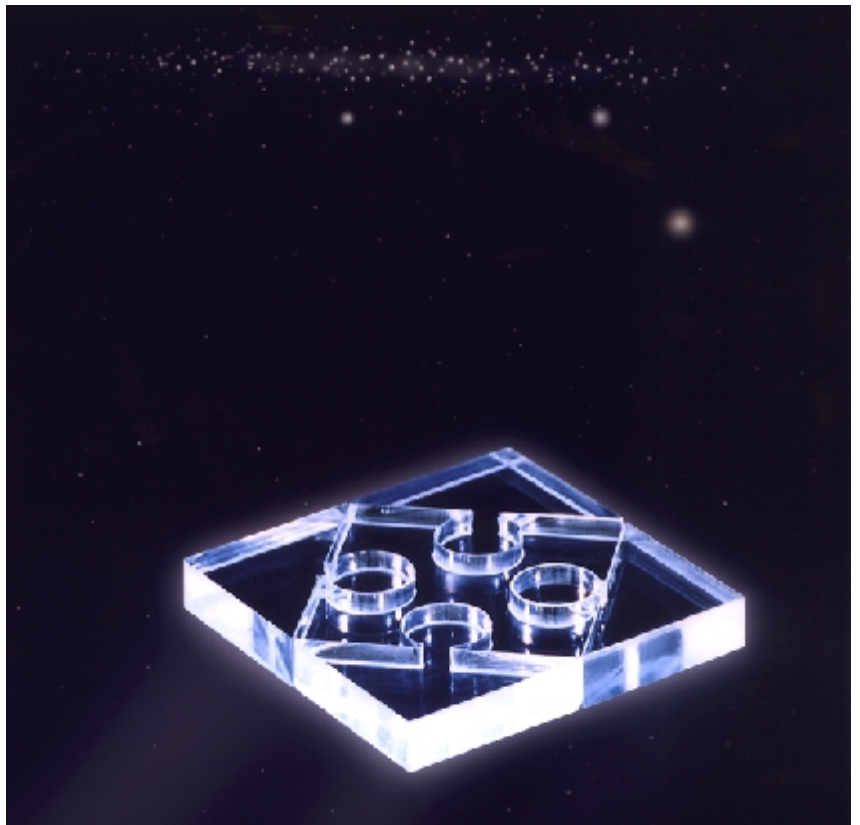

Axyz View/CAD

Graphics Modules

Software Reference Manual



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1. **Axyz View / CAD - the Graphics Module**

1.1 **About this manual**

This manual has two main components:

It explains in detail how to operate the software interface to the graphics modules:

- **Axyz** View
- **Axyz** CAD

Axyz CAD has all the functions offered by **Axyz** View with some additional extensions. Functions specific to **Axyz** CAD will be indicated with the following label:

CAD only

Users of **Axyz** View do not have access to the CAD functions which are shown on the menus but are greyed out.

It is assumed that the reader has an understanding of how to operate the Core Module and one of the sensor modules as explained in the following document

- **Axyz** Core Data Module: Software Reference
- **Axyz** Theodolite Module: Software Reference
- **Axyz** Laser Tracker: Software Reference

This manual also assumes the reader has an understanding of the measurement task and basic system concepts.

The following documents provide background information to **Axyz**:

- **Axyz** “System Concepts” explains the general purpose and structure of the software.
- **Axyz** “Mathematics for Users” provides details of all relevant mathematical techniques.
- MS Visual Basic documentation explains the use of this programming language, except for functions and options specially created for **Axyz**.
- Crystal Report explains the details of report generating.

1.1.1 Document conventions

The following text formatting conventions are in use:

This	Represents
<i>italic</i>	Italic type is used to indicate new or specialist names and terms. Look for a glossary definition or special section for more details.
ALL CAPITALS	The names of computers, folder names, filenames and acronyms.

1.1.2 Keyboard and menu conventions

Key combinations and key sequences have the following meanings:

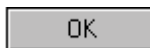
Format	Meaning
KEY1+KEY2	A plus sign (+) between key names means to press and hold down the first key while you press the second key.
KEY1, KEY2	A comma (,) between key names means to press and release the keys one after the other.
ENTER or RETURN	The key equivalent to "carriage return" on a typewriter and which causes a new line when typing text. It may be labelled with a bent arrow.
SHIFT, Shift	The key which produces capital letters. It may be labelled with an upward pointing arrow.
CTRL, Ctrl, ALT, Alt	The "control" and "alternate" keys, generally labelled as "CTRL" and "ALT" on your keyboard.

1.1.3 Windows conventions

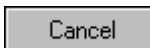
It is assumed that the user is familiar with the Microsoft WINDOWS™ environment. See MS Windows documentation for use of a mouse, windows features and shortcut keys.

Buttons

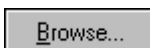
The following standard buttons enable the user to respond to requested inputs.



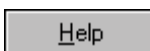
Proceed with actions defined by the settings in the current dialogue box



Ignore any changes made in the current dialogue box. Return to the situation which existed before the current box was accessed.



Search folders on disk for the requested information.



Provide context-sensitive HELP.

The use of these buttons will in most cases not be further described.

Mouse

In the absence of a more detailed description, "click" implies a click on the left mouse button.

1.1.4 On-line HELP

The on-line HELP is derived from this Software Reference Manual using Doc-To-Help™. HELP and the manual each contain essentially the same information with the exception of menu screens. All menu screens are displayed in the manual. Most menu screens are not displayed in HELP because the screen can be viewed in the actual program when using HELP. However HELP does contain some example screens in order to properly explain the operation of particular features.

1.2 Graphics concepts

In contrast to the Data Manager which offers a numerical view of the job data, **Axyz** View and **Axyz** CAD offer a pictorial representation via a graphics window, also called a *viewport*.

Like the Data Manager, the graphics modules allow you to select data items for detailed viewing and analysis although data must be edited with the Data Manager.

The graphical view can also present an immediate visual feedback of the results of on-line measurements. Although measured data is immediately entered into the database, the Data Manager cannot provide such an immediate and intuitive feedback.

Graphical features are therefore particularly useful for analytical and on-line error analysis.

The above features are provided by **Axyz** View, which is the low-end solution for visualizing measurements made with **Axyz** instrument modules LTM and STM/MTM. In brief summary **Axyz** View offers:

- Display of points, shapes and sensors
- Error analysis
- On-line display of standard measurements, build and inspect functions

Axyz CAD goes beyond the features of both **Axyz** View and the Data Manager by offering the possibility of importing and interacting with a CAD model. CAD models, which are defined by points, curves and surfaces, can be imported in various file formats such as IGES, VDA-FS and DXF. Once imported, measured data can be compared against a CAD model in various ways.

1.2.1 Default content

The user can either start graphics with an empty window or with a default content.

In the first case, when the first graphics window is opened it will be empty. To display data in the window, filter options must be selected and set.

In the second case, when the first graphics window is opened it will show all data in the database which matches the current *filter* settings.

1.2.2 2D and 3D views

The graphics window offers both 2D and 3D views of the database.

2D views are orthographic projections onto the planes defined by the axes of the base coordinate system.

The 3D view is also an orthographic view taken from a general camera position. It is not a perspective view.

Note

An orthographic view is preferred in order to reduce misinterpretation of error needle plots. In a perspective view needles of a given size but close to the viewing camera position will appear larger than needles of the same size further from this position.

Either the 3D view occupies the window by itself (single view) or the window is split into 4 parts (split view) to show the 3D view and 2D projections. In the split view one of the views is the *active view*.

1.2.3 Co-ordinate system for 2D and 3D display

The graphics module currently displays 2D data in the base coordinate system.

In the 3D view the axes of the base coordinate system define the axes for standard viewing options, such as an initial view down the +Z axis (of the base coordinate system).

1.2.4 Changing the viewpoint (rotate, translate, zoom)

Graphics commands allow users to manipulate the 3D view of the data by rotating, translating and zooming in or out. These commands do not change the object's coordinates but simply modify the position of the viewing camera.

2D views are only affected by translation and zoom commands. Rotations have no effect.

Rotations and translations are implemented with the scroll bars or by mouse movements inside the graphics window. The mode of operation can be switched between *rotation mode* and *translation mode*.

1.2.5 Choosing which data to display (filter, select by ID and hide)

Only displayed data can be selected for further examination or processing. However it is not necessary to display all the data in the job file since it may be much more convenient to display only certain types of data or specific data objects. This then makes the selection and evaluation processes more efficient.

One technique allows users can to display data depending on *filter* criteria. Data which do not meet the selected criteria will not be displayed.

A major separation of data is provided by deciding which workpieces to display. Workpieces operate like *layers* in other graphics programs. Only data in specified workpieces is shown.

To provide a fuller picture of the measurement network, instrument stations and scale bars can also be separately selected for display. Standardized graphical elements are used to represent stations and will not necessarily correspond exactly to the actual instruments in use.

The display of measured points can be restricted according to type. Shapes, coordinate systems and hidden point devices can also be separately displayed.

A single filter specification is applied to all open graphics windows. The filter settings can be applied to data currently in the database and new incoming data, or to newly generated data only. See "Display Filter" on page 71.

If the filter technique is still not sufficiently precise, users can display data chosen with the *ID select* tool. This offers the spreadsheet view provided by the Data Manager, from where individual data items can be selected. Any choice made here overrides any filter restriction.

A further level of display is provided by the ability to *hide* some of the displayed data, such as the results of an analysis. This hidden data can then be revealed again by the *unhide* command.

1.2.6 Symbols and colour codes

The symbols and colours used to display the individual elements can be set by the user. See "Object display tab" on page 67.

1.2.7 Multiple graphics windows

Each **Axyz** module (CDM, STM/MTM or LTM) can create a single graphics window. Within a module, therefore, multiple windows are not possible. However you may have a additional and different graphics views of your data by opening windows in each module on your system.

When opening further graphics windows in other **Axyz** modules, the displayed content of the first window will appear automatically in the newly opened window, thus keeping all graphics windows consistent.

1.2.8 Selecting items

There are different ways to select data or objects for further evaluation and these are supported by *selection modes*.

Selection methods can only be applied to displayed objects.

Selected objects change colour. The selection colour can be defined by the user. See "Object display tab" on page 67.

Normal selection mode

This applies to all types of displayed objects. Use these techniques:

- Click on an object
- Drag a rectangle around a group of objects.
- Add a new object to an existing selection by keeping the CTRL key pressed during the selection.

Type selection mode

To enable greater precision in selection, type selection mode functions as normal mode except that selection is restricted to objects of a specified type. The selection techniques in normal mode apply here.

When this mode is selected it is necessary to choose one or more of the available type restrictions, i.e.

- All point types
- Standard **Axyz** shapes

CAD only

- CAD surfaces
- CAD curves

Pick mode (sets)

This mode is for selecting individual points in a coordinate set.

Individual points are selected by single mouse click, further points added by CTRL + mouse click.

Lasso mode (sets)

This mode is for selecting multiple points from one or more coordinate sets.

Create a polygon ("lasso") around the required set points by clicking to create a polygon corner. A right click will join the last point to the first and finish the sequence.

Depending on the chosen option, either all points inside or outside the lasso will be chosen.

As an additional refinement, the lasso will operate on either all visible sets or only on a specified sub-group of the visible sets.

Edit menu choice – Select all

If normal selection mode is active, this will select all displayed items.

If type selection mode is active, this will select all displayed items which match the current specific types defined for this mode.

Cancelling selections

To cancel all selections:

- Click on empty space in the graphics window
- Choose "Deselect all" from the "Edit" menu
- Choose "Deselect all" from the popup menu by right mouse click in the graphics window

To cancel one item from a multiple selection:

- Press CTRL and click on a selected object

1.2.9 Display of “infinite” shapes

The display of standard **Axyz** shapes of infinite extent (planes, lines, cylinders, parabolas, cones) is handled as follows:

- The boundaries of shapes calculated by a shape fit function are determined by the minimum and maximum co-ordinates of the fitted points, plus a tolerance of 10% to avoid placing points exactly on the boundary.
- The boundary of shapes resulting from intersections or other analysis functions are calculated from the boundary of the input shapes.
- Shapes imported or input by hand get a default size which can be modified.

1.2.10 Saving views for illustrating reports

You may wish to save the current view for illustrating reports. 3rd. party screen capture programs can provide this facility, possibly with further functions such as annotation. Standard Windows 95 techniques and programs can also enable you to do this. For example, ALT+Print Screen will capture the active program window and place it on the Clipboard. From here it can be pasted into MS Draw for further manipulation.

Alternatively **Axyz** View and CAD offer the facility to copy the current display to the clipboard from where it can be pasted into other documents, such as MS WORD documents.

CAD only

The Export function enables you to export the current view to either JPG or BMP files. See also "Exporting graphics data" on page 10.

1.2.11 Graphical display of on-line measurements

If an instrument module is active and making measurements when a graphics window is open, measured data will be automatically displayed on line. The features of the display depend on the measurement mode. For fuller details see "Graphics and on-line measurement" on page 104.

1.2.12 CAD data

CAD data can be imported by the **Axyz** CAD module where its prime purpose is to provide a reference for comparison with measured data. Imported CAD data cannot be stored inside the **Axyz** job file like, for instance, reference coordinates, although points can be extracted from CAD models, or created on a CAD surface, and then stored in the job file.

Displayed graphics data can be exported in several formats to external files. These include common image formats such as BMP which can then be used to illustrate reports, etc. They also include the import CAD formats. However **Axyz** is not a fully featured CAD system. For example, it does not have the facility to create complex CAD surfaces from 3D point clouds. It can create standard shapes such as cylinders from such point clouds and export these as standard CAD files.

Importing CAD data

CAD data can be imported from an external file in the following formats:

- DXF files (*.dxf)
- VDA-FS files (*.vda)
- IGES files (*.igs)
- Imageware files (*.imw)
- Catia files (*.EXP, *.MOD, *.MODEL)

Exporting graphics data

Selected data can be exported to an external file in one of the following CAD formats:

CAD data can be imported from an external file in the following formats:

- DXF files (*.dxf)
- VDA-FS files (*.vda)
- IGES files (*.igs)
- Imageware files (*.imw)
- Catia files (*.EXP, *.MOD, *.MODEL)

In addition the current display can be exported as an image file in one of the following formats:

- JPEG files (*.jpg)
- Bitmap files (*.bmp)

The coordinate system of the CAD data

When imported, CAD data is assumed to be located in the active coordinate system.

If at any time during the use and analysis of CAD data the active coordinate system is changed, all CAD models already in the graphics window will be re-set into this coordinate system.

However, it is possible to move a CAD model to another location using one of the following transformation techniques:

- By specifying a different coordinate system from the ones currently created in the job file for a particular CAD model (CAD transformation by CS).
- By best fit of a particular CAD model to existing measured points.

Multiple CAD models

Multiple CAD models can be imported. They are given a simple numeric ID depending on the order in which they are imported. This enables the user to choose between them when making transformations and comparisons.

CAD surface orientation

CAD models have normal vectors associated with the individual surface patches which form their surfaces. These vectors point to the "outside". The "outside" is where the surface meets the air. This does not imply that an interior surface of a component is "inside". Interior and exterior surfaces may well be separated by some material, e.g. metal, and each will be separately defined in a CAD model and have its own "outside", where it meets the air.

A positive direction of the surface orientation is therefore from the "inside" towards the "outside". A target with an offset, such as a tooling ball reflector, will have a positive offset when touching the outside surface and a negative offset when touching the inside surface.

On the graphics display, outside surfaces are shown bright and shiny, inside surfaces are duller and darker.

Sometimes models may be imported with the sides wrongly defined. It is then possible to *flip* the surface orientation to the opposite direction. It may also be possible that a number of CAD surface patches have inconsistent insides and outsides. A *harmonize* function is available to change the orientation of all selected patches so that they point in approximately the same direction.

1.3 Starting an Axyz View or Axyz CAD window

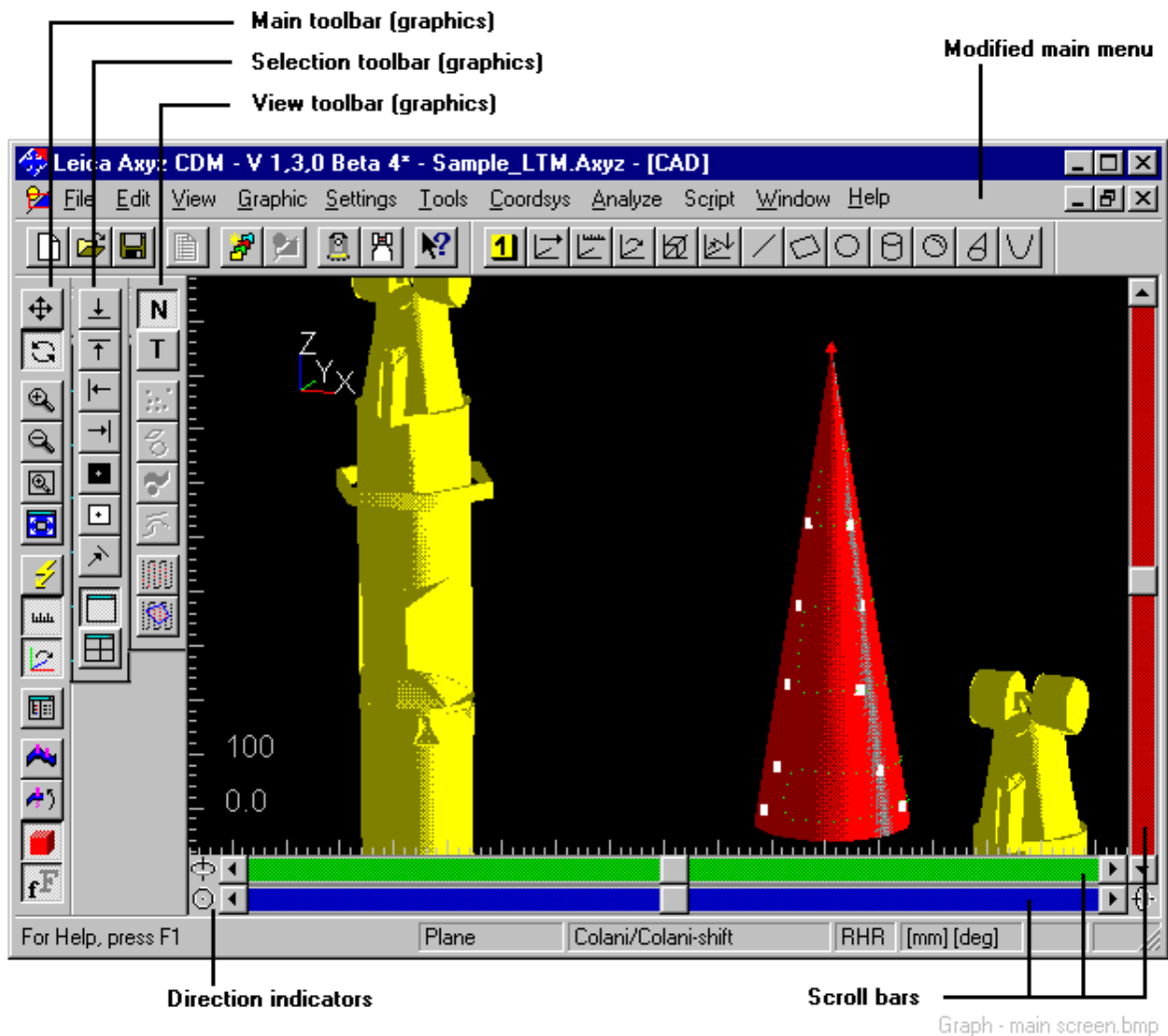
The graphics module can be started from **Axyz** CDM, MTM, STM and LTM.

Open the graphics window:

- By use of the toolbar button 
- By selecting "Graphics" from the "Window" menu of the host module

2. *Axyz View and Axyz CAD graphical interface*

2.1 *Main screen toolbars and controls*



The example shows a graphics window opened from within the Core Data Module (CDM). The window has been maximized to fill the graphics display area. The CDM main menu has been modified and now has the sub-menu "Graphic".

There are 3 additional graphics toolbars which have been collected together on the left hand side for convenience in this example. They may be individually placed on the left, right, top or bottom sides of the graphics window.

2.1.1 Menu and toolbar changes

When the graphics window is activated the host module's main menu is modified as follows:















- A Special **Graphics** menu is added
- The host module's **Edit** and **View** menu options change to correspond with graphics functions
- The **Help** menu changes to support graphics functions and operation

In addition 3 graphics toolbars are added to the module's toolbars. There is no change to the display of main module toolbars, but they must be configured for display before opening the graphics window if you want continued access to them.

If a graphics window is open but another window is activated, e.g. a Data Manager window or measurement window, the additional graphics menus and toolbars will disappear. Toolbars and menus will be re-configured to support the new active window.









2.2 Summary of graphics toolbars

2.2.1 Main toolbar

-  Translation mode (scroll bars and SHIFT+click apply shifts)
-  Rotation mode (scroll bars and SHIFT+click apply rotations)
-  Zoom in one magnification step
-  Zoom out one magnification step
-  Zoom into box drawn in graphics window
-  Fill graphics screen with all elements matching filter criteria
-  Refresh graphics window
-  Show horizontal and vertical rulers at left and top of window
-  Show direction of orientation axes (base system axes)
-  Display data with ID select tool
-  Harmonize surface orientation
-  Flip surface orientation
-  Toggle rendering mode
-  Toggle font size










Graph Toolbar Main.bmp

2.2.2 Selection toolbar

-  N Normal selection mode (by mouse click or inside rectangle)
-  T Selection by type (requires one or more types)
-  Selection by type - Points
-  Selection by type - standard 7 **Axyz** shapes
-  Selection type - CAD surface
-  Selection type - CAD curve
-  Selection of individual set points
-  Select of set points by lasso

Graph toolbar select.bmp

2.2.3 View toolbar

-  +Z view (3D view down base system Z axis)
-  -Z view (3D view up base system Z axis)
-  +X view (3D view down base system X axis)
-  -X view (3D view up base system X axis)
-  +Y view (3D view down base system Y axis)
-  -Y view (3D view up base system Y axis)
-  Isometric 3D view based on base system axes
-  Single 3D view
-  Split view (3D view +2D views on base system planes)



Graph toolbar view.bmp

2.3 Status bars

Axyz View and **Axyz** CAD have the same status bar as the host module.

The left hand side of the status bar gives brief help text about the function of individual menu items, buttons etc. when the cursor is floating over them.

2.4 Scroll bars

Scroll bars enable you to obtain a different camera location and orientation from which to view the displayed information. By choosing either *rotation mode*  or *translation mode*  scroll bar movements will either rotate the camera at its current location or shift it to another location without any rotation.

Although objects change position on the screen, this does not in any way affect the way data is recorded in the database. Only the viewing position is affected.

The scroll bars are clearly labelled in "Main screen toolbars and controls" on page 12.

Rotations and translations can also be implemented by SHFT+ right mouse click and drag in the graphics window.

See also:

"Rotation Mode" on page 74.

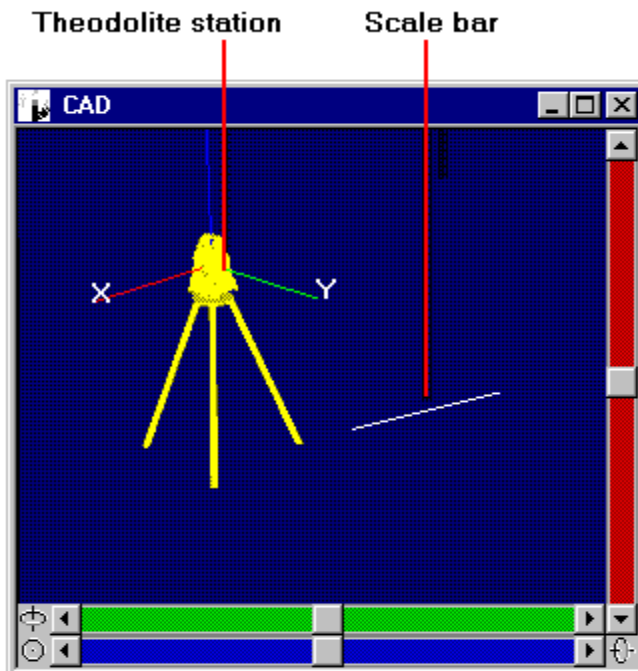
"Translation Mode" on page 75.

Remember

Zoom functions are also available to change the view. See "Zoom: general information" on page 48.

2.5 Gallery of displayed elements

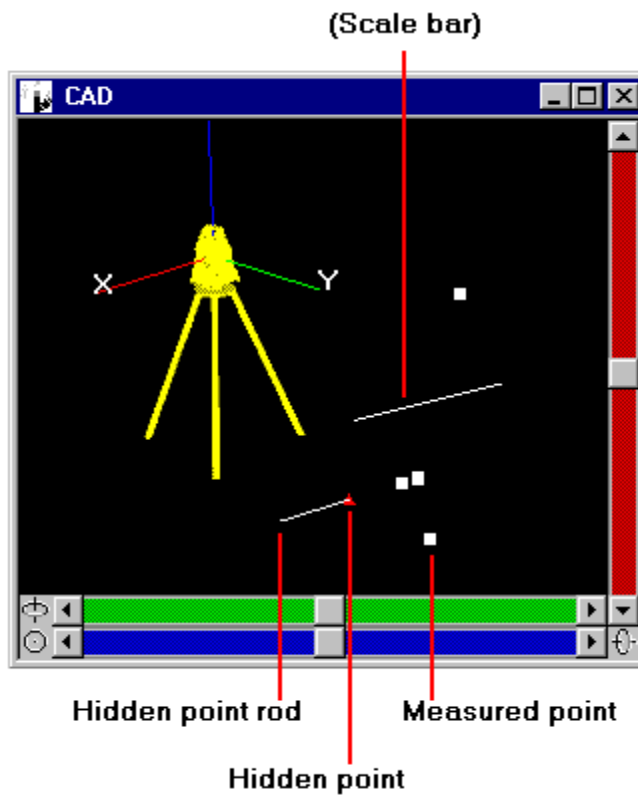
2.5.1 Stations and scale bars



Display of stations and scale bars

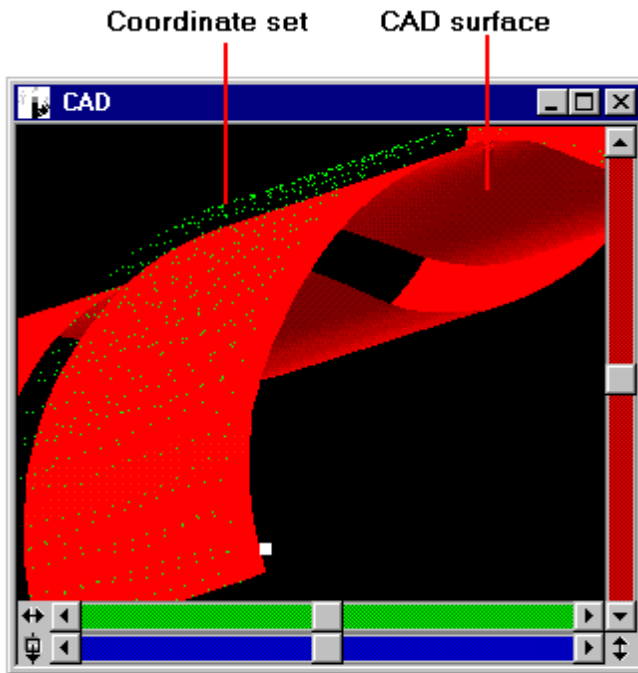
Graph - stns & scale bars.BMP

2.5.2 Points and hidden points



Graph - pts and hid pts.BMP

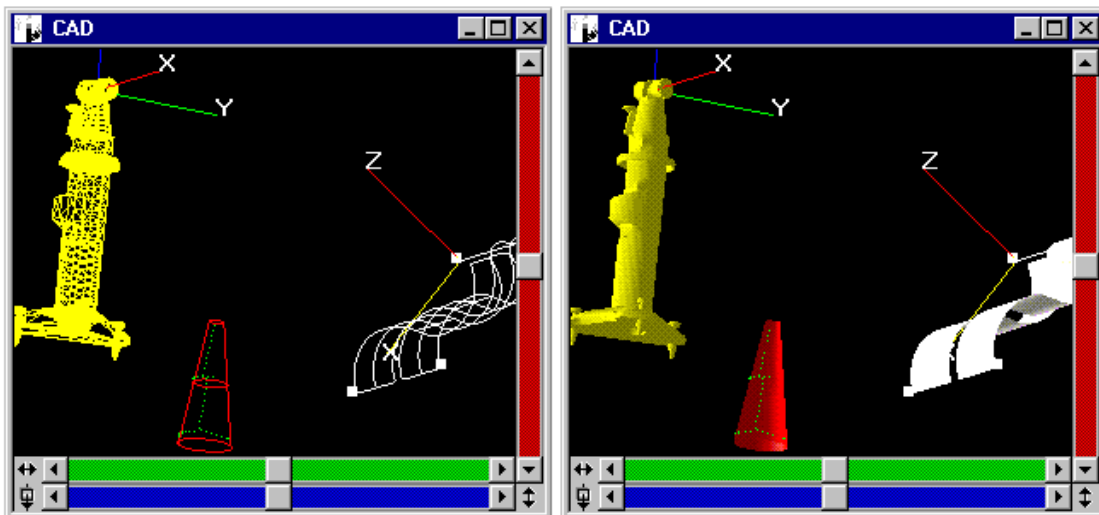
2.5.3 LTM coordinate sets



Set of point coordinates
(resulting from scan of CAD surface)

Graph - coord set.BMP

2.5.4 Wireframe display

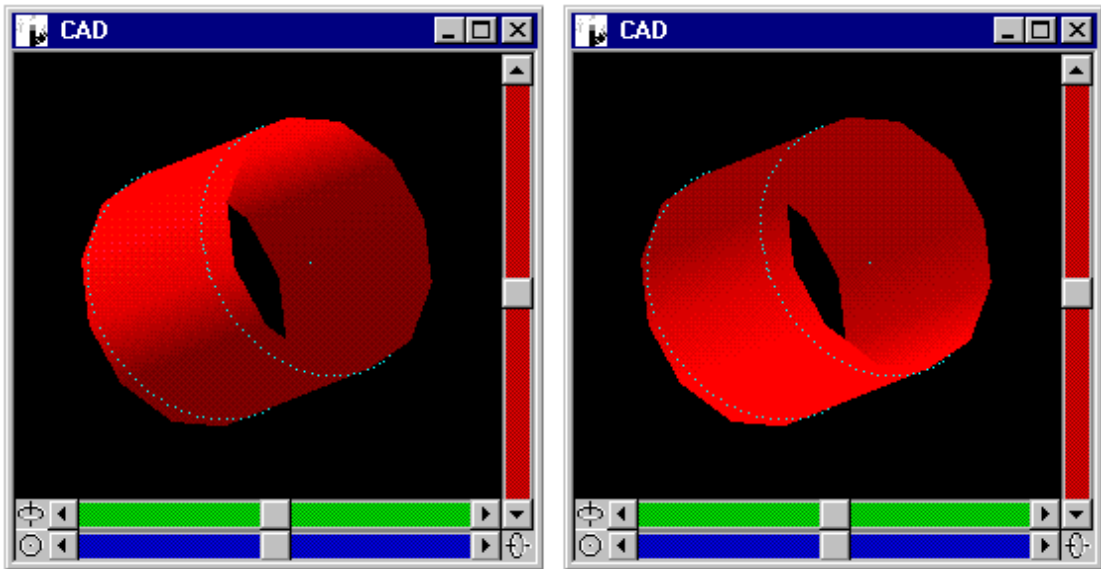


Wire frame display

Corresponding shaded display

Graph - wire frame and rendered.bmp

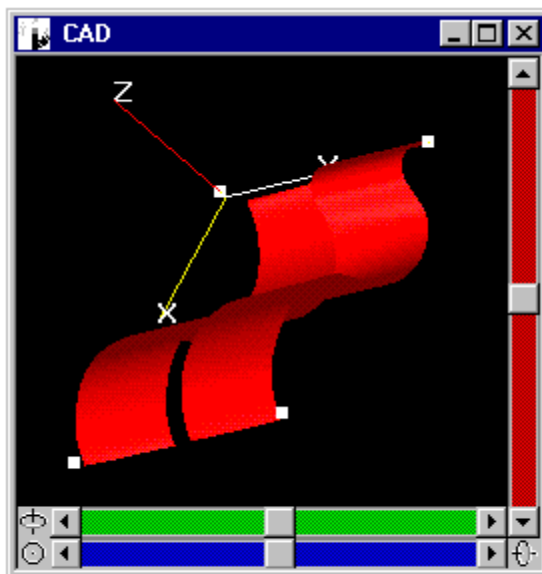
2.5.5 Shaded (rendered) display



Shaded shape under different lighting conditions

Graph - shaded shape.BMP

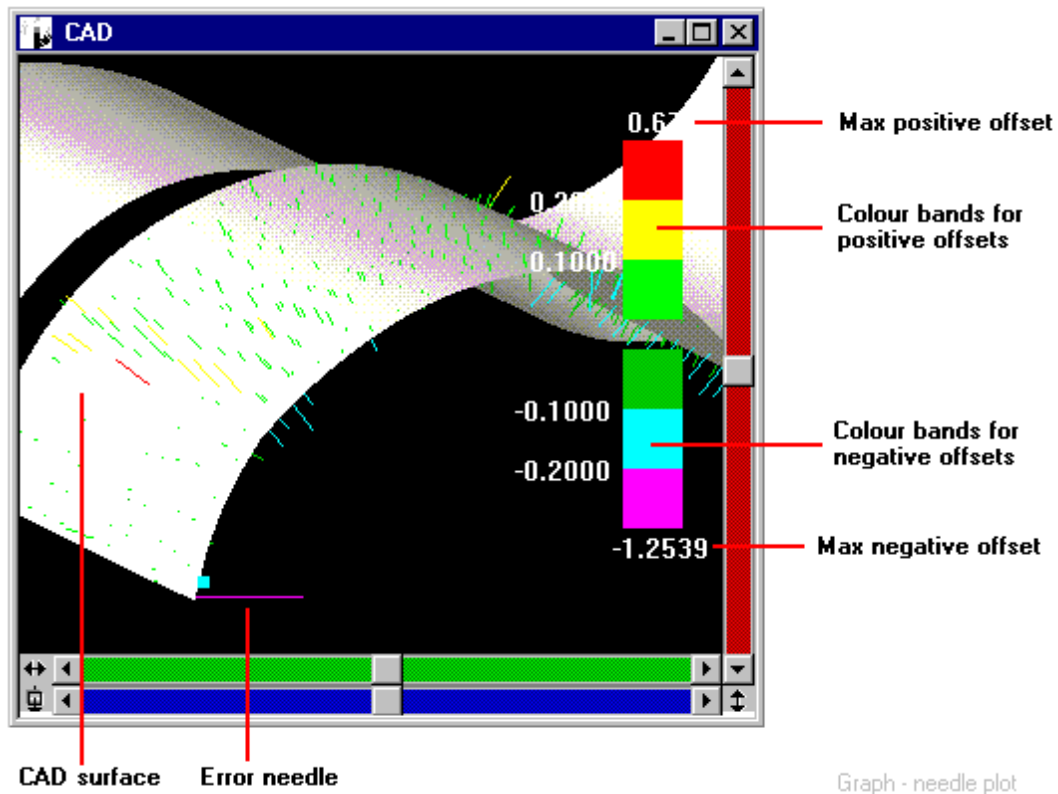
2.5.6 CAD models (free form shapes)



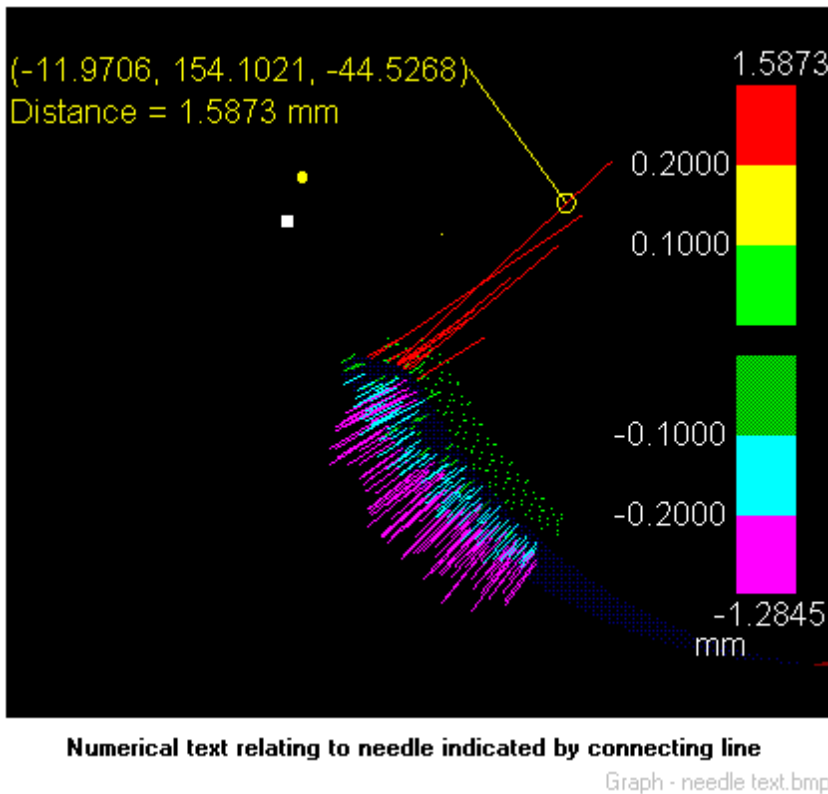
Display of a CAD model

Graph - CAD display.BMP

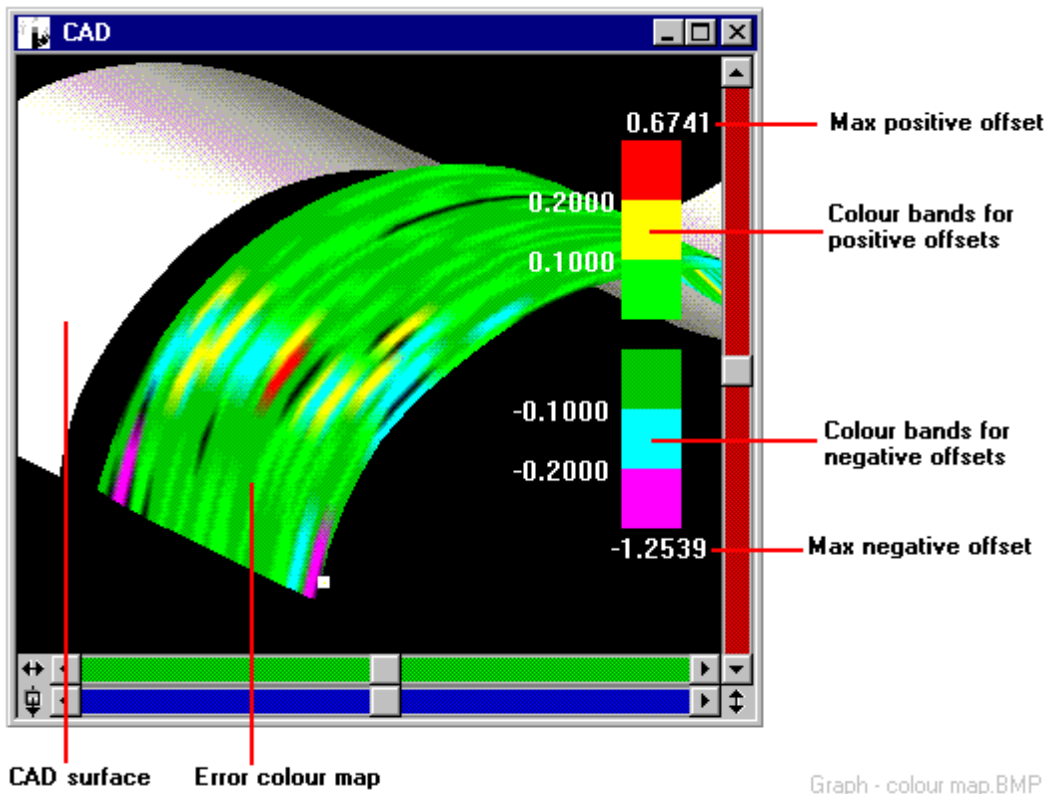
2.5.7 Error needle plot



2.5.8 Error needle text

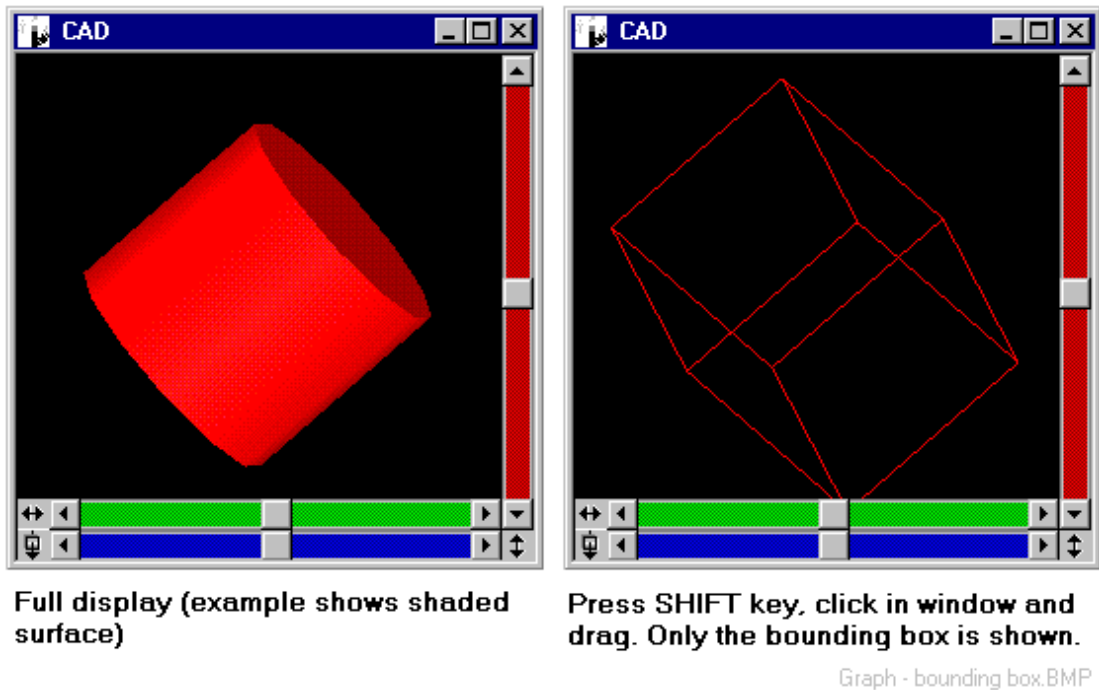


2.5.9 Error colour map



2.5.10 Bounding box display

Useful for fast rotations and translations.



3. Axyz View and Axyz CAD Menu summary

3.1 Introduction

The menu options which are available in an active graphics window are added to the menu of the host module from where the graphics window is created, i.e. from the CDM, STM/MTM or LTM modules.

This section only summarizes the menus which are changed to provide the graphics options. All other menu points are described in the relevant manuals for CDM, STM/MTM and LTM.

Menus which change are:

- **Edit menu**
- **View menu**
- **Help menu**

A **Graphics menu** is added.

3.2 Edit summary









Selection mode:		
	Normal	Normal selection of all types of elements
	Pick set pts.	Select individual points in sets
	Lasso set pts.	Select sub-groups of set points by "lasso"
	Type	Select elements belonging only to specified type
	Point	Select elements of type point only
	Shape	Select elements of type shape only
	CAD surface	Select elements of type CAD surface only
	CAD curve	Select elements of type CAD curve only
Select All	Ctrl+Shift+A	Select all items in the graphics window
Deselect All	Ctrl+Shift+D	Cancel any current selections in the graphics window
Delete		Delete the selected elements
Save as set		Save selected points as a set
Save projected points	CAD only	Save selected points projected onto a CAD surface
Copy to clipboard		Copy the current graphics view to the clipboard
Properties	Alt+Enter	Displays properties of the last selected element

Table Graphics edit menu.BMP

3.3 View summary (a)

Toolbar:		
Main		Display/hide main toolbar
Selection		Display/hide selection toolbar
View		Display/hide view toolbar
Hide:		
Selection		Hide selected data in active view
CAD data	CAD only	Hide CAD data in active view
Analysis data		Hide any analysis data in active view
Hide All		Hide all displayed data
Unhide:		
CAD Data	CAD only	Make hidden CAD data visible
Analysis data		Make hidden analysis data visible
Unhide All		Make all hidden objects visible
Clear:		
Selected data		Clear any selected data from the graphics window
CAD data	CAD only	Clear all CAD models from the graphics window
Analysis		Clear all analysis results from the graphics window
Clear all		Clear all elements from the graphics window
Needle:		
Scale		Changes scale for needle plots
Display text		Show numeric text for selected needles
Clear all text		Clear all needle text from the graphics window

Table Graphics View menu (a).bmp

3.4 View summary (b)









	Zoom:In		Zoom in active view one step
	Out		Zoom out active view one step
	Box		Zoom into box drawn on active view
	Fill Screen		Show all available graphics elements within the active view
	Refresh		Refreshes screen
	Axes display:		
	Shape axes		Display or hide local shape axes
	Base CS axes		Display/hide base system axes
	Orientation axes		Display/hide an orientation axis
	Label display:		
	Show		Show IDs of pre-selected elements
	Show all	Ctrl+Shift+S	Display IDs of all elements
	Hide		Clear IDs of selected elements
	Hide all	Ctrl+Shift+H	Hide IDs of all elements
	Selected data		Show IDs of current selection only
	New data		Show IDs of new data only
	Font:		
	Small		Use small font size for label display
	Large		Use large font size for label display

Table Graphics View menu (b).bmp

3.5 View summary (c)













	+Z	View down +Z base system axis
	-Z	View down -Z base system axis
	+X	View down +X base system axis
	-X	View down -X base system axis
	+Y	View down +Y base system axis
	-Y	View down -Y base system axis
	Isometric	Isometric view
	Rulers	Display/hide vert./horiz. rulers
Rendering:		
	Wireframe	Display elements as wire framework
	Shaded	Display elements with solid surfaces
Screen		
	Single View	Display single 3D view
	Split View	Split window to show 4 views
Light:		
	Move light	Set position of light source
	Parameters	Define parameters of light source

Table Graphics View menu (c).bmp

3.6 Graphic summary (a)

	Options... Display Filter... ID Select CAD history CAD only	Sets diverse display parameters Select attributes which enable display of elements Choose elements to be selected from the Data Manager View/select previously and currently loaded CAD models (files)
	Rotation Mode Translation Mode Rotate around	Switches scroll bars to apply rotation to 3D view Switches scroll bars to apply shifts to 2D and 3D views Apply rotations about centre of gravity or last selected point
	Surface orientation: CAD only Flip	Reverse the orientation of the selected CAD surface patch
	Harmonize	Give consistent orientations to the selected CAD surface patches
	CAD Transformation: CAD only By coordinate system By surface fit	Place CAD models into an existing coordinate system Position a CAD model by fitting to existing measured points
	CAD Compare... CAD only	Compare selected points to CAD model
	Extract Point: CAD only Get all Select Create	Extract all points from CAD model and store in job file Extract selected points from CAD model and store in job file Create points on CAD model surface and store in job file
	Surface Offset...	Calculates off-set correction for a selected list of points

Table Graphics Graphic menu (a).bmp

3.7 Graphic summary (b)

Print graphics:		
Print Report		Print out the graphics window to a formatted report sheet.
Print as PS file		Print graphics window to a postscript file
Import...	CAD only	Imports data in various CAD formats
Export...	CAD only	Exports data in various CAD formats

Table Graphics graphic menu (b).bmp

3.8 Help summary


	Help Topics	F1	Lists the help topics
	Using Help		Instructions on how to use help
	Help Mode	Shift+F1	On-screen, context sensitive help
	About Axyz CAD/View		"Display program information, version number and copyright"

Table graphics help menu.bmp

4. Edit menu

4.1 Selection mode: Normal

Selection mode: Normal command (**Edit menu**) **Alt, E, S, N**

"Normal selection mode "

This applies to all types of displayed objects. Select by:

- Clicking on an object
- Dragging a rectangle around objects.
- Adding to a selection by holding down the CTRL key whilst clicking or dragging

Shortcuts

Toolbar:



Keys:

none

4.2 Selection mode: Pick set points

Selection mode: Pick point command (**Edit menu**) **Alt, E, S, P**

"Pick individual set points "

This mode allows you to select individual set points by:

- Clicking on a point
- Adding a point to a selection by CTRL + click

Shortcuts

Toolbar:



Keys:

none

4.3 Selection mode: Lasso set points

Selection mode: Lasso command (**Edit menu**) **Alt, E, S, L**

"Select set points with the lasso "

This mode is for selecting multiple points from one or more coordinate sets.

Create a polygon around the required set points by clicking to create a polygon corner. A right click will join the last point to the first and finish the sequence. Click ESCAPE to cancel the currently defined polygon.

Depending on the chosen option, either all points inside or outside the polygon ("lasso") will be selected.

As an additional refinement, the lasso will operate on either all visible sets or only on pre-selected sets.

Shortcuts

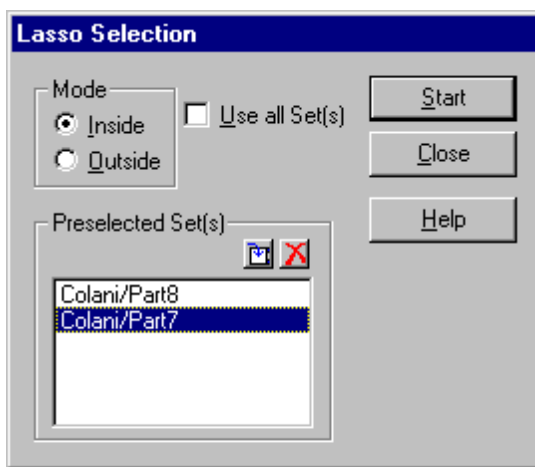
Toolbar:



Keys:

none

4.3.1 Dialogue box: Lasso selection



Graph - Selection Lasso.bmp

Mode

Choose whether points **inside** or **outside** the lasso are to be selected.

Use all sets

Select this option if the lasso should operate on all visible sets.

Cancel this option if the lasso should operate on the listed pre-selected sets.

This option is only available if there pre-selected sets exist, otherwise it is defined as the default and cannot be changed.

Pre-selected sets

If the option to **Use all sets** has not been selected, then the lasso will only operate on the sets listed in this box.

Any sets selected prior to entry to this dialogue box will appear here. You may add more sets to the list at any time before defining the lasso by clicking in the graphics window and selecting the sets you want. Single or multiple

selections can be made and sets already on the list are not affected by re-selection in the display.

Selection in the graphics window does not automatically place items on the list of pre-selected sets. Buttons are available to add or delete sets from the list, as follows:



Add the currently selected sets to the list.



Delete highlighted sets from the list.

Start button

Once the operation of the lasso has been defined, click here to start creating the lasso in the graphics display.

4.4 Selection mode: Type

Selection mode: Type command (**Edit menu**)

Alt, E, S, T

"Type selection mode "

Normal selection techniques apply, but only to specified object types.

Select by:

- Clicking on an object
- Dragging a rectangle around objects
- Adding to a selection by holding down the CTRL key whilst clicking or dragging

You must additionally specify which object types to include. Choose one or more of the following from the **Selection mode** menu:

- Point
- Shape
- CAD surface
- CAD curve

Shortcuts

Toolbar:



Keys:

none

4.5 Selection mode: Point

Selection mode: Point command (**Edit menu**)

Alt, E, S, O

"Point selection type "

Only available if **Type mode** is the active selection mode.
The option then enables objects of type point to be selected.

Shortcuts

Toolbar:



Keys:

none

4.6 Selection mode: Shape

Selection type: Shape command (**Edit menu**)

Alt, E, S, S

"Shape selection type "

Only available if **Type mode** is the active selection mode.
The option then enables objects of type shape to be selected.

Shortcuts

Toolbar:



Keys:

none

4.7 Selection mode: CAD surface

Selection type: CAD surface command (**Edit menu**)

Alt, E, S, U

CAD only "Surface selection type "

Only available if **Type mode** is the active selection mode.
The option then enables objects of type CAD surface to be selected.

Shortcuts

Toolbar:



Keys:

none

4.8 Selection mode: CAD curve

Selection type: CAD curve command (Edit menu) **Alt, E, S, C**
CAD only "Curve selection type "

Only available if **Type mode** is the active selection mode.
The option then enables objects of type CAD curve to be selected.

Shortcuts

Toolbar:



Keys:

none

4.9 Select All

Select All command (Edit menu) **Alt, E, L**
"Select all data in graphics window"

Selects all elements which can currently be displayed, even if not in the current view.

Note

To select individual items, see "Selecting items" on page 7.

Shortcuts

Toolbar:

none

Keys:

Ctrl+Shift+A

Right mouse click: available

4.10 Deselect All

Deselect All command (Edit menu) **Alt, E, D**
"Deselect all selected data"

Cancels any current selection.

Shortcuts

Toolbar:

none

Keys:

Ctrl+Shift+D

Right mouse click: available

4.11 Delete

Delete command (**Edit** menu)

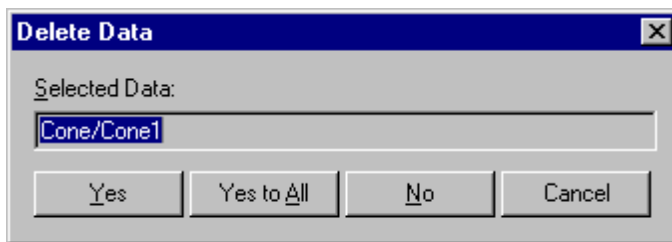
Alt, E, E

"Delete selected data "

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

4.11.1 Dialogue box: Delete



Graph - Delete selection.bmp

The dialogue box will show all currently selected items, one by one. Click **Yes** or **No** to delete or not delete the item currently listed. Click **Yes to All** to delete all selected items.

4.12 Save as set

Save as set command (**Edit** menu)

Alt, E, V

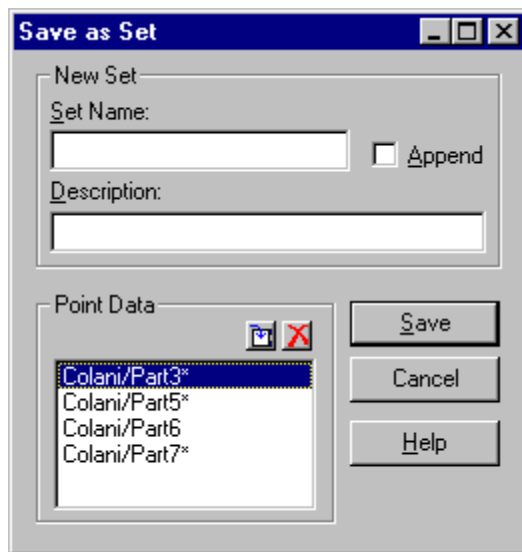
"Save selected points into a set "

Use this command to create a new coordinate set from existing points, sets or parts of sets, or append additional points and set points to an existing set.

Shortcuts

Toolbar: none
Keys: none

4.12.1 Dialogue box: Save as set



Graph - Save as set.bmp

New set


Enter the **set name** of a new or existing set. If the set already exists you can **append** the required data or otherwise the existing data in this set is overwritten. For a new set you can supply an optional text **description**.


Point data

This list shows selected points, sets or parts of sets, which will be combined into the new set.

You may add to this list at any time by clicking in the graphics window and selecting set points by any valid method, including the lasso. Single or multiple selections can be made and sets already on the list are not affected by re-selection in the display.

Selection in the graphics window does not automatically place items on the list of pre-selected sets. Buttons are available to add or delete sets from the list, as follows:

 Add the currently selected sets to the list.

 Delete highlighted sets from the list.

Note

If set points have been selected by lasso, the set name from which they are taken will be listed with an asterisk. This indicates that only some of the points from this set have been selected.

4.13 Save projected points

Save projected points command (**Edit menu**)

Alt, E, C

"Save projected points as set"

This function is intended to offer a means of selecting a subset of points from a set which have been compared to a CAD surface, such as points which are not a good fit to the surface. The selected points are not themselves stored in a specified set, but their projected positions onto the CAD surface are saved.

Note

The function is only available after some form of CAD comparison has been made using the graphics window. This includes:

- CAD compare function
- On-line CAD compare (LTM)
- CAD build/inspect (LTM, MTM)

Warning

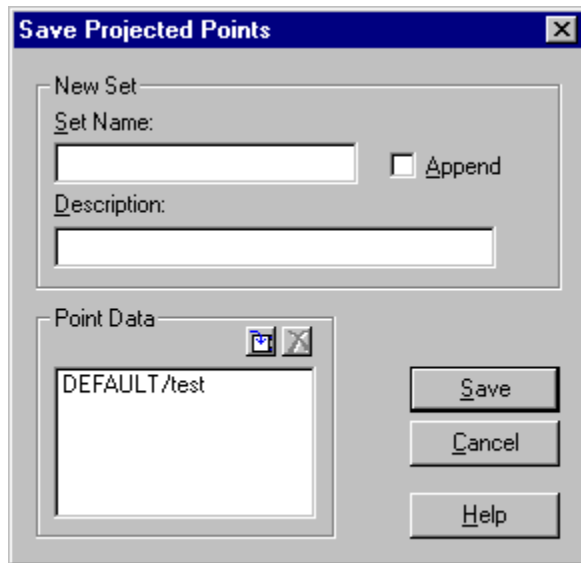
There is currently no restriction on which points may be selected for projection onto the currently employed CAD surface. This is a decision which can only be made by the user. It is possible to select points in the graphics window which have no relevance to the CAD comparison.

Projected points can also be saved from the results dialogue box for CAD Compare. Here a subset of data can be directly specified from the list of compared points. See "Dialogue box: Compare results" on page 85.

Shortcuts

Toolbar:	none
Keys:	none

4.13.1 Dialogue box: Save projected points



Graph - Save projected points.bmp

New set

Enter the **set name** of a new or existing set. If the set already exists you can **append** the required data or otherwise the existing data in this set is overwritten. For a new set you can supply an optional text **description**.

Point data

This list shows selected points, sets or parts of sets, which will be projected onto the CAD surface. The projected points will be combined into the new set.

You may add to this list at any time by clicking in the graphics window and selecting set points by any valid method, including the lasso. Single or multiple selections can be made and sets already on the list are not affected by re-selection in the display.

Selection in the graphics window does not automatically place items on the list of pre-selected sets. Buttons are available to add or delete sets from the list, as follows:



Add the currently selected sets to the list.



Delete highlighted sets from the list.

Note

If set points have been selected by lasso, the set name from which they are taken will be listed with an asterisk. This indicates that only some of the points from this set have been selected.

4.14 Copy to clipboard

Copy to clipboard command (**Edit menu**)

Alt, E, C

"Copy the graphics view to the clipboard "

Select this option to copy the current graphics view to the clipboard. This image may then be pasted into other documents such as Microsoft WORD97 in order to assist documentation.

Only the graphics image is copied. Alternative screen capture methods, such as the standard windows key sequence "ALT + Print Screen" will record the current graphics module window. This includes menus, scroll bars etc., as well as the current job file image. None of these additional screen elements is recorded by **Copy to Clipboard**.

Shortcuts

Toolbar: none

Keys: none

4.15 Properties

Properties command (**Edit menu**)

Alt, E, P

"Shows properties of last selected item"

This command displays extensive details about the last selected item in the graphics window. The details appear in a small dialogue box which can optionally be displayed permanently so that further selection will refresh the details about the currently selected object. In the case of a multiple selection, details on the last selected object are shown.

The "drawing pin" icon indicates if the box remains displayed. Click the symbol to show one of the following:



Dialogue box is not permanently displayed (pin is not "pushed in")



Dialogue box remains displayed (pin is "pushed in")

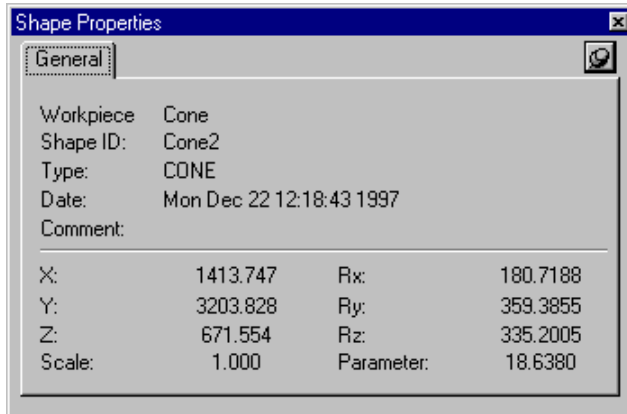
Shortcuts

Toolbar: none

Keys: Alt+Enter

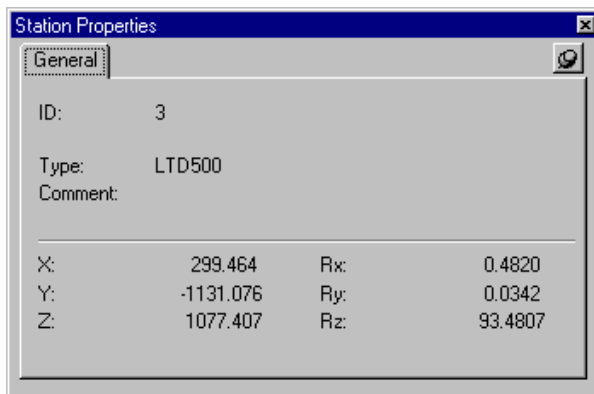
Right mouse click: available

4.15.1 Example: properties for shape



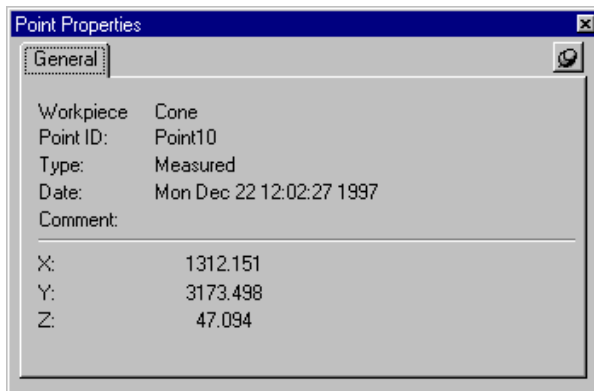
Graph properties - shape.BMP

4.15.2 Example: properties for station



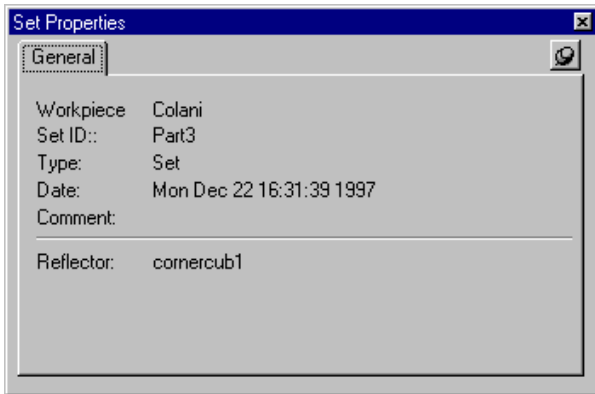
Graph properties - station.BMP

4.15.3 Example: properties for point



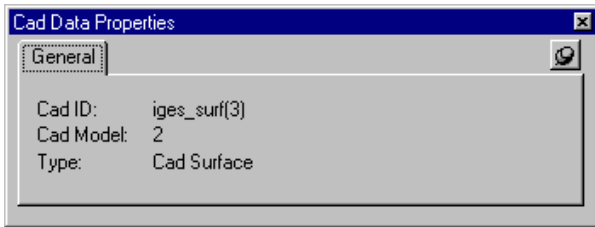
Graph properties - point.BMP

4.15.4 Example: properties for set



Graph properties - set.BMP

4.15.5 Example: properties for CAD data



Graph properties - CAD data.bmp

5. View menu

5.1 Toolbar: Main

Toolbar: Main command (**View menu**) **Alt, V, T, M**
"Show or hide the main toolbar"
Displays or hides the main graphics toolbar.

Shortcuts

Toolbar:	none
Keys:	none

5.2 Toolbar: Selection

Toolbar: Selection command (**View menu**) **Alt, V, T, S**
"Show or hide selection toolbar"
Displays or hides the graphics selection toolbar.

Shortcuts

Toolbar:	none
Keys:	none

5.3 Toolbar: View

Toolbar: View command (**View menu**) **Alt, V, T, V**
"Show or hide standard views toolbar"
Displays or hides the toolbar for standard graphics views.

Shortcuts

Toolbar:	none
Keys:	none

5.4 Hide: Selection

Hide Selection command (**View menu**) **Alt, V, H, S**
"Hide selected data"

Hides selected objects. The objects are not permanently removed from the graphics window and can be revealed again using the **Unhide all** command.

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

5.5 Hide: CAD data**Hide CAD data** command (**View menu**)**Alt, V, H, C**

"Hide all CAD data" (or a listed item)

CAD only

Hides imported CAD data. The data are not permanently removed from the graphics window and can be revealed again using the **Unhide all** command.

The menu option offers a list if more than one CAD model is currently displayed. Select either **All** to hide all imported CAD models or choose one of the individually listed models to be hidden.

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

5.6 Hide: Analysis data**Hide Analysis data** command (**View menu**)**Alt, V, H, A**

"Hide all analysis data"

Hides displayed data resulting from an analysis, such as comparison of a point set with a CAD surface. The data are not permanently removed from the graphics window and can be revealed again using the **Unhide all** command.

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

5.7 Hide All

Hide All command (**View menu**)
"Hide all data"

Alt, V, D

Hides all displayed data. The data are not permanently removed from the graphics window and can be revealed again using the **Unhide all** command.

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

5.8 Unhide: CAD data

Unhide CAD data command (**View menu**)
"Unhide all CAD data" (or a listed item)

Alt, V, U, C

CAD only

Makes hidden CAD data visible again.

The menu option offers a list if more than one CAD model is currently hidden. Select either **All** to reveal all imported CAD models or choose one of the individually listed models to be re-displayed.

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

5.9 Unhide: Analysis data

Hide Analysis data command (**View menu**)
"Unhide all analysis data"

Alt, V, U, A

Makes all hidden analysis data visible again.

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

5.10 Unhide All

Unhide All command (**View menu**)
"Unhide all data"

Alt, V, L

Makes all hidden data visible again.

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

5.11 Clear: Selected Data

Clear: Selected Data command (**View menu**)
"Clear selected data from graphics window"

Alt, V, C, S

Removes the currently selected data from the graphics window. It must be re-loaded to see it again.

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

5.12 Clear: CAD Data

Clear: CAD Data command (**View menu**)
"Clear all CAD data" (or a listed item)

Alt, V, C, D

CAD only

Removes imported CAD models from the graphics window. They must be re-loaded to viewed again.

The menu option offers a list if more than one CAD model is currently imported. Select either **All** to remove all imported CAD models or choose one of the individually listed models to be removed.

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

5.13 Clear: Analysis

Clear: Analysis_ command (View menu)
 "Clear analysis from graphics window"

Alt, V, C, A

Clears the graphics window of any data resulting from an analysis, such as needle plots produced by a data comparison. The calculation must be repeated to see the data again.

Shortcuts

Toolbar: none
 Keys: none
 Right mouse click: available

5.14 Clear All

Clear All command (View menu)
 "Clear the entire graphics window"

Alt, V, E

Clears all displayed objects from the graphics window. To view data again it must be reloaded.

Shortcuts

Toolbar: none
 Keys: none
 Right mouse click: available

5.15 Needle: Scale

Needle: Scale command (View menu)
 "Change needle scale"

Alt, V, N, S

Change the scale factor for plotting error needles here. The value of the error is multiplied by the factor and the resulting dimension used to generate the plot. Any analysis will show whether the chosen scale is appropriate for the task.

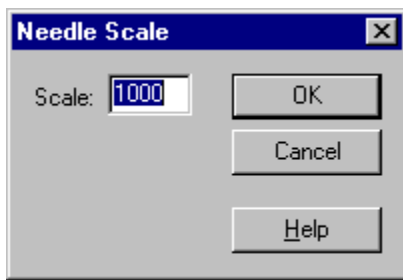
Note

This factor can also be set in the "Options" menu. See "Error display tab" on page 68.

Shortcuts

Toolbar: none
 Keys: none

5.15.1 Dialogue box: Needle scale



Graph View menu - needle scale.BMP

Scale

Enter a suitable scale factor here.

5.16 Needle: Display text

Needle: Display text command (**View menu**)

Alt, V, N, D

"Start display of needle text"

When error needles are displayed, numerical details relating to selected needles can also be displayed. The steps are as follows:

1. When the dialogue box opens, select the required details.
2. With the dialogue box still open, click on a selected needle in the graphics window.
3. Move the cursor. A connecting line from the selected needle to the required position of the needle text box is drawn.
4. Click a second time to fix the end of the connecting line. The numerical text is then displayed.

When the box is closed, existing needle text remains displayed but further text cannot be selected.

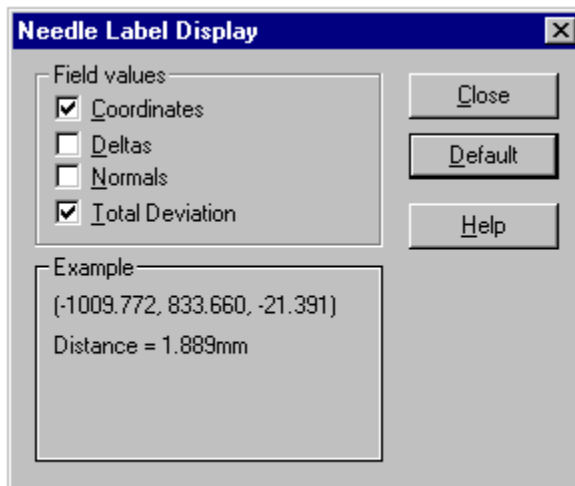
For an example of the display, see "Error needle text" on page 20.

Shortcuts

Toolbar: none

Keys: none

5.16.1 Dialogue box: Needle label display



Graph - Needle label display.bmp

The amount of detail shown is defined by the options selected here. Coordinates and components refer to the coordinate system axes used in the measurement window.

Note

Offset is from measured point to reference point or surface.

Field values

Coordinates

Coordinates of the measured point.

Deltas

Components of the offset.

Normals

Components of the normal offset vector.

Total deviation

Length of the offset.

Default button

Click this button to specify the default selection of details.

Example

An example of what will be shown corresponding to the currently selected details.

5.17 Needle: Clear all text

Needle: Clear all text command (**View menu**) **Alt, V, N, C**
"Clear all needle text"
Remove text associated with error needles from display.

Shortcuts

Toolbar: none
Keys: none

5.18 Zoom: general information

Zoom command (**View menu**) **Alt, V, Z**

The user has 3 different methods to zoom, i.e. to vary the apparent distance to the displayed object:

1. Zoom in one magnification step
2. Zoom out one magnification step
3. Zoom into a box drawn on the screen

A single zoom factor for the zoom-in and zoom-out actions can be set by the user. See "General tab" on page 65.

5.19 Zoom: In

Zoom In command (**View menu**) **Alt, V, Z, I**
"Zoom in one step"
Enlarges the size of the displayed object in the active view.

Shortcuts

Toolbar: 
Keys: none

5.20 Zoom: Out

Zoom Out command (**View menu**) **Alt, V, Z, O**
"Zoom out one step"
Reduces the size of the displayed object in the active view.

Shortcuts

Toolbar: 
Keys: none

5.21 Zoom: Box

Zoom Box command (**View menu**)

Alt, V, Z, B

"Start zoom box"

Choose the **Zoom box** command. In the active view click and hold the left mouse button and draw a rectangle around the area to be enlarged. The contents of this rectangle will then be expanded to fill the view.

Note

Drawing a box in this way is otherwise used to select items within the box.

Shortcuts

Toolbar:



Keys:

none

5.22 Zoom: Fill Screen

Fill Screen command (**View menu**)

Alt, V, Z, F

"Fill data to screen"

Shows all available graphics elements inside the current graphics window. If the view is split only the active view is affected.

Shortcuts

Toolbar:



Keys:

none

5.23 Refresh

Refresh command (**View menu**)

Alt, V, F

"Refresh screen"

This command refreshes the current content of the graphics window and removes invalid items from the display. This is done by re-reading the database for all objects which currently meet the display criteria.

Shortcuts

Toolbar:



Keys:

none

5.24 Axes display: General information

Axes display command (**View menu**)

Alt, V, A

You can optionally display 3 different types of axes:

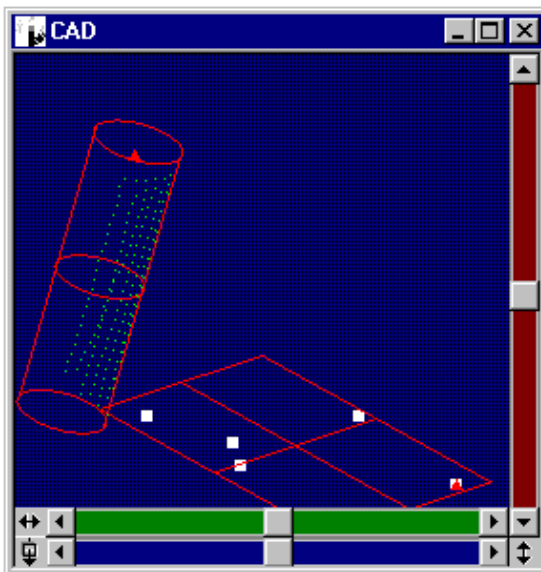
- Axes of the base coordinate system which move when the viewpoint changes
- Orientation axes, parallel to base system axes, which are always displayed in the window
- Local shape axes

Note

Axes display can also be set in the "Options" menu. See "General tab" on page 65.

5.24.1 Example display: Shape axes

Plane and cylinder without local axes

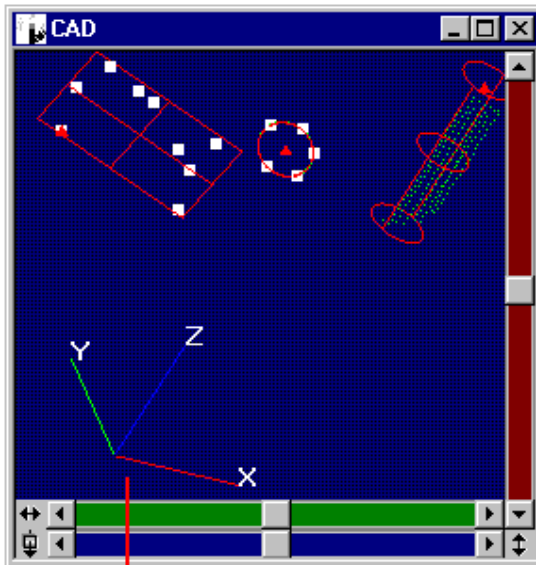


Plane and cylinder with local axes

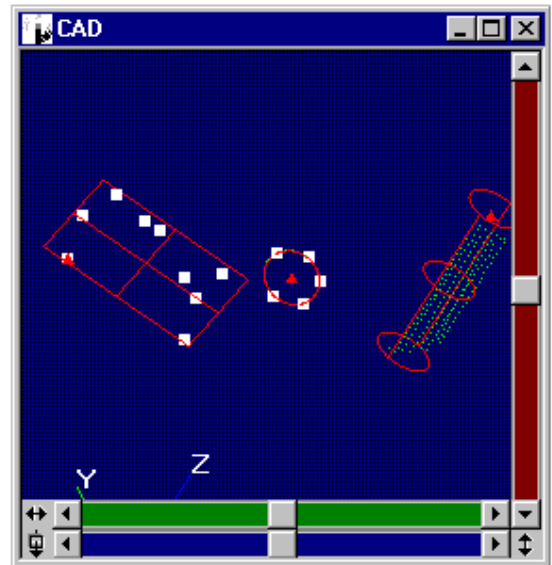


Graph ex shape axes.bmp

5.24.2 Example display: Base CS axis



Base coordinate system axes

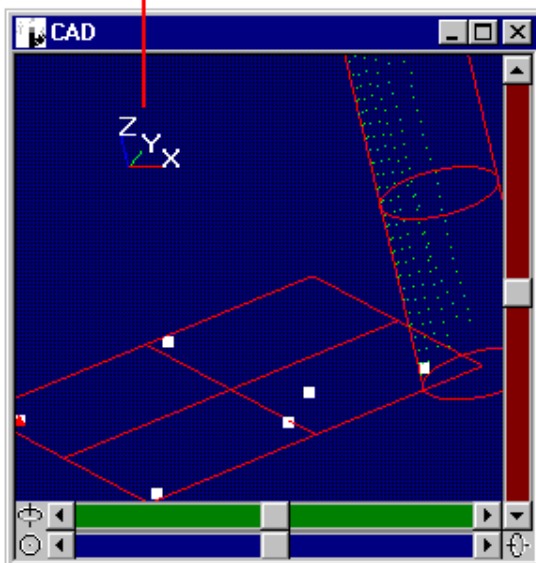


Axes move when viewpoint changes

Graph ex base axes.bmp

5.24.3 Example display: orientation axes

Orientation axes



Location of axes is fixed when viewpoint changes



Graph ex ori axes.bmp

5.25 Axes display: Shape axes

Axes display: Shape axes command (**View menu**)

Alt, V, A, S

"Show or hide shape axes"

The local origin and axes of individual shapes can be displayed by selecting this option.

Shortcuts

Toolbar: none
Keys: none

5.26 Axes display: Base CS axes

Axes display: Base CS axes command (**View menu**) **Alt, V, A,B**
"Show or hide Base CS axis"

Data is stored in the base coordinate system. Select this option to display the location of the base system origin and the direction of its axes.

The base coordinate system represents a fixed location (the origin) and fixed directions. These axes therefore change location and rotate when the viewpoint changes.

Shortcuts

Toolbar: none
Keys: none

5.27 Axes display: Orientation axes

Axes display: Ori. axes command (**View menu**) **Alt, V, A, O**
"Show or hide orientation axes"

When the view is manipulated you may lose sight of the base coordinate system axes, if these are currently displayed. This option provides a continuous display of axes in the top left corner of the graphics window. These represent the current orientation of the base system axes. Their location does not change when the viewpoint changes.

Shortcuts

Toolbar: 
Keys: none

5.28 Label display: General information

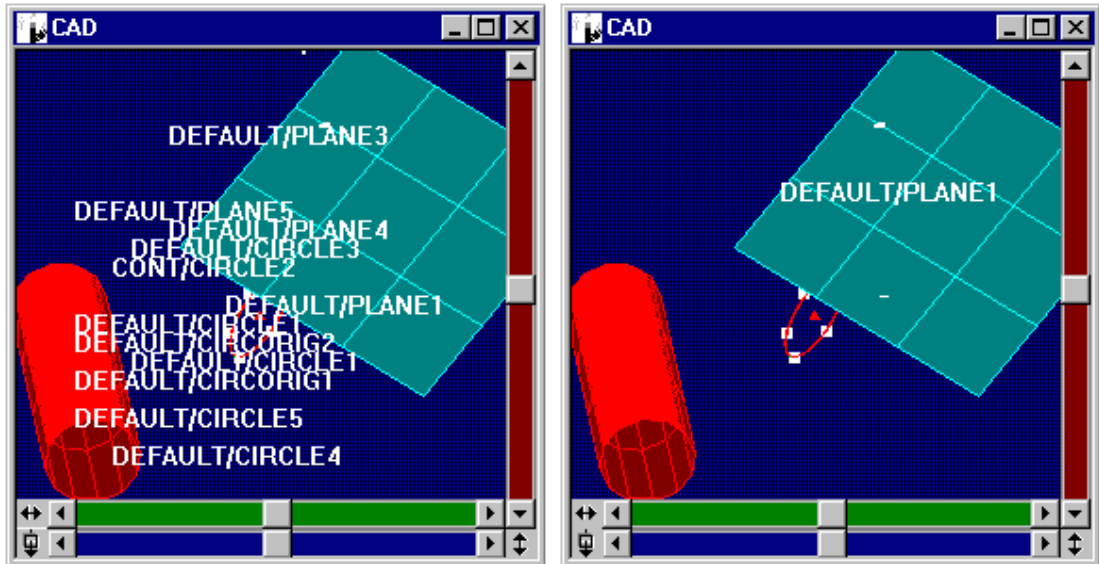
Label display command (**View menu**) **Alt, V, B**

Labels, i.e. identifiers in the format "workpiece ID/item name", can be displayed for some or all or none of the displayed items.

Note

Label display can also be set in the "Options" menu. See "General tab" on page 65.

5.28.1 Example display: labels



Show all labels

Show labels of selected objects
(the plane in the example above)

Graph - labels.bmp

5.29 Label display: Show

Label display: Show command (**View menu**)
"Show labels of selected data"

Alt, V, B, O

Select this option to show labels for pre-selected items. The labels will then remain displayed, even if the items are subsequently deselected. This is useful for reporting purposes where you wish to utilize colours for items when not selected but require some labelling.

Shortcuts

Toolbar:	none
Keys:	Ctrl+Shif+S

5.30 Label display: Show all

Label display: Show all command (**View menu**)
"Show all labels"

Alt, V, B, A

Select this option to show labels for all items loaded in the graphics module (not just in the current view).

Shortcuts

Toolbar: none
Keys: none
Right mouse click: available

5.31 Label display: Hide

Label display: Hide command (**View menu**) **Alt, V, B, I**
"Hide labels"

Remove labels of selected items from the display. These labels can only be restored by re-creating them. There is no corresponding "unhide" command.

Shortcuts

Toolbar: none
Keys: none

5.32 Label display: Hide all

Label display: Hide all command (**View menu**) **Alt, V, B, H**
"Hide all labels"

Remove all labels from the display. These labels can only be restored by re-creating them. There is no corresponding "unhide" command.

Shortcuts

Toolbar: none
Keys: Ctrl+Shif+H
Right mouse click: available

5.33 Label display: Selected data

Label display: Selected data command (**Manip. menu**) **Alt, V, B, S**
"Show only labels of selected data "

As items are selected, this option will show their labels. When they are deselected the labels disappear.

Shortcuts

Toolbar: none
Keys: none

5.34 Label display: New data

Label display: New data command (**View menu**) **Alt, V, B, N**
 "Show labels of new data "

New data is added to the job file during a measurement session, for example measurements and calculated shapes. As they are placed in the database they are also displayed in the graphics window. This option will add labels to all new items which are displayed after the option is selected.

Shortcuts

Toolbar: none
 Keys: none

5.35 Font: Summary

Font command (**View menu**) **Alt, V, O**

You can toggle between a large and small font size for the display of labels and needle text.



Click in for small fonts, click out for large fonts.

5.36 Font: Small

Font: Small command (**View menu**) **Alt, V, O, S**
 "Set small font"

Uses the currently defined small font size for display of labels and needle text. Size is defined on the label options tab. See "Options" on page 64.

Shortcuts

Toolbar:  (click in)
 Keys: none

5.37 Font: Large

Font: Large command (**View menu**) **Alt, V, O, L**
 "Set large font"

Uses the currently defined large font size for display of labels and needle text. Size is defined on the label options tab. See "Options" on page 64.

Shortcuts

Toolbar:



(click out)

Keys:

none

5.38 Standard Views: general information**Standard Views** command (**View menu**)**Alt, V, V**

Standard views offer standard initial camera positions for the 3D view. They do not apply to the 2D views.

If the user applies rotations or shifts away from a standard view, the menu choice and toolbar button will be altered to indicated that this view has been cancelled.

The views are currently derived from the axes of the base coordinate system.

5.39 Standard Views: +Z**+Z View** command (**View menu**)**Alt, V, V, Z**

"View from +Z axis"

Place the camera so that the +Z axis (base system) points towards it.

Shortcuts

Toolbar:



Keys:

none

5.40 Standard Views -Z**-Z View** command (**View menu**)**Alt, V, V, Z**

"View from -Z axis"

Place the camera so that the -Z axis (base system) points towards it.

Shortcuts

Toolbar:



Keys:

none

5.41 Standard Views: +X

+X View command (View menu)

Alt, V, V, X

"View from +X axis"

Place the camera so that the +X axis (base system) points towards it.

Shortcuts

Toolbar:



Keys:

none

5.42 Standard Views -X

-X View command (View menu)

Alt, V, V, X

"View from -X axis"

Place the camera so that the -X axis (base system) points towards it.

Shortcuts

Toolbar:



Keys:

none

5.43 Standard Views: +Y

+Y View command (View menu)

Alt, V, V, Y

"View from +Y axis"

Place the camera so that the +Y axis (base system) points towards it.

Shortcuts

Toolbar:



Keys:

none

5.44 Standard Views -Y

-Y View command (View menu)

Alt, V, V, Y

"View from -Y axis"

Place the camera so that the -Y axis (base system) points towards it.

Shortcuts

Toolbar:



Keys:

none

5.45 Standard Views: Isometric

Isometric View command (**View menu**)

Alt, V, V, I

"Show isometric view"

Place the camera so that all 3 axes (base system) indicate the same scale.

This is an isometric view in which the projected axes make an angle of 60° with their neighbours.

Shortcuts

Toolbar:



Keys:

none

5.46 Rulers

Rulers command (**View menu**)

Alt, V, S

"Show or hide rulers"

Displays or hides vertical and horizontal rulers in the 3D graphics window. The unit markings depend on the units set in the CDM.

Shortcuts

Toolbar:

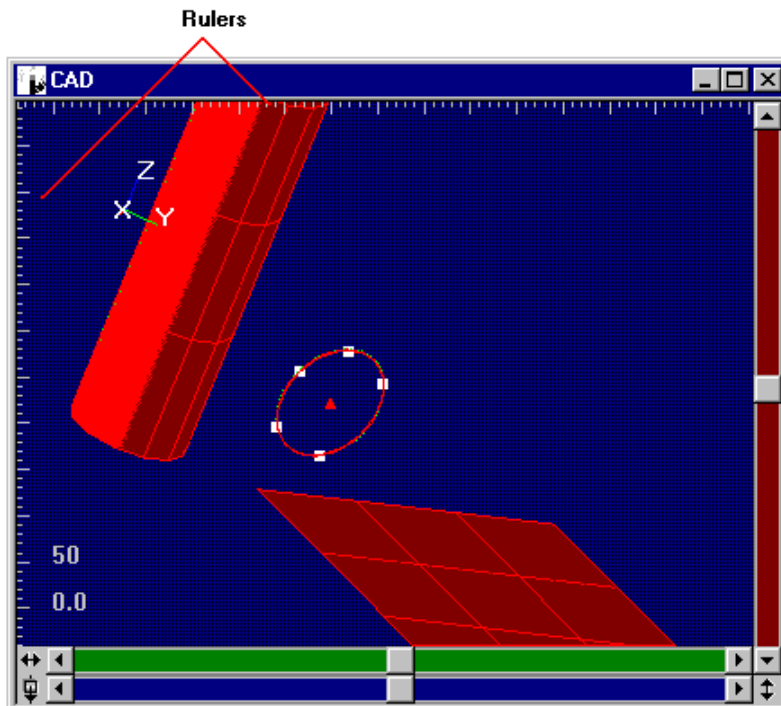


Toggle on and off

Keys:

none

5.46.1 Sample display of rulers




Graph - rulers.bmp

5.47 Rendering: Summary

Rendering command (**View menu**)

Alt, V, G

You can display objects in a "wireframe" format or with shaded surfaces.

 Click in for shaded surfaces, click out for wireframe display.

5.48 Rendering: Wireframe

Rendering: Wireframe command (**View menu**)

Alt, V, G, W

"Show surfaces in wireframe mode "

Displays objects as if constructed from a network of straight lines. This looks like a wire framework, hence the name.

Shortcuts

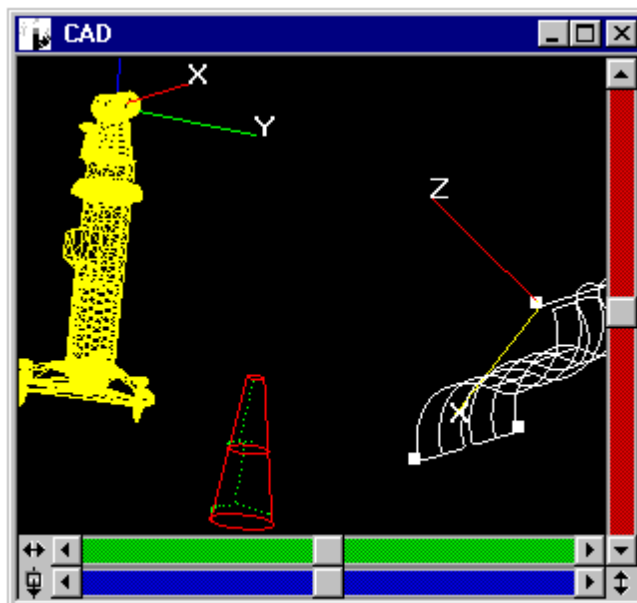
Toolbar:

 (click out)

Keys:

none

5.48.1 Sample wireframe display



Graph - wire frame.BMP

5.49 Rendering: Shaded

Rendering: Shaded command (**View menu**)

Alt, V, G, S

"Show surfaces in shaded mode "

Displays objects so that their surfaces appear to be solid. The appearance also depends on the location and type of the modelled light source.

Shortcuts

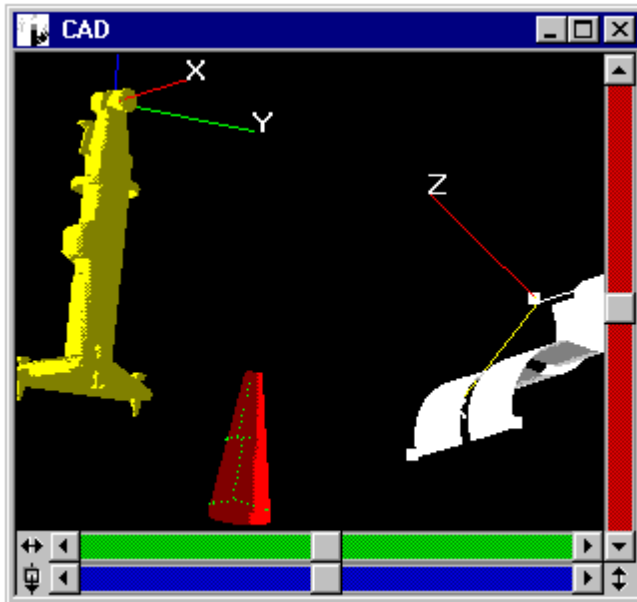
Toolbar:



(click in)

Keys:

none

5.49.1 Sample shaded display

Graph - rendered.bmp

5.50 Screen: Single View**Screen: Single View** command (**View menu**)**Alt, V, R, S**

"Switch to single view"

This switches from a split view to display a single 3D view of the displayed object. It is an orthographic view, not a perspective view.

Shortcuts

Toolbar:



Keys:

none

5.51 Screen: Split View**Screen: Split View** command (**View menu**)**Alt, V, R, V**

"Split into four view"

This switches from a single view to a window split into 4 different views. Three views display the 2D projection of the objects into planes defined by the axes of the base co-ordinate system.

- Top left: XY
- Bottom left: XZ
- Bottom right: YZ

The fourth view shows the 3D display in the top right quadrant.

When you click on one of the views, this becomes the active view and is given a green border.

Shortcuts

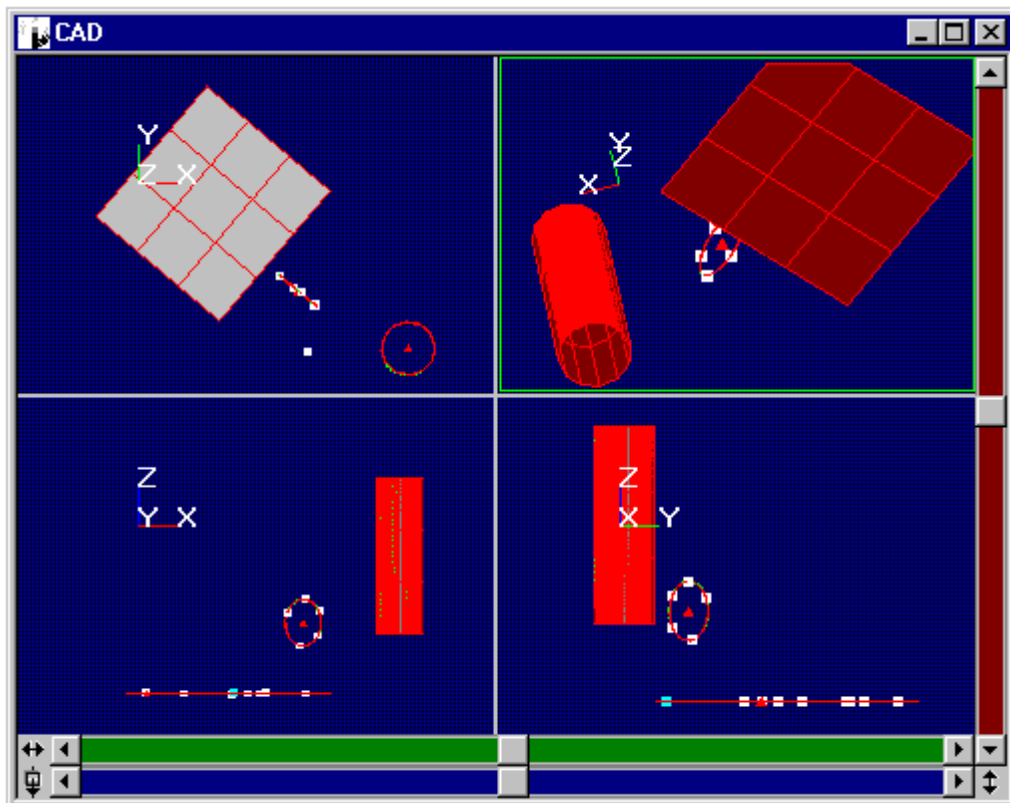
Toolbar:



Keys:

none

5.51.1 Example display: split view



Graph - split view.bmp

In this example the 3D view (top right) is the currently active view and is displayed with a green border.

5.52 Light: general information

Light command (View menu)

Alt, V, I

Moves virtual light source to desired location and sets light parameters.

5.53 Light: Move Light

Light: Move Light command (**View menu**)

Alt, V, I, M

"Move light source"

Shows the virtual light source which can be moved by dragging the mouse with the left mouse button clicked.

The light source can be removed by clicking the right mouse button in the window.

Note

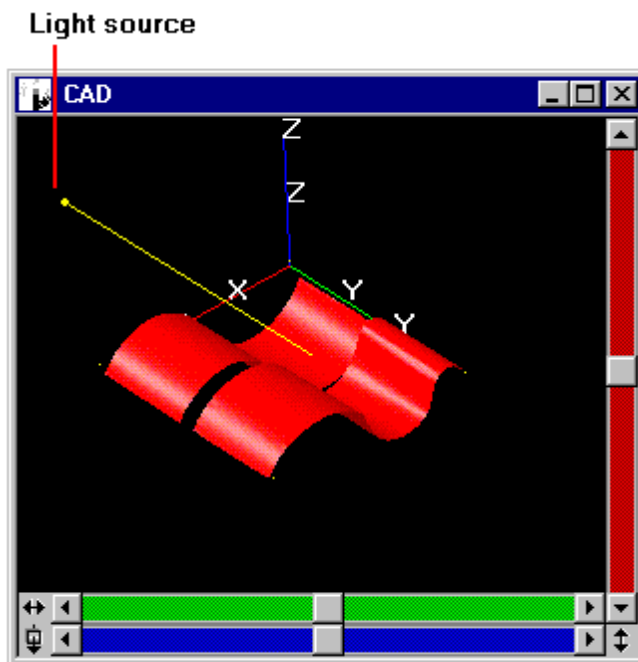
As long as the light source is activated, selection of objects does not work.

Shortcuts

Toolbar: none

Keys: none

5.53.1 Example display: light source



Graph - light source.BMP

5.54 Light: Parameters

Light: Parameters command (**View menu**)

Alt, V, I, P

"Set light parameters"

Sets ambience and intensity of the virtual light source. This function is valid for shaded objects for a better 3D effect.

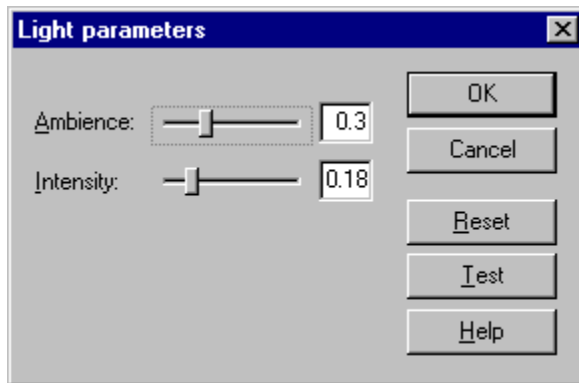
These parameters can also be set in the **Options** menu. See "General tab" on page 65.

Shortcuts

Toolbar: none

Keys: none

5.54.1 Dialogue box: Light parameters



Graph - light parameters.BMP

Ambience

Creates a more diffuse light source. At value = zero the simulated light is a small source creating high-contrast shadows. At value = 1 the light is very spread out, resulting in very weak shadows.

Intensity

Sets the intensity of the light coming from the virtual light source. At value = zero a very dim light is simulated, at value = 1 a bright light is simulated.

Test button

Allows to see and correct the effect on the objects without closing and reopening the menu.

Reset button

Click this button to re-set ambience and intensity to default values.

6. Graphic menu

6.1 Options

Options command (**Graphic menu**) **Alt, G, O**
"Open graphics options dialog"

Defines various display options using 4 separate tabs.

Shortcuts

Toolbar:	none
Keys:	none

6.1.1 Common dialogue settings

The following options apply to all the tabs:

Save as default

If selected, stores the current settings on all the tabs as the default settings.

Apply to new data only

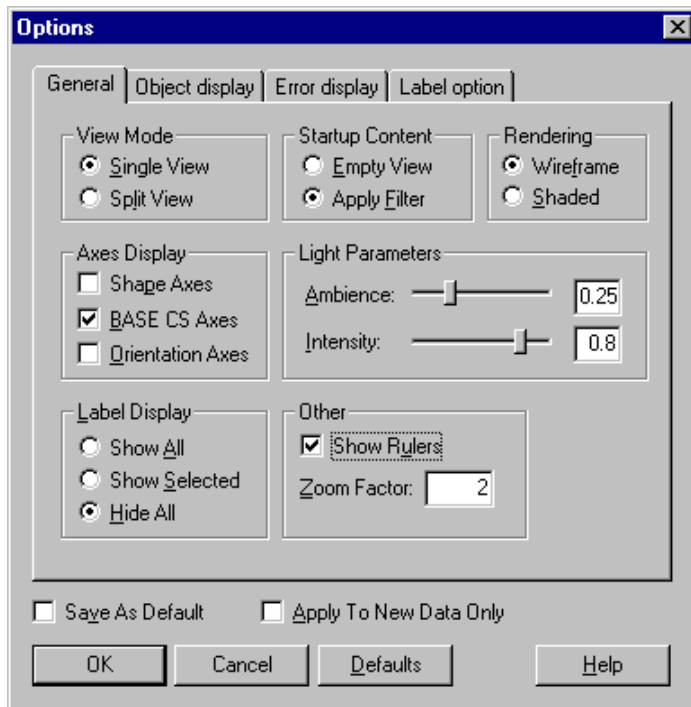
If selected, any changes made will only apply to new data displayed in currently open graphics windows.

Otherwise changes apply to both currently displayed and new data.

Defaults button

Click this button to set everything to the stored default values.

6.1.2 General tab



Graph Options - gen tab.BMP

View Mode

Configures the graphics window for single view or a split view with 4 separate panes.

Startup content

Empty view

Select this option to start up graphics display with nothing displayed in the windows. To view any data you must then select and set filter criteria.

Apply filter

Select this option to start up graphics display showing all data in the data base with the current filter settings applied. Since the filter settings can restrict the data which is displayed you may not see every data item in the data base.

Rendering

Defines whether the display should show the objects as wire frames or as shaded objects.

It is recommended to use wire frame display for fast updates of translations and rotations as well as for refreshing the window.

Axes display

This selection determines which axes are displayed.

Shape axes

If chosen, all shapes show their local axes.

Base CS axes

If chosen, the base coordinate system origin and axes are displayed.

Orientation axis

If chosen, an orientation axis is always shown in the top left corner of the graphics window. The axial directions are parallel to the base axes.

See also "Axes display: General information" on page 50.

Light parameters

Defines ambience and intensity of the virtual light source for optimal viewing of shaded objects.

Ambience

Creates a more diffuse light source. At value = zero the simulated light is a small source creating high-contrast shadows. At value = 1 the light is very spread out, resulting in very weak shadows.

Intensity

Sets the intensity of the light coming from the virtual light source. At value = zero a very dim light is simulated, at value = 1 a bright light is simulated. See also: "Light: Parameters" on page 62.

Label display

This choice determines which items have their IDs displayed.

Show all

All displayed items also have their ID labels displayed.

Show selected

Only selected items have their ID labels displayed.

Hide all

No items are displayed with ID labels.

Other

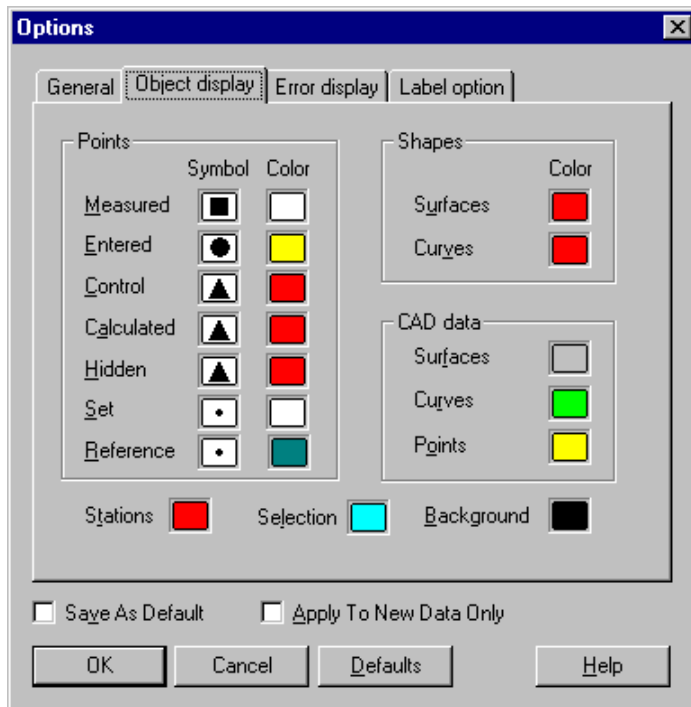
Show rulers

Select this option to see horizontal and vertical ruler margins.

Zoom factor

Defines the factor for the zoom functions on the "View" menu.

6.1.3 Object display tab

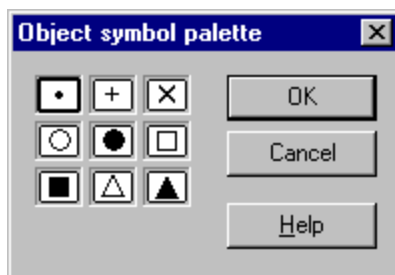


Graph Options - obj dsp tab.BMP

Use this tab to alter the symbols for displayed points and the colours used to display data elements, as well as selection and background options.

Symbol palette for displayed points

Click on a symbol to obtain the following palette:



Graph - Symbol palette.BMP

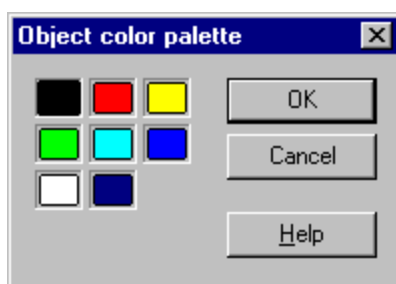
Click to select the required symbol.

Colour palette for displayed data elements

Colours can be set for the following displayed elements:

- Points
- Shapes
- Imported CAD models
- Stations
- The background
- Selected items

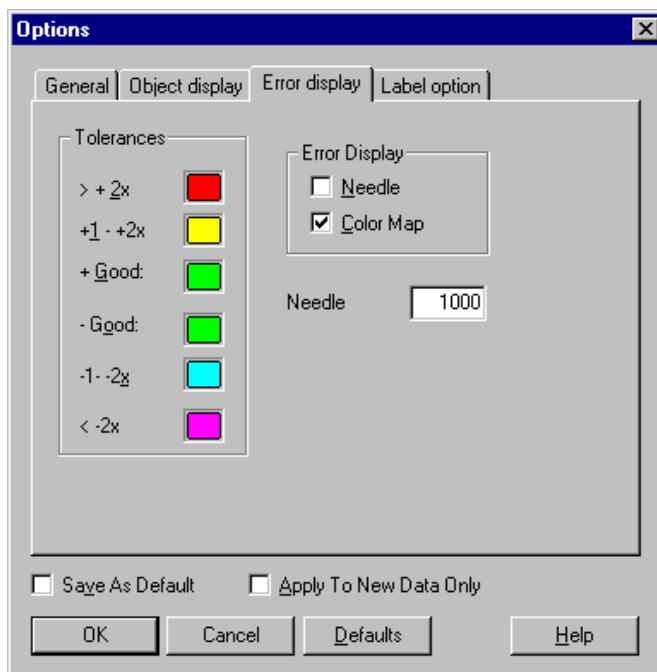
Click on a colour box to obtain the following palette of 8 colours.



Graph - colour palette.BMP

Click to select the required colour.

6.1.4 Error display tab



Graph options - err tab.BMP

Use this tab to alter the display options for error offsets.

Tolerances

Click on a colour box to obtain the standard Windows colour palette for defining colours for error tolerances.



Graph - colour palette for tols.BMP

Error display

Offset errors can be displayed as *needles* (vectors) and/or in the form of a *colour map*. Select the options you want.

For example of needle plot, see "Error needle plot" on page 20.

For example of error colour map, see "Error colour map" on page 21.

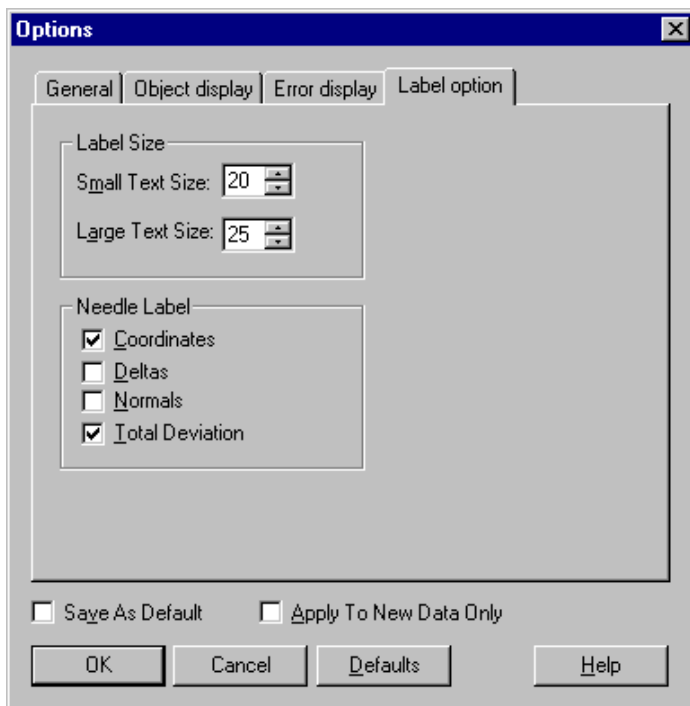
Needle

Set the scale factor for plotting error needles here. The value of the error is multiplied by the factor and the resulting dimension used to generate the plot.

Note

This factor can also be set in the "View" menu. See "Needle: Scale" on page 45.

6.1.5 Label options tab



Graph - Options label tab.bmp

Label size

When IDs are selected for display, one of two text sizes can be chosen. These are defined by the point values given in the two scroll boxes.

Needle label

Numerical details on offset errors can be displayed by clicking on selected needles. See also "Needle: Display" on page 46.

The amount of detail shown is defined by the options selected here. Coordinates and components refer to the coordinate system axes used in the measurement window.

Note

Offset is from measured point to reference point or surface.

Coordinates

Coordinates of the measured point.

Deltas

Components of the offset.

Normals

Components of the normal offset vector.

Total deviation

Length of the offset.

6.2 Display Filter

Display Filter command (**Graphic menu**)

Alt, G, F

"Opens display filter dialog"

The filter option allows the user to specify which types of data are to be displayed in the graphics window. Newly generated data within a module (CDM, MTM, STM, LTM) are displayed in all open graphics windows as long as they match the specified filter settings.

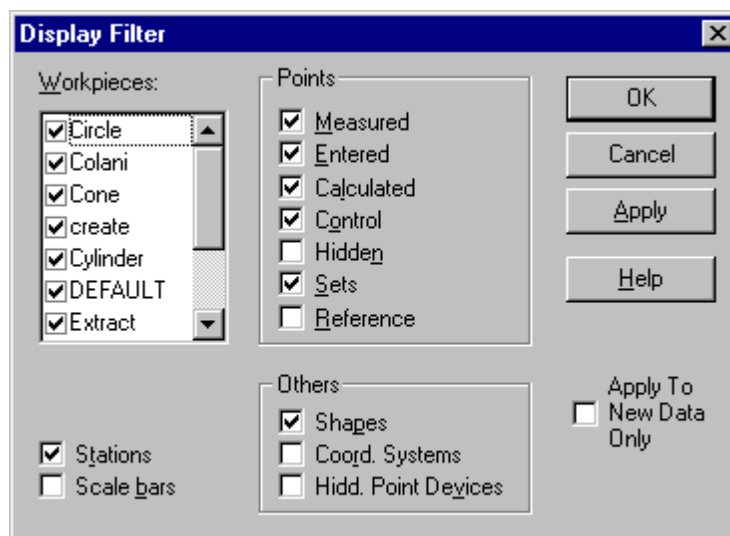
In the filter dialogue box the user can select

- layers (workpieces, stations, scale bars) and
- filters for the object types within the workpieces (point types, shapes etc.)

Shortcuts

Toolbar: none
 Keys: none

6.2.1 Dialogue box: Filter



Graph - Filter.BMP

Workpieces (layers)

Select the workpieces (layers) you want to display.

Points

Select the type of points you want to display.

Others

Select the other features you want to display.

Stations

Select this option to show stations. A standard representation is used which may not correspond to the particular instrument at a given station.

Scale bars

Select this option to show scale bars.

Apply to new data only

Select this option if the specified filter options are to be applied to newly generated data only, otherwise all existing data will have the new filter settings applied.

OK button

The OK button sets a new filter setting for data generated in the future and closes the dialogue box.

Apply button

The APPLY button applies the filter settings to existing data and displays the selected data in the graphics window. It allows also to preview the results of the filter. It does not close the dialogue.

6.3 ID Select

ID Select command (Graphic menu)

Alt, G, I

"Display data with ID select tool "

Select which graphic items to be displayed by using the ID select tool. This offers the Data Manager window from where specific items can be highlighted for display. It may be useful to clear the screen before using this display method.

Selections made with this tool override any option set by the **Display Filter**. For example, a shape selected with this tool will be displayed, even if the filter excludes shapes.

Shortcuts

Toolbar: 
 Keys: none

6.4 CAD history

CAD history command (Graphic menu) **Alt, G, Y**
 "Open CAD history dialog "

The CAD file "history" list has two functions:

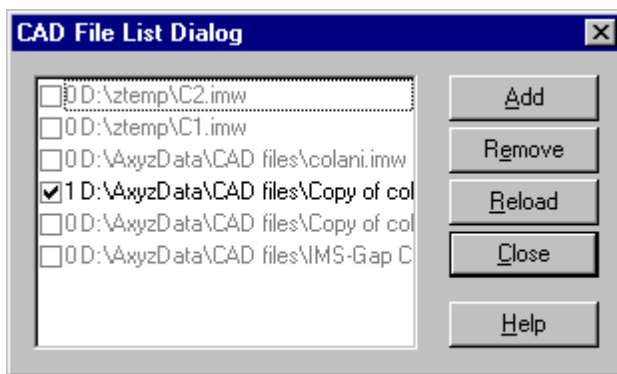
1. It maintains a list of CAD models which have been imported, enabling them to be individually reloaded
2. It indicates which CAD models should be automatically loaded when the current job is started.

Files of CAD models can be directly added to the list.

Shortcuts

Toolbar: none
 Keys: none

6.4.1 Dialogue box: CAD file list



Graph - CAD file history list.bmp

The list shows the CAD models (files) which have been imported into this job.

Click on a file name to highlight it, then click **Reload** to re-import it into the display.

If the checkbox next to the file is checked, the associated file will be loaded when ever this job is started up.

To remove a file from the list, click to highlight it, then click the **Remove** button.

To add a file to the list, click on the **Add** button. This brings up the standard **Import** dialogue box which is used for selecting a CAD file to be added to the list. Note that this action does not itself import the file into the graphic window. It only places the file on the list. To load the file at this time, click to highlight it and then click **Reload**.

Files currently loaded are shown in black, others in grey.

6.5 Rotation Mode

Rotation command (**Graphic menu**)
"Set rotation mode"

Alt, G, R

This mode enables the 3D view to be rotated about the base system axes In this mode each scroll bar applies a rotation about one of the axes.

There are two different ways to apply rotations:

1. Use the scroll bars to change the full display. Click on the bar or drag the button to apply a rotation.
2. Use the SHIFT key, click in the window and drag the mouse. This is a faster operation because only the bounding boxes of the displayed elements are rotated on screen. See "Bounding box display" on page 21.

The centre of rotation may be either:

- The centre of mass of all displayed objects
- The last selected point

See "Rotate around" on page 75.

Shortcuts

Toolbar:



Keys:

none

6.6 Translation Mode

Translation command (**Graphic menu**)

Alt, G, T

"Set translation mode"

This mode enables the 3D view to be translated (shifted) with respect to the base system axes. In this mode each scroll bar applies a translation about one of the axes.

There are two different ways to apply translations:

1. Use the scroll bars to change the full display. Click on the bar or drag the button to apply a shift.
2. Use the SHIFT key, click in the window and drag the mouse. This is a faster operation because only the bounding boxes of the displayed elements are translated on screen. See "Bounding box display" on page 21.

Shortcuts

Toolbar:



Keys:

none

6.7 Rotate around

Rotate around command (**Graphic menu**)

Alt, G, A

"Set point to rotate around"

The rotation point is normally the "centre of mass" of all displayed data. This is an internally computed location which gives weight to points, shapes, surfaces and curves.

It may be more convenient to set another point. This option allows you to specify a rotation point which is one of the following:

- Centre of mass
- A selected point
- A location defined by manually input coordinates

Shortcuts

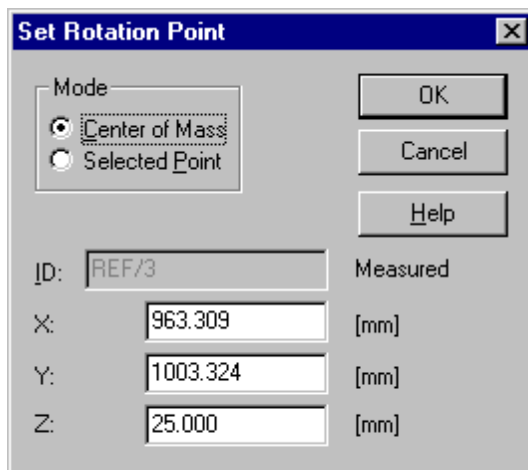
Toolbar:

none

Keys:

none

6.7.1 Dialogue box: Rotate around



Graph - Rotate around.BMP

Mode

Choose a rotation point which is either the **centre of mass** of all displayed data or is a **selected point** chosen from the displayed data or manually specified.

If you choose **selected point** you can then click in an open graphics window to change the selected point to the one you want. After selecting the point, click OK to make it the centre of rotation.

ID

This shows the ID of any selected data. If you call the function with pre-selected data and a multiple selection, the last selected item is shown in this box. If you call the function with no pre-selected items, this box is blank.

X,Y,Z values

This shows the X,Y,Z coordinates of the data item whose ID is displayed in the **ID** box. If no items are displayed the **ID** box is blank and the coordinates are zero.

You may enter any other values into these boxes if you want to manually specify a particular spatial location for use as the rotation point.

6.8 Surface orientation: Flip

Surface orientation: Flip command (**Graphic menu**) **Alt, G, U, F**
 "Flip surface orientation "

Reverses the surface orientation of the selected CAD surface. For information on surface orientation see "CAD surface orientation" on page 11.

Shortcuts

Toolbar: 
 Keys: none

6.9 Surface orientation: Harmonize

Surface orientation: Harmonize command (**Graphic menu**) **Alt, G, U, H**
 "Harmonize surface orientation "

Provides a consistent direction for all the selected CAD surfaces. For information on surface orientation see "CAD surface orientation" on page 11.

Shortcuts

Toolbar: 
 Keys: none

6.10 CAD transformation: By Coordinate System

CAD Transf. by coord. syst. command (**Graphic menu**) **Alt, G, N, C**
 "Execute a transformation of a CAD model into a coordinate system"

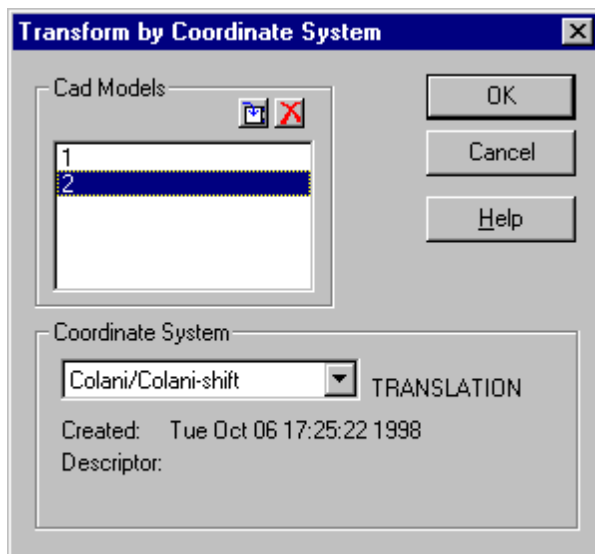
CAD only

Imported CAD models are assumed to be defined in the active coordinate system and on import are transformed accordingly. If this is wrong they will not be correctly positioned with respect to measured data. With this option all imported CAD models can be transformed into another existing coordinate system using the transformation parameters of that system.

Shortcuts

Toolbar: none
 Keys: none

6.10.1 Dialogue box: Transform by coordinate system



Graph - CAD transf. by coord. sys.BMP

CAD models

Any pre-selected CAD models will appear here. You may add other models to the list at any time before transformation by clicking in the graphics window and selecting the ones you want. Single or multiple selections can be made.

Selection in the graphics window does not automatically place items on the list. Buttons are available to add or delete from the list, as follows:

 Add the current selection to the list.

 Delete highlighted items from the list.

When the list has the items you wish to transform, highlight one or more for transformation into the selected coordinate system.

Coordinate system

Select the coordinate system into which you want to transform the CAD models by choosing from available systems in the drop-down list.

6.11 CAD transformation: By Surface Fit

CAD Transf. by surface fit command (**Graphic menu**) **Alt, G, N, S**
"Execute a best fit transformation of a CAD model"

CAD only

Imported CAD models are assumed to be defined in the currently active coordinate system and, when imported, are transformed accordingly. If this is wrong they will not be correctly positioned with respect to measured data. With this option you can fit an imported CAD model to a measured set of points by a best-fit transformation.

Calculation of the transformation may take some time and it is therefore limited to 40 iterations. During this sequence it can be stopped at any time at the end of the current iteration. After each iteration, transformation parameters and the RMS value of the fit are updated and the CAD model is transformed into its updated position in the graphics window.

Once stopped, the calculation can be re-started from the currently transformed position. If after 40 iterations the result is not sufficiently accurate, another calculation can be made from the current position by clicking the **Solve** button again.

To speed up the fitting process, two options are available:

1. The user can manually move the CAD model into an approximately correct position.
2. The user can define an offset value which will be used to create temporary points offset from the measured points. Transformation is then done using the temporary points.

When a satisfactory fit is obtained, the user can optionally store the transformation parameters as a new coordinate system.

Shortcuts

Toolbar:	none
Keys:	none

6.11.1 Dialogue box: Surface fit

Transformation Parameters					
X	-76.596	[mm]	Rx	359.456	[deg]
Y	3.922	[mm]	Ry	1.042	[deg]
Z	37.357	[mm]	Rz	359.731	[deg]

Graph - CAD transf. by surf.bmp

New coordinate system

Enter an **ID** and optional **Description** for a new coordinate system if you want to store the transformation parameters.

Adding to Point Data and CAD Data lists

Pre-selected data will appear in the lists. You may add other data to the lists at any time before fitting by clicking in the graphics window and selecting the ones you want. Single or multiple selections can be made.

Selection in the graphics window does not automatically place items on the list. Buttons are available to add or delete from the list, as follows:



Add the current selection to the list.



Delete highlighted items from the list.

Point data

Contains the ID of the points to which the CAD model will be fitted.

Offset

If the selected points were measured by laser tracker, select the corresponding **Reflector ID** from the drop-down list. The radius of the reflector housing then appears as the **offset** value and will be used as a correction when fitting the points to the loaded CAD model.

Alternatively you can directly enter the amount of any constant offset which should be taken into account.

The offset should be entered as a negative value if the inside of a surface was measured.

CAD data

Contains the ID of the CAD model used for the surface fit. If multiple CAD models have been imported, only one CAD model should be selected. If this is not the case, a warning is given.

Manual positioning

To speed up the fitting process the selected CAD model can be manually positioned. If this box is checked then the translation and rotation functions, applied using the scroll bars, will affect only the CAD model which can then be moved relative to the other graphical elements displayed.

Return to the best fit calculation when the model position looks close to the data.

Status

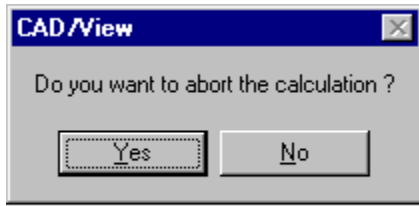
This shows the current **Iteration** (maximum 40) and the current **RMS** value of the fit.

Solve button

Click this button to start a calculation and follow the progress of the calculation results box.

Cancel/Stop button

During computation of the transformation the **Cancel** button converts to a **Stop** button. Click **Stop** to obtain the following dialogue box:



Graph - CAD transf. by surf. STOP.bmp

If you stop, you can continue the calculation from the current position by clicking **Solve** again with iteration value = 1.

If you continue, you continue from the current position with iteration value = current iteration.

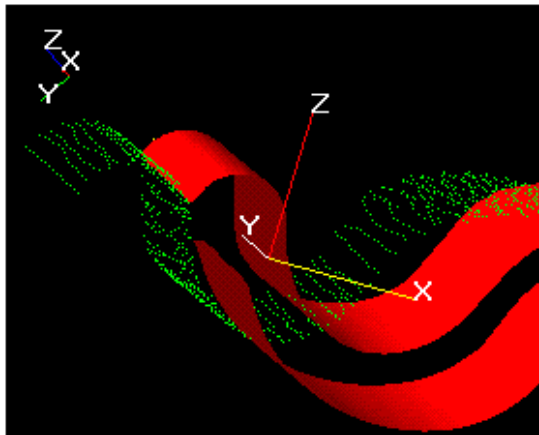
Transformation parameters

The transformation parameters for the surface position corresponding to the current iteration are shown here. The parameter values are calculated from the active coordinate system.

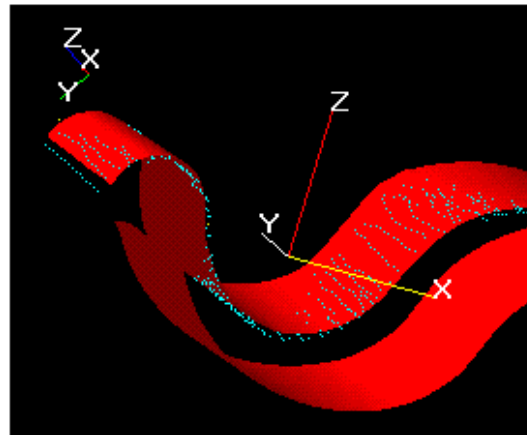
Save button

If you want to store the transformation parameters as a new coordinate system, click **Save**.

6.11.2 Example: Points fitted by transformation to CAD surface



Before transformation:
Points and surface do not fit



After transformation:
Best fit of points to surface

Graph Ex - CAD transf. by surf fit.BMP

6.12 CAD Compare

CAD Compare command (**Graphic menu**)
"Compare CAD model to points"

Alt, G, C

CAD only

This function compares a selected group of points to elements of an imported CAD model.

For comparison to curves, a target offset is not permitted since a unique direction for the offset cannot be defined.

For comparison to surfaces, an offset can be applied to the points to allow for target thickness, an offset target or reflector offset. The offset is applied along the perpendicular from the actual target point to the surface of the CAD model. The direction of the offset must be clearly defined. CAD surface patches have an "outside" and "inside". An offset target on the outside has a positive offset whilst one on the inside has a negative offset. For a more detailed explanation see "CAD surface orientation" on page 11.

The results of comparison show the deviations between CAD model and measured points as needle plots and/or a colour map.

The tolerance bands for the colour-coded error map are taken from the tolerances defined in the CDM "Settings" menu.

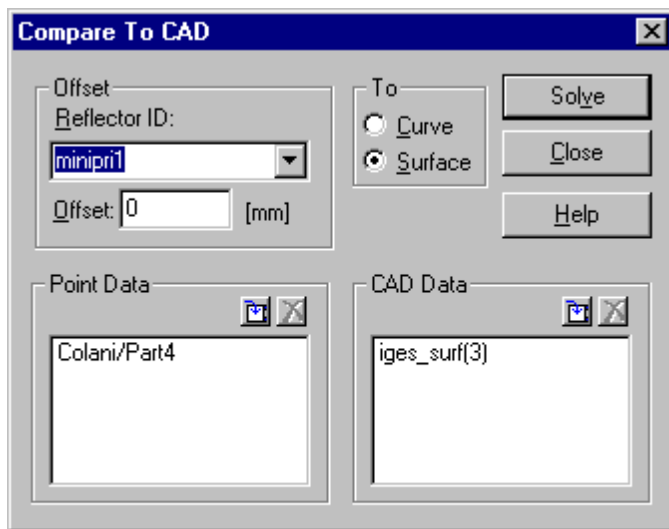
The type of error display (needle plot and/or colour map), as well as the colours for the colour map, are defined in the graphics options. See "Error display tab" on page 68.

For example of needle plot, see "Error needle plot" on page 20.
For example of error colour map, see "Error colour map" on page 21.

Shortcuts

Toolbar:	none
Keys:	none



6.12.1 Dialogue box: Compare



Graph - compare to CAD.BMP

Pre-selected data will appear in the **Point Data** and **CAD Data** lists. You may add other data to the lists at any time before fitting by clicking in the graphics window and selecting the ones you want. Single or multiple selections can be made.

Selection in the graphics window does not automatically place items on the list. Buttons are available to add or delete from the list, as follows:

-  Add the current selection to the list.
-  Delete highlighted items from the list.

Offset

Only applicable to comparison with surfaces.

If the selected points were measured by laser tracker, select the corresponding **Reflector ID** from the drop-down list. The radius of the reflector housing then appears as the **offset** value and will be used as a correction when fitting the points to the loaded CAD model.

Alternatively you can directly enter the amount of any constant offset which should be taken into account.

To

Specify whether a CAD **surface** or CAD **curve** is to be used for the comparison.

Point data

Shows all the points which will be compared with the selected CAD model.

CAD data

Shows the CAD data used for comparison.

Solve button

Click this button to calculate the comparison. Results are shown in the graphics window as a needle plot or colour plot of offset errors, depending on the display settings.

Numerical results are displayed in a results dialogue.

6.12.2 Dialogue box: Compare results

Compare Results

General Statistics of Deviations

	Positive	Negative	Absolute
Maximum:	1.587	-1.570	1.587
Average:	0.225	-0.216	0.221
Std.:	0.146	0.157	0.150
RMS:	0.151		

Out of Tolerance Statistics

Tolerance: 0.100

Number of Points: 3405

Good:	853	25 %
1-2x Over:	826	24 %
>2x Over:	1726	51 %

	Wp/Pt ID	X	Y	Z	DevX
1	COLANI/PART8:1	576.878	48.490	89.688	0.064
2	COLANI/PART8:2	567.078	48.590	82.479	0.069
3	COLANI/PART8:3	557.719	48.852	75.023	0.068
4	COLANI/PART8:4	548.629	50.067	67.238	0.101
5	COLANI/PART8:5	539.864	52.308	59.114	0.101

Show Out of Tolerance Only

Graph - Compare to CAD results.bmp

General statistics of deviations

The offsets are analysed in different ways as follows:

Offsets are grouped into **positive**, **negative**, and **absolute** values. For each of these 3 groups the **maximum** value, **average** value and standard deviation (**std**) are calculated.

An **RMS** value is calculated for the absolute values.

Out of tolerance statistics

Various out-of-tolerance statistics are calculated.

Tolerance shows the tolerance threshold which is set in the **CDM Settings menu** (Analyse Warnings) using the "Comparison Tolerances / Total Tolerance" field.

The **Number of points** used in the calculation is displayed.

Each offset falls into one of 3 bands:

1. Good = within tolerance
2. $1 - 2x$ = offset is between one and two times the threshold
3. $2x$ = offset is more than twice the threshold

For each band the number and percentage of points in that band is shown.

Details/Overview button

When summary data only is displayed, click the **Details** button to see the numerical results box. When all details are displayed, click the **Overview** button to see only the summary information.

Numerical results box

For every point, the following items are shown:

- Workpiece and point ID
- 3 coordinate values of the measured point in the active coordinate system
- 3 axial deviations of the offsets in the active coordinate system
- Total deviation (vector length) of the offset
- Reflector used at this point
- Reflector offset
- Out of tolerance flag (blank = good, * = $1 - 2x$, ** = $> 2x$)
- 3 coordinate values of the corresponding surface point (the "projected" point) in the active coordinate system.

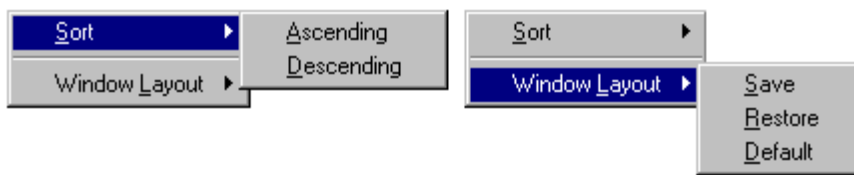
Manipulating the display of numerical results

The numerical display can be manipulated in a way similar to the Data Manager display.

Click on one or more column headings and drag to move them to a new position.

Drag the column separators to change the column widths.

Right-click to obtain the following popup menu:



Graph - compare to CAD popup.bmp

If a column has been selected, the display can be re-arranged to show the values in this column in ascending or descending order.

The current grid layout can be **saved** or the last saved layout **restored**. Alternatively the **default** layout (internally defined) can be specified.

Show out of tolerance only

Select this option to show only out-of-tolerance points in the numerical results box.

Specifying a subset of compared points

Use left click, shift + left click and ctrl + left click on the rows of the numerical results grid to specify a subset of compared points. These points will also be indicated in the graphical display as white triangles.

If a subset is specified in this way, only the items in the subset will be used for storage and reporting.

Report

Click this button to prepare a presentation-quality report using the **Report Generator**.

The report shows the details currently displayed in the dialogue box. Set the appropriate dialogue box options to achieve the display you require.

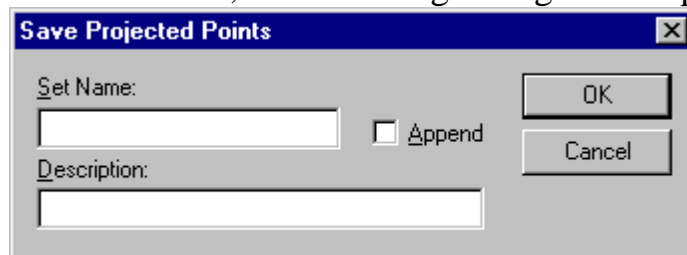
If a subset of numerical results has been specified, only the subset will be included in the report.

Save

Click this button to save the projected points to a set. The projected points are the surface points at the feet of the perpendiculars from the measured points to the CAD surface.

If a subset of numerical results has been specified, only projected points relating to the subset will be stored.

When selected, the following dialogue box appears:



Graph - Compare to CAD results - save.bmp

Use this box to define a set for storing the points. If the set already exists the points can be appended to others already in the set by checking the **Append** option.

6.13 Extract Point: general information

Extract Point command (**Graphic menu**)

Alt, G, E

CAD only

Transfers points from imported CAD models to an **Axyz** database and stores them as points of type reference, control or entered.

There are different methods of extracting points from a CAD model. Some CAD models may not contain point information, only curve and shape information. This command also allows users to manually select points on the surface of a CAD model by simply clicking on the image.

Extracted points stored as reference points are stored by default under the reference ID "CAD".

6.14 Extract point: Get all

Extract Point: Get all command (**Graphic menu**) **Alt, G, E, G**
 "Get all points from the CAD model and extract them for later storage"

CAD only

First import a CAD model. This command only works for a single imported model.

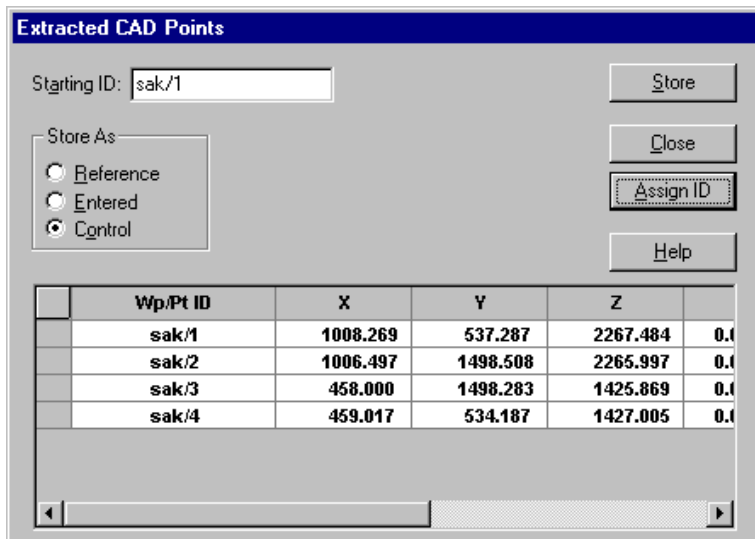
This command then extracts all points defined in the model and stores them in the job file under a specified point ID. Default point IDs are offered or users can create their own by entering a starting ID for automatic point naming.

Additionally the function tries to find a normal through the points based on the underlying CAD model. This normal can then be used in vector mode for building and inspection.

Shortcuts

Toolbar: none
 Keys: none

6.14.1 Dialogue/results box: Extract all points



Graph - extract all CAD pts.BMP

Starting ID

Enter a starting workpiece name and point ID for the first point on the list of extracted points.

Store as

Points can be stored as one of the following types:

- Reference points
- Entered points
- Control points

When stored as reference or control points, the coordinate values are referenced to the local coordinate system of the CAD model.

When stored as entered points, the coordinate values are referenced to the base coordinate system.

Assign button

Click this button to alter the default IDs. This action will assign the starting ID to the first point in the points list. The following points are automatically incremented.

Points list

Shows the points extracted from the CAD model.

6.15 Extract point: Select

Extract Point: Select command (**Graphic menu**) **Alt, G, E, S**
"Select points from a CAD model and extract them for later storage"

CAD only

First import one or more CAD models. This function then allows you to extract any individual points defined in the imported models by clicking on the points you want.

Note

Extracted points are referenced to the local axes of their corresponding CAD model.

The points are stored in the job file under a specified point ID. Default point IDs are offered or users can create their own by entering a starting ID for automatic point naming.

When the function is called, the dialogue/results box is displayed. This is identical to the dialogue/results box for the function to extract all points from a CAD model.

In the graphics window, then use the left mouse button to click on the required points. Selected points then appear in the results box.

See "Dialogue/results box: Extract all points" on page 89 for a full description of how the box operates.

Shortcuts

Toolbar:	none
Keys:	none

6.16 Extract point: Create

Extract Point, Create command (**Graphic menu**) **Alt, G, E, C**
"Create points on the CAD model and extract them for later storage"

CAD only

First import one or more CAD models. This function then allows you to create points by clicking on the surface of the model.

Note

Created points are referenced to the local axes of their corresponding CAD model.

The points are stored in the job file under a specified point ID. Default point IDs are offered or users can create their own by entering a starting ID for automatic point naming.

When the function is called, the dialogue/results box is displayed. This is identical to the dialogue/results box for the function to extract all points from a CAD model.

In the graphics window, then use the left mouse button to click on the required points. Selected points then appear in the results box.

See "Dialogue/results box: Extract all points" on page 89 for a full description of how the box operates.

Shortcuts

Toolbar:	none
Keys:	none

6.17 Surface Offset**Surface Offset** command (**Graphic menu**)**Alt, G, S**

"Calculate offset correction for selected points"

The purpose of this function is to calculate points on a free-form digitized surface. Typically such a surface will be measured by scanning a target or reflector across the surface and generating a high density of measured positions. These positions are offset from the surface by the target thickness, target offset or reflector offset and must be corrected to corresponding surface positions. The corrected locations are stored in a point set defined by the user.

The correction is done by calculating a perpendicular to the surface for each point and then applying a correction along this perpendicular. For each measured point there is therefore one corresponding corrected point.

The surface can be defined either by the surrounding points themselves or by an imported CAD model representing the surface.

Note 1

If the measured points are distributed in an irregular pattern, so are the corrected points.

Note 2

If individual points are to be corrected, then a target offset or reflector offset should be applied to the points in question.

See the instrument module's reference manual for further information.

Shortcuts

Toolbar:	none
Keys:	none

6.17.1 Direction of offset

Correction is along a perpendicular from the measured point to the surface point but a positive direction for this perpendicular must be specified. If an

offset is defined as positive this means that the target is positively shifted along the local perpendicular. The corrected surface point must therefore be located in the opposite direction.

Surface defined by the measured points themselves

Currently the perpendicular has a positive direction defined by the viewing position for the graphics window, i.e. the closest point to the user in the set of points to be offset defines the positive side of the surface.

If the shift must be made in the other direction then either the viewing position must be altered or the offset must be entered as a negative value.

In case of doubt, users are advised to try both options.

Diagram: Overview of CAD surface offset

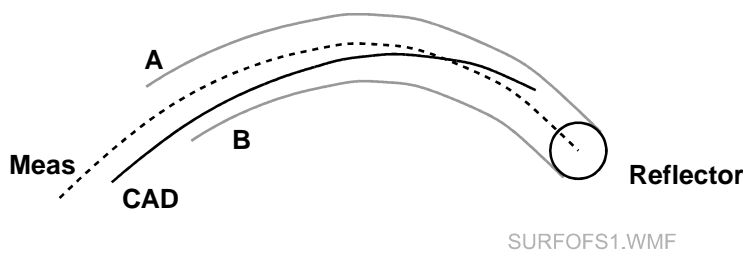
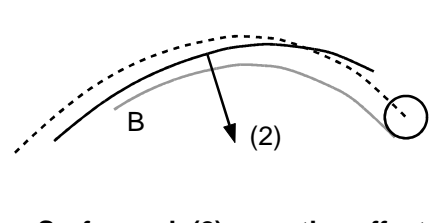
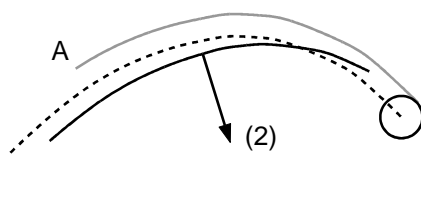
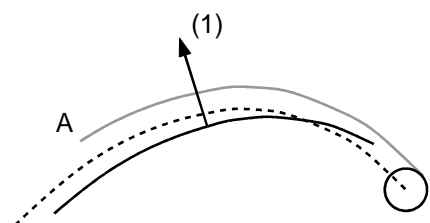
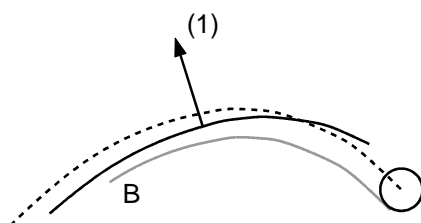


Diagram: CAD surface offset corrections



SURFOFS2.WMF

Surface defined by an imported CAD model

CAD only

If a CAD model is available for the measured surface, it may be imported to help in defining the direction of the offset correction.

The model and measured surface will not, in general, be in the same place. Determining differences is likely to be an objective of the measurement.

The overview diagram shows the situation. Reflector centre positions have been measured and information must be given to indicate if the corrected surface points lie on surface (A) or (B).

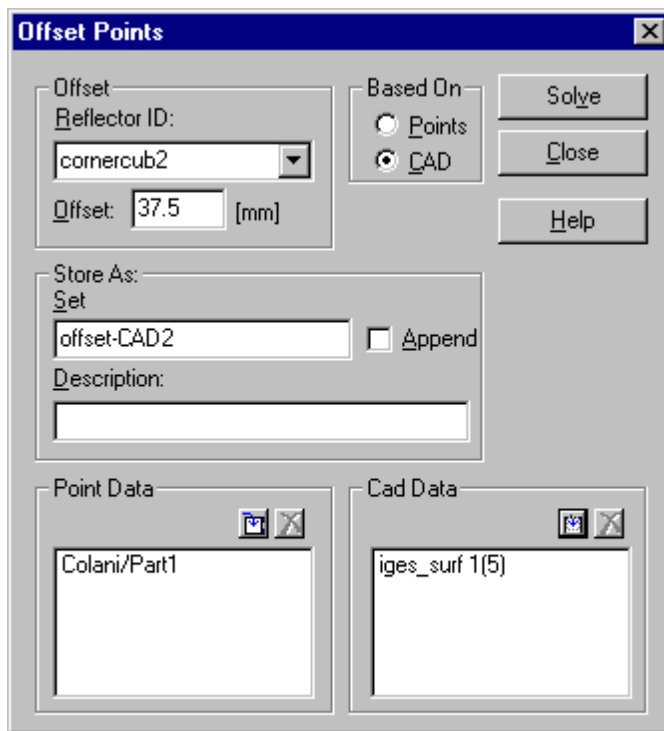
The imported CAD surface is also shown. CAD surfaces have "outsides" and "insides" and the positive direction is from the inside towards the outside. In the display, outsides have a brighter appearance than insides, which helps identify direction. This direction can be reversed by using the **Flip** function.

The diagram of corrections shows the 4 possible combinations of surface orientation and positive or negative offset, together with the resultant correction surface (A) or (B). You need to arrange for the correct combination in order to get the correction you require.

See also "Surface orientation: Flip" on page 77.

See also "CAD surface orientation" on page 11.

6.17.2 Dialogue box: Surface offset



Graph - Surf. offset.BMP

Pre-selected data will appear in the **Point Data** and **CAD Data** lists. You may add other data to the lists at any time before offset calculation by clicking in the graphics window and selecting the ones you want. Single or multiple selections can be made.

Selection in the graphics window does not automatically place items on the list. Buttons are available to add or delete from the list, as follows:



Add the current selection to the list.



Delete highlighted items from the list.

Offset

If the selected points were measured by laser tracker, select the corresponding **Reflector ID** from the drop-down list. The radius of the reflector housing then appears as the **offset** value and will be used as a correction when fitting the points to the loaded CAD model.

Alternatively you can directly enter the amount of any constant offset which should be taken into account.

The offset should be entered as a negative value if the inside of a surface was measured.

Based on

Specify if the surface is defined by the measured **Points** themselves or by an imported **CAD** model.

Store as**Set**

Specify an ID for the coordinate set where the offset points will be stored.

Append

Select this option to append the offset points to an existing coordinate set. This option is useful if you have built up the measured surface in patches.

Description

Enter an optional description for the calculated offset points.

Point data

This shows the selected points from which the offset points will be calculated.

CAD data**CAD only**

If correction is **based on** an imported CAD model, this shows the selected CAD model used to define the surface to which the measured points should be corrected.

Solve button

Click this button to calculate the offset points. Results are displayed in the graphics windows.

6.18 Print Graphics: Print Report

Print Graphics: Print Report command (**Graphic menu**) **Alt, G, P, P**

"Generates a graphics report "

This generates a single page report which includes an image of the current graphics view.

Shortcuts

Toolbar:	none
Keys:	none

6.19 Print Graphics: Print as PS File

Print Graphics: Print PS File command (**Graphic menu**) **Alt, G, P, F**
"Print Postscript file"

This will print an image of the current graphics window to a Postscript printer. An appropriate printer must be connected.

Shortcuts

Toolbar:	none
Keys:	none

6.20 Import

Import command (**Graphic menu**) **Alt, G, M**
"Import CAD data"

CAD only

Imports data in several standard CAD formats. It is assumed that the external data is defined in the currently active coordinate system. If this is correct then the model will be displayed in the correct relation to any measured data. If not, it may be necessary to further transform the data into the correct position. See "CAD transformation: By Surface Fit" on page 79.

Shortcuts

Toolbar:	none
Keys:	none

6.20.1 Dialogue box: Import



Graph - Import.bmp

A standard Windows 95 dialogue box is used to select the file containing the CAD data to be imported.

Look in

Select the drive and folder that contains the job you want to open

File Name

Click on a listed file, or type the name of the file, containing the CAD data you want to import. Multiple file selection from the list is permitted.

Files of Type

Select which existing files to display from the following type list:


- Imageware files (*.imw)
- Catia files (*.EXP, *.MOD, *.MODEL)
- Catia files (*.*)
- IGES files (*.igs)
- VDA-FS files (*.vda)
- DXF files (*.dxf)

Some Catia files may not have a standard extension, hence the general format option above. However, this option will only work if selected files are of type Catia.

Open button

Click the **Open** button or press <ENTER> to import the data in the chosen file.

Windows HELP

Standard Windows help is available in a "popup" box by clicking on the question mark button  and then clicking on part of the box for which help is required.

6.21 Export

Export command (**Graphic menu**)
"Export CAD data"

Alt, G, X



Exports selected data to external files in several standard CAD formats or store the current graphics display in a standard image file.

Shortcuts

Toolbar: none
Keys: none

6.21.1 Dialogue box: Export



A standard Windows 95 dialogue box is used to specify the file and CAD format to which the currently selected is to be exported.

Save in

Select the drive and folder where you want to export your data.

File Name

Type the name of the file which will contain the CAD data you want to export.

Save as Type

Select a standard CAD format from the following type list:

- Imageware files (*.imw)
- Catia files (*.EXP, *.MOD, *.MODEL)
- Catia files (*.*)
- IGES files (*.igs)
- VDA-FS files (*.vda)
- DXF files (*.dxf)


Alternatively select an image format used to output the current graphics view:

- JPEG files (*.jpg)
- Bitmap files (*.bmp)

Save button

Click the **Save** button or press <ENTER> to export the selected data.

Windows HELP

Standard Windows help is available in a "popup" box by clicking on the question mark button  and then clicking on part of the box for which help is required.

7. Help menu

7.1 Help Topics

Help Topics command (**Help menu**) **Alt,H,H**
 "List Help topics "

This takes you to the **Contents** section of the on-line HELP. From here you also have access to the **Index** and **Find** tabs.

Shortcuts

Toolbar icon: none
 Keys: none

7.2 Using Help

Using Help command (**Help menu**) **Alt,H,U**
 "Display instructions about how to use help"

This command displays the standard Windows 95 Help file about using Help systems.

Shortcuts


Toolbar icon: none
 Keys: none

7.3 Help Mode

Help Mode command (**Help menu**) **Alt,H,M**
 "Display help for clicked on buttons, menus and windows"

This provides an on-screen, context-sensitive HELP. When chosen, the mouse pointer changes to a Help pointer. You can then click on windows, buttons and menu choices to display context-sensitive Help relating to the chosen item.

Shortcuts

Toolbar icon: 
 Keys: SHIFT+F1

7.4 About Axyz CAD/View

About **Axyz CAD/View** command (**Help menu**) **Alt,H,A**

"Displays program information, version number and copyright"

Shortcuts

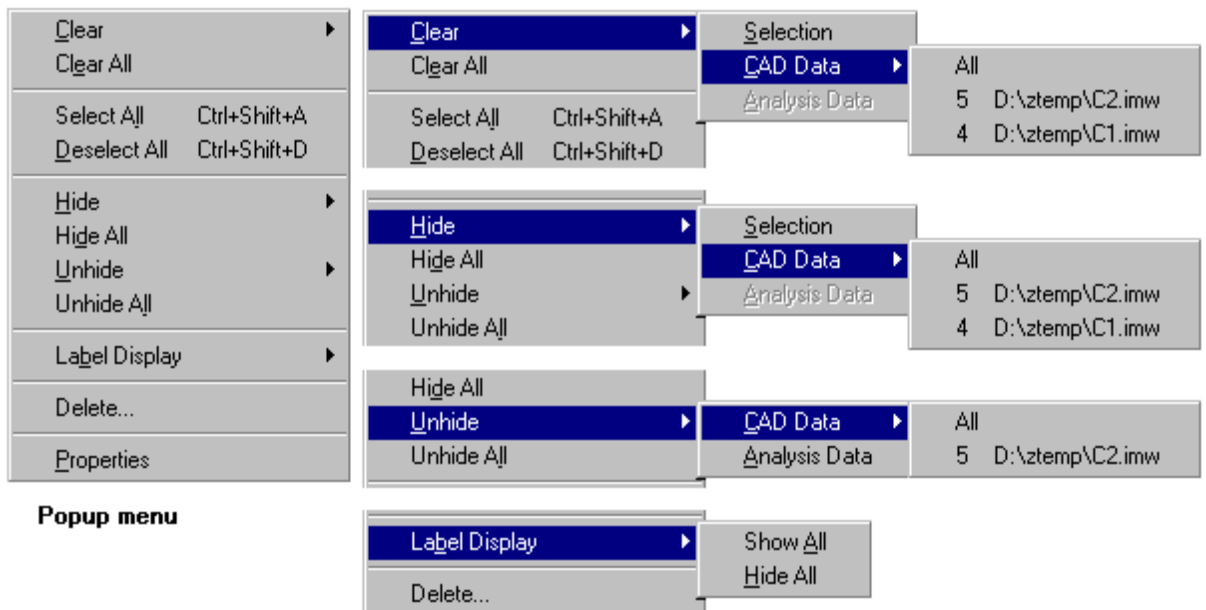
Toolbar icon: none

Keys: none

8. Shortcut menu on right mouse click

8.1 Right click in graphics window

This provides the following shortcut menu with direct access to main menu functions described elsewhere in this document. (Examples only of currently imported and hidden CAD files.)



Additional options

Graph - rt mouse click.bmp

9. Graphics and on-line measurement

9.1 Standard measurements

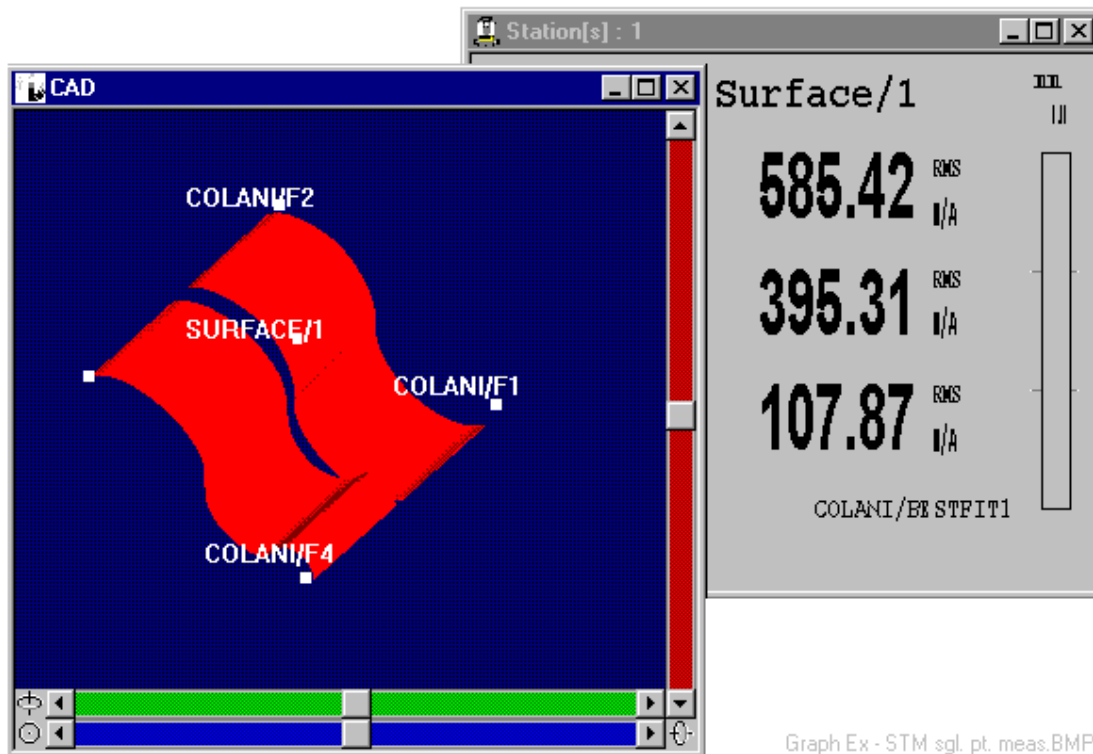
See the LTM and STM/MTM manuals for detailed operation of standard measurement modes.

9.1.1 Single point measurement (LTM, STM/MTM)

When point coordinates are calculated, the point appears in the graphics window.

The example shows a point "Surface/1" measured by the STM. Once its coordinates are available in the measurement window it automatically appears in the graphics window.

Example display: Single point measurement



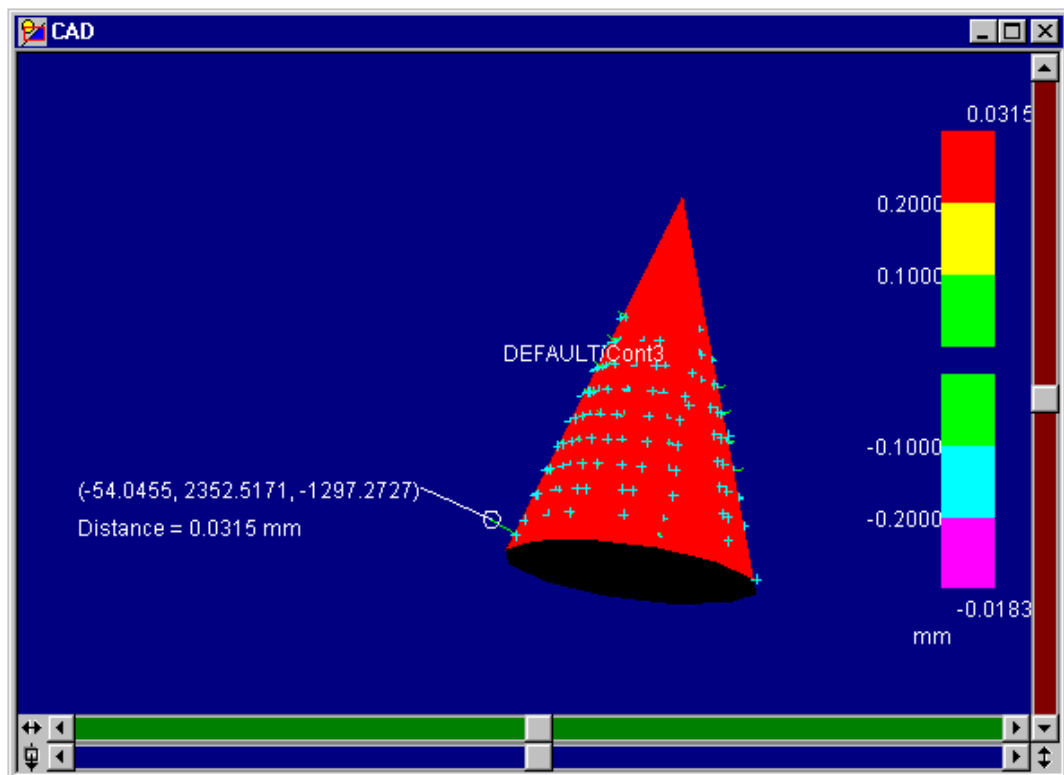
9.1.2 Continuous and grid measurement (LTM)

If a tracker measures continuously, for example to record the surface of a cone, the measurements are transmitted in blocks to the database and graphics window.

The example shows a measurement set scanned on the surface of a cone on line and displayed as the scanned data was created.

On completion of the scan the cone was calculated and immediately automatically displayed in the graphics view. Residual offsets are shown for each scanned point and needle text has been displayed for one of the offsets.

Example display: Continuous measurement



Graph ex - cone scan and calc.bmp

9.2 Build/inspect points (LTM, STM/MTM)

See LTM and STM/MTM manuals for detailed operation of modes for building and inspecting points.

In Build and Inspect modes the graphics module shows the deviation between reference points and corresponding measured points.

During Build and Inspection, the module's measurement window provides a continuous update of the deviation between the reference points and the measured points.

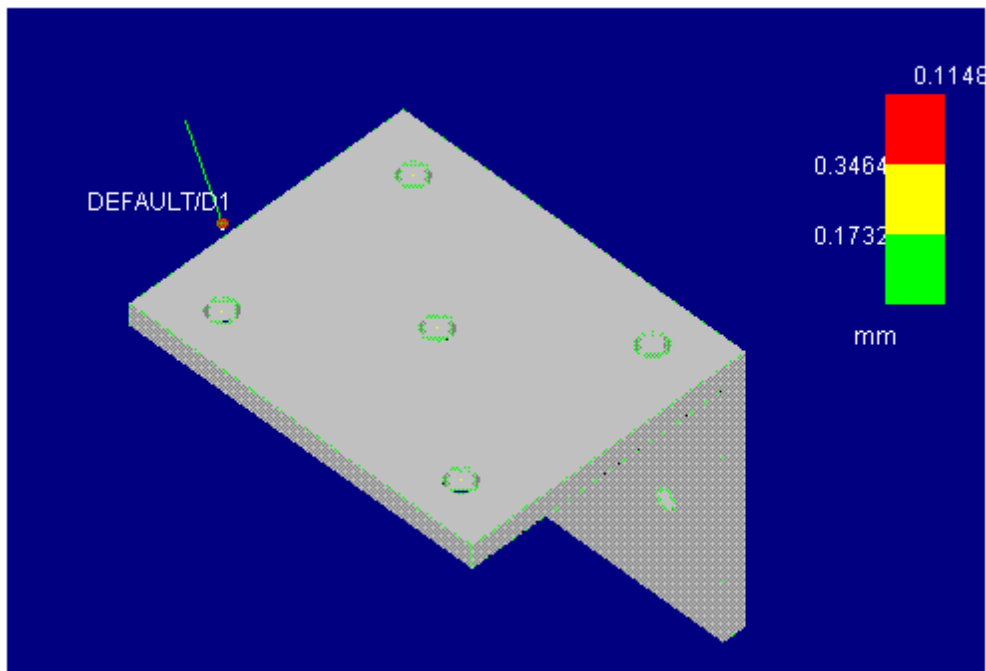
However the graphics window will only display an offset when a point is measured and stored in the database. Offsets are displayed as needle plots, colour-coloured according to the tolerance band.

In **Build mode** the offset is only shown for the current point. When you exit Build mode the last error plot is removed from the display.

In **Inspect mode** offsets are displayed for all points checked and measured so far. When you exit Inspect mode, the error plots remain displayed.

The example shows the build point just measured, together with the associated error needle. To assist visualization the associated CAD model has also been imported.

9.2.1 Example display: On-line build points



Graph - ex. on-line build points.bmp

9.3 Build/inspect CAD/shape surfaces (LTM, STM/MTM)

See LTM and STM/MTM manuals detailed operation of modes for building and inspecting CAD and standard **Axyz** shape surfaces.

During Build and Inspect, the module's measurement window provides a continuous update of the perpendicular distance from the target to the shape or CAD surface.

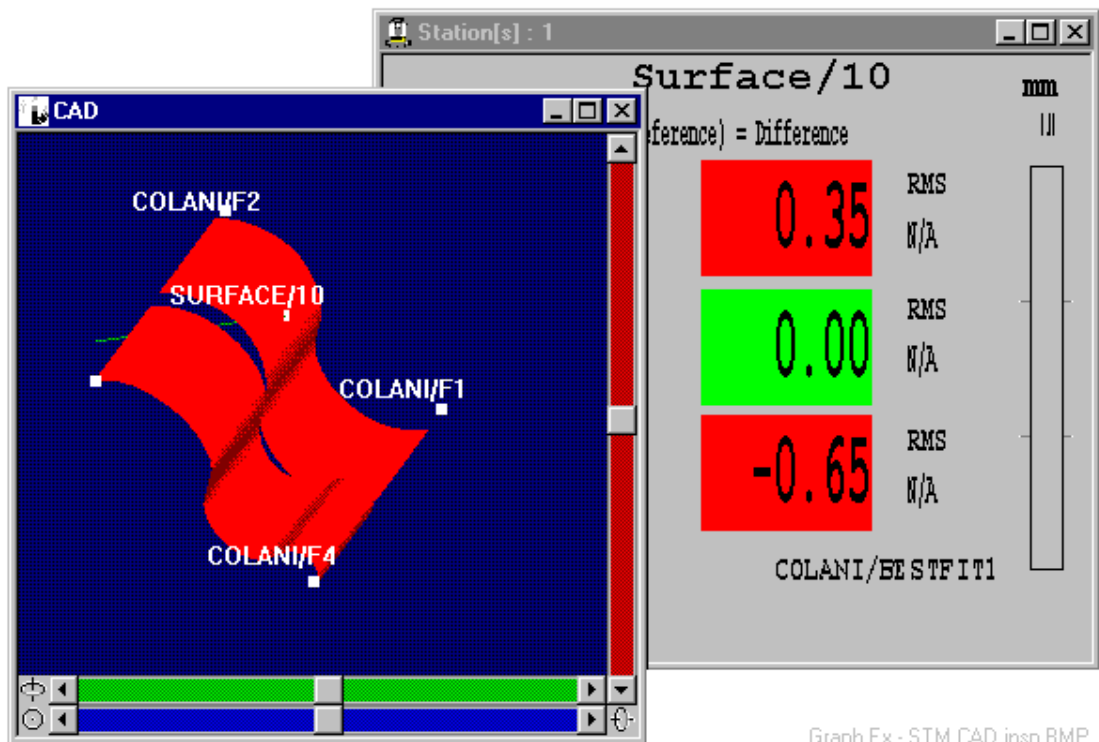
However the graphics window will only display an offset when a point is recorded in the database. Offsets are displayed as needle plots, colour-coloured according to the tolerance band.

In **Build mode** the offset is only shown for the current point. When you exit Build mode the last error plot is removed from the display.

In **Inspect mode** offsets from the CAD or shape surface are displayed for all points checked and measured so far. .

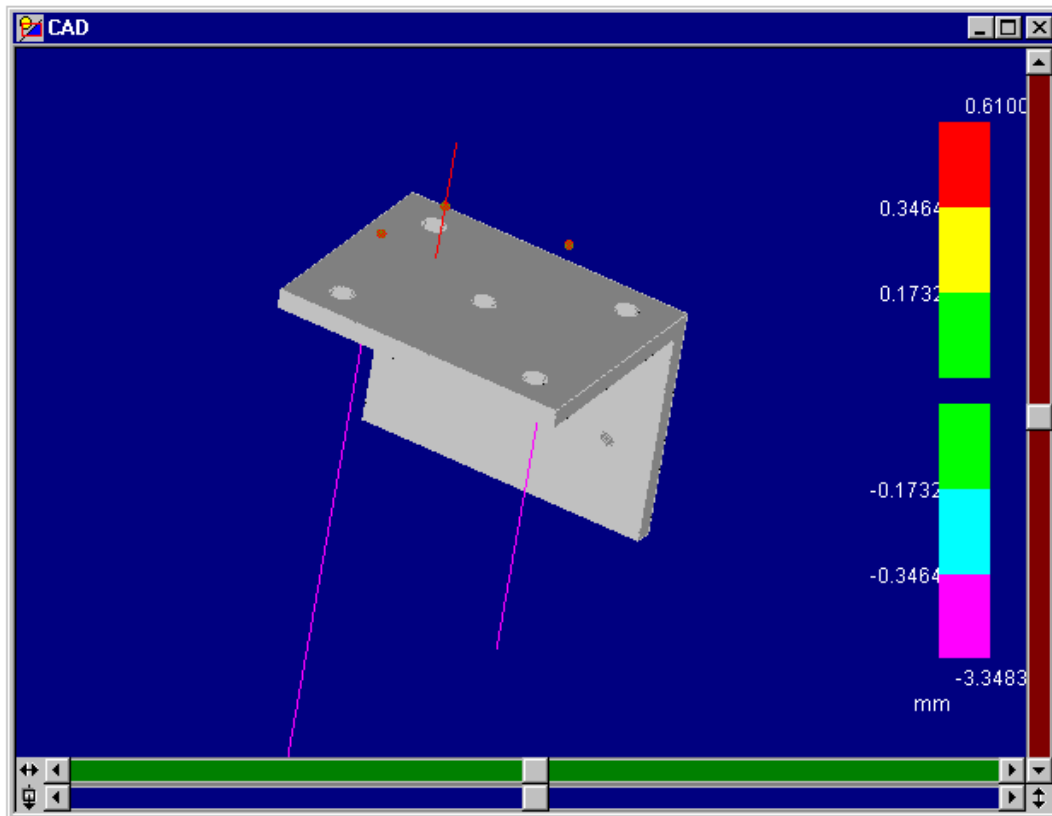
Example 1 shows point "Surface/10" checked against a CAD model using the STM. Example 2 shows a check against a plane surface after 3 points have been measured.

Example 1 display: Inspect CAD



Graph Ex - STM CAD insp.BMP

Example 2 display: Inspect CAD



9.4 On-line CAD comparison

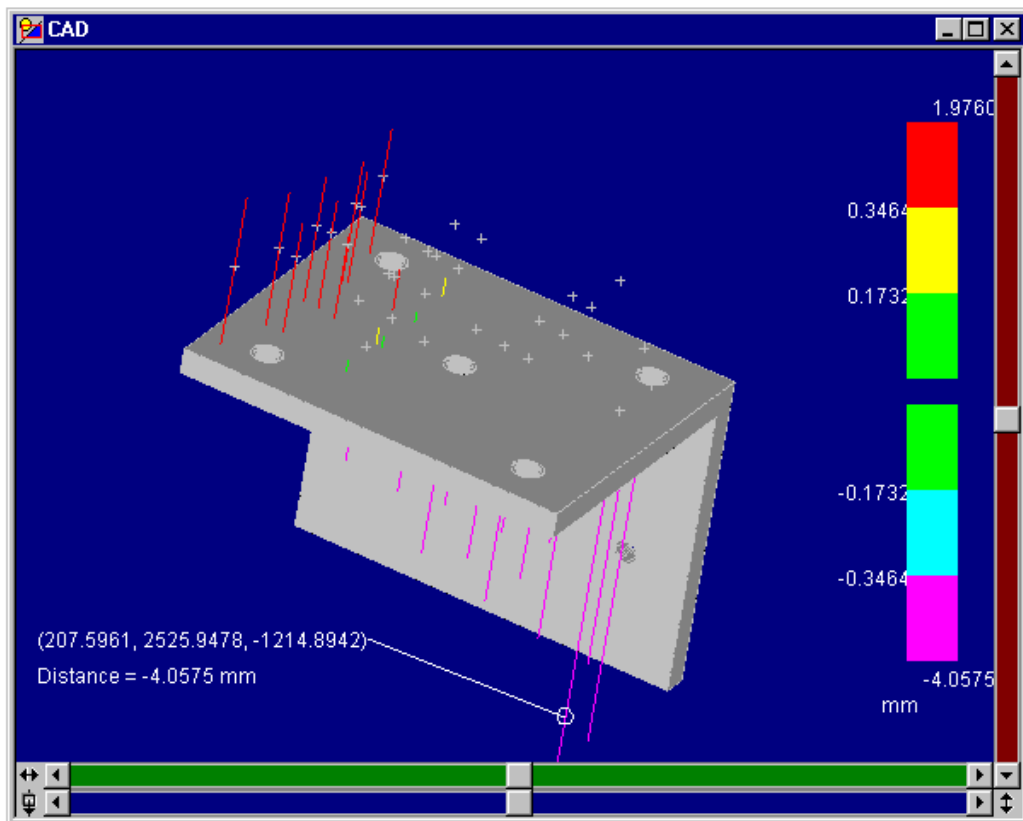
See LTM manual for detailed operation of this measurement mode.

The standard CAD Compare function involves scanning a set of points on a surface, importing the CAD model, then calculating and displaying the offsets of all points in the set.

This can be achieved on line by first importing the CAD model. As points are scanned on the surface they are shown in the graphics window, together with a needle and/or surface colour offset.

The example shows needle text added during the comparison.

9.4.1 Example display: On-line CAD comparison



Graph - ex. on-line CAD compare.bmp