this window.

The polygon line of the boundary points can - but does not have to - be closed. If the first and last point are not identical, the area is automatically closed.

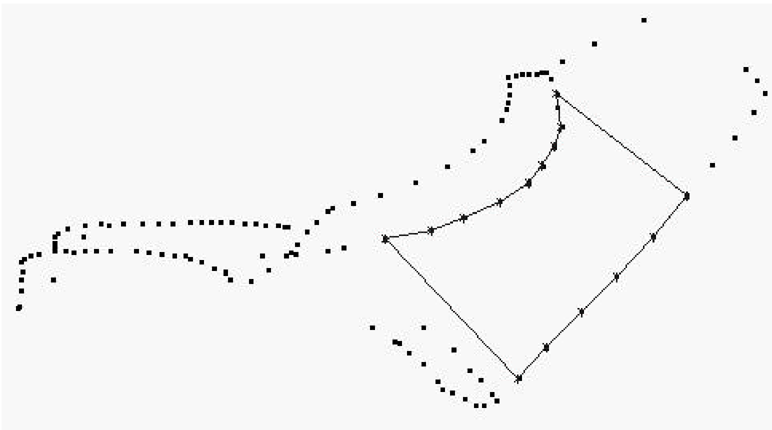


Figure 3-8

deselect

The <deselect> function allows you to delete the last defined boundary area and define a new area.

save

Define a scanning zone and then click on the <Save> function.

A window opens in which you can enter a name for the scanning area.

Enter a name for the scanning zone and confirm it with <Save> or <RETURN>.

The defined scanning zone is stored.

read

Click on <read>.

A window opens for selecting a saved scanning area.

Select a scanning zone.
Confirm your selection by clicking on the <Open> key.

The selected scanning zone is displayed on the screen and can be used to calculate the scanning lines.

3.7.2 Parameters for calculating the start and end points

You must define further parameters to calculate the scanning lines.

Select the <Calculate scanning lines> function.

A window opens in which you can enter further parameters.

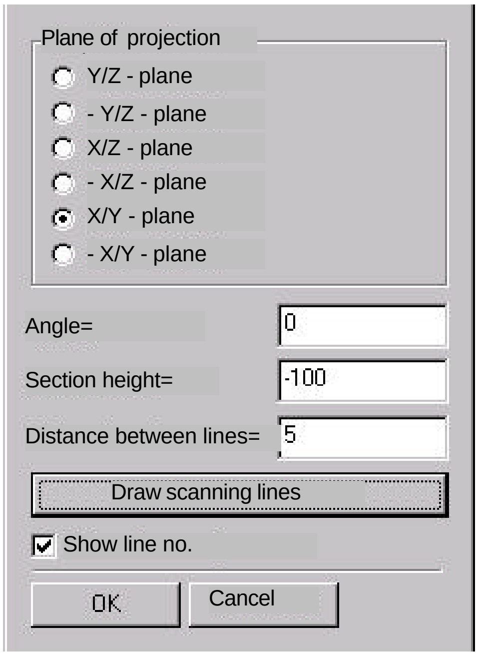


Figure 3-9

Projection plane

The defined areas are projected into one of the three main planes, with the normal in the respective plane defining the probing directions of the start/end points. Probing always occurs against the normal direction on the respective plane.

Example: X/Y - plane

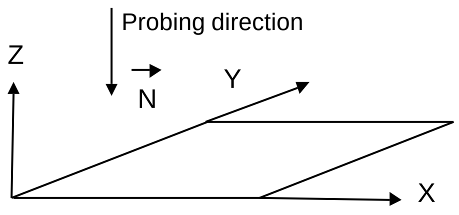


Figure 3-10

In this case, probing occurs from the direction of the positive Z-axis, i.e. from top to bottom (Z -).

Example: -X/Y - plane

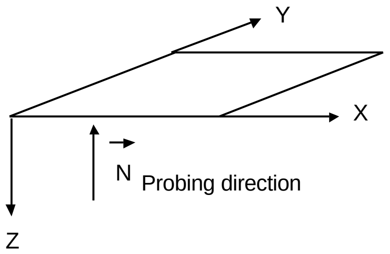


Figure 3-11

In this case, probing occurs from the direction of the negative Z-axis, i.e. from bottom to top (Z+).

angle

With this parameter you can define the angle of the calculated scanning lines in the projection plane.

Example: Angle = 0.0 ° Angle = 30.0 °

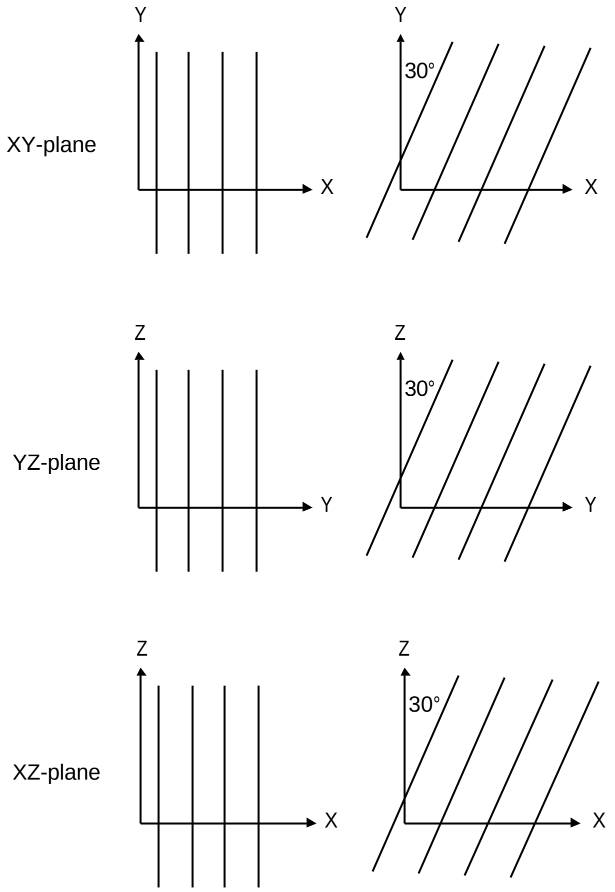


Figure 3-12

section height

With the section height you define the vertical distance from the first scanning line to the coordinate zero point.

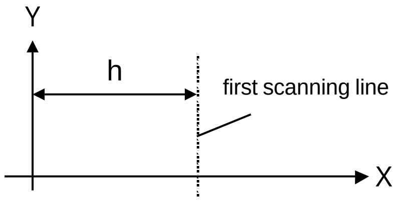


Figure 3-13

line distance

The line distance defines the distance between the individual scanning lines.

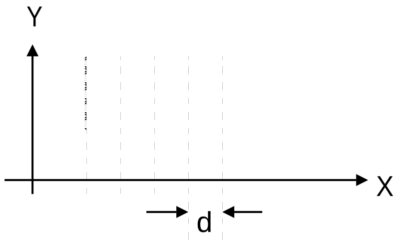


Figure 3-14

You can control the direction of the scanning lines using the symbol for the line distance.

Example: Start value: 5 mm, Line distance: +2 mm

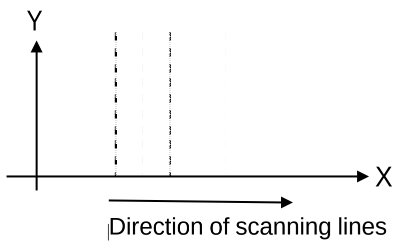


Figure 3-15

Start value: 5 mm, distance between lines: - 2 mm

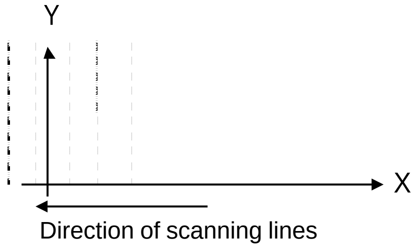


Figure 3-16

Draw scanning lines

This command draws in the scanning lines and their direction.

Display line numbers

The numbers of the individual scanning lines are displayed.

Operation

Enter the necessary parameters and confirm with <OK>.

The start/end points for the subsequent scanning run are calculated and graphically displayed .

The dialog window for defining the parameters for the scanning run then appears:

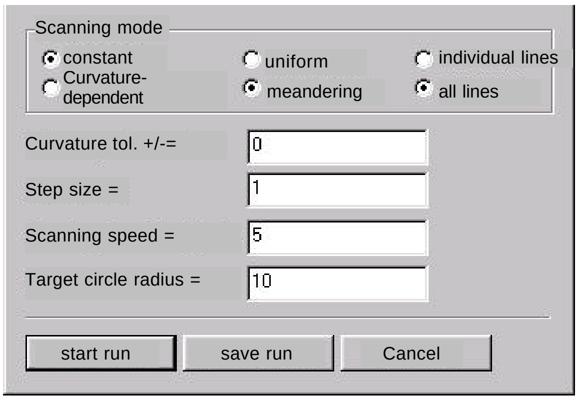


Figure 3-17

3.7.3 Parameters for the scanning run

Operation

After calculating the start and end points, the dialog window for the scanning run parameters is displayed.

Enter the relevant parameters or select a function and confirm with <OK>.

Select "Start run" to start scanning.

constant

The points are recorded with a constant point distance during the scanning run.

curvature dependent

The points are recorded in relation to the curvature change of the contour to be scanned.

uniform

The calculated lines are all scanned in the same direction.

meandering

The calculated lines are scanned in a meandering fashion. This method has the advantage that the sensor only has a short distance to travel until the new start point of next line.

individual lines

The points of each individual line are transferred to HOLOS by the measuring software immediately after scanning the respective line.

all lines

All lines are scanned before transmission of the line points. The points of all lines are then transferred together to HOLOS by the measuring software.

Curvature tolerance

This parameter defines the curvature tolerance for the scanned contour during curvature-dependent point recording. If the curvature tolerance is exceeded, a new measuring point is accepted.

Step width

This parameter defines the distance between the recorded points during point recording with a constant distance.

In the case of curvature-dependent point recording, the maximum distance between points is defined. If no curvature change occurs in the contour within the specified area, a new measuring point is accepted after reaching the specified distance.

scanning speed

This parameter defines the traverse rate of the coordinate measuring machine during the scanning run.

Target circle radius

The target circle radius defines the radius of a circle around the target point of a scanning line. After entering this target circle, the coordinate measuring machine reduces its traverse rate, in order to end the scanning run when it reaches the target point.

start run

This function starts the scanning run with the previously calculated start/end points and the defined parameters.

save run

This function allows you to save the scanning run so that you can execute it later.

> **CAUTION**
>
> In the case of coordinate measuring machines with a rotational swivel device (DSE), the current DSE position must be known for the stored run, so that it can be set for a subsequent run.
> You must therefore specify that the machine is a DSE machine when installing HOLOS or do this in the system settings!
>
> see HOLOS Operating Manual, Appendix B, System settings

Click on the <Save run> function.

In the case of DSE machines the input window for defining the DSE position is displayed:

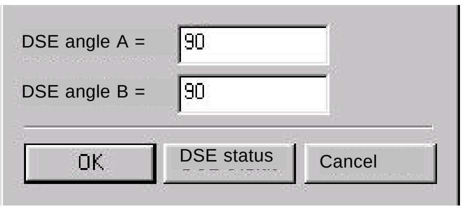


Figure 3-18

Enter the values for angles A and B into the fields.

Or:
Click on the <DSE status> function. If the UMESS option CADLINK is active, the DSE position is requested by CADLINK and applied to the input fields.
Accept the values with <Ok>.

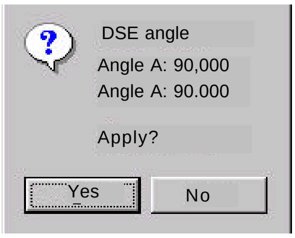


Figure 3-19

Confirm the entered angles, if they are correct, with <Yes>.

The measuring run is saved.

Cancel

You can cancel the entire procedure using this function.

3.8 Scanning surface

The function serves to record larger areas without manual division and to digitize them automatically in general.

UX — The <Scanning surface> function can only be used in conjunction with the UMESS-UX measuring software and a measuring probe system on CNC-controlled measuring machines.

NT — If the NT-version is linked to UMESS-UX, the same restriction applies.

Operation

First of all define the area.

To do this, you must record two limiting curves. These can be recorded in the following ways:

- directly with <Digit curve> in CADLINK
- graphically interactively on the screen
- through CAD formatting, which does not allow segmented curves.

The limiting curves are connected to form a surface using the <Lofting> function in the <Digitize>-<Curve->Surface> menu. This surface defines the area which is to be recorded. Any curvature changes are possible within the area.

Select the defined area by clicking on it with the left mouse button.

Select the <Scanning surface> function to scan the surface.

After clicking on the function, the meandering scanning lines are graphically displayed. A window opens in which you can enter the parameters listed below:

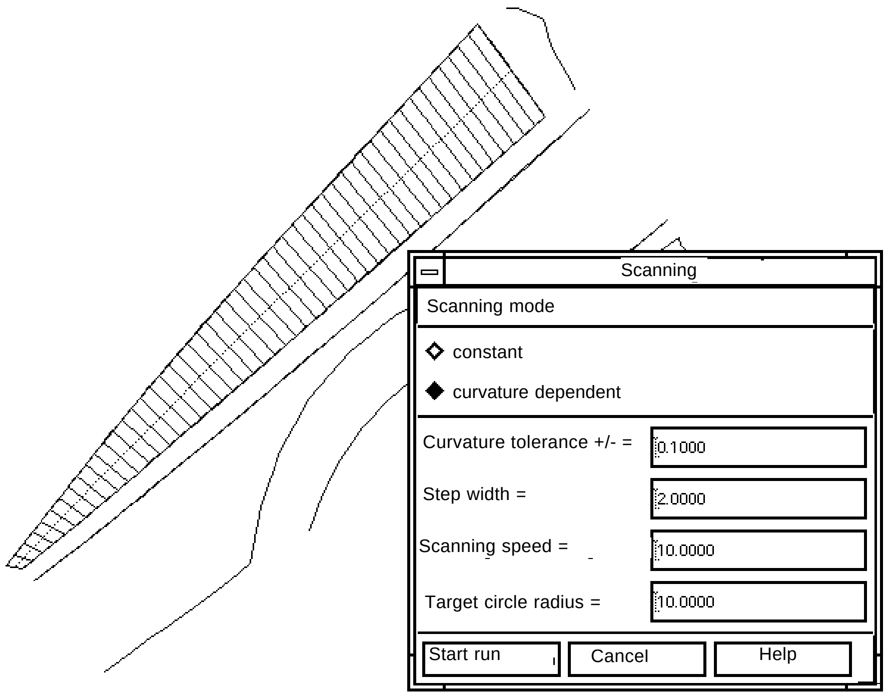


Figure 3-20

Enter the relevant parameters or select a function and confirm with <OK>.

Select the "Start run" function in order to start scanning.

The start and end points are applied to the measuring software and the defined area scanned. Digitization points, scanning lines and scanning zone are saved and can be managed with the <Data> function in the digitizing menu.

A window opens for entering the parameters for polynomial degree, continuity and segmentation.

A surface is calculated from the scanned zone. The scanning lines are selected automatically.

constant

The points are recorded with a constant point distance during the scanning run.

curvature dependent

The points are recorded in relation to the curvature change of the contour to be scanned.

curvature tolerance

This parameter defines the curvature tolerance for the scanned contour during curvature-dependent point recording. If the curvature tolerance is exceeded, a new measuring point is accepted.
🕮 see HOLOS Operating Manual, Chap. 7.1

step width

This parameter defines the distance between the recorded points during point recording with a constant distance.
During curvature-dependent point recording, the maximum point distance is thus defined. If no curvature change occurs in the contour within the specified area, a new measuring point is accepted after reaching the specified distance.

scanning speed

This parameter defines the traverse rate of the coordinate measuring machine during the scanning run.

target circle radius

The target circle radius defines the radius of a circle around the target point of a scanning line. After entering this target circle, the coordinate measuring machine reduces its traverse rate, in order to end the scanning run when it reaches the target point.

start run

This function starts the scanning run with the previously calculated start / end points and the defined parameters.

cancel

This function cancels the entire procedure.

3.9 Manual digitization

After calling up the function, select which digitizing result will be transferred to Holos:

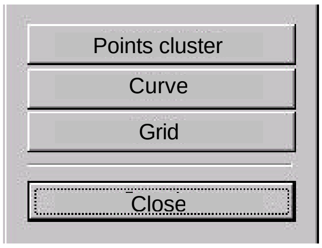


Figure 3-21

Points cluster: Digitize individual points.
Curve: A curve is generated from the digitization points.
Grid: A surface is calculated in HOLOS from the digitization points.

3.9.1 Points cluster and curve

Select the measuring method:

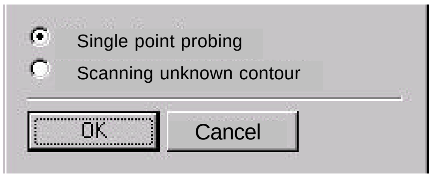


Figure 3-22

Single point probing

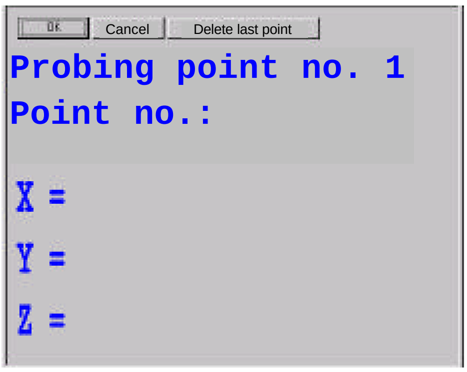


Figure 3-23

- Probe the digitization points.
  Undo incorrect probings with "Delete last point".
- The points are transferred to HOLOS with the "OK" key.

Scanning unknown contour

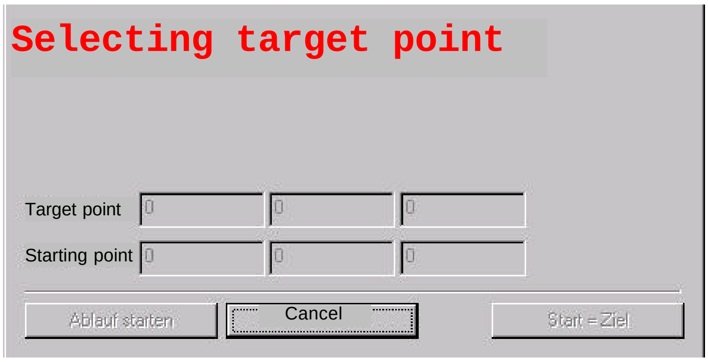
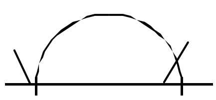


Figure 3-24

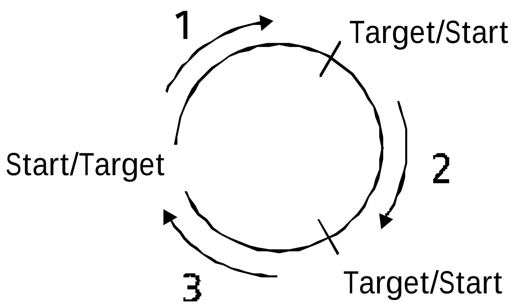
- First probe the target point.
- Then probe the start point and position the machine in front of the start point.

CAUTION

The start point must not be the same as the target point.
The start and target points must not lie opposite one another on a straight line in the probing direction. **Not possible:**

Start  Target

If you wish to scan a cylinder, you must divide it up into at least three segments, so that the angles between the start and target points are < 180°:



Click on the "Start run" key.

The scanning parameters are displayed

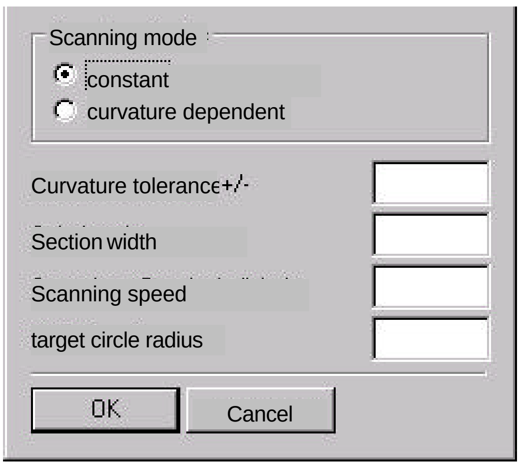


Figure 3-25

Enter the parameters:

constant	The points are recorded with a constant distance between points.
curvature-dependent	The points are recorded in relation to the curvature change of the contour to be scanned.
curvature tolerance	This parameter defines the curvature tolerance for the scanned contour during curvature-dependent point recording. If the curvature tolerance is exceeded, a new measuring point is accepted. see HOLOS Operating Manual, Chap. 7.1
Step width	This parameter defines the distance between the recorded points during point recording with a constant distance. During curvature-dependent point recording, the maximum point distance is thus defined. If no curvature change occurs in the contour within the specified area, a new measuring point is accepted after reaching the specified distance.
scanning speed	This parameter defines the traverse rate of the coordinate measuring machine during the scanning run.
Target circle radius	The target circle radius defines the radius of a circle around the target point of a scanning line. After entering this target circle, the coordinate measuring machine reduces its traverse rate, in order to end the scanning run when it reaches the target point.

Click on "OK"

The run is started.

3.9.2 Grid

The input window for the number of points is displayed:

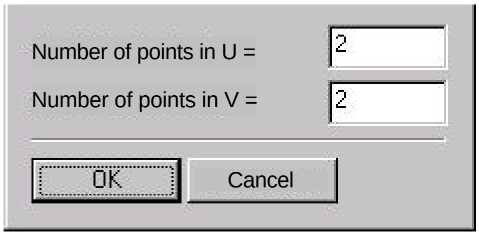


Figure 3-26

Enter the number of required digitization points in the U- and V-direction and click on "OK"

The probing window is displayed:

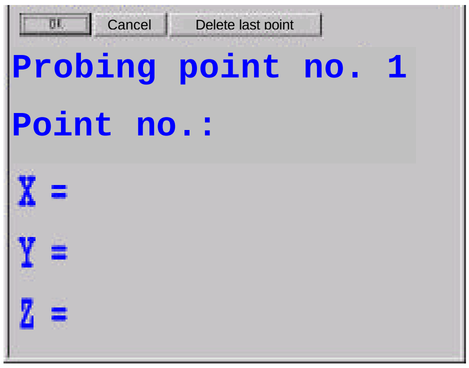


Figure 3-27

Probe the digitization points.
Undo incorrect probings with "Delete last point".

The points are transferred to HOLOS by pressing "OK".

3.10 Digitization points

Digitization points are points which have been probed manually with the coordinate measuring machine as individual points (CADLINK function <Digit point>).

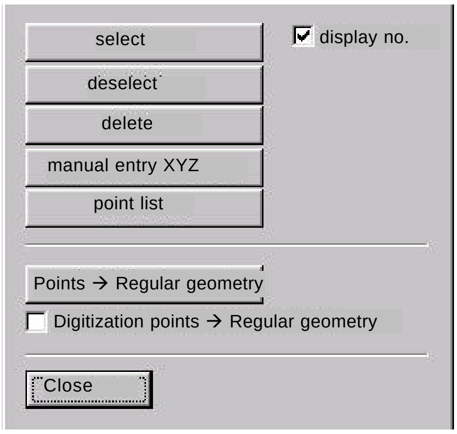


Figure 3-28

function	**Meaning**
select	Mode for selecting digitization points. You can select digitization points by clicking with the left mouse button, or by dragging a window over the points to be selected using the <Trap> function.
deselect	Cancel selection of all selected digitization points.
display no.	Display point numbers of selected digitization points on the screen.
delete	Delete all selected digitization points.
manual entry	Manually enter the coordinates for digitization points:

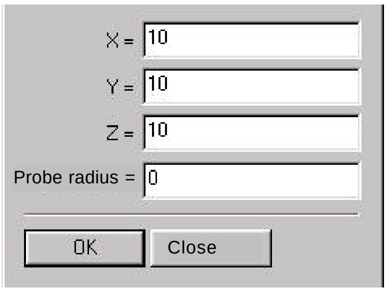


Figure 3-29

Enter the point coordinates into the corresponding fields.

Enter a value for the probe radius if you wish to further process the entered digitization points together with points that have already been probed. For example, in order to generate curves, you can only use points which have been probed with the same probe radius.

Confirm the entry with <OK>.

The digitization point is accepted in HOLOS-NT and displayed on the screen.

Display point list (NT) / (UX)	Output the coordinates of all selected digitization points in a text editor.
Points → Regular geometry	Generate a regular geometry element from the selected digitization points (see CAD functions).
Digitization points → Regular geometry	Generate a regular geometry element from digitization points which you probe manually on the coordinate measuring machine, as soon as they are transferred from CADLINK to HOLOS-NT (see Regular geometries in HOLOS-NT).

3.11 Scanning lines

Scanning lines cannot be recorded in conjunction with any measuring software. Manual measuring machines (except for SCANMAX) or UMESS 300 do not provide any such functions.

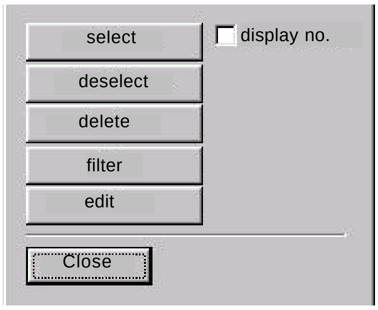


Figure 3-30

function	Meaning
select	Mode for selecting scanning lines. You can select scanning lines by clicking on them with the left mouse button, or by pulling up a window around the lines to be selected using the <Trap> function.
deselect	Cancel selection of all selected lines.
display no.	Display numbers of the scanning lines.
delete	Delete all selected scanning lines.
filter	Filter scanning lines (see Filter scanning lines).
edit	Edit scanning lines (see Edit scanning lines).
mark undefined normals (UX)	This function is only available if you have installed the **milling option**. All scanning lines for which no normal vectors are defined, are marked in color.
display normal vectors (UX)	This function is only available if you have installed the **milling option**. The normal vectors on the scanning lines are displayed on the screen.

Filter scanning lines

There are two ways of scanning points on scanning lines:

- Curvature-dependent filter
- Smoothing of scanning lines

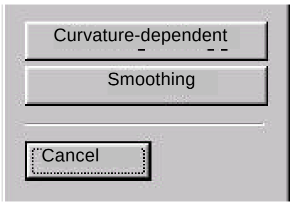


Figure 3-31

Select all scanning lines which are to be filtered.

Select the filter method and confirm your selection with <OK>.

The scanning lines are filtered according to the selected method.

Curvature-dependent filter:

All selected scanning lines are filtered depending on curvature.

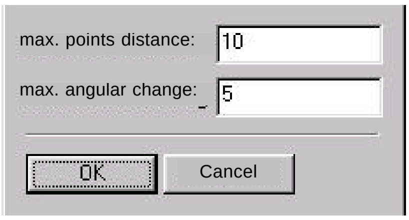


Figure 3-32

max. point distance	Controls the maximum distance between points on the scanning line, if the criterion for curvature-dependent filtering is not met.
max. angle change	Defines the value for the maximum angle change after which a point on the scanning line is accepted.

Smoothing:

With this function you can smooth very grainy points on a scanning line.

All selected scanning lines are smoothed. Scanning lines which have been generated directly on the workpiece surface cannot be smoothed (see functions for generating measuring runs).

Three degrees of smoothing are available.

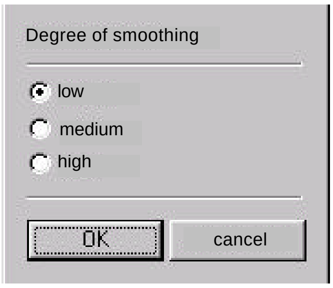


Figure 3-33

low	The scanning lines are only smoothed a little.
medium	The scanning lines are smoothed to an average degree.
high	The scanning lines are smoothed to a high degree.

The degree of smoothing to be selected depends on how much the points on the scanning line are subject to fluctuations. In the case of more grainy point distributions, you must use a higher degree of smoothing.

Process scanning lines

Select the <Digitize> - <scanning lines> function.

The window for managing scanning lines is displayed:

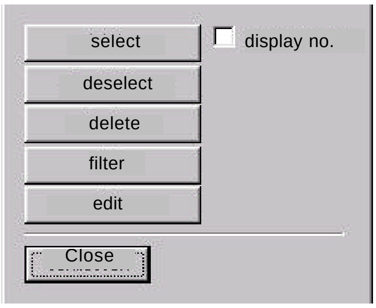


Figure 3-34

Select the function <edit>

A window appears for controlling the edit function:

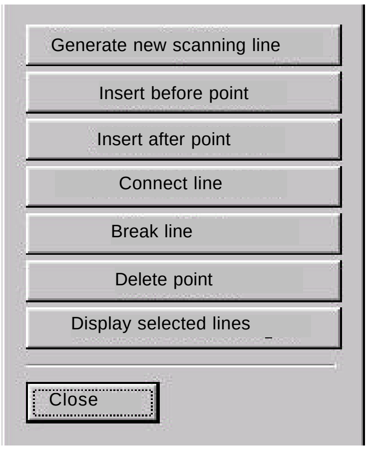


Figure 3-35

Generate new scanning line

New scanning lines can be generated from existing CAD points, digitization points or from points on already existing scanning lines.

Click on <Produce new scanning line>.

The message "Select: NEW LINE" appears in the status line.

Select the points for the new scanning line.

The points are connected and marked as a scanning line.

When you select points for the new scanning line, a window will appear which shows the number of the new line as well as the coordinates of the last selected point:

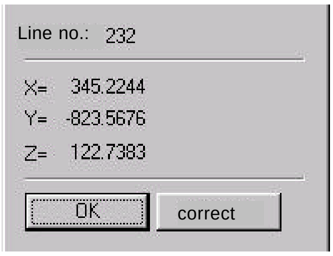


Figure 3-36

By clicking on <Correction> you can remove the last point selected.
To do this, the "Select: NEW LINE" mode must still be active. If you have already exited this mode, delete points using the <Delete point> function.

You exit the mode for generating a new scanning line by clicking on the <Generate new scanning line> function again. You can then generate another scanning line or exit the mode for selecting points, so that the "Select: NEW LINE" message disappears.

Generate sweep (UX)

This function is only available if you have installed the "Milling" option on your system.

You can generate scanning lines from sweep curves (see Generating sweep curves).

Insert points

You can insert points before or after an existing point in existing scanning lines.

To select the points to be inserted, select the <Select points> function in the <Objects> menu.
Only points which are selected via this function can be added to a scanning line!

Select the points which you wish to insert.
Pay attention to the order when selecting the points, as the points are inserted into the scanning line in the order of their selection.

A window appears on the screen, which shows the coordinates of the selected points:

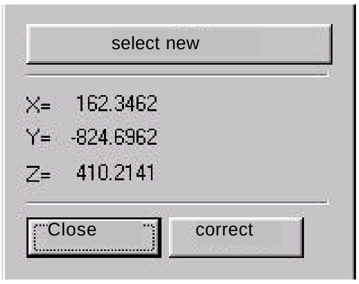


Figure 3-37

select new — Deletes all previously selected points.

correct — Removes the last selected point.

After you have selected all the points to be inserted, you can add these points either before a particular point or after a particular point.
In order to define whether a point on a line lies before or after the selected points, you must activate the visibility for curve orientation in the dialog window for graphic representation.

The orientation of the scanning lines is indicated by an arrow.

Insert points before a point

Click on the <Insert before point> function.

The message "Select point on scanning line" appears in the status line.

Click with the mouse pointer on the point of a scanning line, before which the selected points are to be inserted.

The selected points are inserted before the point clicked on.

Insert points after a point

Click on the <Insert after point> function.

The message "Select point on scanning line" appears in the status line.

Click with the mouse pointer on the point of a scanning line, after which the selected points are to be inserted.

The selected points are inserted after the point which you have clicked on.

Connect lines

You can connect two scanning lines to form one scanning line.

Select two scanning lines and click on the <Connect lines> function.

You obtain a new scanning line which consists of the two selected lines.

The two lines are not changed by this, as HOLOS always generates a new line.
You can remove the two originally selected lines using the <Delete> function.
If you select more than two scanning lines, the first two lines selected are always joined.

Break line

You can divide a scanning line using this function.

Click on the "Break line" function.

Click on the point of a scanning line at which the line is to be divided.

You obtain two new scanning lines, which meet at the point that has been clicked on.

Delete point

You can remove points from a scanning line.

Click on <Delete point>.

In the status line the message "Select: DELETE POINT" appears.

Click on a point with the mouse pointer.

The point is removed from the structure of the scanning line.

Define DSE vector (UX)

This function is only available if you have installed the "Milling" option on your system.

Scanning lines without normal vectors cannot be milled. When digitizing scanning lines, the scanning vector and a DSE position vector are transferred from CADLINK to HOLOS-UX.

If scanning lines are generated manually, this information is not available. You must therefore define a vector.

Select a scanning line for which you wish to define a normal vector.

Select "Define DSE vector".

A dialog window appears:

Enter a normal vector for the first point on the scanning line in the input fields or define the main direction with one of the direction keys.

Display selected lines

You can display the points on a scanning line in numeric form in order to assess them.

Select one or several scanning lines.

Click on <Display selected lines>.

An editor appears on the screen, in which the selected lines are displayed.

With the editor you can output the displayed lines on a connected printer (System Default Printer).

If you change the scanning lines or the values of the points on a scanning line in this editor, the changes are only local. They cannot be adopted by HOLOS!

3.11.1 Generate sweep curves generate (UX)

This function is only available if you have installed the "Milling" option on your system.

In order to define a sweep curve, preset the following:

- Start point
- End point
- Intersection plane
- Sweep radius

Select the "Generate sweep" function.

A dialog window appears:

Enter the coordinates of the **start and end point** in the input fields. Both points are located on the sweep curve.

Define an **intersection plane** for the sweep curve by clicking on it. The intersection plane is positioned at the start point, and the end point is projected into the intersection plane if it is not already located there.

Enter a **sweep number** in order to determine the radius.
To do this, a file called "sweep.tab" must be located in the /users/holos/sys directory, through which a particular radius can be allocated to a sweep number. The file is an ASCII file and contains the following entries:
No_1 Radius_1
No_2 Radius_2 etc.
If a sweep number is entered, then the corresponding radius is read out of the file and accepted.

Instead of a sweep number, you can also enter the **sweep radius** directly.

Define the **distance** between the points on the sweep curve. Then click on the <OK> key.

The sweep curve is calculated.

A clear sweep curve can still not be generated with these presettings, as on principle there are two solutions. HOLOS-UX therefore represents both sweep curves on the screen:

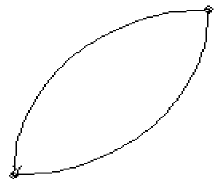


Figure 3-38

Click on the sweep curve which you wish to accept.

The selected sweep curve is accepted and saved as a scanning line in HOLOS-UX.

Figure 3-39

3.11.2 Scanning areas (UX)

Scanning areas are groups of scanning lines.

They can be manually defined by generating and saving a group of scanning lines. They can also be automatically defined after scanning an area (see <Scan area> function).

Scanning areas are stored on the hard disk under the name "AREA_x" (x = number.

The following functions are available for managing scanning areas:

select	Select a stored scanning area. All lines in the area are marked in color. Previous scanning line selections are cancelled.
delete	Delete saved scanning areas.
save	Save manually selected scanning lines as an area.

4 CAD Functions

This chapter describes the functions of the <CAD> menu.

The functions serve mainly to generate surfaces, curves, points or elements of regular geometry.

The main <CAD> function is divided into the following functions:

• Patches → surface	Reparameterization of patches, i.e. closing and smoothing transitions
• Patches → curves	Generating curves from patches
• Surface → points	Generation of points from surfaces
• Curves → points	Generating points from curves
• Curves → lines	Generation of lines from curves
• Connect Bezier points	Connection of Bezier boundary points and curves
• Regular geometry analysis	Identification and generation of regular geometries contained in free form geometries
• Generate regular geometry	Generating elements of regular geometry
• Convert points	Conversion of different point quantities

NOTE

Before transfer to other systems, you can process generated surface data with the CAD function. Before doing this, however, you should be clear about the further use of the surface data, as the “Reparameterization” functions directly change the surface data.

Example

The local accuracy of a surface is changed during the formation of tangential transitions. This will have different effects depending on the use of the surface data:

- Changes in the local accuracy are of great importance if the generated surface is used for quality assurance, e.g. for measuring production components with the help of data from a master component. In this case, the quality of the surface transitions is relatively unimportant. However, the measuring accuracy of the surfaces which has been achieved during digitization is decisive.
- Changes in the local accuracy play a secondary role if the generated surface is used for generating milling data. However, the quality of the milling data is directly dependent on the quality of the surface transitions.

4.1 Reparameterization of patches

With the <Patches -> Surface> function, individual surfaces or patches are combined to form a segmented surface. The patches (= surface segments) have common boundary curves. You define the continuity of the surface transitions yourself. The generated patches can subsequently be reactuated as individual surfaces. The entire process is called “Reparameterization”.

Prerequisite

The prerequisite for reparameterization is that the individual surfaces which are combined have the same orientation. In other words: the directions of the u and v parameters and thus the direction of the surface normals must be identical.

You can check the orientation with the <Analysis> function in the <Objects> menu and rotate it with the <Rotate orientation> function in the same menu. On principle, however, you should make sure during digitization that all surfaces are generated with the same orientation.

Procedure

The procedure is divided into two main steps:

- Specify the number of surfaces that are to be combined in the S and T direction. Select surfaces.
- Specify the number of patches of the new surface as well as their degree of continuity and polynomial degree = Reparameterization of surfaces.

4.1.1 Define number of surfaces, select surfaces

Enter the number of surfaces that are to be combined in the S and T direction, in the function input window.

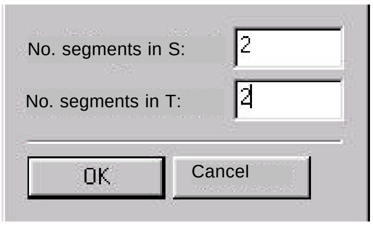


Figure 4-1

Pay attention to the sequence when selecting the surfaces. The order depends on the direction of the S and T or u and v parameters. The inter-relationship is as follows:

The global parameters S and T of the entire surface result from the local parameters u and v of the individual surfaces which are to be combined: u -> S, v -> T.

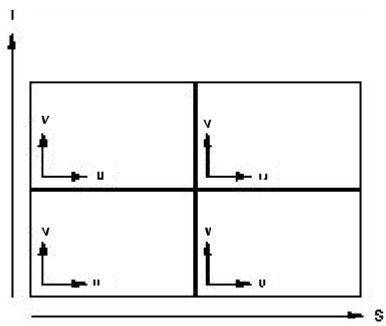


Figure 4-2

Begin at one edge of the entire surface and first select all individual surfaces in the direction of the S or u parameter.

Then go one surface further in the direction of the T or v parameter.

Then reselect all surfaces in the S direction
(see Fig. 4-3).

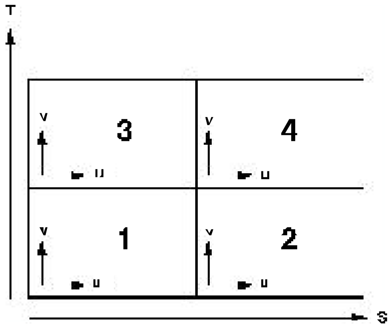


Figure 4-3

> ***NOTE***
>
> If you do not keep to this order or if the orientation of the individual surfaces does not agree, this program cannot calculate a valid new surface.

When you click on the first surface (or the first patch) a further window appears on the screen, in which information is output about the patch that you have selected and which contains further functions.

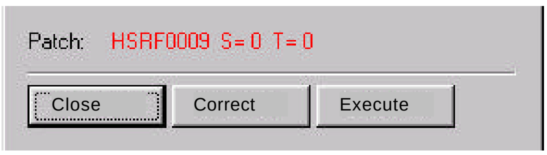


Figure 4-4

Information or function	Meaning
Patch: HSRFxxxx	Name of the clicked on patch.
S=x T=x	Parameter number of the patch. Start is S=0 / T=0. Non-segmented surfaces are also parameterized, but only have one segment in each parameter direction.
<Close>	Closes the window. If you click on a further patch, the window opens again.
<Display> (UX)	If the content of the graphic window is changed in the mean time using one of the functions <Rotation>, <Zoom> or <Move>, then the orientation and number of the selected patches will no longer be visible. <Display> displays them again.
<Correct>	Undoes the selection of the patch which you last clicked on.
<Execute>	Executes the <Patches -> Surface> function, i.e. starts reparameterization.

4.1.2 Number of patches, degree of continuity and polynomial degree

When you have clicked on all surfaces that are to be combined and have activated the <Execute> function in Fig. 4-4, you must enter the degree of continuity, polynomial degree and number of patches for the new surface in an input window.

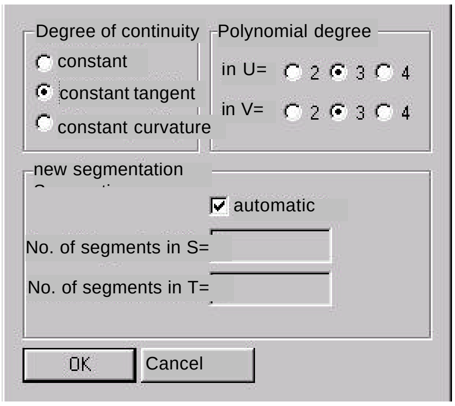


Figure 4-5

Option or function	Meaning
degree of continuity	Degree of continuity of surface transitions. The degree of continuity is dependent on the polynomial degree of the new patches. The following applies: Polynomial degree > = 1: constant transition (C0-continuity) Polynomial degree > = 2: constant tangent transition (C1-continuity) Polynomial degree > = 3: constant curvature transition (C2-continuity)
polynomial degree	Polynomial degree of the new patches. Can be between 2 and 4.
new segmentation	Number of segments of the new surface in S and T direction.
“automatic”:	The program presets the segments dependent on the degree of continuity. If you require another segmentation, deselect the “automatic” option and enter the number of segments yourself.

<Cancel> Cancels the reparameterization function.
<OK> Executes the reparameterization.

4.1.3 Results

A new segmented surface is formed in accordance with your data, whose segments have common boundary curves and defined transitions.

The patches of the old surface are masked and are no longer visible. However, they are retained as data.

NOTE

As the old surface is only masked, but still present, it should be deleted before conversion into a VDA file!

Masked surfaces can but do not have to be deleted. The CAD user can then decide himself which he wishes to use, as he may have better processing options.
The standard deviation and the max. deviation of the surface points on the old surface from the newly generated surface are output in the status line.

4.1.4 Reparameterization example

The transition between two digitized surfaces is to be closed. To do this, the two adjacent rows of patches on each surface are to be parameterized into a new surface. The remaining patches of the old surfaces must then also be reparameterized into new surfaces.

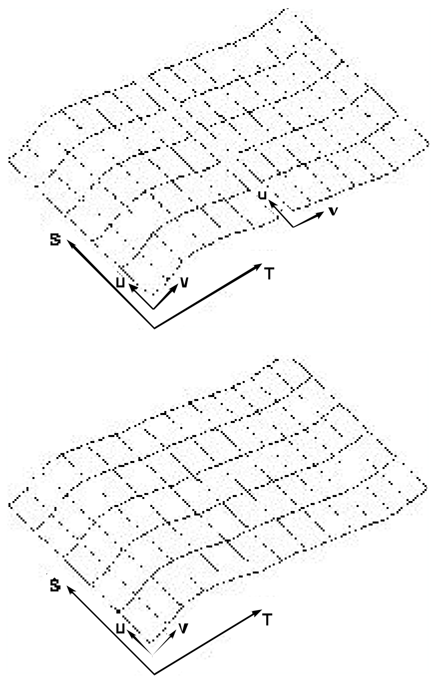


Figure 4-6

First make sure that the surfaces have the same orientation and determine the u and v direction, so that you can enter the number of patches in the S and T direction.

Call up the <Patches -> Surface> function.

An input window opens. (Fig. 4-1)

Enter the number of patches in the S and T direction.
In the example, S=5, T=4.

Click on <OK>.

Click on the patches which are to be combined: the first row in the S direction, the second row in the S direction etc., until all patches are numbered.

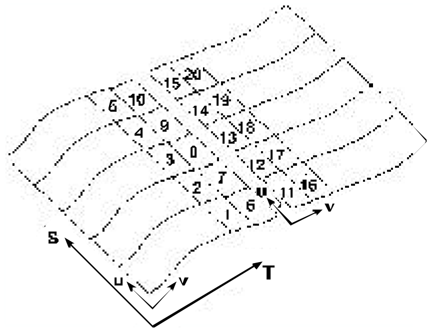


Figure 4-7

As soon as you click on the first patch, the window in Fig. 4-4 appears.

You can undo an incorrect selection using the <Correct> function.

When you have selected all patches, call up the <Execute> function in the same window.

The window in Fig. 4-5 opens.

Enter the degree of continuity, the polynomial degree and the number of segments and confirm with <OK>.

The new surface is calculated and graphically represented. The deviations from the old surface points appear in the status line.

4.2 Curves from patches

You can generate curves on surface segments (patches) using the <Patches -> Curves> function in the <CAD> menu.

Operation

- Select the surface segments on which you wish to generate curves.
- Click on the < Patches -> Curves> function.

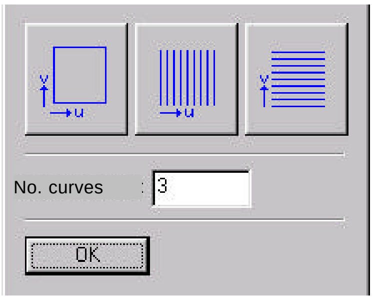


Figure 4-8

There are three ways of generating curves:

1. Generate curves on the boundary curves of the selected surface segments.
   If you apply the function to segmented surfaces, then all four boundary curves from each patch are saved:

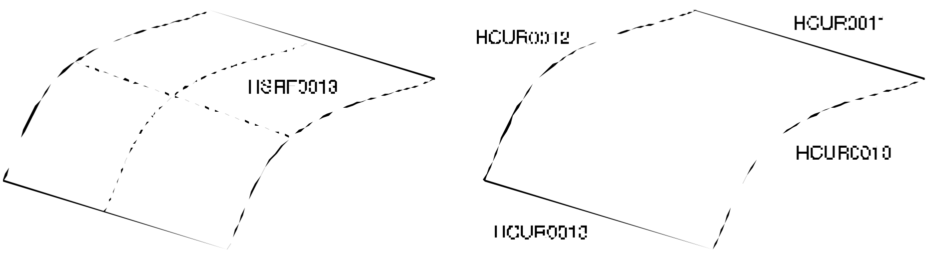


Figure 4-9

2. Generate curves in the direction of the u parameter of the selected surface segments.

3. Generate curves in the direction of the v parameter of the selected surface segments.

⇘ To display the parameter directions, activate the analysis function and click on the relevant surface segments.

⇘ Define the number of curves for generating curves in the u or v parameter directions.

⇘ Click on the corresponding display of the functions described above.

↳ The curves are generated.

4.3 Points from surfaces

You can generate points on surfaces, surface segments or faces using the <Surfaces -> Points> function in the <CAD> menu.

Operation

Select a surface segment, a surface or a face, on which you wish to generate points.

Click on the <Surfaces -> Points> function.

An input window opens:

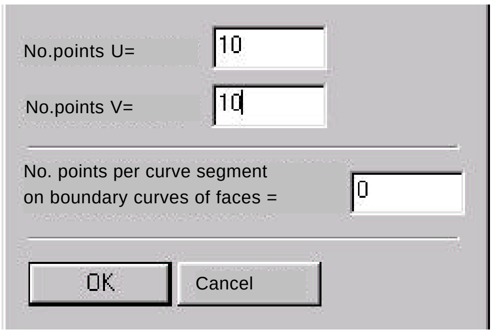


Figure 4-10

Generate points on a surface or a surface segment:

Enter the number of points in the U and V parameter directions.

Generate points on a face:

Enter the number of points which are to be generated on a curve segment of the face.

Click on <OK>.

The points are generated.

4.4 Points from curves

You can generate points on curves using the <Curves→ Points> function in the <CAD> menu.

Select the curves on which you wish to generate points.

Click on the < Curves -> Points> function.

An input window opens.

Enter the number of points which you wish to generate for a curve segment. Click on <OK>.

The points are generated.

On segmented curves only one point is generated at the respective segment limits, i.e. no duplicate points occur.

4.5 Lines from curves

You can generate scanning lines from curves using the <Curves -> Line> function in the <CAD> menu.

Select the curves on which you wish to generate points.

Click on the <Curves -> Line> function.

An input window opens:

Enter the number of points which you wish to generate for a curve segment. Click on <OK>.

The scanning lines are generated.

4.6 Connect Bezier points

With this function you can connect individual Bezier points or boundary curves of different surfaces, in order to close gaps or overlaps that have occurred during digitization.

Select the <Connect Bezier points> function in the <CAD> menu.

The parameter input window is displayed:

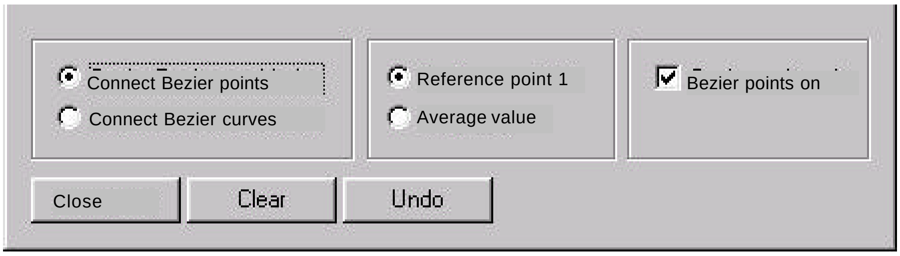


Figure 4-11

First switch on the <Bezier points on> option.
The Bezier points of the boundary curves of surfaces must be visible in order to connect Bezier points or curves.

The Bezier points are displayed:

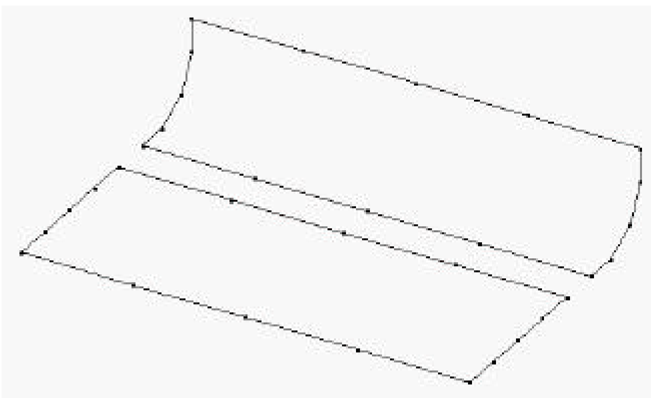


Figure 4-12

Select the mode in which you wish to work:

Reference point 1

When connecting Bezier points, the first selected point is used as reference. The second selected point is drawn onto the first point, so that it lies exactly on this point.
When connecting Bezier curves, the first selected boundary curve is used as reference. The second selected curve is drawn onto the first curve, so that it lies exactly on its position.

Average value

Select this option if the first selected element is **not** to be used as reference, but if an average value is to be formed between both elements.

Select whether points or curves are to be connected to each other:

Connect Bezier points

Bezier points are connected to each other.

Click on a Bezier point on the first surface.

The point is marked in color.

Click on a Bezier point on the second surface.

Both points are connected and displayed in the graphic representation:

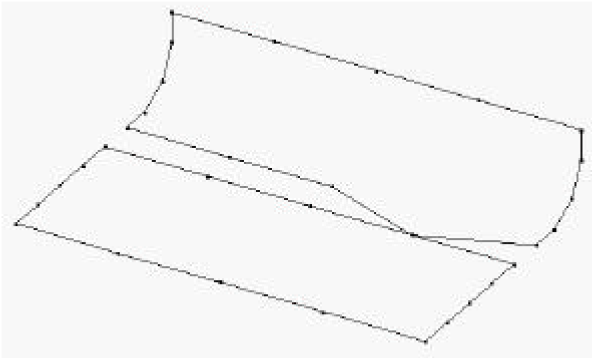


Figure 4-13

CAD functions

Connect Bezier curves

Bezier curves are connected to each other.

Click on a Bezier curve on the first surface.

The points of the curve are marked in color.

Click on a Bezier curve on the second surface.

The two curves are connected and displayed in the graphic representation:

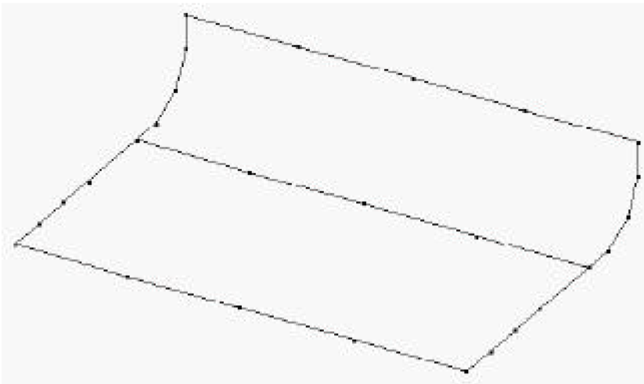


Figure 4-14

<Close>

Closes the input window.

<Clear>

Cancels the selection of a point or a curve, if you have inadvertently selected the wrong element.

<UNDO>

Undoes the last connection.

4.7 Regular geometry analysis

With this function you can investigate whether regular geometry elements are contained in free form geometries. Analysis is used to identify, generate and save such elements.

Select one or more surface elements in order to investigate their regular geometries.

Click on <Regular geometry analysis>.

A selection window for regular geometry elements appears:

- Plane
- Circle
- Sphere
- Cylinder
- Cone

Select the options for all elements which you wish to generate on the selected free form geometries. Click on <OK> to start the analysis.

The analysis is performed.

The result of the analysis is displayed. You obtain information about found and generated regular geometries.

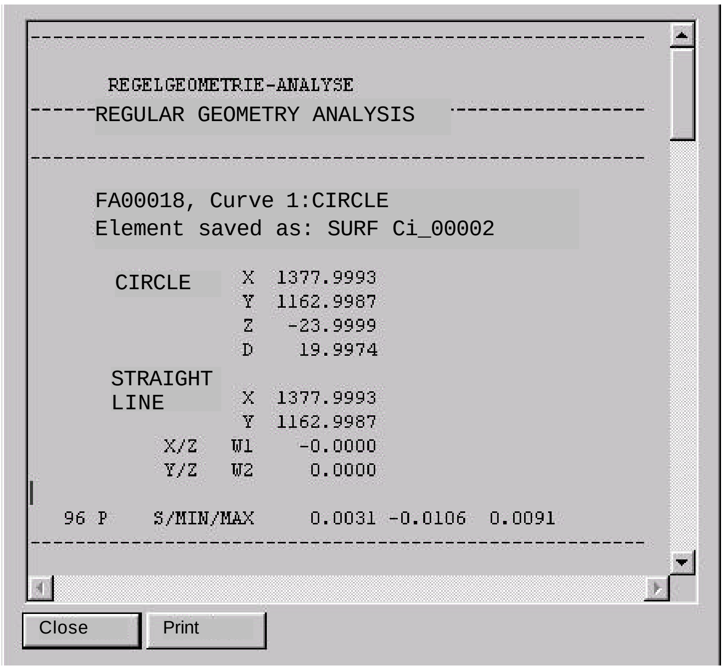


Figure 4-15

4.8 Generate regular geometries

Regular geometry elements can be generated with this program section.

The following elements can be generated in HOLOS:

- Slot
- Rectangular hole
- Circle
- Plane
- Sphere
- Cylinder
- Cone

4.8.1 Generate elements as free form geometries

Regular geometries can be generated as free form geometries.

Select CAD functions in the menu bar and click on the <Regular geometries> function.

A dialog window appears in the screen:

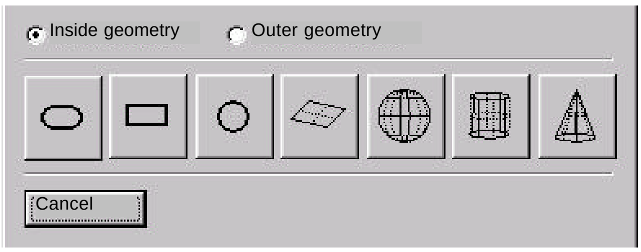


Figure 4-16

In order to generate an element, click on the appropriate icon with the left mouse button.

A dialog window appears for defining the parameters.

The parameters for the individual elements are described in the following sections.

Slot

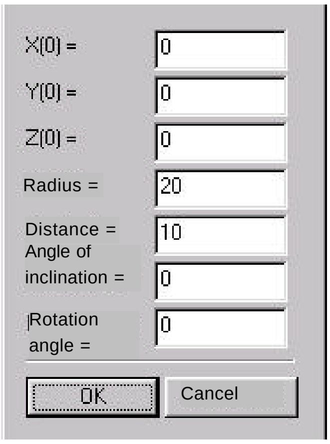


Figure 4-17

X(0), Y(0), Z(0)	A slot is an element which consists of two semi-circles. Enter the mid-point coordinate of the first circle.
Radius	Enter the radius of the two semi-circles.
Distance	Enter the distance of the two semi-circles.
Angle of inclination	The angle of inclination denotes the angle of inclination around the Y/Z-plane. Enter a value for the angle of inclination.
Rotation angle	The rotation angle denotes the rotation angle around the Z-axis. Enter a value for the rotation angle.

After clicking on the <OK> key, the slot is calculated and displayed on the screen.

Rectangular hole

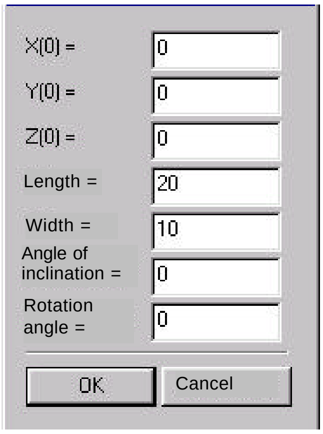


Figure 4-18

X(0), Y(0), Z(0)	Enter the coordinates of the mid-point for the rectangular hole.
Length	Enter a value for the length of the rectangular hole.
Width	Enter a value for the width of the rectangular hole.
Angle of inclination	The angle of inclination denotes the angle of inclination around the Y/Z-plane. Enter a value for the angle of inclination.
Rotation angle	The rotation angle denotes the rotation angle around the Z-axis. Enter a value for the rotation angle.

After clicking on the <OK> key, the rectangular hole is calculated and displayed on the screen.

Circle

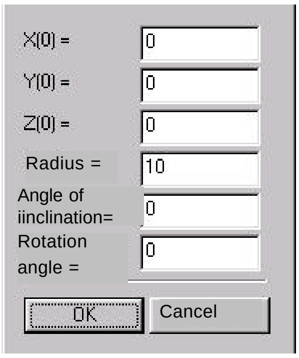


Figure 4-19

X(0), Y(0), Z(0)	Enter the coordinates of the circle mid-point.
Radius	Enter a value for the circle radius.
Angle of inclination	The angle of inclination denotes the angle of inclination around the Y/Z-plane. Enter a value for the angle of inclination.
Rotation angle	The rotation angle denotes the angle of rotation around the Z-axis. Enter a value for the rotation angle.

Select either the “Inside geometry” option to generate an internal circle, or “Outer geometry” for an external circle.

After clicking on the <OK> key the circle is calculated and displayed on the screen.

Plane

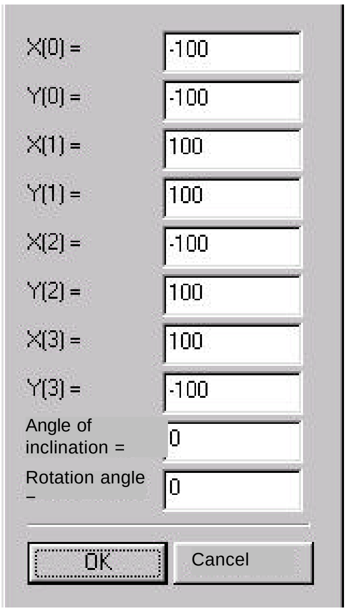


Figure 4-20

A plane is defined by four points in the X/Y-plane at the height Z = 0. You can use the transformation functions (mirroring, rotation, translation) to obtain a plane in another position.

X(0), Y(0):	Enter the coordinates of the first plane point
X(1), Y(1):	Enter the coordinates of the second plane point
X(2), Y(2):	Enter the coordinates of the third plane point
X(3), Y(3):	Enter the coordinates of the fourth plane point
Angle of inclination	The angle of inclination denotes the angle of inclination around the Y/Z-plane. Enter a value for the angle of inclination.
Rotation angle	The rotation angle denotes the rotation angle around the Z-axis. Enter a value for the rotation angle.

After clicking on the <OK>key a plane is calculated and displayed on the screen.

Sphere

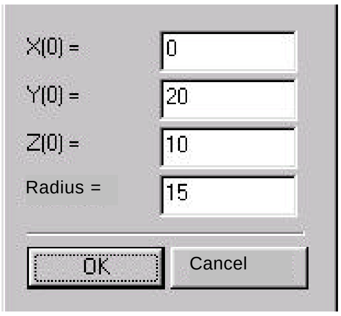


Figure 4-21

X(0), Y(0), Z(0)	Enter the coordinates of the mid-point of the sphere.
Radius	Enter a value for the radius of the sphere.

Select either the option “Inside geometry“ to generate an internal sphere or “Outer geometry” for an external sphere.

After clicking on the <OK> key a sphere is calculated and displayed on the screen.

CAD functions

Cylinder

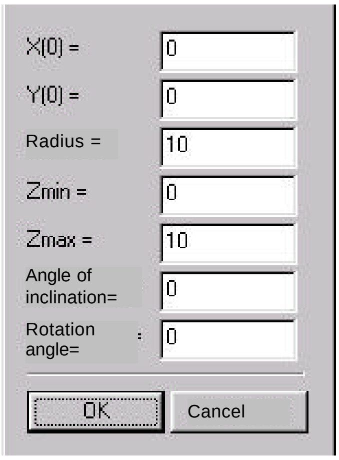


Figure 4-22

X(0), Y(0)	Enter the coordinates of the piercing point of the cylinder axis with the X/Y-plane.
Radius	Enter a value for the cylinder radius.
Zmin	Enter a value for the lower position of the cylinder.
Zmax	Enter a value for the upper position of the cylinder.
Angle of inclination	The angle of inclination denotes the angle of inclination around the Y/Z-plane. Enter a value for the angle of inclination.
Rotation angle	The rotation angle denotes the rotation angle around the Z-axis. Enter a value for the rotation angle.

Select either the “Inside geometry” option to generate an internal cylinder or “Outer geometry” for an external cylinder.

After clicking on the <OK> key a cylinder is calculated and displayed on the screen.

Cone

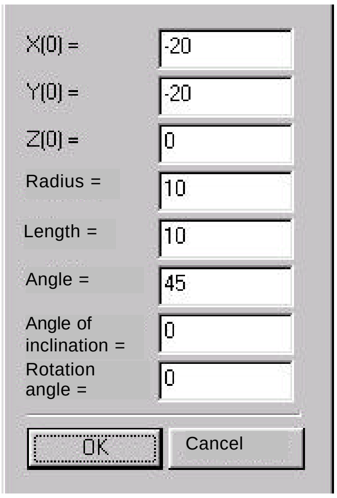


Figure 4-23

X(0), Y(0)	Enter the coordinates of the piercing point of the cone axis with the X/Y-plane.
Radius	Enter a value for the cone radius.
Z(0)	Enter a value for the lower position of the cone.
Length	Enter a value for the length of the cone.
Angle	Enter a value for the cone angle.
Angle of inclination	The angle of inclination denotes the angle of inclination around the Y/Z-plane. Enter a value for the angle of inclination.
Rotation angle	The rotation angle denotes the rotation angle around the Z-axis. Enter a value for the rotation angle.

Select either the “Inside geometry” option to generate an internal cone or “Outer geometry“ for an external cone.

After clicking on the <OK> key, a cone is calculated and displayed on the screen.

4.8.2 Generate elements from digitized points when probing

Regular geometry elements can be directly generated by probing points on the workpiece (DIGIT POINT).

Generate regular geometry elements from manually probed points

Select the <Data>-<Digitization points> functions in the "Digitizing" menu.

The dialog window for managing digitization points is displayed.

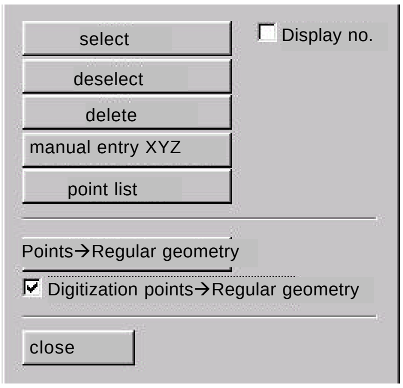


Figure 4-24

Switch on the <Digitization points → Regular geometry> option so that digitization points are automatically converted into a regular geometry element as soon as they are transferred from CADLINK to HOLOS. The elements are automatically recognized in this case.

CAUTION

Please note that there is no automatic recognition for a slot or a rectangular hole!

Generate regular geometry elements from selected points

If digitization points already exist in HOLOS-NT, they can be selected and a regular geometry element generated from them.

Select the required digitization points.

Then click on <Points → Regular geometry>.

The dialog window for defining the required element appears on the screen.

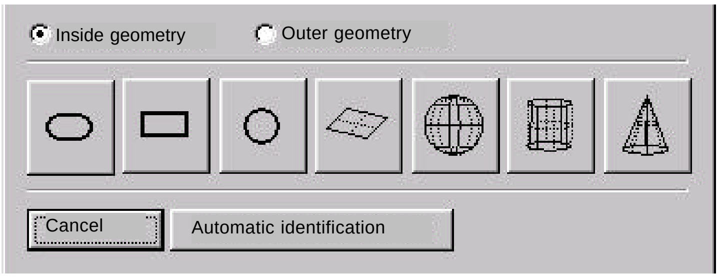


Figure 4-25

If you wish HOLOS-NT to automatically define which element can be generated from the selected points, select the <Automatic identification> function.

If you wish to generate a particular element, click on the relevant icon.

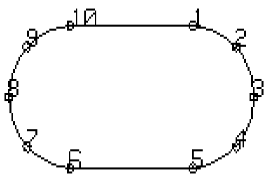
Select either the “Inside geometry” option or “Outer geometry” in order to generate the corresponding element for a circle, sphere, cylinder or cone.

4.8.3 Probing rules

In order to generate a regular geometry element from digitization points, the following guidelines must be observed:

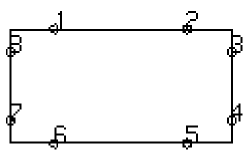
Slot

- Probe or select at least 6 points.
- The number of points must be divisible by two.
- The points must be regularly distributed on both semi-circles (e.g. 8 points: 4 points on semi-circle 1, 4 points on semi-circle 2.)
- A logical sequence of point distribution must be maintained.



Rectangular hole

- Probe or select eight points.
- Two points must be located on each of the four straight pieces.
- A logical sequence of point distribution must be observed.



Circle

Probe or select at least 3 points.

Plane

Probe or select at least 3 points.

Sphere

Probe or select at least 4 points.

Cylinder

Probe or select at least 9 points.

Cone

Probe or select at least 9 points.

If only 3 points are probed or selected, a circle **and** a plane are always generated during automatic identification, as it is not possible to clearly determine which element is to be generated.

4.9 Convert points

You can convert CAD and digitization points into scanning lines or scanning lines into points.

The following functions are available for this:

CAD points → Scanning line

A scanning line is generated from a sequence of CAD points.

Click on the < CAD points -> Scanning line> function.

Click on the CAD point at which the scanning line is to begin.

Click on a second CAD point, at which the scanning line is to end.

A scanning line is generated and displayed on the screen.

DIGIT points → Scanning line

A scanning line is generated from a sequence of DIGIT points.

Click on the < DIGIT points -> Scanning line> function.

Click on the DIGIT point at which the scanning line is to begin.

Click on a second DIGIT point at which the scanning line is to end.

A scanning line is generated and displayed on the screen.

Scanning line → CAD points

CAD points are generated from a scanning line.

- Select a scanning line.
- Click on the < Scanning line -> CAD points > function.
- All points on the scanning line are accepted as CAD points.

Scanning line → DIGIT points

DIGIT points are generated from a scanning line.

- Select a scanning line.
- Click on the < Scanning line -> DIGIT points > function.
- All points on the scanning line are accepted as DIGIT points.

CAD points → DIGIT points

DIGIT points are generated from CAD points.

- Click on the < CAD points -> DIGIT points > function.
- All CAD points are accepted as DIGIT points.

Sel. CAD points → DIGIT points

DIGIT points are generated from CAD points which are selected in the "Digitization" menu with the <Digitization points> function and the <Select> command.

- Click on the < sel. CAD points -> DIGIT points > function.
- All selected CAD points are accepted as DIGIT points.

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