A large, light blue wireframe sphere is positioned on the left side of the page. It is composed of a grid of lines that form a spherical shape, with a smaller, more detailed wireframe sphere nested inside it, creating a sense of depth and perspective. The lines are thin and light blue, set against a white background.

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Graphical Model Manipulation Guide

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1 Introducing the Design Model Editor

The Design Model Editor enables you to reposition selected objects in a model using the mouse pointer. Model manipulation using the Model Editor takes place within the Model Editor 3D View, which incorporates features specific to that View type.

1.1 Scope of this Guide

This guide introduces the facilities in both the Model Editor 3D View and the Model Editor itself. This manual is set out as follows:

- [Selection](#) introduces element Selection, and the meanings of the different Selection graphics.
- [Introducing the Model Editor 3D View](#) introduces the Model Editor mode of operation within a 3D View Window.
- [Model Editor Operations](#) introduces the Model Editor itself, describing the selection, positioning and orientation facilities available within Model Editor mode.
- [Graphical Equipment Modification](#) introduces the facilities that have options to speed the modification of Equipment.
- [Graphical Component Modification](#) introduces the modification facility which allows you to interactively move piping Components along the legs of a pipe route and rotate them about the centreline of the pipe tube.

1.2 Glossary

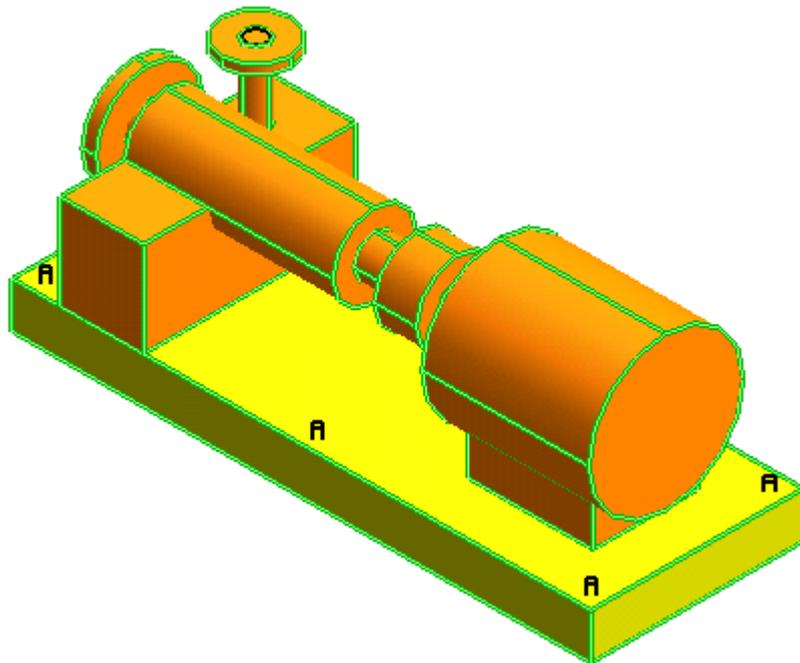
Feature	Point, P-point, line or P-line on the 3D model that can be used for alignment.
Graphical Selection	One or more elements selected for subsequent manipulation using the <i>Locator Handle</i> .
Selection Set	When in Navigate mode, the elements selected by a pointer click. For an Equipment, all the constituent primitives will be selected, for a piping Component, all connected Components will be selected.
Linear Movement Handle	A handle situated on the Locator Handle, which when selected for a drag operation, constrains movement of the selection to be along the direction of the selected major axis.
Locator Handle	A collection of handles which together provide a mechanism for positioning and orientation of selected elements.

Movement Increment	The incremental step in current distance units that a selection will move in the direction of a major axis of the <i>Locator Handle</i> when a planar movement handle or a linear movement handle is dragged.
Movement Axis	The axis identified by the <i>Linear Movement Handle</i> . During a drag operation, the current selection will be constrained to move in the direction of the movement axis only, while following the movement of the pointer.
Movement Plane	The plane identified by the <i>Planar Movement Handle</i> . During a drag operation, the current selection will be constrained to move in the Movement Plane only, while following the movement of the pointer.
Planar Movement Handle	A handle situated on the <i>Locator Handle</i> , which when selected for a drag operation constrains movement of the selection to be in the plane indicated by the <i>Planar Movement Handle</i> . That is, the XY, XZ or YZ plane of the <i>Locator Handle</i> .
Rotation Increment	Incremental step in degrees that a selection will rotate when a Locator rotation handle is dragged.
Reference Point	Position used as a datum point for subsequent movement of the <i>Graphical Selection</i> .
Ship Item	A Design database element that represents an engineering item that can be individually selected and manipulated to modify Ship layout. For example, Equipment, Steel Section, Piping Component.

2 Selection

2.1 Introducing Element Selection

Selecting an element (when **not** in Model Editor mode) highlights that element and all of its constituent primitives with a green line:



The highlight colour used is the same irrespective of whether you have read/write access rights or read-only access rights.

Note: This is not the case in Model Editor mode.

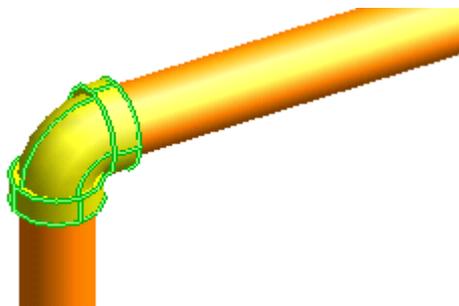
2.2 Selecting Piping Components

When selecting a piping Component, all related items are also selected. For example, when selecting a Valve, the related Flanges and Gaskets are selected as well:

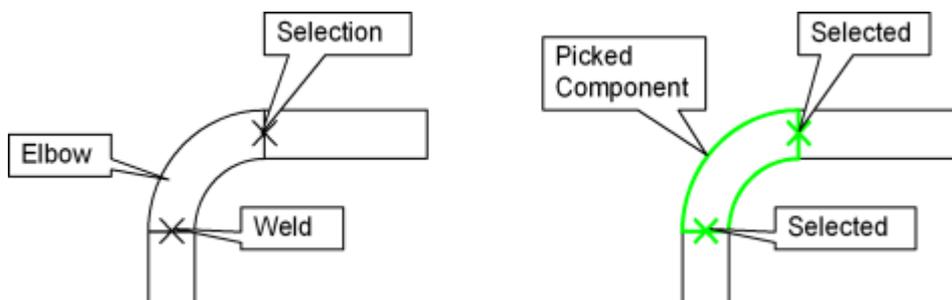


Note: The selected elements (known as the **Selection Set**), only constitute the **graphical** selection (as highlighted with a green line) - the selected current element is (in the above case) still only the Valve element itself.

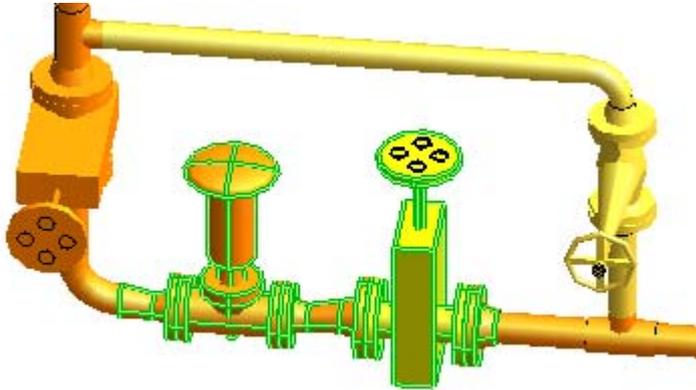
The above situation only applies where the arrive and leave directions of the selected piping Component are in line with each other. In the case of (for example), an Elbow, only the Elbow itself and any connected zero-length Components (e.g. Welds) are selected. See below:



Diagrammatically, the above situation is:



If a Component which has arrive and leave directions which are in line also has Components which are directly connected to it, then those Components are selected as well. For example:

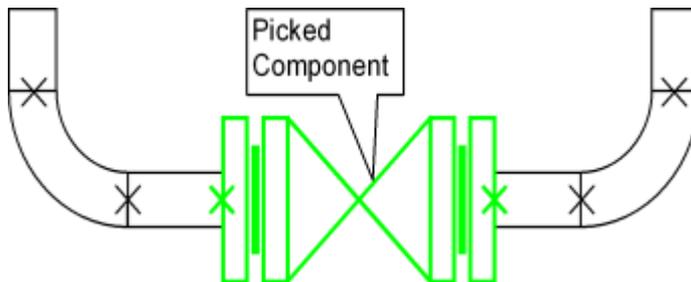


Connected Components are selected up to, but not including:

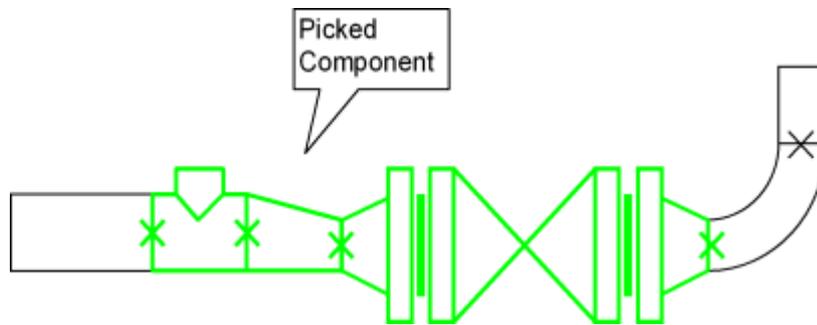
- An element which changes direction, e.g. Elbow, Bend, etc.
- A 'directly connected-to element', e.g. Tee, Cross, etc. where the CREF or CRFA is set
- A bad alignment between Components, e.g. bad offset, alignment, etc.

Further examples of Component selection sets are shown below:

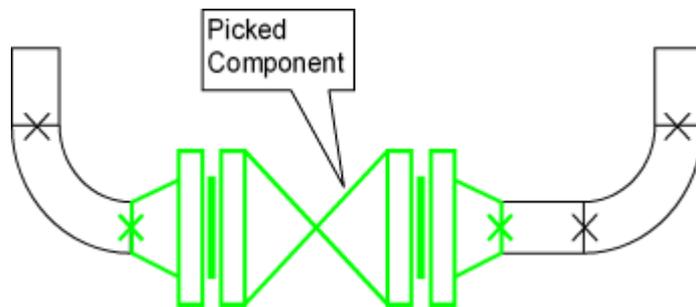
Example: Flanged Valve within a straight leg of a Branch.



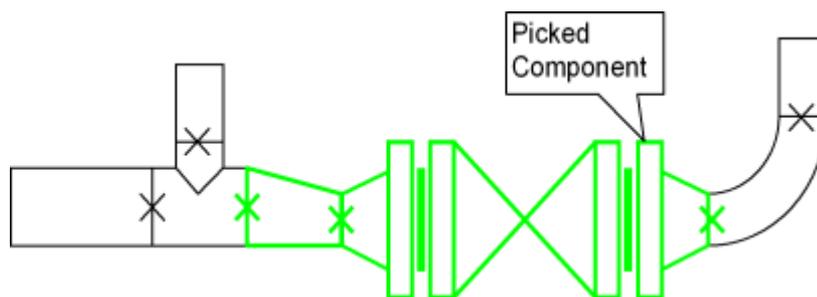
Example: Flanged Valve with weld-neck Flanges connected to an Elbow:



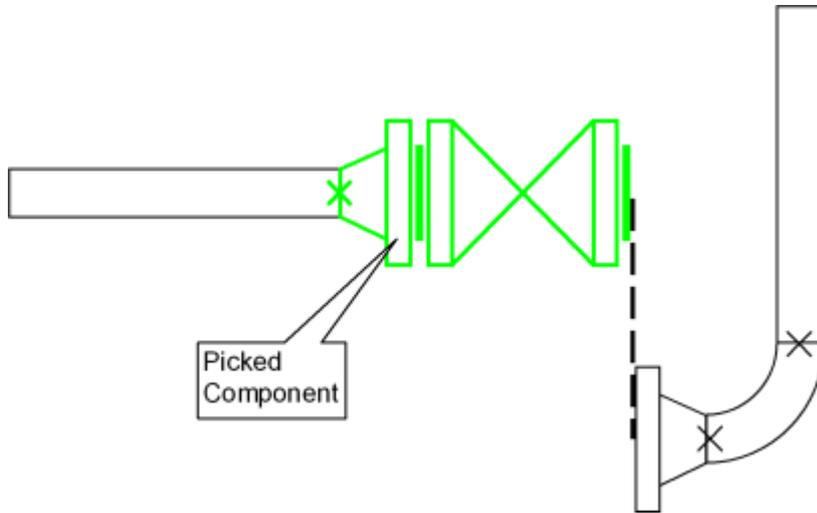
Example: Connected assembly between a change in direction and connected Tee:



Example: Connected assembly between a change in direction and an unconnected Tee:

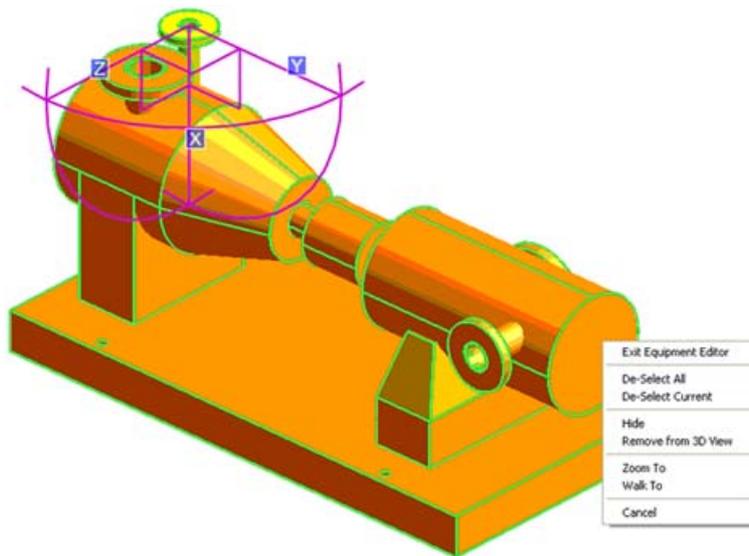


Example: Bad alignment, between Valve assembly and one of its flanges:



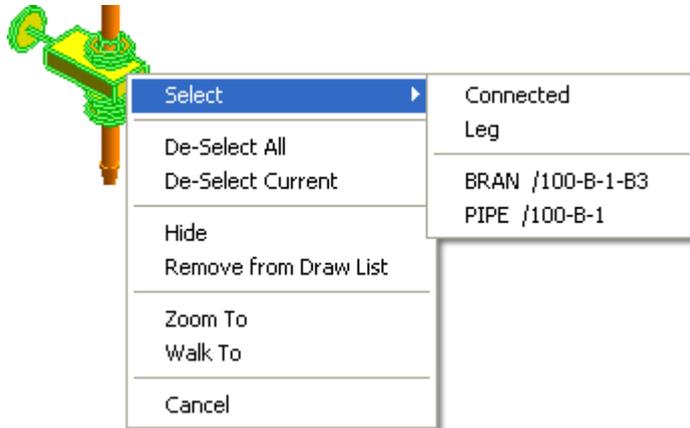
2.3 Menus on Selection Sets

2.3.1 Equipment Items



In the example shown above, **De-Select All** would de-select the entire pump; **De-Select Current** would clear the graphical selection of the current element but leave the rest of the elements in the selection selected.

2.3.2 Piping Components



Note: The above menu is for selection using the right-hand mouse button - only the element under the pointer is selected. Selection using the left-hand mouse button selects the element under the pointer and connected elements.

Select Connected selects all Components connected to the current Component. **Select Leg** selects Components in the same Pipe leg as the current Component.

All other options are as for Model Editing mode.

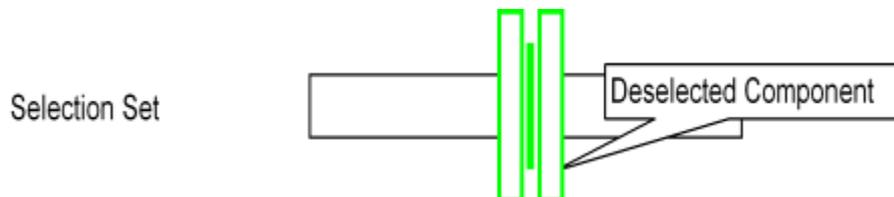
2.4 Component Deselection

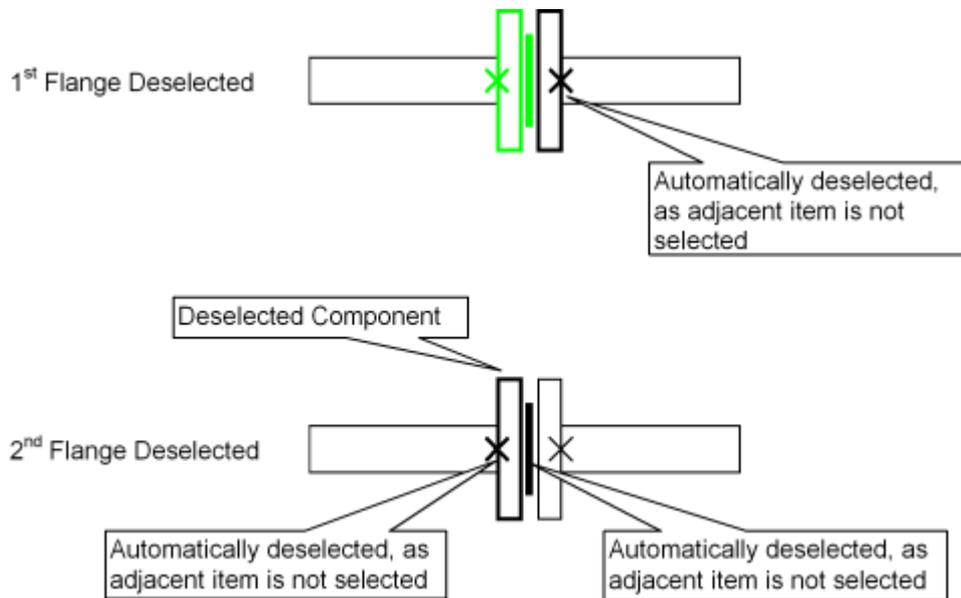
Ctrl-click on a selected item removes it from the current selection set.

Holding the  key down while dragging out a selection rectangle removes the selected items from the current selection set.

Connected zero length or connected invisible components should never be left orphaned when either of their adjacent components are removed from the selection set.

Example: De-selection of a flanged break in line:





3 Introducing the Model Editor 3D View

3.1 3D View Windows

3D Views within Outfitting Design may be used in one of three modes of operation:

- Navigate mode
- Event Driven Graphics mode
- Model Editor mode

3D View windows can be used to display all or part of the design model. No graphics are displayed in a 3D View window until model elements are added to the **draw list** and **view limits** are set.

In **Navigate Mode** (the default setting), view windows allow you to select an element simply by clicking on it, which navigates to it in the database and makes it the **current element**. In this mode, the prompt bar across the top of the viewing area contains the prompt **Navigate:**.

In **Event-Driven Graphics (EDG) mode**, mouse pointer picks are used as part of an event-driven graphics routine. You are invited to perform a graphical pick on an element or a graphical feature in the displayed model. The prompt bar contains an instruction which prompts you to perform a graphical selection. You are not able to enter Model Editor mode whilst in EDG mode (and vice versa).

In **Model Editor** mode, one or more elements can be selected, and those elements can be moved or rotated dynamically by dragging with the mouse pointer. The prompt bar contains the prompt **Modify**.

In this User Guide, a 3D View that can be switched into Model Editor mode is called a **3D Model Editor View**. Outfitting Design normally starts with a 3D Model Editor View shown. New 3D Model Editor Views can be created by selecting **Display>Graphical View** from the menu bar, or by using the **Create** button on the **3D View Control** form.

3.2 Manipulating the Design Model View

View manipulation operations are accessed using:

- the **View** menu on the main menu bar
- the 3D View , obtained by clicking on the 3D View background with the right mouse button
- buttons located next to the 3D view on a 3D View Window
- function keys on the keyboard
- menus on Design items
- direct manipulation of the 3D view using the mouse.

This section describes the 3D View Window manipulation operations. Many of these operations can be accessed using more than one method. The **View** menu selections are introduced, along with a note on other methods that may be used to invoke the same operations.

3.2.1 3D View Menu



View menu



3D View

- **Middle Button Drag**



The **Middle Button Drag** menu is used to set the action of subsequent middle mouse button drag operations on a 3D View.

The model displayed in a 3D View can be zoomed, rotated or panned (according the menu option selected) by pressing the middle mouse button or mouse wheel over the 3D View and moving the mouse.

Middle mouse button drag operations can also be set using function keys and buttons on the 3D View: **F2** for Zoom In/Out, **F3** for Pan and **F5** for Rotate.

Note: **Walk** mode is inactive unless the 3D view is displayed in perspective.

>Zoom Rectangle

Enables you to perform a zoom-in operation by dragging out a rectangle around the volume required to fill the 3D View.

>Zoom In/Out

Enables you, with the middle mouse button held down, to magnify or reduce the view by moving the mouse **up** (away from you) to zoom in, or **down** (towards you) to zoom out.

The middle mouse button can be set in this mode by using the **View** main menu, the **View**, the **Zoom In/Out** button on the 3D View Window and the **F2** button on the keyboard.

>Rotate

In this mode, hold down the middle button and move the mouse **up/down** to rotate the view vertically or **left/right** to rotate the view **horizontally**. The initial movement determines the axis of rotation; to rotate about the other axis, release and press again the middle button.

The middle mouse button can be set in this mode by using the **View** main menu, the **View**, the **Rotate** button on the 3D View Window and the **F5** button on the keyboard.

> Pan

Lets you move across the view in any direction. In this mode, hold down the middle button and move the mouse **towards** the part of the view that you want to see.

The middle mouse button can be set in this mode by using the **View** main menu, the **View**, the **Pan** button on the 3D View Window and the **F3** button on the keyboard.

> Walk

Selects **walkthrough mode**, in which the eye point moves towards or away from the model (only works in perspective views). In this mode, hold down the middle button and move the mouse **up** to walk **towards** the model or **down** to walk away from the model.

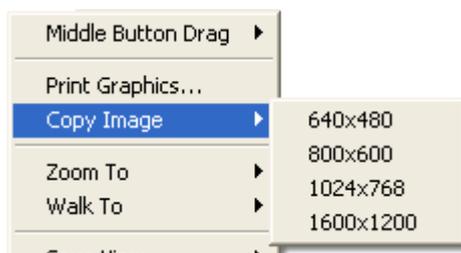
The middle mouse button can be set in this mode by using the **View** main menu, the **View**, the **Walk** button on the 3D View Window and the **F6** button on the keyboard.

- **Printing the 3D View**

The content of the active 3D View Window can be output to a printer by clicking on **View>Print Graphics...**

This displays a standard Windows **Print** form, giving you the ability to select a printer, set the number of copies to produce, and set properties of the print.

- **Copying the 3D View to the Windows Paste Buffer**



The content of the active 3D View Window can be copied to the Windows paste buffer by clicking on one of the **View>Copy Image** options. The options 640x480 up to 1600x1200 refer to the resolution of the image copied to the paste buffer.

The copied image can be pasted into another Windows application that supports picture objects, such as a Word Processor or picture-editing package.

- **Zoom To**



Zoom To zooms and pans the 3D View to get the required part of the 3D model to fill the view window.

>Selection

The current element, or the graphical selection if one exists, fills the 3D View.

>Identify Element

This allows you to centre the view on an identified element in the graphics, and zooms the view such that the identified element fills the 3D View window.

Note: Identifying an element with a pointer pick in this way does not set the selected element to be the Current Element.

>Entire Draw List

This centres the view on the centre point of the entire draw list and zooms the view so that all the elements in the display list fill the 3D View window.

- **Walk To**

Walk To zooms and pans the 3D View to get the required part of the 3D model to fill the view. **Walk To** differs from **Zoom To** in that it removes items between your eye position and the target item that are not in the immediate vicinity of the target item. Items in the immediate vicinity of the target will continue to be displayed, so it may be necessary to remove items still obscuring the target item by removing them from the Draw List.

- **Save View and Restore View**



Save View stores the current state of a 3D view so that the view direction and magnification can be restored when required. Up to four views can be saved at any one time.

Restore View allows you to select a saved view and change the active 3D view settings to the saved values. Any of the views 1 to 4 that do not contain saved view details are greyed out.

Views can also be restored by using the Restore View buttons on the left side of the 3D View Window.

- **Look, Plan and Isometric**

Look

Allows you to select from a range of orthogonal views.

Plan

Allows you to view the model from above.

Isometric

Lets you select any of the four isometric views.

- **Set Centre Of View**



Set Centre Of View allows you to pan the 3D view such that the identified element or screen position is centred in the 3D view.

>Selection

This centres the 3D view on the current element, or on the graphical selection if one exists.

>Identified Element...

This allows you to centre the 3D view on an element picked with the mouse pointer.

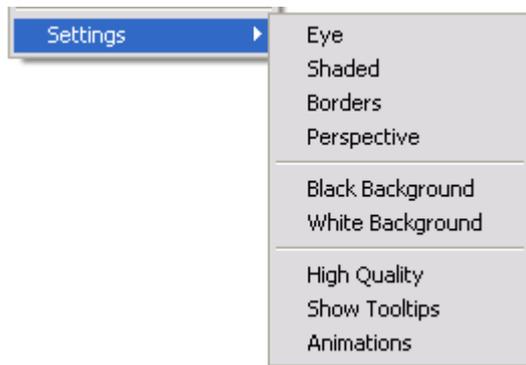
Note: Identifying an element with a pick in this way does not set the picked element to be the Current Element.

>Screen Pick

This allows you to identify a position (which could be in free space) in a 3D view to become the centre of view.

Clicking on the 3D view with the middle mouse button also performs this operation.

- **Settings**



The **View>Settings** menu appears on the main View menu only. It is not on the view .

>Eye, >Shaded, >Borders and >Perspective

These menu commands control the Eye, Shaded, Borders and Perspective modes.

>Black Background and >White Background

Sets the background colour of the currently active 3D View to black or white. Black is recommended as the standard working colour for the view background. White can be the best choice of background colour if a 3D view is to be printed, or its contents copied to another application.

Other 3D view background colours can be set by using the **3D View Options** form found under **Settings>Graphics, 3D Views** tab, and the **3D View Control** form found under **Display>View Control....**

>High Quality

This feature can be used to toggle between 'high' and 'standard' quality images of the Design model. A high quality image is slower to draw and manipulate than a standard quality one.

This option does not affect the Arc Tolerance property on the **Representation** tab of the **Graphics Settings** form (**Settings>Graphics**). This is an independent property that allows you to control the display quality of some of the more complex elements in Outfitting.

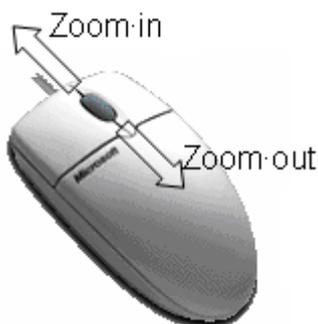
>Show Tooltips

This feature toggles a 'Tooltip' function. If enabled, the name of the element under the mouse pointer is displayed in the Tooltip.

>Animations

This feature toggles smooth pan and zoom operations in 3D View when the Zoom To and Walk To options are used. The zoom operation is animated to show the transition from the original view definition to the final view definition. This feature only operates if the system determines that the hardware is capable of performing a smooth pan and zoom with the size of model displayed in the 3D View.

3.2.2 Mouse Wheel Zoom



Rolling the mouse wheel forwards zooms in on the currently active 3D View. Rolling the mouse wheel backwards zooms out on the currently active 3D View.

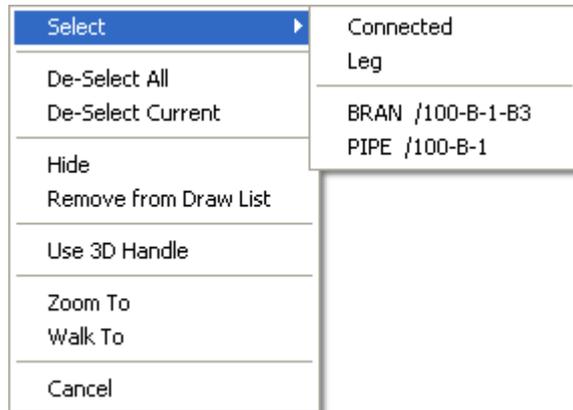
In both cases, holding down the  or Ctrl key at the same time as rolling the mouse wheel controls the speed of the operation. Holding the Ctrl key down makes the mouse wheel zoom in and out faster. Holding the  key down makes the mouse wheel zoom in and out slower.

3.2.3 Design Item Entries

This section describes view options on elements in the Model Editor. The element must be selected.



(Equipment Selected)



(Piping Component Selected)

The following viewing options are available on a design item:

Menu Option	Description
Edit >Equipment	Removes the Movement Handle (if present) from the Equipment item, allowing only Equipment editing functions to be carried out. (The Movement Handle can be reinstated if required by double-clicking on the  icon on the main toolbar.
Select>Connected	(Piping Components only). Selects Components connected to the selected Component.
Select>Leg	(Piping Components only). Selects Components in the same pipe leg as the selected Component.
Select>BRAN . . .	(Piping Components only). Selects the owning Branch.
Select>PIPE . . .	(Piping Components only). Selects the owning Pipe.
De-Select All	Clears the current graphical selection.
De-Select Current	Clears the graphical selection of the current element (but leaving the rest of the elements in the selection selected (for example, Components in a selected Branch)).
Hide	Removes the graphical selection from the display, but does not remove it from the drawlist
Remove from Draw List	Remove the graphical selection from the drawlist
Use 3D Handle	(Piping Component selected) Switch back to 3D Movement Handle (see below for further details).

Menu Option	Description
Zoom To	Centres the view on the current graphical selection, or on the current element if there is no graphical selection. The current element or graphical selection fills the graphics window
Walk To	Same as Zoom To except that Walk To removes any item between your eye position and the target object if that item is not in the immediate vicinity of the target item.

Note: Selecting a Piping Component while in Model Edit mode causes the Graphical Component Modification facilities to be entered. The **Use 3D Handle** menu selection switches from the Graphical Component Modification Handle to the 3D Movement Handle.

3.2.4 View Manipulation Toolbar Buttons

The View Manipulation toolbar on the left side of the 3D View window provides quick access to the most commonly used view manipulation operations.

3.2.5 Clipping and Capping

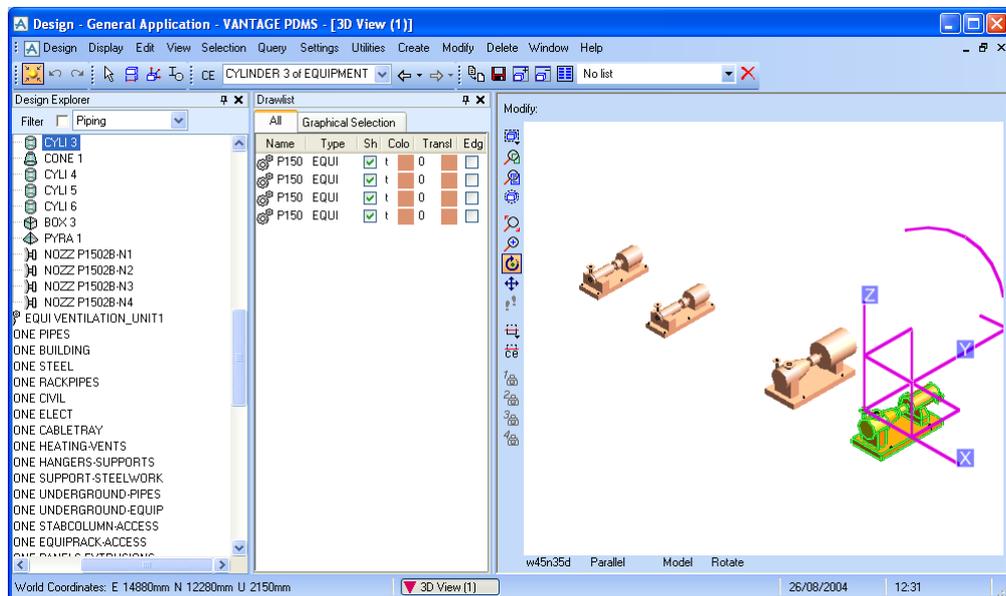
Clipping displays only those parts of the model which fall inside a clipping box. Capping allows the faces cut by the clip box to be filled with a colour. Capping is available only on machines with graphics cards that support this feature.

On Model Editor 3D Views, these features are made available from the 3D View toolbar.

See [Clipping](#) for a description of the clipping features.

4 Model Editor Operations

4.1 Model Editor Mode



The Model Editor is a mode of operation in Outfitting Design which enables you to reposition selected Items using the mouse pointer.

 You enter Model Editor mode by clicking the Model Editor button on the main toolbar, and return from the Model Editor to Design Navigate mode by clicking the button again. Alternatively, the **Edit>Model Editor** menu selection may be used to enter and leave Model Editor mode.

In this user guide, a **3D View** that can be switched into Model Editor mode is called a **3D Model Editor View**. See [Introducing the Model Editor 3D View](#) for details of the 3D Model Editor View. The features described here for selecting, moving and rotating items by using the mouse are available only in the Model Editor.

4.1.1 Element Selection in the Model Editor

Groups of selected Items can be moved or rotated in a single operation. The collection of selected items is called the **Graphical Selection**. The Items that can be selected and modified using the Model Editor are listed in [Selectable Items](#).

Items can be added to or removed from the current Graphical Selection by picking them using the mouse pointer. Selection facilities are provided which allow you to select groups of related items in a single selection operation.

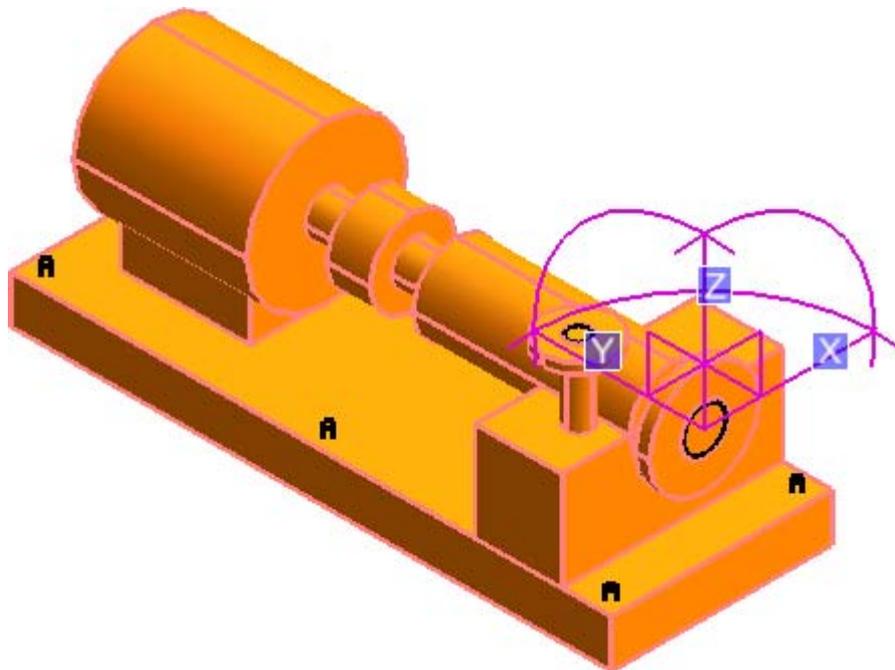
Drag rectangle (**Fence**) selection allows groups of elements to be selected easily. You can define whether to select only those elements that are wholly within the rectangle or to include those that are partially within the rectangle.

A **Re-Select** function is provided to go back to the previous Graphical Selection. This is useful if the Graphical Selection has been lost by accidentally using a clear selection operation or beginning another selection.

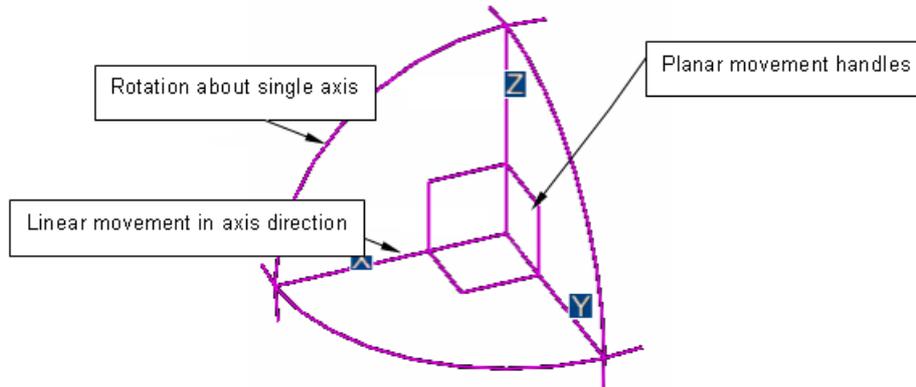
Clicking in blank space in a 3D Model Editor View, or using **De-Select All** on elements clears the Graphical Selection.

A **Locator Handle** appears when a Graphical Selection is present. This is used to manipulate the position and orientation of the entire Graphical Selection.

Note that if the element is marked as Read-Only, the selection is highlighted using a red line (rather than a green line):



4.1.2 Locator Handle

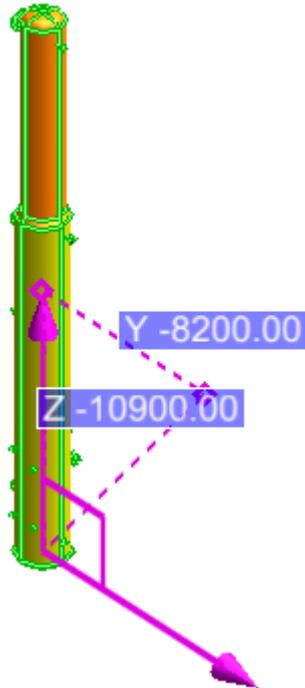


The **Locator Handle** is a collection of individual graphical manipulation handles grouped together. The Locator Handle can be used to drag the entire Graphical Selection to a new position or rotate the entire Graphical Selection through an angle about a selected axis.

This combination of direct graphical manipulation handles offers you the ability to move selected items constrained in a direction or to lie in a plane, or rotate the selection about an axis.

See [Positioning and Orientation using the Locator Handle](#) for details of using the locator handle.

4.1.3 Movement

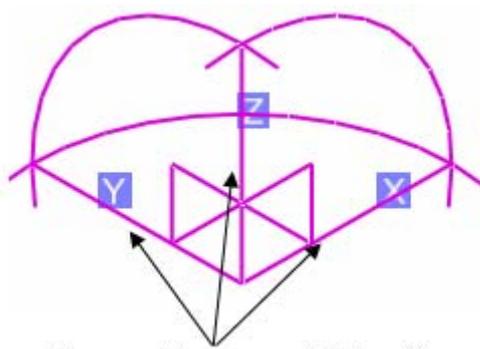


A Graphical Selection is moved using linear and planar handles on the Locator Handle, or by using the **Edit** menu.

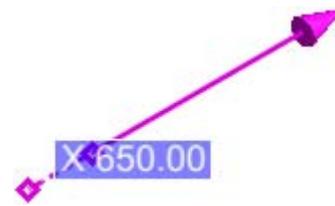
Dragging a linear or planar handle with the mouse pointer moves the current Graphical Selection. The movement is made in steps, the size of which can be controlled by you (the **Movement Increment**). This allows the Graphical Selection to be positioned accurately in relation to its original position.

The Graphical Selection can be moved until it is aligned with another item in the display by using Locator Handles, the Edit menu, or by dragging with Feature Identification mode switched on (see *Alignment*).

Clicking and dragging one of the three **Linear Movement Handles** constrains the movement of the selection to be in the direction of the selected axis.

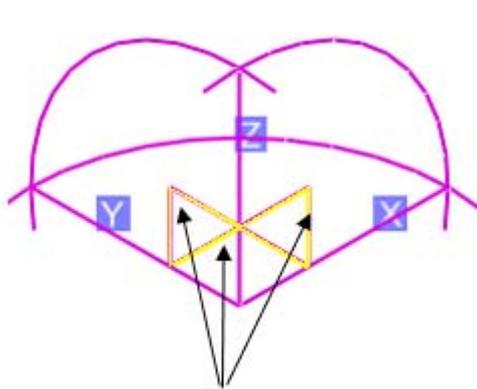


Linear Movement Handles

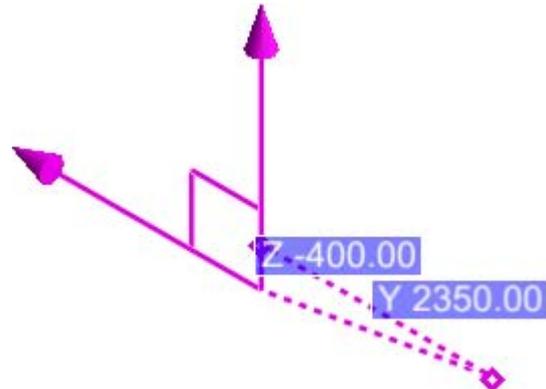


Linear Constrained Movement

Clicking and dragging one of the three **Planar Movement Handles** constrains the movement of the selection to be in the plane of the selected planar handle.

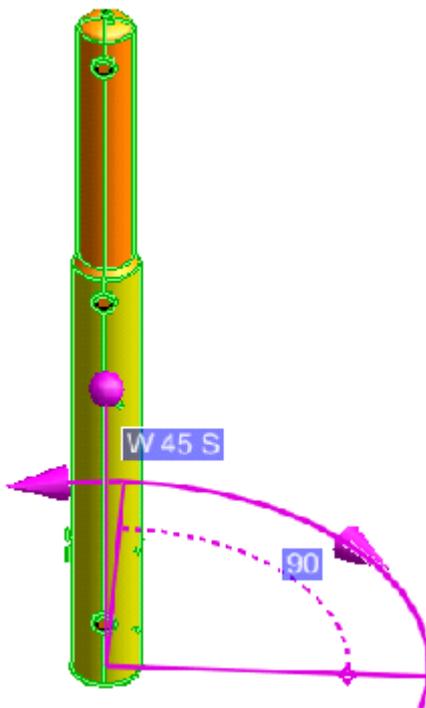


Planar Movement Handles



Movement Constrained to be in a Plane

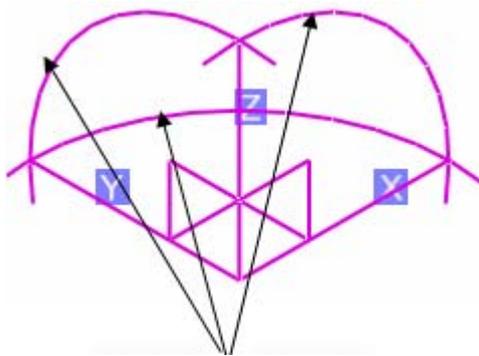
4.1.4 Rotation



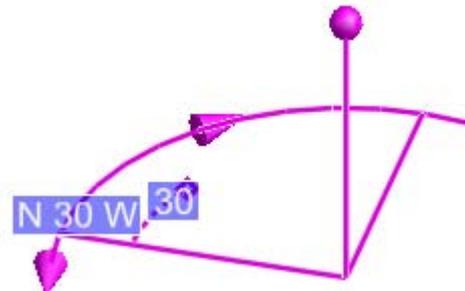
The Graphical Selection is rotated using a Rotation handle. The selection rotates in angular steps as it is dragged with the mouse, the size of which can be controlled by you (the **Rotation Increment**). This allows the Graphical Selection to be rotated accurately from its original orientation.

The Graphical Selection can be rotated until an axis of the Locator Handle is aligned with another item in the display by using Locator Handles, or by dragging with Feature Identification switched on (see [Alignment](#)).

Clicking and dragging one of the three **Rotation Handles** constrains the rotation of the selection to be about the axis corresponding to the selected rotation handle.



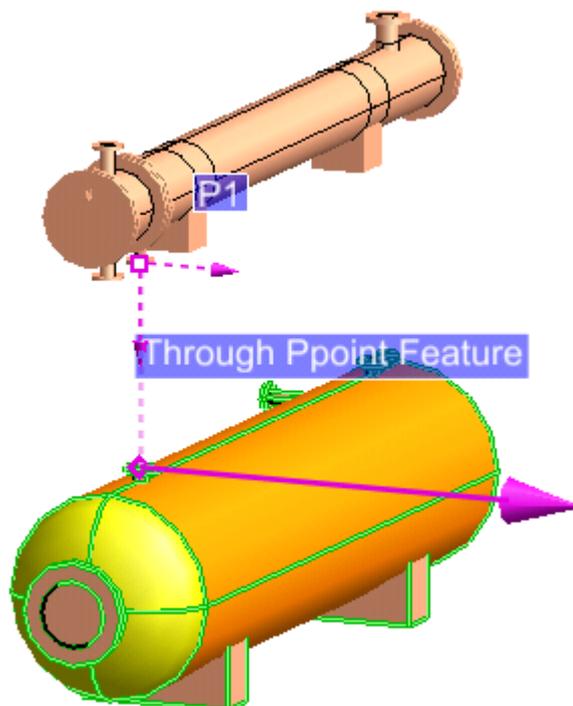
Rotation Handles



Constrained Rotational Movement

4.1.5 Alignment

The Graphical Selection can be moved or rotated until it aligns with a point, P-point, P-line or straight line (edge) in the model. In this document, the target points and lines are called **features**.



The origin of the Locator Handle is the reference datum for aligning the Graphical Selection.

4.1.6 Locator Handle as a Frame of Reference

The Locator Handle can be moved or rotated independently of the Graphical Selection. This allows you to set a datum for movement and alignment operations, or to set an axis of rotation about which the Graphical Selection can be rotated.

4.1.7 Feedback

The locator handle changes shape to show movement or rotation constraints.

Movement and rotation feedback for freehand operations is displayed both in the 3D View and on the status bar. This allows both world position and displacement from the starting position to be shown. The distance values are output in the style and units set on the **Current Session Units** form (**Settings>Units**).

If feature alignment is in use, feedback is given on features as the mouse pointer passes over them, and graphical feedback is provided to help achieve the correct alignment in a 3D model.

4.1.8 Unconstrained Positioning

The Locator Handle provides functions for positioning the Graphical Selection constrained in a given direction or in a plane. However, it is sometimes necessary to specify a new position without any constraints applied to movement of the Graphical Selection.

An unconstrained position can be specified by typing world co-ordinates into a form, by typing a 3D offset from the current Location Handle position, or by snapping to a Point feature.

4.1.9 Undo and Redo

Undo and Redo functions in Model Editor mode allow you to step backwards or forwards through one or more movement or rotation operations. Undo and Redo operate on a sequence of direct graphical manipulation operations in the Model Editor.

Note: Undo/Redo operations can also take place outside of Model Editor Mode. If the Undo operation involves moving into or out of Model Editing mode, then the switch into that mode happens automatically, and the Model Editor button and menu option reflect the change. The selection set and handle appropriate to the editing operation that was being used will also be restored.

Note: Other 'undoables' (operations or sequences of operations that can be undone) can be defined as a PML 'undoable object' - see the [Software Customisation Guide](#).

4.1.10 Performance

The speed of interactive selection and dragging operations is dependent on both the specification of the hardware being used, and on the complexity of the model displayed in the 3D View. Generally, it is advisable to minimise the size and complexity of the displayed model in order to obtain good interactive feedback from the system.

Performance tips when using Model Editor:

- Display only those elements that are necessary for the modification that you are performing. As you drag a graphical selection on the screen, the display is continuously redrawn.

- Avoid using large graphical selections. It may be better to make bulk moves in small groups.
- Avoid drawing the model with high levels of detail. For example, do not display the model with holes drawn; do not use a fine arc tolerance.
- Avoid drawing the model with P-points switched on.

4.2 Element Selection in the Model Editor

In order to move or rotate items, you must first select the items to modify. The collection of selected items is called the **Graphical Selection**. Items may be added to or removed from the current Graphical Selection by various selection methods:

- picking with the mouse pointer
- dragging a rectangular fence around items to be selected
- using selection operations to select related groups of items
- clearing the Graphical Selection.

The Outfitting Design database elements that can be selected and modified using the Model Editor are listed in [Selectable Items](#).

4.2.1 Selection Feedback

Selected elements are highlighted so that they stand out from all the other elements in the graphics display.

A **Locator Handle** appears when a Graphical Selection is present. This can be used to manipulate the position and orientation of the entire Graphical Selection.

- **Modifiable and non-modifiable elements**

Elements that can be moved or rotated by you are highlighted with a green wireframe highlight when you click on them in Model Editor mode. If you do not have permission to move or rotate an element, it is highlighted in a red wireframe.

It is not always possible to determine whether a move or rotation operation can be carried out when items are selected. It is possible that a move or rotation operation could be rejected if Outfitting Data Access Control determines that the current user is not permitted carry out the operation.

4.2.2 Selecting Items Using the Mouse Pointer

Items are selected by clicking on the item with the left mouse button in the 3D graphics view.

The **Ctrl** key is used to add unselected items to the current selection or remove selected items from the Graphical Selection. Available selection methods are:

- Single click on an unselected item creates a new Graphical Selection containing that one item.
- Single Ctrl-click on an unselected item to add it to the current Graphical Selection.
- Single Ctrl-click on a selected item to remove it from the current Graphical Selection.
- Picking implied tube, or using a **Select Leg** operation on a Piping Item (see [Item-Specific Selection Operations](#)), selects a Pipe leg. Using the Ctrl key with a Pipe leg selection adds to the Graphical Selection if an unselected item is picked. Ctrl with selected implied tube pick removes the Pipe leg.

Note: That the Ctrl with a selection on a selected item does not remove the selection from the list.

4.2.3 Fence Selection

A group of items can be selected by using a **fence selection**. There are two fence selection options - **Wholly Within** and **Wholly And Partially Within**.

Wholly Within selects items that are entirely contained inside the rectangular boundary of a fence selection.

Wholly And Partially Within selects both items that are entirely contained inside the rectangular boundary of a fence selection, and items that cross the boundary.

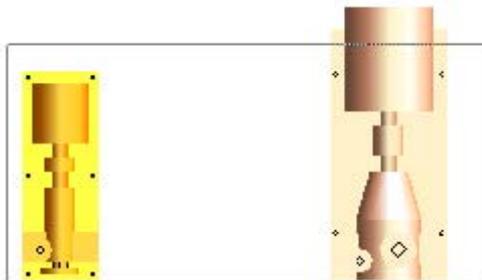
Fence selection can be carried out with either the right or left mouse button. The 'Within' setting is achieved from a right mouse button fence select - see below.

- **Fence select using the left mouse button**

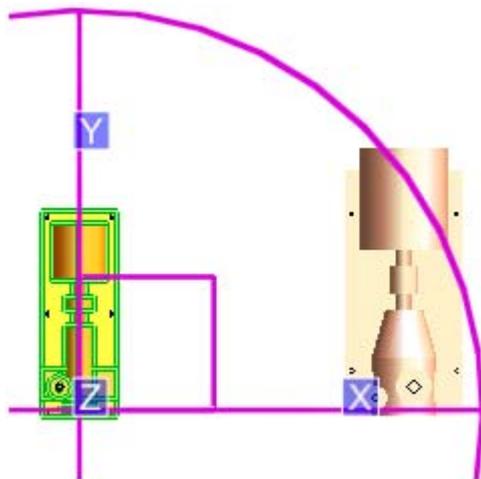
Drag a rectangle surrounding the items to be selected by pressing the left mouse button down at one corner of the rectangle, and drag the mouse pointer to the opposite corner. The selection takes place when the mouse button is released.

The items selected depend on the current 'Within' setting - see **Fence Select using the right mouse button** below.

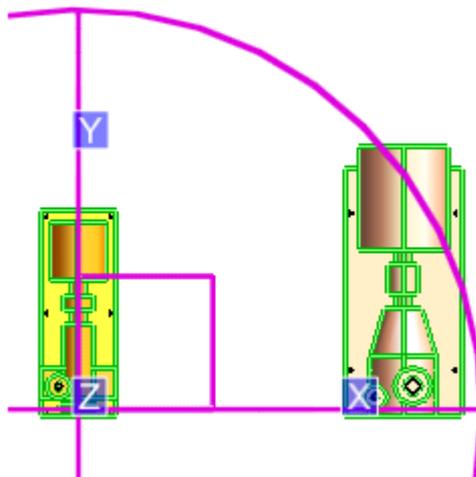
The illustrations below show the effects of each selection.



selection rectangle



if **Wholly Within** is selected

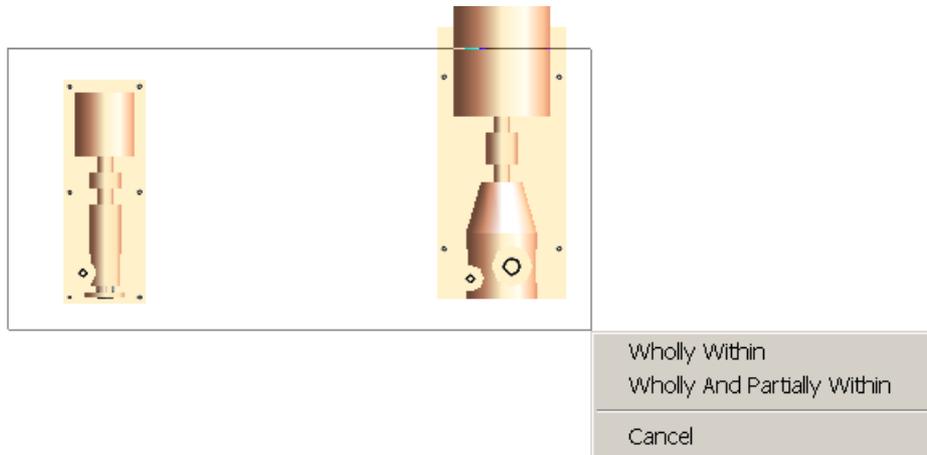


if **Wholly And Partially Within** is selected

Pressing the **Esc** key during the drag aborts the selection.

- **Fence Select using the Right Mouse Button**

Drag a rectangle surrounding the items to be selected by pressing the right mouse button down at one corner of the rectangle, and drag the mouse pointer to the opposite corner. The menu shown in the picture below appears when the mouse button is released.



The selection takes place when one of the options on the menu is selected.

Pressing the **Esc** key during the drag or prior to selecting from the menu aborts the selection. Clicking away from the selection or selecting **Cancel** on the menu also aborts the selection.

- **Adding to an existing Graphical Selection with a fence selection**

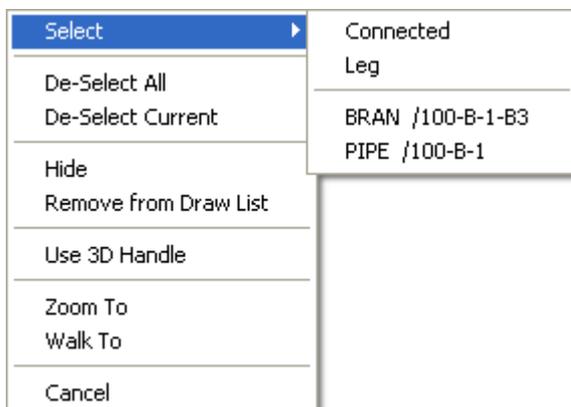
Holding the **Ctrl** key down while performing a fence selection adds the selected items to the existing Graphical Selection.

- **Removing selected items from an existing Graphical Selection with a fence selection**

Holding the  key down while performing a fence selection removes the selected items from the existing Graphical Selection.

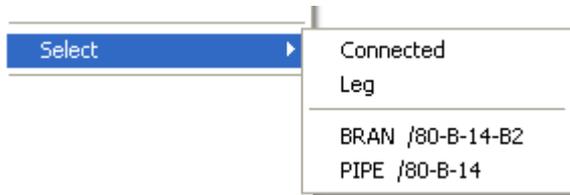
4.2.4 Item-Specific Selection Operations

Item-specific selection operations can be found on some Ship items.



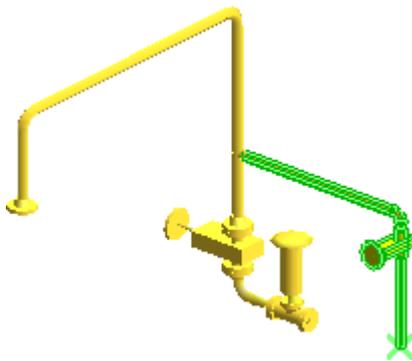
on a **Piping Component** showing selection options

- **Select Pipe and Branch Owners**



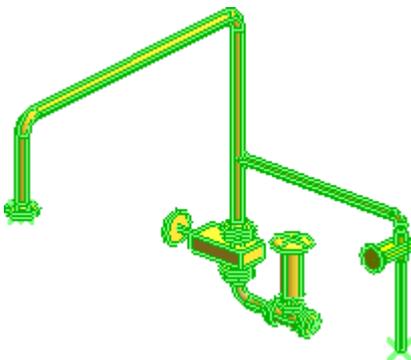
- **Select Branch**

The **Select BRAN** option selects the owning Branch, highlighting it with a green line:



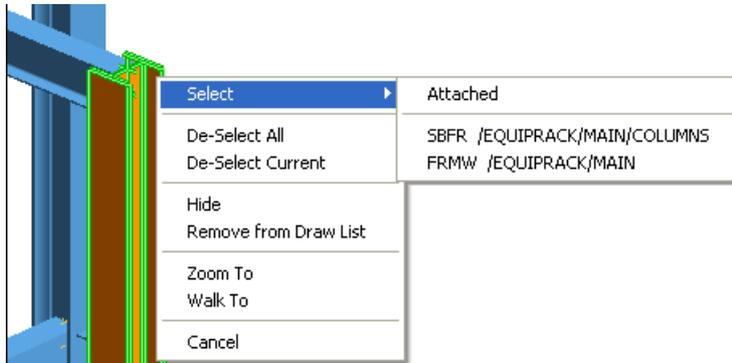
- **Select Pipe**

The **Select An Owner>PIPE** option selects the owning Pipe, highlighting it with a green line:



- **Select Attached Steelwork Sections**

The **Select>** options on a Steelwork Section have a similar function to that with Piping Components.



If a Section is selected, then **Select>SBFR** selects all elements in the owning Subframework.

Select >FRMW . . . selects the owning Framework.

4.2.5 Clearing the Graphical Selection

There are four methods to clear a Graphical Selection:

- Click in blank space in the graphics 3D view.
- Select **De-Select Current** on a selected element in the 3D view.
- Select **De-Select All** on an element in the 3D view. (This is provided for the case where the 3D view is full, so no part of the 3D view background can be seen.)
- Leave Model Editor mode.

4.2.6 Reinstating the Previous Graphical Selection

If a Graphical Selection has been lost accidentally by clearing the selection or by starting a new selection, the previous selection can be reinstated by selecting **Edit>Re-Select** from the main menu bar.

Leaving Model Editor mode clears the Graphical Selection, but you can reinstate the last Graphical Selection on return to Model Editor mode by using **Edit>Re-Select**.

4.2.7 Selection Menu

The **Selection** menu on the main menu bar contains commands for setting properties of the Locator Handle and the Graphical Selection.



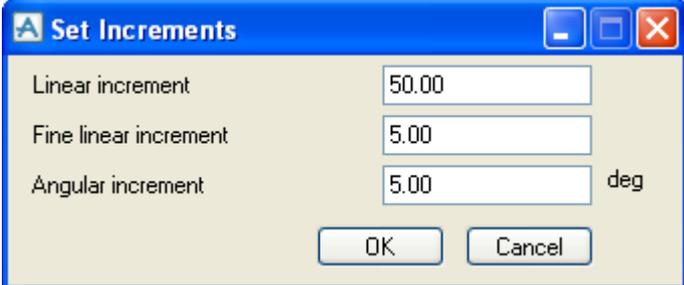
- **Feature Highlighting**

Enables or disables **Feature Identification Mode**. Feature Identification Mode is described in [Positioning and Orientation using the Locator Handle](#).

If the mouse pointer is over a 3D Model Editor view, and the Model Editor is active, pressing the **F** key on the keyboard toggles between feature identification mode being switched on or off.

- **Set Increments**

Set Increments shows a form for setting the active movement or rotation increments:



Field	Value	Unit
Linear increment	50.00	
Fine linear increment	5.00	
Angular increment	5.00	deg

The Linear increment is specified in the currently active units, or units can be specified by using Outfitting units of measure syntax.

- **Set Handle Colour**

Allows you to change the colour of the Locator Handle. The list of available colours is shown on the submenu.

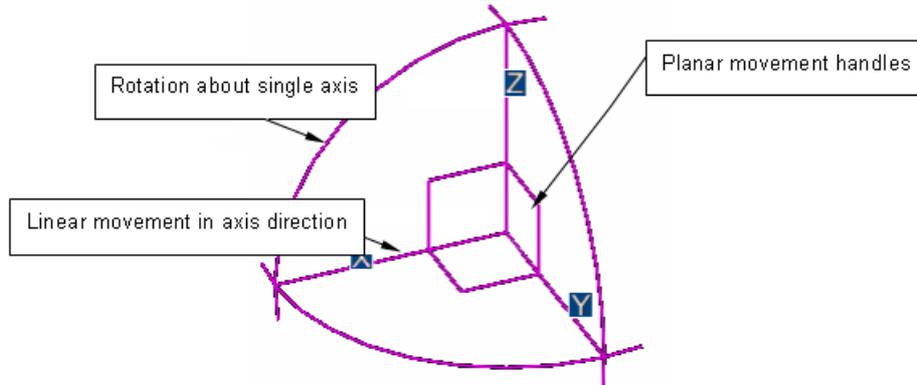
- **Drag Image**

During a drag operation using the Locator Handle, an image of the Graphical Selection follows a constrained path defined by the current mouse pointer position. The style of feedback for all items in the Graphical Selection can be selected from the submenu list.

- **Select Rectangle**

Sets the mode of operation of Select Rectangle on the left mouse button to be **Wholly Within** or **Wholly And Partially Within**.

4.3 Positioning and Orientation using the Locator Handle



The Locator Handle consists of a family of graphical manipulation handles, each of which applies a constraint to the way in which the Graphical Selection is moved.

This section describes how to move or rotate the current Graphical Selection using the Locator Handle.

4.3.1 Overview

The Locator Handle provides three ways to move or rotate a Graphical Selection:

- dragging the linear, planar or rotation handles freehand with the mouse pointer
 - aligning with points, P-points, P-lines or straight lines (edges) on other displayed Ship items
 - typing in offset distance or angular displacement values
- **Aligning the Graphical Selection with points or lines on other displayed items**

When aligning a Graphical Selection with other Ship items in the displayed model, you enter **feature identification mode**, where the mouse pointer is sensitive to finding features on the Design graphics. Features are points, straight lines (edges), P-points or P-lines. Points are located at vertices on the model, such as the corner of a box, and at the mid-point of lines. Lines are straight edges on the model (Design Aid graphics cannot be used as a feature).

Feature identification mode is turned on and off by selecting **Feature Highlighting** on the **Selection** menu, or by pressing the **F** key when the mouse pointer is over a 3D Model Editor View, and the Model Editor is active.

Some operations turn on feature identification mode temporarily to allow you to pick a feature. For example, **Edit>Move Selection>Snap To Point**. Once the required feature is identified, the mode reverts to its state before the command was actioned.

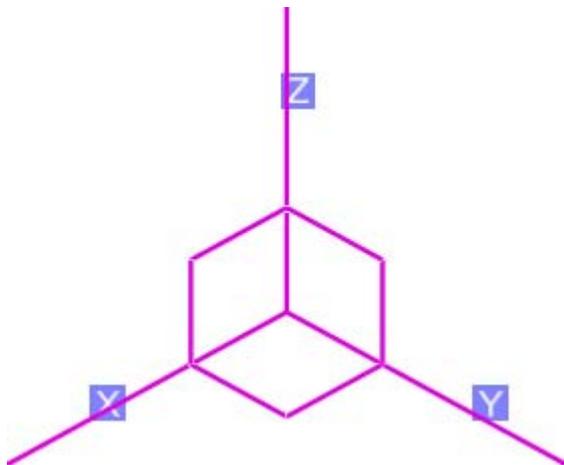
Aligning the Locator Handle with features in the model is described in [Linear Movement Handle](#) to [Rotation Handle](#).

- **Automatic Scrolling**

If the target location for a drag operation is outside of the 3D view, the mouse pointer can be moved to an edge of the view, where the view will pan automatically up, down, left or right according to the 3D view edge that the mouse pointer hits. The mouse pointer must move in order for the panning to continue. This may necessitate you making a small movement of the pointer near to the view edge to keep the pan operation going.

This technique for panning the view is appropriate for locating a target position that is just out of view.

4.3.2 Linear Movement Handle



The Linear Movement handle allows you to move the Graphical Selection constrained in the direction of the linear handle axis. The size of each step of the movement is defined by the current **movement increment**.

Dragging a linear handle with the left mouse button moves the Locator Handle and Graphical Selection in the direction of the linear handle.

To initiate a linear drag, press the left mouse button down over one of the linear movement handles. With the left button still pressed, moving the mouse drags the Graphical Selection constrained in the selected direction, in steps defined by the movement increment.

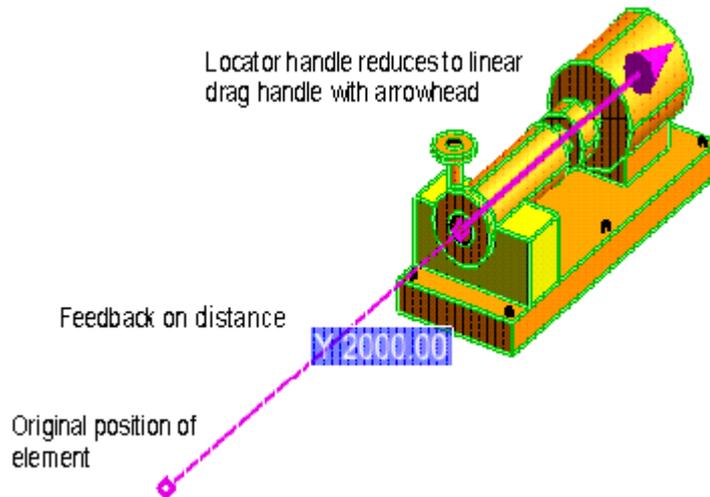
- **Moving one Movement Increment at a Time**

If the movement increment is small relative to the magnification of the 3D view, it can be difficult to move the mouse freehand to a precise displacement from the Locator Handle's original position. Fine control over positioning can be achieved by dragging with a linear handle so that it is close to the required position then, while continuing to hold down the mouse button, press the plus (+) or minus (-) key on the numeric keypad. This moves the Graphical Selection by one movement increment in the direction of the linear handle if + is pressed, or in the opposite direction if - is pressed.

Using the arrow keys in this way moves the Graphical Selection by 0.1 of the current movement increment for each press of the key.

- **Feedback**

When moving a selection in a constrained direction, the Locator Handle changes to a cut-down version of the full handle to show the direction of movement, as shown below. The current World position of the Locator Handle is displayed on the status bar, and an offset from the original position of the handle is displayed on the 3D View.



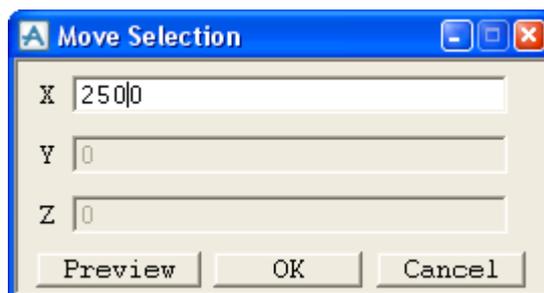
As the mouse moves over a linear handle, the pointer symbol changes to the linear drag pointer.

A Linear Handle has the following movement operations on its shortcut menu:



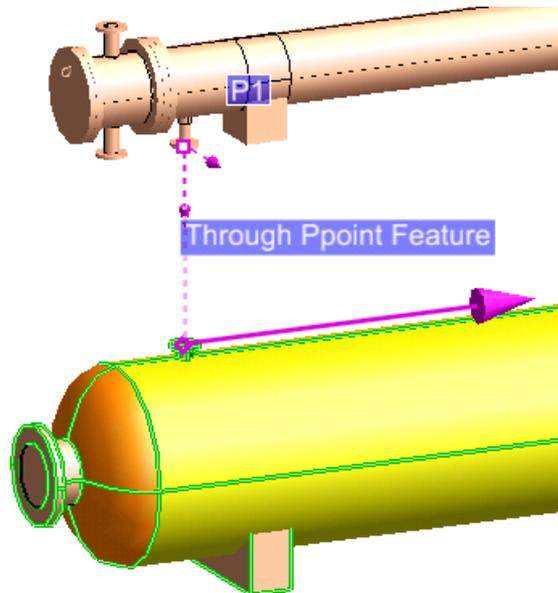
Enter Value^o

This command shows the following form:



The field corresponding to the selected axis is activated for input. In this case, entering 2500 in the **X** field tells the Graphical Selection to move by 2500mm in the X direction of the Locator Handle.

Align with Feature^o



Repositioning a Graphical Selection to align with a Nozzle using the linear handle and feature alignment.

This method allows you to position the Graphical Selection in relation to another object on the screen, but forces the Graphical Selection to move only along the selected axis. The sequence of operations is as follows:

1. Make a Graphical Selection.
Optional: Position the Locator Handle at the required datum position.
2. Select **Align with Feature** on the linear handle .
3. Move the mouse to the target feature. This highlights the target feature, and the mouse pointer changes shape to indicate that the Graphical Selection will be aligned with the target position if the mouse button is clicked.
4. Click the left mouse button to move the Graphical Selection to the target position.

Linear drag can align with a point feature or a line feature.

- **Point feature Alignment**

When positioning the Graphical Selection to a point feature, the origin of the Locator Handle is aligned with the target point such that the target point is projected onto the line of movement.

This situation is illustrated below (in two dimensions):

- **Alignment with a Line or P-line Feature**

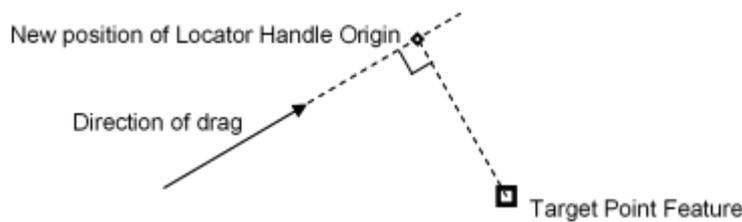
There are two cases to consider:

- Selected line feature is orthogonal to the line of movement

If the line selected line feature is orthogonal to the line of movement, then the feature line is treated as a feature point. Any position along the feature line projects onto the same point on the movement line.

- Selected line feature not orthogonal to the line of movement

If the line selected line feature is not orthogonal to the line of movement, then the intersection of the extended feature line with the line of movement becomes the new Locator Handle origin position. If the extended feature line and the movement line do not intersect in 3D, then the point chosen is the nearest point on the line of movement to the extended feature line.



This situation is illustrated below (in two dimensions):

- **Alignment with a P-point Feature**

There are two cases to consider:

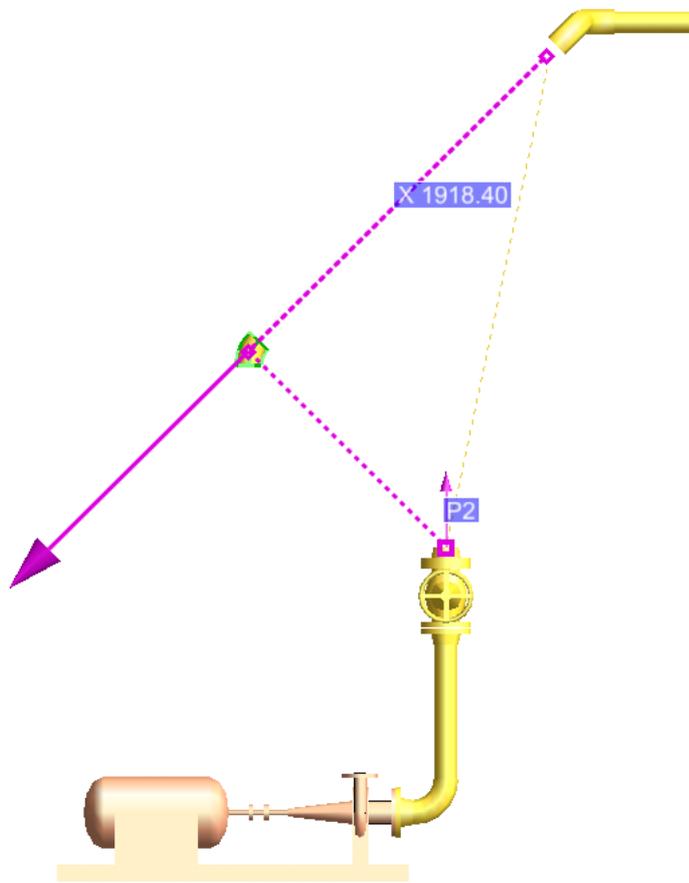
- P-point as point feature

A P-point feature may be treated as a point feature, and works as described above for points.

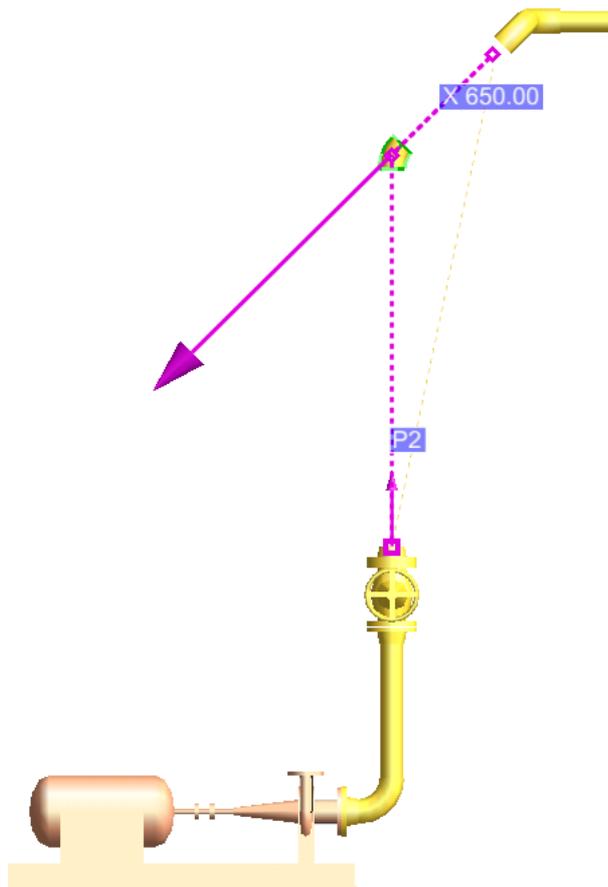
- P-point as a Line feature

A P-point has a direction, which is indicated by the arrow on a P-point feature symbol. If the mouse pointer is moved over the P-point arrow, then the intersection of the P-point direction with the line of movement becomes the new Locator Handle origin position. If the P-point direction and the movement line do not intersect in 3D, then the point chosen is the nearest point on the line of movement to a line projected from the P-point position in the P-point direction.

The following pictures illustrate the difference between P-point as a point and P-point as a line:



Mouse over P-point position

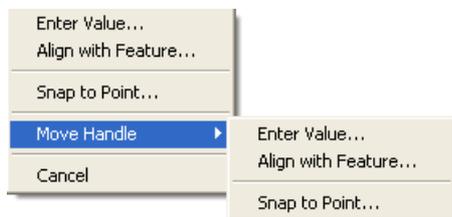


Mouse over P-point arrow

Snap To Point

Snap To Point allows the Graphical Selection to be moved to a Point feature. The Graphical Selection is not constrained to move along the direction of the Linear Handle. This is described in [Positioning and Orientation Using the Edit Menu](#).

Move Handle

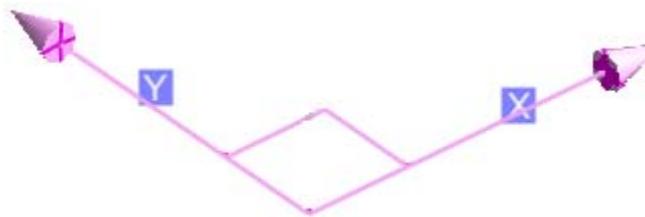


The **Move Handle** submenu provides the same movement commands as the main Linear Handle menu, but these commands move the Locator Handle only. They do not move the Graphical Selection.

The Locator Handle may be moved independently of the Graphical Selection in order to change the datum position for the next operation on the Graphical Selection.

4.3.3 Planar Movement Handles

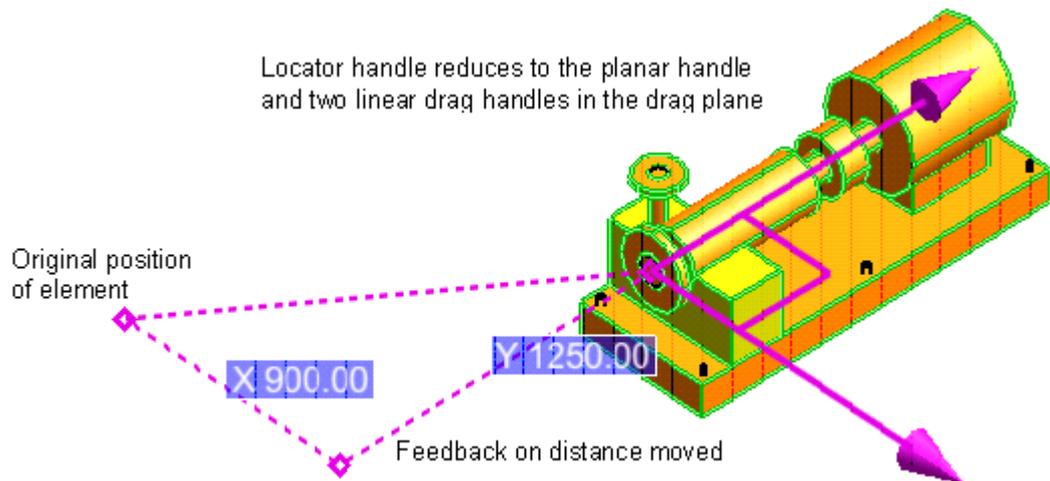
Each of the planar movement handles constrains the drag operation such that the Graphical Selection moves only in the plane of the selected handle. The handle moves in steps determined by the current Movement Increment setting.



To initiate a planar drag, you press the left mouse button down over one of the planar movement handles. With the left button still pressed, moving the mouse drags the Graphical Selection constrained in the selected plane, in steps defined by the movement increment.

- **Feedback**

A triangle is displayed on the current constraint plane, between the original position of the handle and the current position. The relative movement distances are shown on the sides of the triangle. The current World position of the Locator Handle is displayed on the status bar. All values are shown in the current selected units.



The Locator Handle changes to a simple version of the full handle to show the plane of movement as shown below.

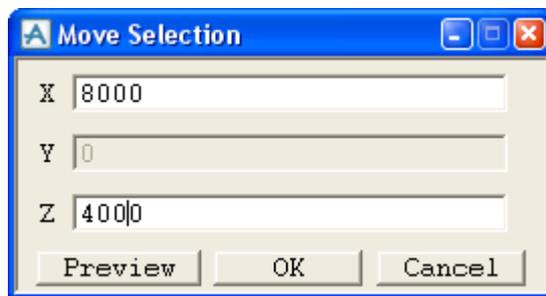
As the mouse moves over a planar handle the pointer symbol changes to the planar drag symbol.

A Planar Handle has the following movement operations on its shortcut menu:



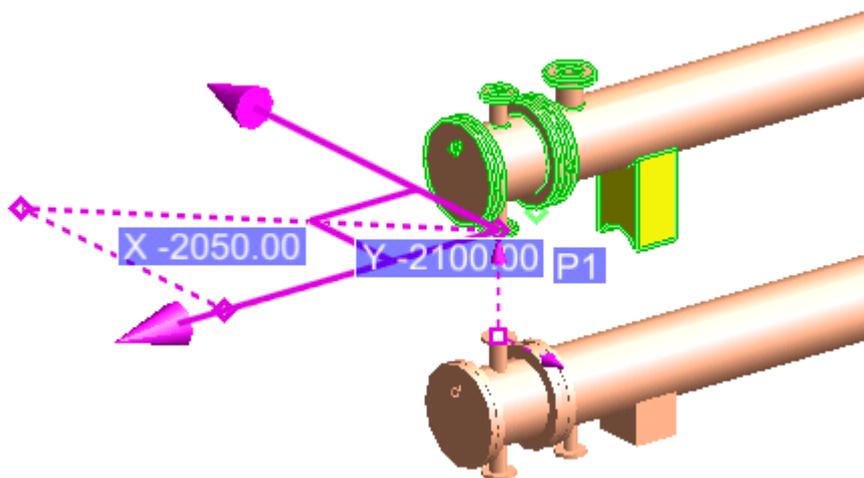
Enter Values⁰

This command shows the following form.



The fields corresponding to the selected plane are activated for input. In this case, entering 8000 in the X field and 4000 in the Z field tells the Graphical Selection to move by X8000mm Z4000mm in the XZ plane of the Locator Handle.

Align with Feature...



This facility allows you to position the Graphical Selection in relation to another object on the screen, but forces the Graphical Selection to move only in the selected plane. The sequence of operations is as follows:

1. Make a Graphical Selection.
Optional: Position the Locator Handle at the required datum position.

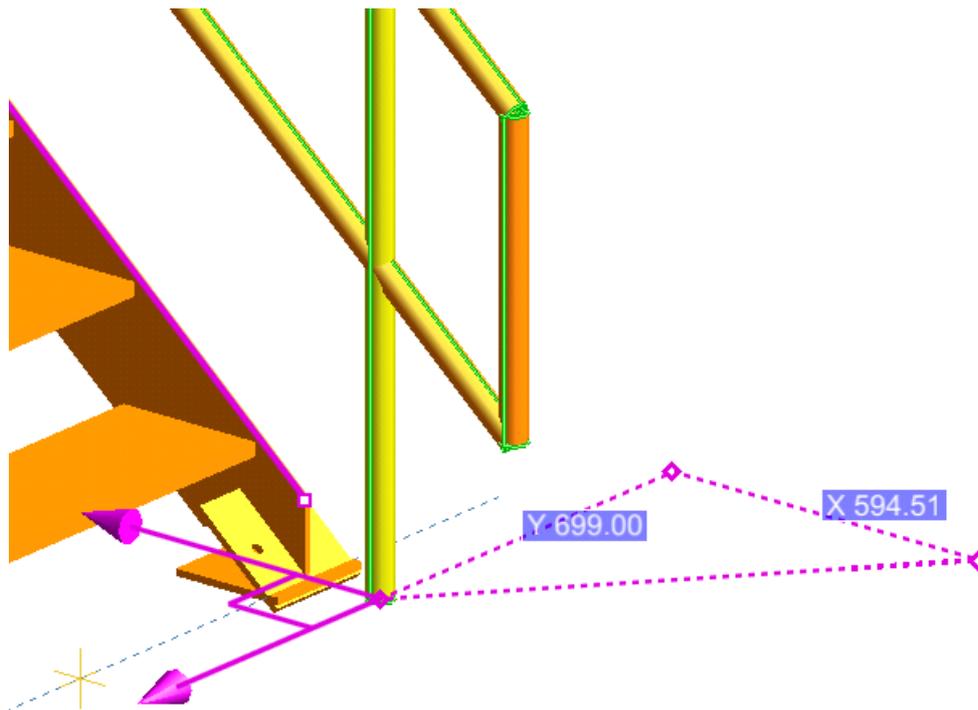
2. Select **Align with Feature...** from the planar handle.
3. Move the mouse to the target feature. A marker appears at the target point, and the mouse pointer changes shape to indicate that the Graphical Selection will be aligned with the target position if the left mouse button is clicked.
4. Click the left mouse button to move the Graphical Selection to the target position.

- **Point feature Alignment**

When positioning the Graphical Selection to a point feature, the origin of the Locator Handle is aligned with the target point such that the target point is projected onto the plane of movement. For example, the picture above shows the target P1 P-point position being projected onto the plane of movement of the Graphical Selection.

- **Alignment with a Line or P-line Feature**

If a planar move is to be aligned with a line feature, then the Locator Handle origin is placed where the extended feature line or P-point direction intersects with the movement plane. For example, in the following picture, the handrail is dragged in a horizontal plane, with the bottom of the first post positioned where the top of the stringer intersects with the plane. The feature selected is an edge on the top of the stringer.



Snap To Point^o

Snap To Point... allows the Graphical Selection to be moved to a Point feature. The Graphical Selection is not constrained to move in the plane of the Linear Handle. This is described in [Positioning and Orientation Using the Edit Menu](#).

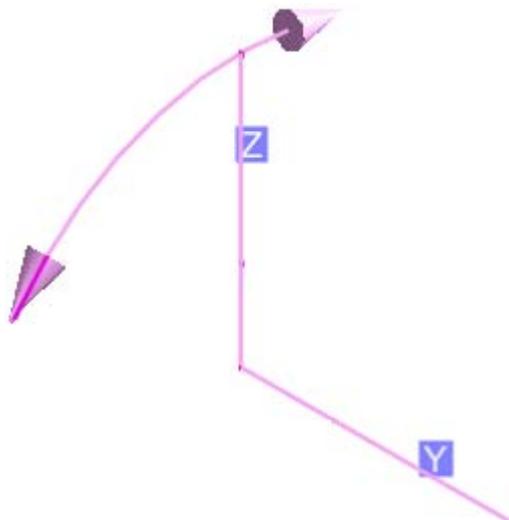
Move Handle



The **Move Handle** submenu provides the same movement commands as the main Planar Handle menu, but these commands move the Locator Handle only. They do not move the Graphical Selection.

The Locator Handle may be moved independently of the Graphical Selection in order to change the datum position for the next operation on the Graphical Selection.

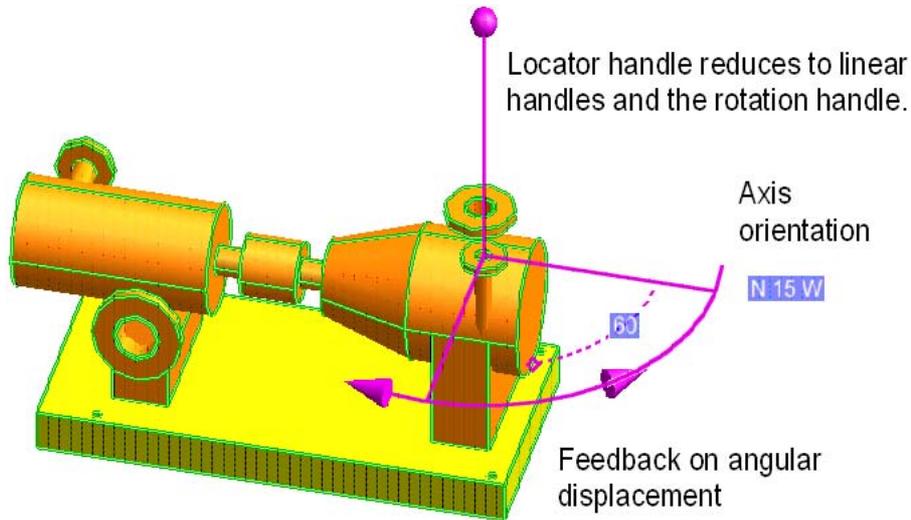
4.3.4 Rotation Handle



The rotation handles allow you to rotate the Graphical Selection around the relevant axis using the current **angular increment** to control the angular step size.

Dragging a Rotation handle with the left mouse button rotates the handle and the Graphical Selection about the axis of rotation. To perform a rotation, press the left mouse button over the relevant rotation handle. With the left button still depressed, drag the mouse to perform the rotation.

- **Feedback**



The angular movement from the original orientation is shown as the Locator Handle is rotated. The angular displacement is also shown in the status bar.

As the mouse moves over a rotation handle, the pointer symbol changes to the rotation drag symbol, and half of the Rotation Handle arc changes to show two arrows. This feedback indicates which of the axes will be aligned with a feature when feature alignment is used.

- **Rotation Handle**

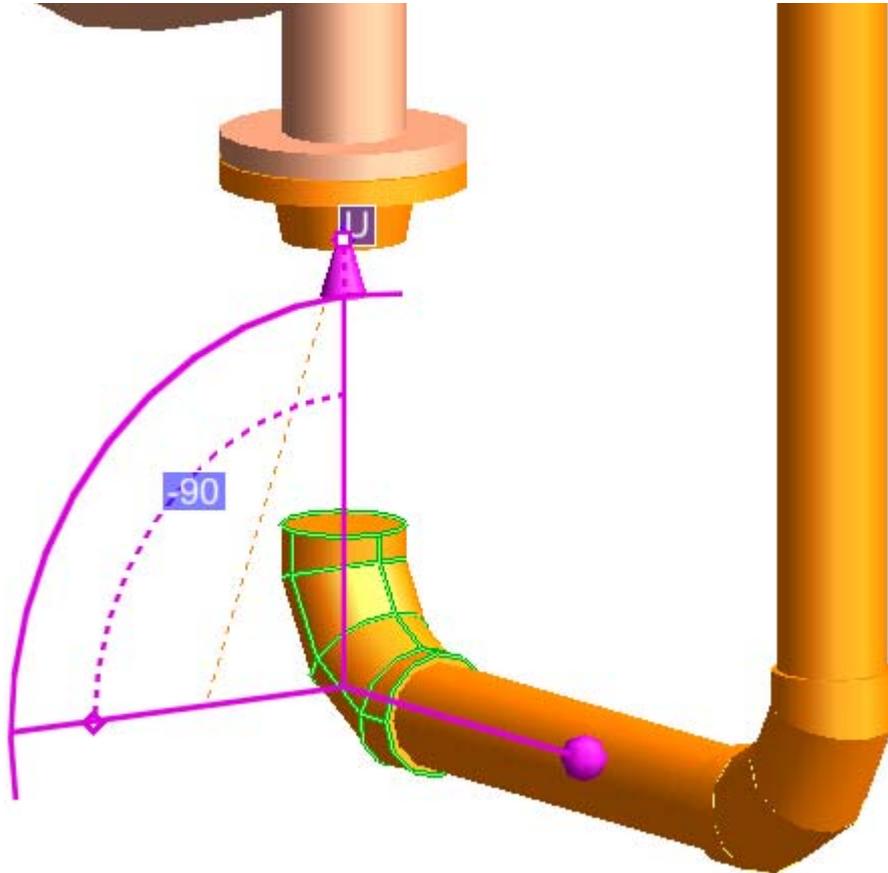
A Rotation Handle has the following movement operations on its shortcut menu:



Enter Value^o



This allows the Graphical Selection to be rotated about one of the Locator Handle axes.

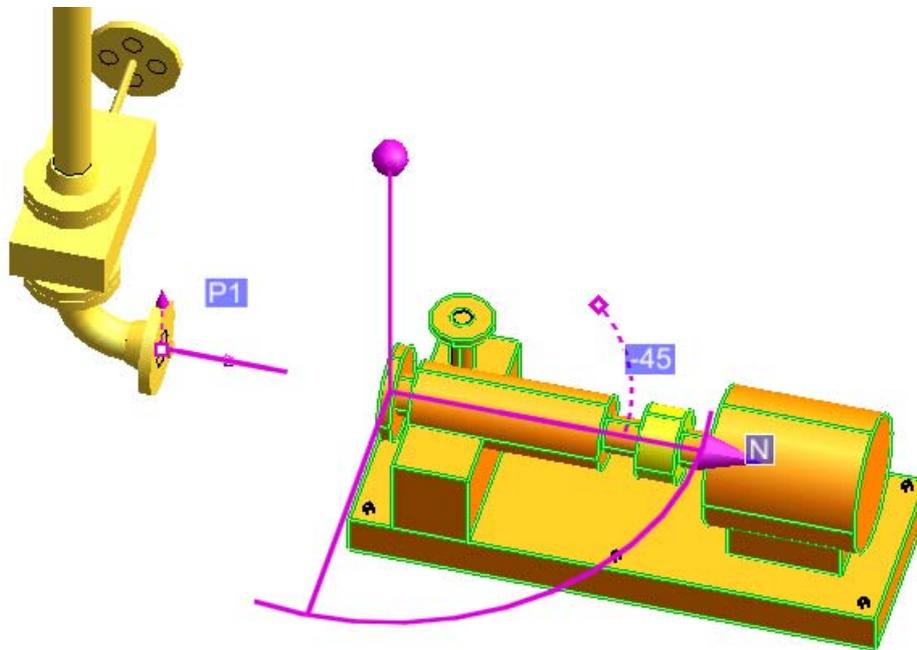
Orient to Point

Rotating an elbow to align with a Nozzle using a rotation handle and feature alignment

The sequence of operations is as follows:

1. Make a Graphical Selection
Optional: Position the Locator Handle at the required datum position
2. Select **Orient to Point...** from the Rotation handle
Move the mouse to the target point. The mouse pointer changes to indicate that a point has been located, and the axis is directed towards the point.
Click the primary mouse button to rotate the Graphical Selection to the target orientation.

Align with Direction

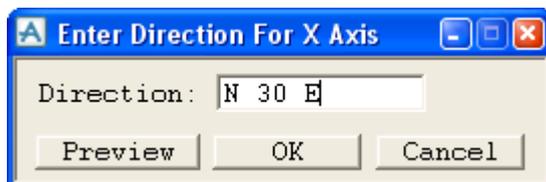


Rotating a pump to align with a flange using a rotation handle and feature alignment

The sequence of operations is as follows:

1. Make a Graphical Selection
Optional: Position the Locator Handle at the required datum position
2. Select **Align with Direction...** from the Rotation Handle .
3. Move the mouse to the target line (edge) or P-point direction. The mouse pointer symbol changes to indicate that the axis will be directed parallel to the edge. If the Graphical Selection is shown 180 degrees out of alignment, press the  key to get the alternate alignment. On a P-point, this can be achieved by choosing one of the arrows on the P-point feature.
4. Click the left mouse button to rotate the Graphical Selection to the target orientation.

Align with



Rotates the selection until the chosen axis points in the given direction. The Graphical Selection is rotated about one of the Locator handle axes, such that the chosen axis points as close to the direction specified as possible.

Rotate Handle



The Rotate Handle submenu provides the same rotation commands as the main Rotation Handle menu, but these commands rotate the Locator Handle only. They do not rotate the Graphical Selection.

The Locator Handle may be rotated independently of the Graphical Selection in order to change the frame of reference for the next operation on the Graphical Selection.

Rotate Handle>To World

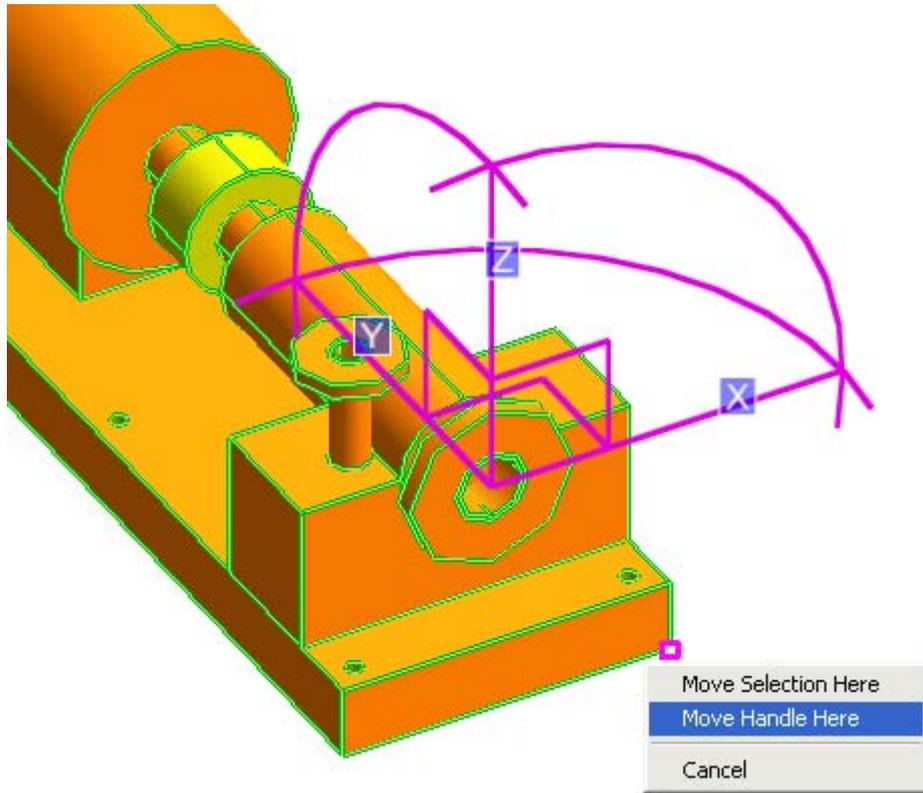
This command aligns the Locator Handle with the World co-ordinate system, without rotating the Graphical Selection. The Locator Handle Y axis points North, and the Z axis points Up.

4.3.5 Feature Highlighting

Having made a graphical selection in Model Editor mode, use **Selection>Feature Highlighting** to switch into a mode where features are identified as the mouse pointer passes over them on a 3D view. If Feature Highlighting is on, selecting it again switches feature snapping off. Alternatively, the **F** key can be used to toggle feature identification on and off if it is pressed over the 3D View while in Model Editor mode.

If the Graphical Selection is dragged using the Locator Handle while Feature Highlighting is on, it aligns itself with key features on the displayed model as the mouse pointer passes over them. See the sections on Linear, Planar and Rotation Handles for a description of how feature highlighting works for each handle.

There is an alternative method to select a feature. Moving the mouse over the 3D model without dragging the locator handle still highlights features. Pressing the right mouse button over a highlighted feature shows a menu that allows the Graphical Selection or the Locator Handle to be moved to the selected position.



for a point feature while in feature identification mode

Selecting **Move Handle Here** in the picture above moves the handle to the selected point.

In order to select features of an item, it is necessary to move the mouse pointer over the item before features are shown. In most cases, the target P-point or P-line lies on, or inside, an item, so selecting a feature is straightforward. In the few cases where the P-point or P-line is outside of the item, or partly obscured by another item in the scene, it is necessary to make sure that the mouse pointer first passes over the associated item.

On steelwork items with P-lines, the JUSL P-line is shown as a feature.

Feature identification:

- The Locator Handle can be moved to features on selected or unselected items.
 - The Graphical Selection cannot be moved to a reference point on selected items, because the selected items are shown in their new location when a reference point is found.
- **Cancelling the Drag**

At any point of the move, you can cancel the drag operation by pressing the **Esc** key. This is a standard way of cancelling a drag operation on Windows. When the drag is cancelled the selection reverts to its original position and remains selected.

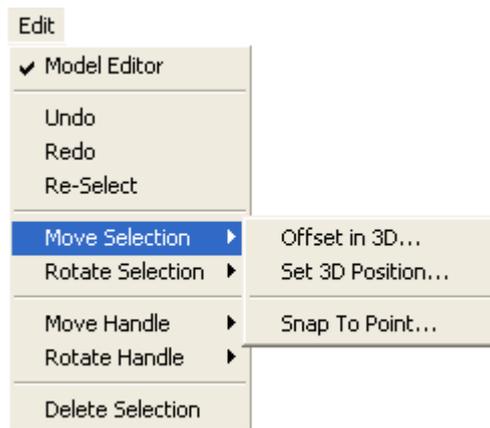
4.3.6 Moving the Locator Handle Independently of the Graphical Selection

A Locator Handle can be moved independently of the Graphical Selection. This allows a datum position to be set for subsequent move operations, or an axis of rotation to be set for subsequent rotation operations.

The Locator Handles and the Edit menu provide commands for moving and rotating the Locator Handle on its own. In order to drag the Locator Handle without the Graphical Selection, select the linear, planar or rotation handle by pressing the left mouse button down, and then press the **H** key on the keyboard. This detaches the Locator Handle from the Graphical Selection. The H key can be used to toggle between moving the Locator Handle on its own, and moving the Graphical Selection with the Locator Handle.

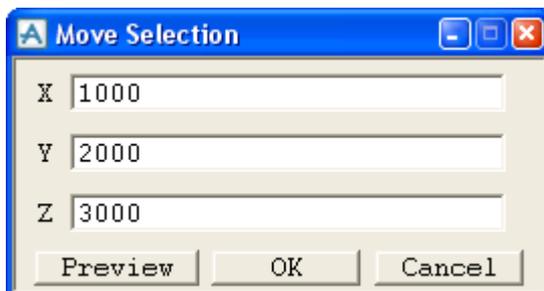
4.4 Positioning and Orientation Using the Edit Menu

4.4.1 Move Selection and Move Handle



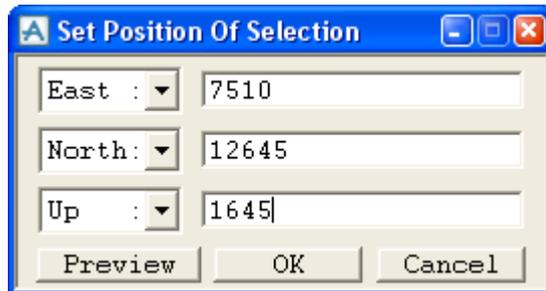
Move Selection moves the Graphical Selection. **Move Handle** moves the Locator Handle only. The three operations described below apply to both **Move Selection** and **Move Handle**.

- **Move Selection/Handle>Offset in 3D...**



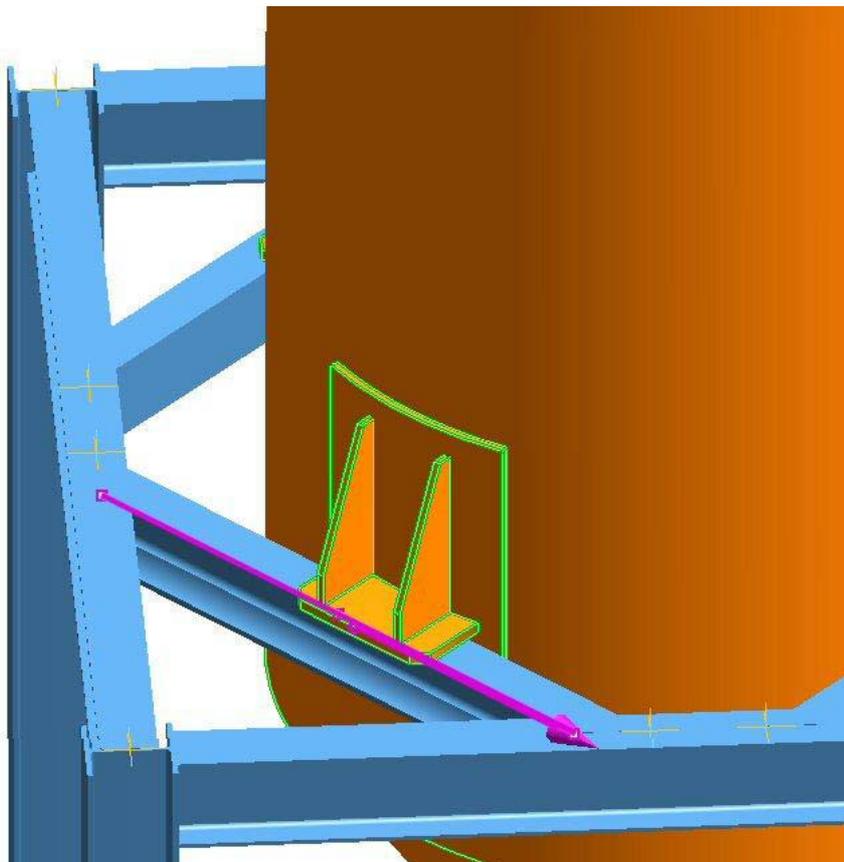
The Graphical Selection can be moved relative to its original position, in the co-ordinate system of the Locator Handle. The position of the Graphical Selection only changes if **OK** is clicked.

- **Move Selection/Handle Set 3D Position...**



This form shows the current position of the Locator Handle in World co-ordinates. Changing the settings and clicking **OK** moves the selection to the specified world co-ordinates.

- **Move Selection/Handle>Snap to Point**

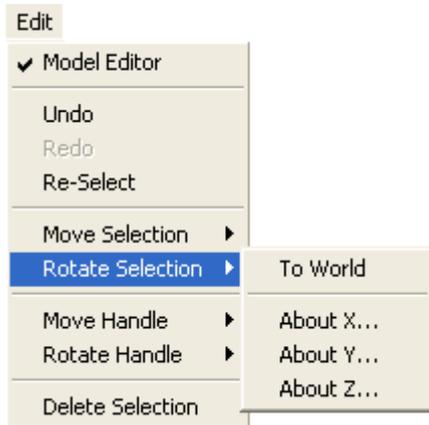


Repositioning an Equipment to align with the centre of a SCTN

This facility allows you to position the Graphical Selection at a selected position in relation to another object on the screen. The sequence of operations is:

1. Add one or more Ship items into a Graphical Selection
Optional: Position the Locator Handle at the required datum position
2. Select **Move Selection/Handle>Snap to Point** from the Edit menu
3. Move the mouse pointer to the target position. The pointer changes to indicate that the Graphical Selection will snap to the target feature
4. Click the left mouse button to move the Graphical Selection to the target position.

4.4.2 Rotate Selection and Rotate Handle



Rotate Selection rotates the Graphical Selection. **Rotate Handle** rotates the Locator Handle only. The four operations described below apply to both **Rotate Selection** and **Rotate Handle**.

- **Rotate Selection/Handle>To World**

This operation reorientates the Locator Handle and Graphical Selection such that the Y axis of the Locator Handle points in the World North direction, and the Z axis points in the World Up direction.

- **Rotate Selection/Handle>About X/Y/Z**

These three operation show the **Rotate Selection/Handle About** axis form for the selected axis.



This allows the Graphical Selection to be rotated about one of the Locator Handle axes.

4.5 Clipping

4.5.1 Clipping Submenu

Clipping lets you display only those parts of the model which fall inside a clipping box. The **Clipping submenu** is displayed by right-clicking on the **Clipping & Options** icon on the 3D View toolbar. The options available from this menu are:

Enable

Controls whether the clipped model or the whole model is displayed. The default is for clipping to be off.

Capped

When you use clipping, only the parts of the model which lie within the clipping box will be displayed. Where items are intersected by the clipping box, they can have a coloured cap added to show that they extend beyond the displayed region. Note that this feature is not available on all graphics cards.

To control whether or not caps are added, set Cap on or off. The default is for capping to be off.

Colour...

To change the colour used for capping, select the required colour from the displayed **Clip Cap Colour** form.

CE

Sets the clipping box to the current element.

Owner

Sets the clipping box to the owner of the current element.

Limits Box

Sets the clipping box to the dimensions of your explicitly defined Limits Box.

Pick Item

Sets the clipping box to the element you select from the 3D View.

Pick Limits

Lets you specify the extent of the clipping box by constructing a box between two points identified by picking on the displayed graphics. Positioning options for picking are controlled using by selecting from the options on the **Positioning Control** form.

Explicit

Selecting the **Explicit...** option displays the **Clip - 3D View** and **Positioning Control** forms. If a clipping box has previously been defined its dimensions and origin are shown on the **Clip - 3D View** form; if not, a default sized box is placed at the origin of the view. The current settings for the box are shown in the 3D View as a box, in the default aid line colour.

These forms allow you to define a new clipping box by either:

- Entering the dimensions and co-ordinates of the origin (centre) directly into the text-boxes on the **Clip - 3D View** form. You can use the drop-down list boxes to set the **North/South**, **East/West** and **Up/Down** axes as necessary.
- Entering the dimensions directly into the text-boxes on the **Clip - 3D View** form, and then picking the required origin in the 3D View with the cursor. Note that the **Clip - 3D View** form will be automatically updated with the picked co-ordinates. You can use the EDG facilities on the **Positioning Control** toolbar to select the type of item to be picked in the 3D View, and the mode the software will use to derive the point.

and then clicking **Apply**.

You can also change the orientation of the clipping box, by defining a plane through which it passes. The icon buttons at the top of the Orientation frame allow you to define a plane by picking either three explicit points or two points, the third point is taken as the current working plane. Alternatively, you can edit the **Y is** and **Z is** test boxes, to set the orientation of the clipping box.

To extend the clipped volume by a specific amount, enter a number into the **Extend Clipped Volume by** gadget.

Dismiss the forms when you are satisfied with the settings.

You must also select the **Enable** menu option to make the setting take effect in the view.

Planes

Allows up to six individual planes to be defined to clip the model - see [Six-Plane Clipping](#).

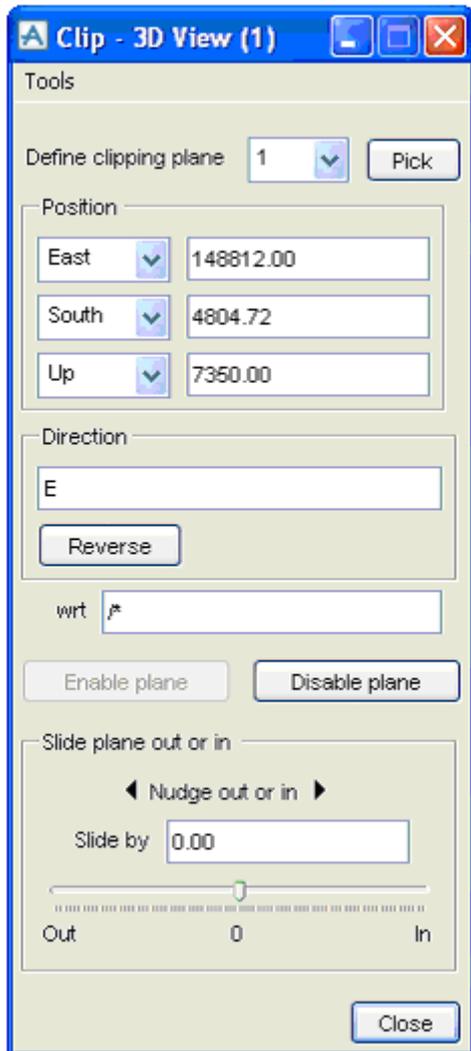
4.5.2 Six-Plane Clipping

As an alternative to the clipping box, up to six individual planes may be defined to clip the model. The planes may be aligned on Ship items such as panels and beams, or by selecting ship grid lines.

The 6-plane clipping feature and the clipping box are mutually exclusive. Enabling one has the effect of disabling the other and clearing any related forms and aid graphics.

Clipping planes can be at any angle, for example to suit tapered compartments on a ship. Up to six planes can be defined, and the direction of a plane is considered to point into the region of interest.

Right-clicking on the **Clipping & Options** icon on the 3D View toolbar and selecting the **Planes** option displays the **Clip - 3D View** form.



The **Define Clipping Plane** drop-down list is used to select the plane (1-6) to be defined.

The **Position** drop-down list and data entry fields are used to set the position of the selected plane.

The **Direction** field is used to set the direction.

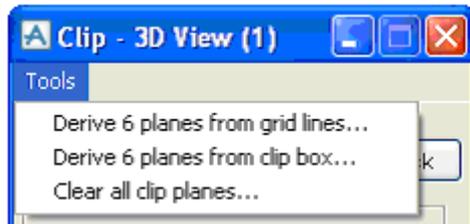
Clicking the **Pick** button enables a clipping plane to be aligned, for example, on a Ship item such as a panel or beam, which is picked from the 3D View. The system will then automatically fill in the Position and Direction fields based on the position and orientation of the picked item.

The **Reverse** direction button is useful where a deck plate is picked and the view must be above or below it.

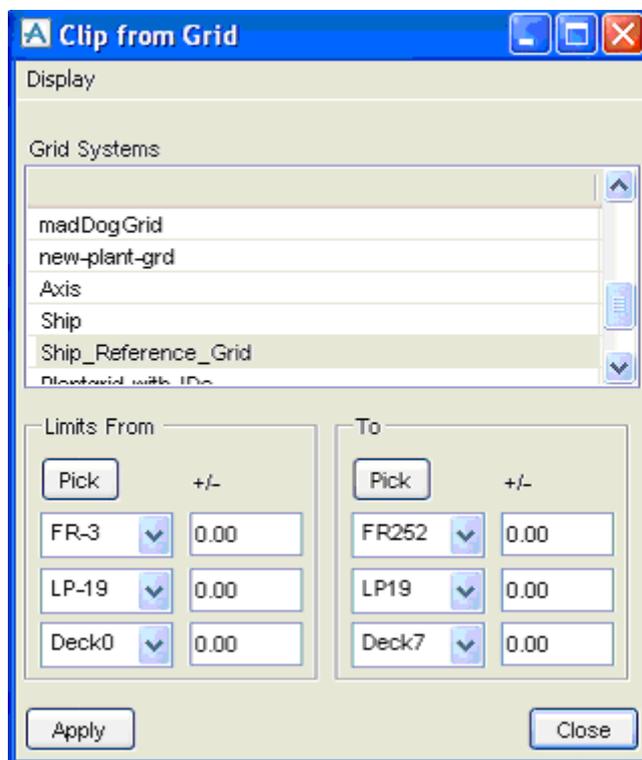
Once the plane position and direction have been obtained from the picked item, the plane can be enabled, using the **Enabled plane** button.

The clipped volume can then be finely adjusted if necessary by using the gadgets at the bottom of the form to slide the selected plane in or out.

Planes can be automatically defined based on the clipping box, e.g. following clip CE, then adjusted individually. Planes can also be defined by selecting grid lines from a grid system. In this case, select **Derive 6 planes from grid lines** from the **Tools** menu on the **Clip - 3D View** form:



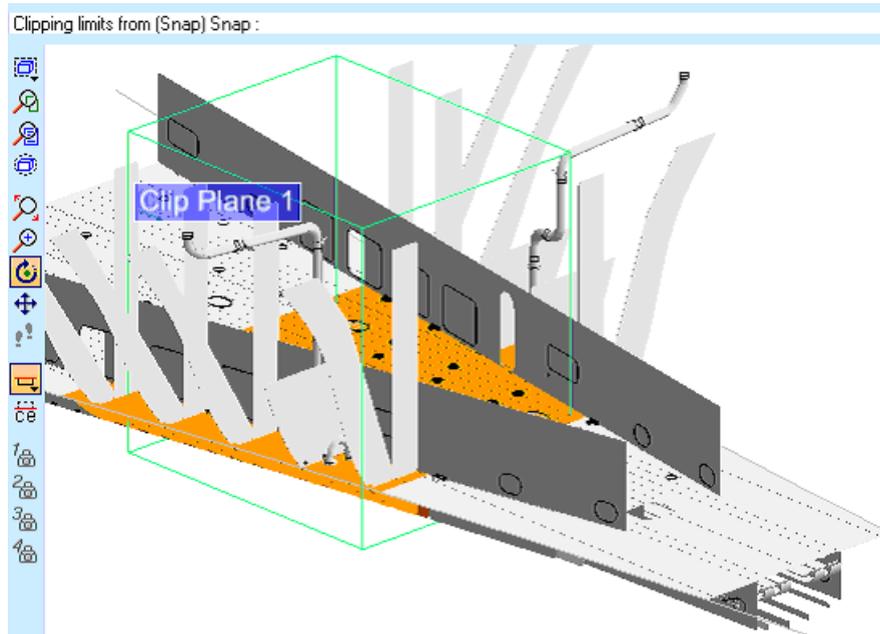
The **Clip From Grid** form is displayed:



The **Grid Systems** list shows the available grid systems for the project. When one of these is selected, the lower half of the form will change to reflect the grid system selected.

Individual grid lines to delimit the clipped volume can be selected from the **Limits From** and **To** drop-down option lists, or the nearest grid lines to two picked positions can be automatically selected using the two **Pick** buttons. Positive or negative offsets (in mm) relative to the grid lines can be entered into the +/- boxes.

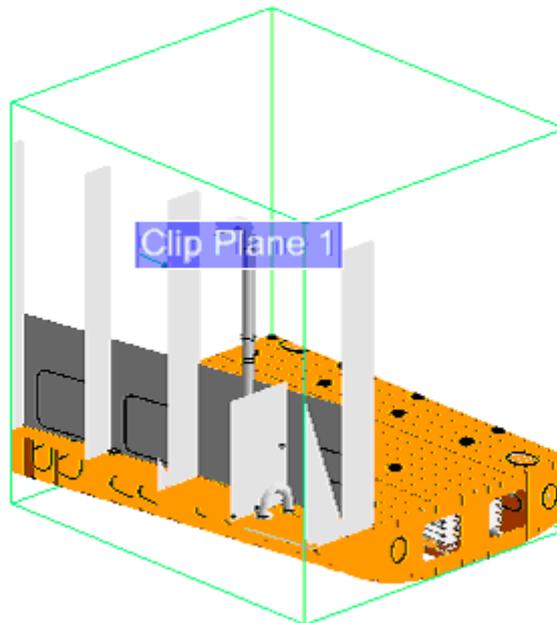
After selecting/picking the grids, the defined volume will be marked graphically:



The positions of the clipping planes will be automatically entered into the form in terms of grid lines and offsets:

Limits From		To	
<input type="button" value="Pick"/>	+/-	<input type="button" value="Pick"/>	+/-
FR185	11.00	FR196	-250.00
LP-7	-211.00	LP6	-225.00
Deck0	824.00	Deck2	-1116.00

When the **Apply** button is pressed, the clipping planes are applied to the view:



To assist in selecting the appropriate grid lines for clipping, any position can be picked to display it in World and Grid Coordinates. Select **Picked position in grid coords...** from the **Display** menu on the **Clip From Grid** form: the **Display Grid Coords** form is displayed.



4.6 Undo and Redo



The ease with which you can manipulate the model using the graphical techniques provided in Outfitting Design makes the provision of an 'undo' facility a natural requirement.

There are three types of activity that are recognised while you are in Model Editor mode. For each of these, the current state is saved before the change in order that it may be restored by a subsequent Undo.

Changes to the database as a result of manipulating the Graphical Selection either by direct graphical manipulation or from the context sensitive menus can be undone. (The selection set and the position/orientation of the Locator Handle are also restored.)

There are two ways you may undo an activity:

- Using the standard Undo and Redo icons ( ) in the main toolbar.
- Using the **Undo** and **Redo** options on the **Edit** pull-down menu.

You may step back through undo states one at a time. Following an undo, you can then choose to redo the sequence, stepping forward one state at a time until the sequence of changes that were undone are restored. If you do one or more "undos" and then save a new state, the redo option is no longer available and the corresponding icons/menu options become inactive.

Switching between applications in Outfitting Design causes the Modify mode button to be switched off and the undo/redo states to be re-initialised.

Note: Undo/Redo operations can also take place outside of Model Editor Mode. If the Undo operation involves moving into or out of Model Editing mode, then the switch into that mode happens automatically, and the Model Editor button and menu option will reflect the change. The selection set and handle appropriate to the editing operation that was being used are also restored.

Other 'undoables' (operations or sequences of operations that can be undone) can be defined as a PML 'undoable object' - see the [Software Customisation Guide](#).

4.7 Delete Selection

Delete Selection on the Edit menu deletes from the database all items in the Graphical Selection. This operation is only available while a Graphical Selection exists.

Note: You will be asked to confirm the deletion.

4.8 Selectable Items

The following table lists element types that can be selected and modified using the Model Editor. Note that some types of element can be modified if they belong to an administrative element such as a ZONE or FRMW, but they cannot be individually modified if they belong to a Ship Item. For example, A SCTN element can be selected and moved if it belongs to a FRMW or SBFR element, but not if it belongs to a TMPL element.

Ship Item	Selectable Elements
EQUIPMENT	SITE>ZONE>EQUI
PIPE (and CABLE TRAY)	
PIPE/CABLE TRAY	SITE>ZONE>PIPE using the Select Owners operation
BRANCH	SITE>ZONE>PIPE>BRAN using Select Owners operation
Pipe component	SITE>ZONE>PIPE>BRAN>(any component)
HVAC	
HVAC	SITE>ZONE>HVAC using Select Owners operation
BRANCH	SITE>ZONE>HVAC>BRAN using Select Owners operation
HVAC component	SITE>ZONE>HVAC>BRAN>(any component)
HANGERS	
RESTRAINT	...PIPE>REST & ...HVAC>REST using Select Owners operation
HANGER	...PIPE>REST>HANG & ...HVAC>REST>HANG
PIPE TRACK	SITE>ZONE>PTRA
ROUTING PLANE	SITE>ZONE>RPLA or SITE>ZONE>STRU>RPLA RPLA also exists under EQUI, PTRA, SUBE, SUBS - RPLA is NOT a significant element in these situations
PENALTY VOLUME	SITE>ZONE>PVOL or SITE> ZONE>STRU>PVOL Note: PVOL also exists under EQUI, PTRA, SUBE, SUBS - PVOL is not a significant Model Editor element in these situations
STRUCTURES	
Primitive owned directly by STRU	SITE>ZONE>STRU>(Primitive)
SUBSTRUCTURE	SITE>ZONE>STRU>SUBS
FRAMEWORK	...STRU>FRMW using Select Owners operation

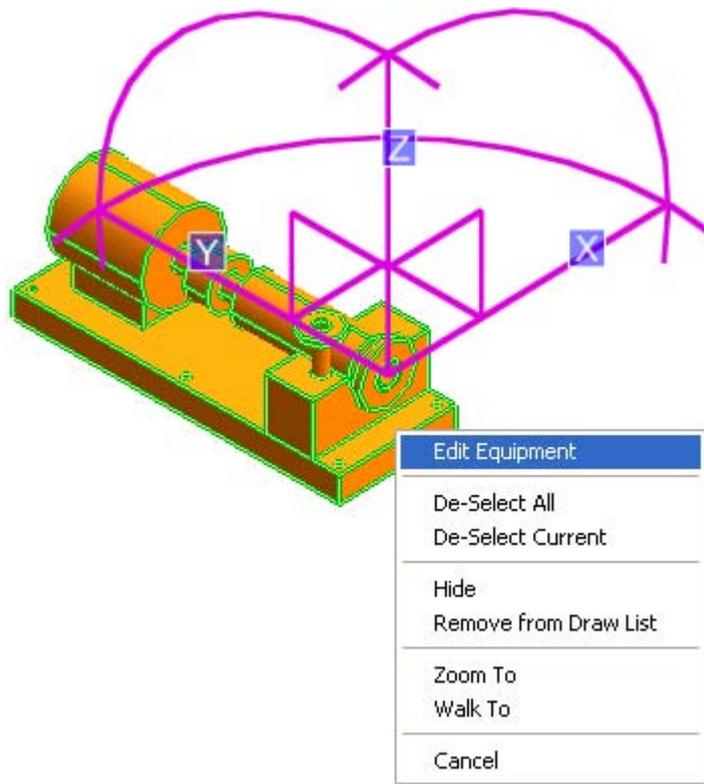
Ship Item	Selectable Elements
SUBFRAMEWORK	...STRU>FRMW>SBFR using Select Owners operation
Collection of FLOOR	...STRU>FRMW>CFLOOR using Select Owners operation
Collection of WALL	...STRU>FRMW>CWALL using Select Owners operation
Collection of SCREED	...STRU>FRMW>CSCREED using Select Owners operation
Note: The following elements may be owned by FRMW, SBFR, CFLOOR, CWALL or CSCREED	
GENSEC	GENSEC
WALL	WALL
PANEL	PANE
FLOOR	FLOOR
GWALL	GWALL
SCREED	SCREED
PNODE	PNOD
SCTN	SCTN
STWALL	STWALL
PALJ	PALJ
DRAW	SITE>DRAW or SITE>ZONE>DRAW Note: DRAW also exists under EQUI, PTR, SUBE, SUBS - DRAW is NOT a significant element in these situations. See selection rules for those element types
BOUNDARY	SITE>BOUN or SITE>ZONE>BOUN
GROUND MODEL	SITE>GRDM
DATUM	SITE>ZONE>DATU

Note: The Model Editor does not work with Design Template elements in the Template World. It is not possible to selected elements owned by a TPWL>TMAR>TMPL hierarchy.

5 Graphical Equipment Modification

5.1 Introducing Graphical Equipment Modification

Entering Model Edit mode, clicking on an Equipment Item and selecting **Edit Equipment** from the shortcut menu enables the Graphical Equipment Modification (GEM) facilities.

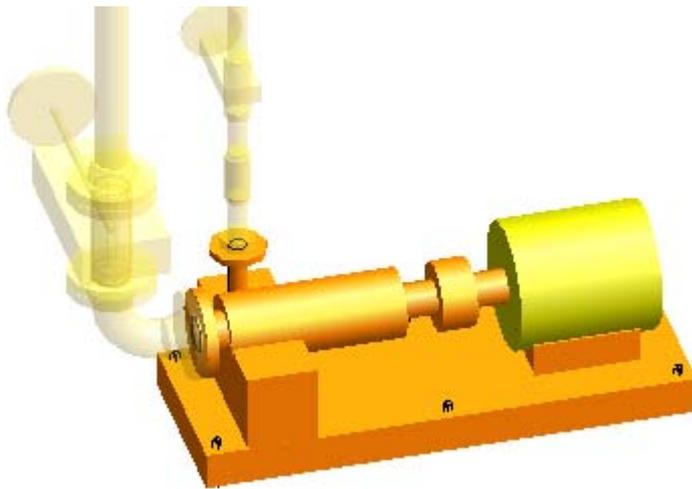


GEM gives menu options which facilitate the graphical modification of an Equipment item and its 'offspring', down to primitive level.

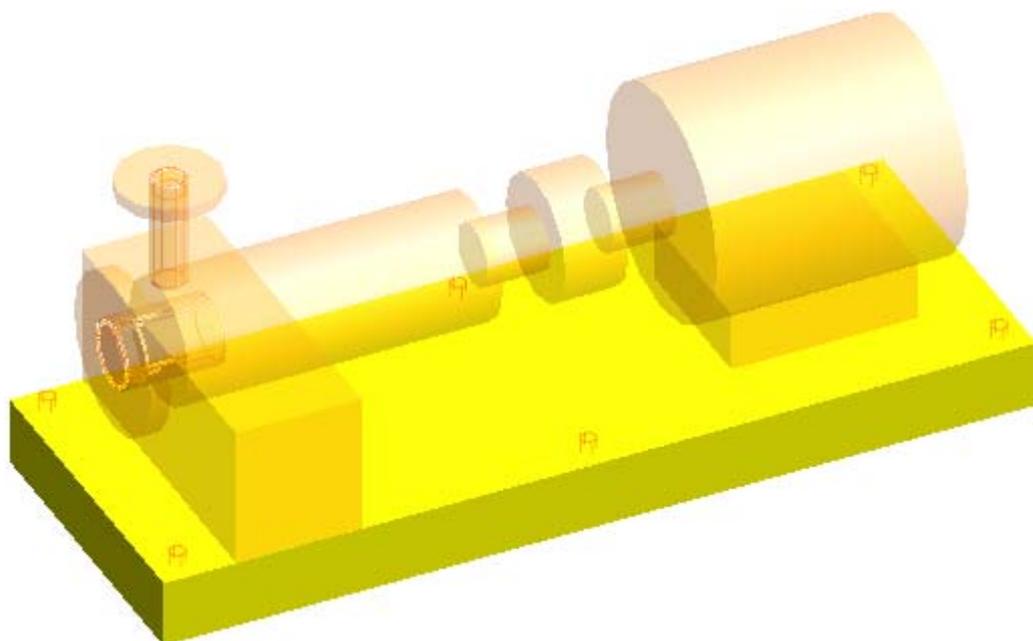
5.2 Equipment Modification Characteristics and Facilities

5.2.1 Display Characteristics

Selecting an Equipment item and enabling GEM makes non-Equipment items in the display translucent. For example:



Clicking on a primitive which itself contains primitives causes the other Equipment primitives to become translucent. Negative primitives are drawn in wireline.



5.2.2 Modification Facilities

Elements below the hierarchical level of a selected primitive can be accessed using the **Edit** <*primitive*> shortcut menu selection (for example **Edit BOX**).

Elements below the hierarchical level of a selected primitive can now be selected and manipulated using the standard facilities, see [Model Editor Operations](#).

To exit GEM, select **Exit Equipment Editor** from the shortcut menu.

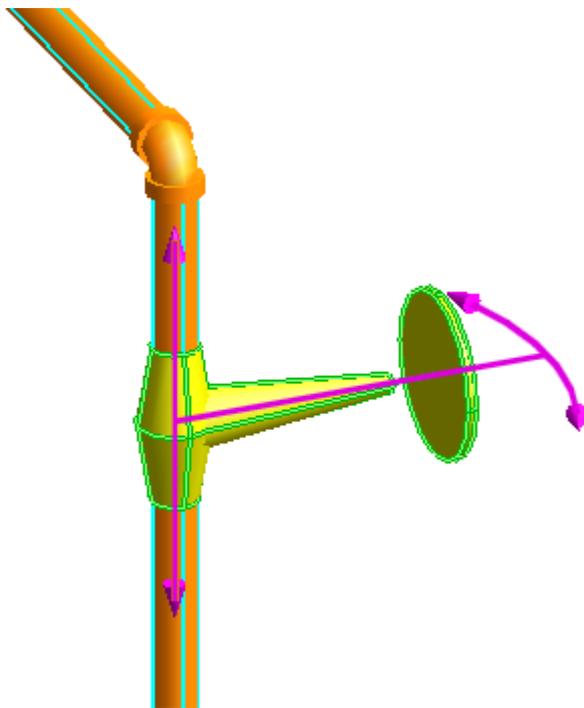
6 Graphical Component Modification

6.1 Introducing Graphical Component Modification

Graphical Component Modification (GCM) enables you to use the mouse to move and rotate a Component or a selection of contiguous Components within the constraints of a pipe route.

GCM is entered automatically when you click on a piping Component **while in Model Editor mode**. You do not have to be in the Design Pipework application to be able to use this facility, which enables you to move interactively a Component along the legs of a pipe route and to rotate a Component about the tube centreline.

The Movement Handle in this case appears as show below:



The following facilities and constraints are available:

- rotation about the tube centre line
- constrained positioning along the path of the pipe route:
 - increment snapping

- feature highlighting
- Components can only be repositioned where there is sufficient space to fit them in the route
- automatic reorder of the elements within the hierarchy to suit the new position within the pipe route
- the ability to reposition the handle within the constraints of the Component selection set (along the centreline of the pipe)
- the initial orientation of a selection should be maintained where possible
- undo/redo changes.

The system does not try and resolve any inconsistencies that may occur from the repositioning of a Component. For example if a Reducer is moved into another leg of a Branch, the Components and tube between the Reducer's original position and its new position in the Branch remain the same.

Note: in the above case, if a Component is moved across a Reducer, the Component is **not** automatically reselected from the Specification; this must be done 'manually'.

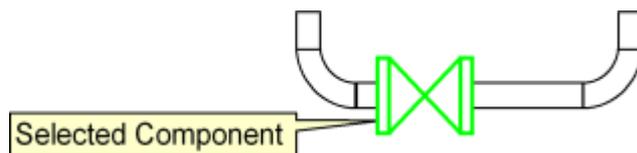
GCM is enabled automatically by first entering Model Edit mode and then selecting of a Piping Component or a sequential set of Components which are within the same leg of a Pipe Branch, and provided the selection set has certain characteristics.

GCM is exited either by leaving Model Edit mode or by selecting another element that breaks the rules for displaying the Component Modification handle.

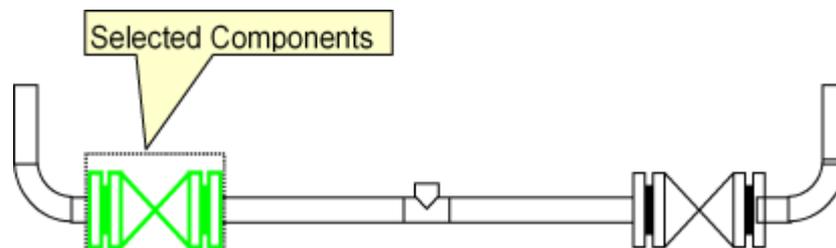
6.2 Selection Set for GCM

(See [Selection](#) for general information about Selection.) The movement handle is only shown when the selection set contains:

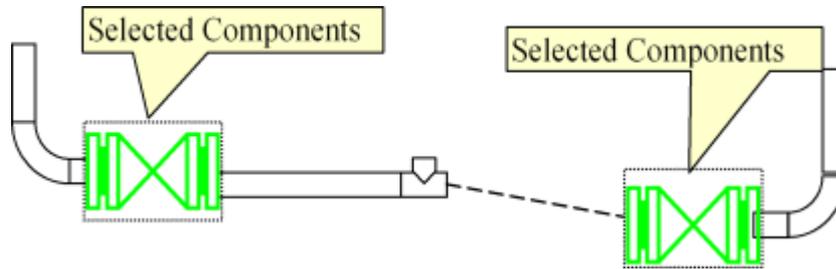
- A single Piping Component which does not cause the Branch to change direction, i.e. the Component has a parallel Arrive and Leave direction:



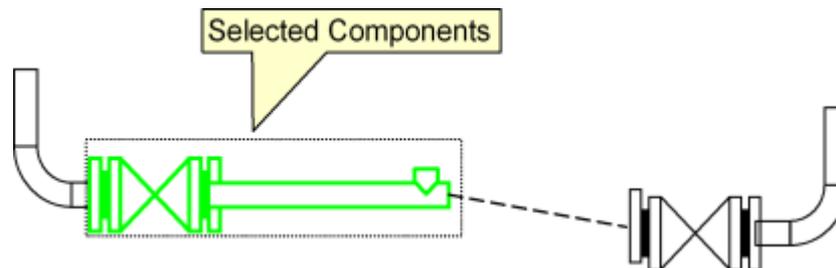
- A sequential set of Piping Components which lie within the same leg of a Branch, i.e. there is no change in direction or a bad alignment exists in the leg:



- In the following example the Component Modification Handle is **not** displayed.

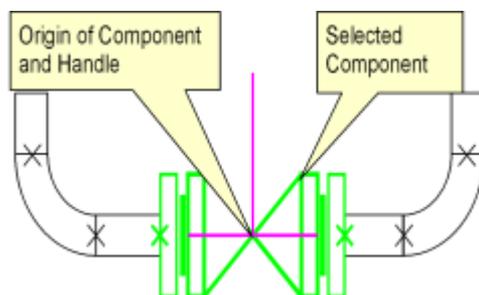


- In this example the Component Modification Handle **is** displayed



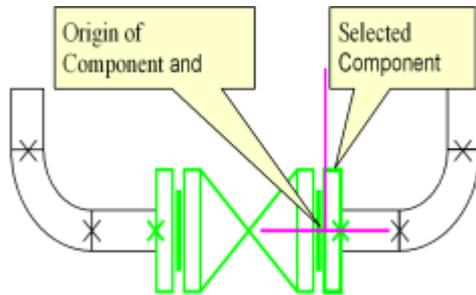
6.2.1 Component Modification Handle

The Component Modification Handle only appears where the selected Component(s) conform to the rules as defined above.



By default the origin of the initial Component identified to define a selection is used to position the handle.

Picking a Component already within the selection set moves the handle to the origin of the identified element:

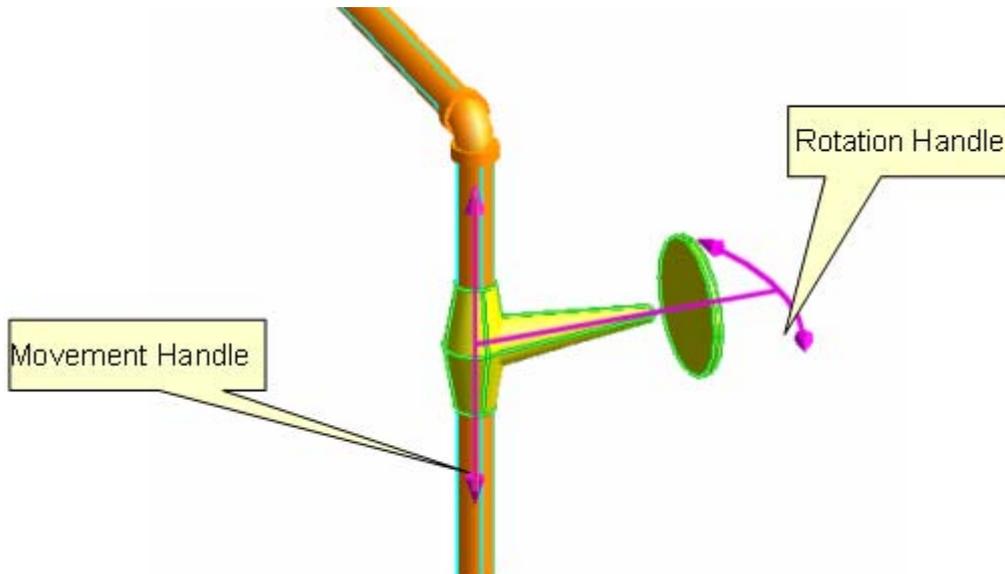


However, selecting an item in the selection with the primary mouse button does **not** change the position of the handle; it only shows the appropriate selection for the identified item.

6.3 Operations in GCM

The Component Modification Handle has two parts:

- the **Movement Handle** - this is used to move the selected Components along the path of the pipe route
- the **Rotation Handle** - used to rotate the selected Components about the centreline of the primary Component



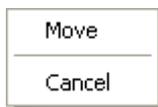
6.4 Movement Handle

This handle is used to move the selected Components within the constraints of the of the Pipe route that the selected Components exist in.

6.4.1 Dragging

The handle can be dragged by using either using primary or secondary mouse buttons. The legs that the selection can be dragged into are highlighted with a turquoise line (see above figure). By default, the handle moves in multiples of the currently defined **linear increments** - see [Element Selection in the Model Editor](#).

When dragging using the secondary mouse button, you are presented with a context-sensitive menu on button up. The menu displays the available options which relate to the drag and when in a special action mode (e.g. feature highlighting, see [Feature Highlighting](#)), the target, if applicable. If no special actions are active, you are given the option to accept the new position or cancel the operation and the handle and selection return to their original position.



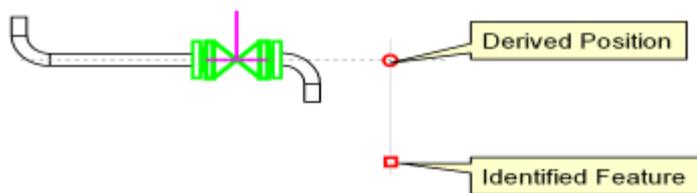
6.4.2 Feature Highlighting

With Feature Highlighting 'on', dragging with the primary mouse button held down causes features such as p-points or p-lines to be highlighted when the pointer moves across them. Highlighted features can then be 'snapped' to. Feature highlighting can be activated either from the F 'hotkey' or from **Selection>Feature Highlighting** on the main menu bar.

As the alignment with a feature invariably relates to the leg the Components are in, when feature highlighting is active the drag movement is constrained to lie along the leg the selected Component is currently in, not the whole pipe route. This prevents the inadvertent repositioning of Components into a different leg when trying to align with a feature.

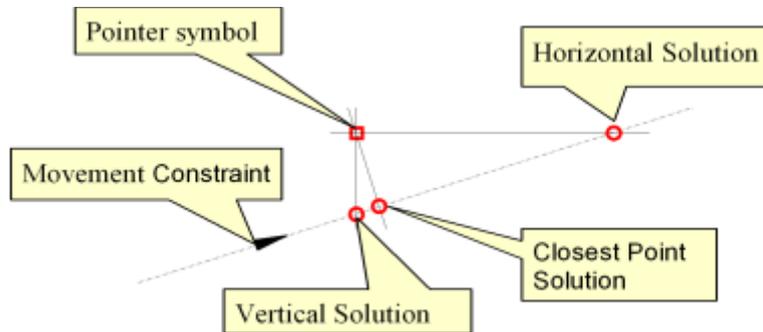
When no feature is found initially, the handle moves using the default movement increments until a feature is identified. Selected Components cannot moved past either end of the pipe leg they are within.

Where a derived position is not within the bounds of the leg or cannot physically fit within a segment of a leg, the selected Components are positioned at the nearest extent of the leg closest to the derived position. Feedback is given to indicate that the positions of the items are not in alignment with the identified feature.



Where there is more than one position solution, the system has default behaviour to derive the initial position (see [Feature Highlighting](#) for further details). However, it is possible to cycle through the possible positions and choose the desired one. The P hotkey is used for this.

Subsequent feature identification within the same drag uses the last solution type to derive the position, where possible. If there is no position solution to the feature selection, the system reverts to its default behaviour.



6.4.3 Nudging the Handle

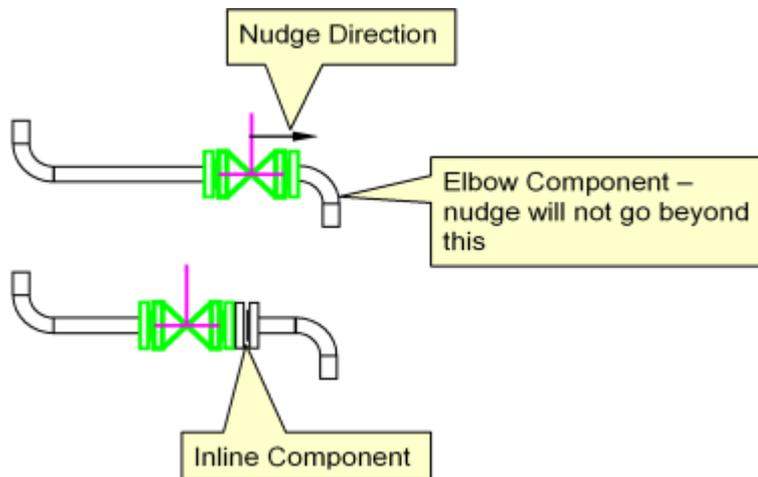
Once a drag has been started using the primary or secondary mouse button, you can finely adjust the positioning of the selected Components using hotkeys. You can 'nudge' the manipulation handle when dragging in a linear direction, using the numeric keypad + and - keys. This moves the handle by + or - the current linear increment.

In a similar way to nudging a Component you may nudge the position of the handle both by the default linear increment for major positioning, and by a fine value for accurate positioning (e.g. clearance from surfaces). To facilitate this a 'fine nudge' setting is available, where the granularity of the movement is less than that of the current linear increments.

Linear increments are controlled from the **Set Increments** form, see the Outfitting Design online help for details.

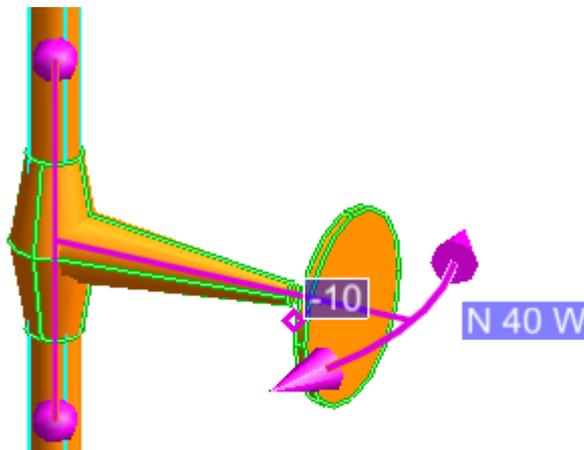
Similar to the nudging using the + and - hotkeys, the fine adjustment uses the arrow keys on the numeric keypad (or the numeric keypad 2 and 8 keys when Num Lock is 'off').

Once a nudge has been performed, then dragging has no effect, but the mouse key must be kept held down. Nudging restricts the movement within bounds of the leg or segment of leg that the selected Components are within. Nudging does not take the selected Components past an inline Component or change in direction.



6.5 Rotation Handle

The Rotation Handle allows you to rotate interactively the selected Components about the centreline of the Pipe that the handle is positioned on.



6.5.1 Dragging

The Rotation Handle (and the graphical selection it is attached to) can be dragged by either the primary or secondary mouse buttons, and allows a full 360° rotation about the centreline of the pipe. The legs that the selection can be dragged into are highlighted with a turquoise line (see above figure).

Dragging the handle with the secondary mouse button is the same as using the primary mouse button, but presents you with a context-sensitive menu which relates to the direction and rotation of the handle, see [Popup Menus on the Component Modification Handle](#).

6.5.2 Feature Highlighting

Use of Feature Highlighting with the Rotation Handle is similar to using Feature Highlighting with the Movement Handle, see [Feature Highlighting](#).

When performing a free rotate, if feature highlighting is active but no feature is identified, the rotation uses the currently defined angular increment value. When a feature is identified, the handle is aligned in the appropriate manner, dependent on the feature identified. See [Popup Menus on the Component Modification Handle](#) and [Hotkeys](#) for details of shortcut menu and hotkey options available when manipulating the rotation handle.

6.5.3 Nudging the Handle

Once a drag has been started using the primary or secondary mouse button, you can adjust the derived angular offset using the + and - hotkeys for the rotation handle.

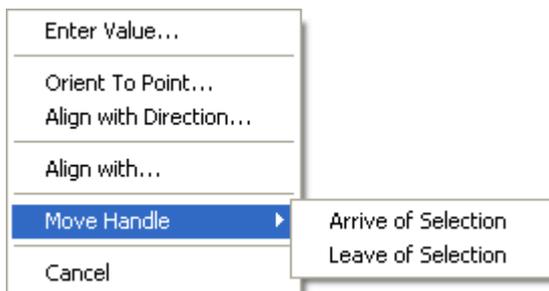
As with moving, if a direction is derived from an alignment with a feature, using the nudge increments the rotation from the derived direction.

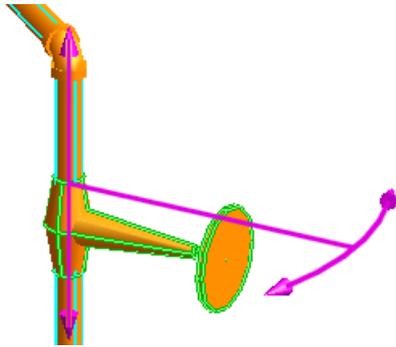
The Rotation Handle can be 'nudged' in the same way as the Linear Handle, see [Nudging the Handle](#).

6.5.4 Repositioning the Handle

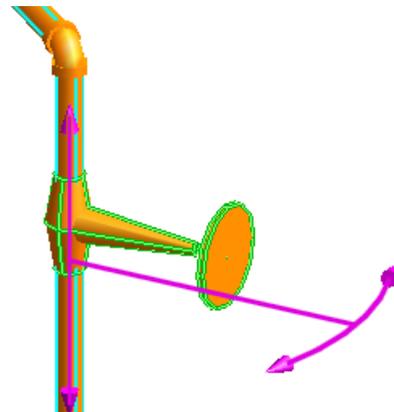
The default position of the Rotation Handle is at the origin of the Component initially selected when defining the selection. Identifying another Component in the selection repositions the handle to the origin of the identified item.

In some instances you may wish to reposition the handle at a position which does not correspond to the origin of a Component. You can reposition the handle to the extremities of the selected Components via a pop-up menu on the movement handle:





(Arrive of Selection)



(Leave of Selection)

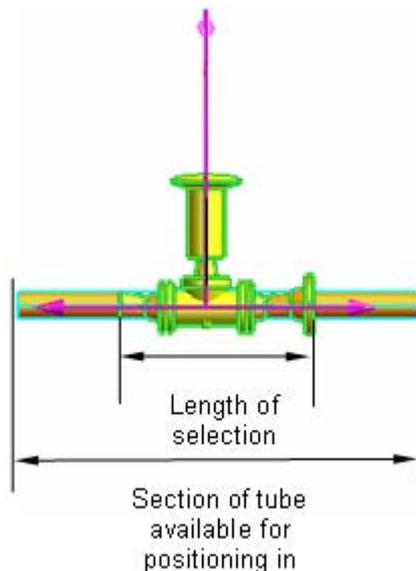
6.6 Movement and Rotation Characteristics

6.6.1 Movement Handle

You can reposition the selected Components freely along the route of the pipe Branch into any segment where the Components can fit. All selection and handle movements can be undone and redone using the **Undo/Redo** buttons.

The following rules are for where the selected Components can be positioned within a route:

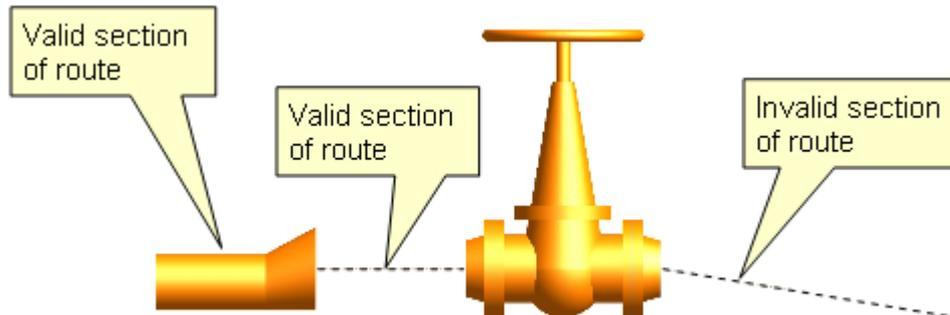
1. There must be enough implied tube for the selected Components to be positioned in.



Where there is tube adjacent to the selected Components, then the length of the selected Components and the adjacent tube is taken to be a continuous segment.

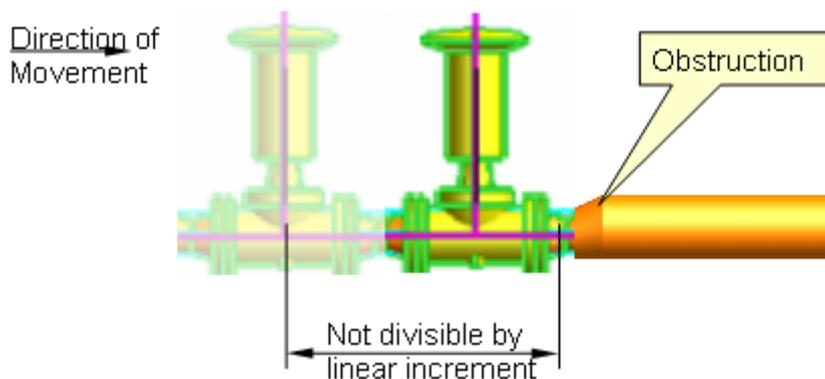
2. The tube between two adjacent Components must parallel to the Arrive and Leave directions of the adjacent Components.

As the repositioning of Components does not reselect the adjacent Components or elements, this allows for the instances where the selected Components are included into a segment of pipe which has a different bore, but which still allows the Components to be moved.



By default where there are no obstructions or changes of directions within a line, the Components being moved will move using the currently defined linear increments.

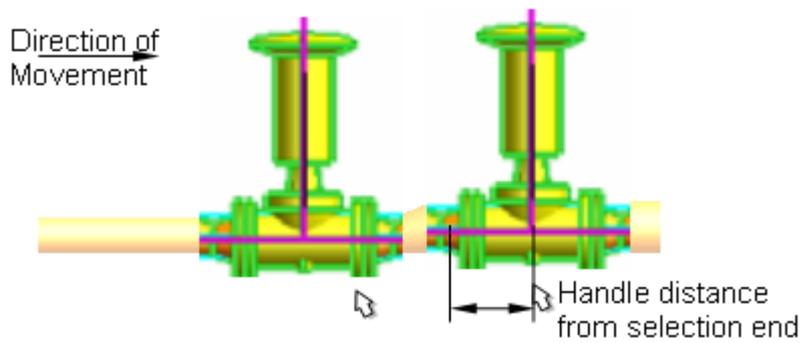
When an extremity of the selection of Components is coincident with or passes the approach side of an obstruction or change in direction (i.e. a Bend or Elbow), the leading extremity of the selection snaps to the approach of the obstruction.



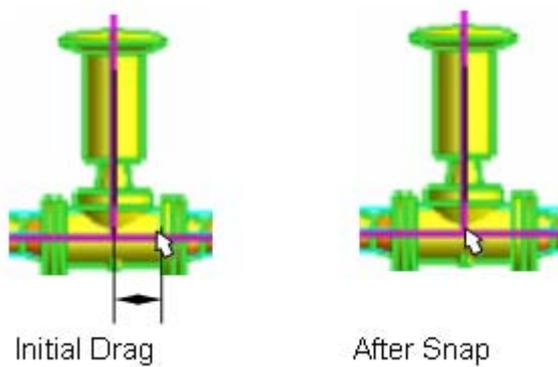
Where a selection is snapped to a Component, feedback is given to inform you that this has taken place.

Where the selection has snapped to an obstruction or change in direction, the movement will stop until the pointer passes over a valid segment of tube, at which point the selection moves to the new segment of pipe, or until the pointer movement implies that you want to drag the selection past the obstruction or change in direction.

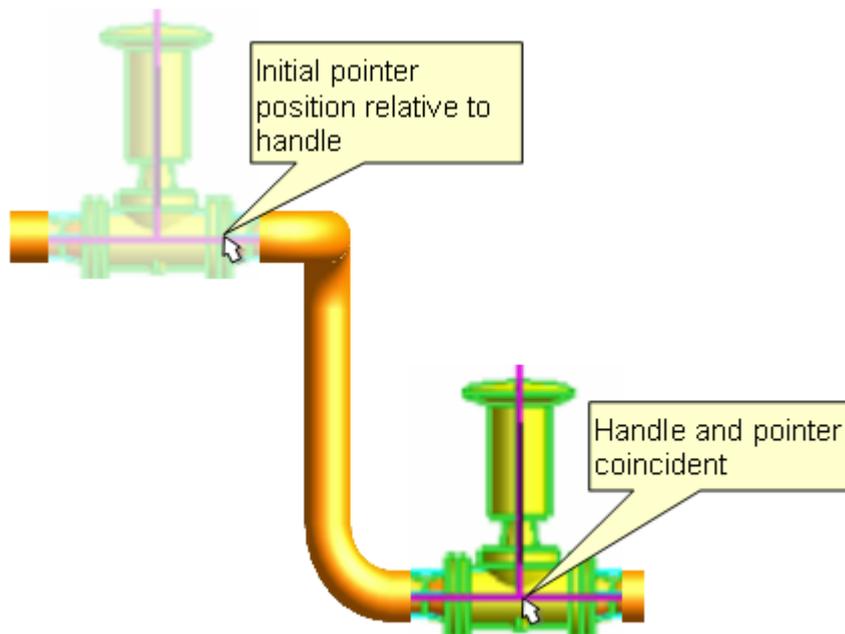
The selection will only move past the obstruction or change in direction, where there is sufficient tube to move the Components and when the mapped position of the pointer is at least the distance from the origin of the handle to the opposite extremity of the selection.



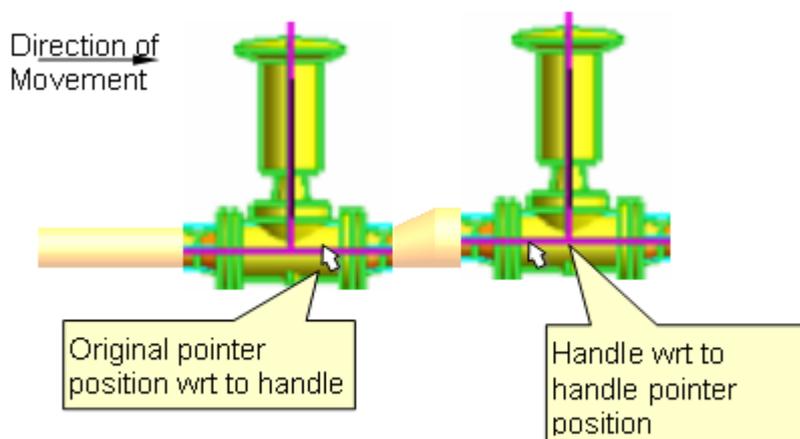
Note: in this case the position of the pointer mapped onto the centreline of the tube is the position of the origin of the handle. When the selection is first dragged, the mapped position of the pointer is with respect to the handle.



Where the selection is moved past the obstruction or change in direction by identifying a segment of tube, the selection will be moved so that the handle is at the mapped position of the pointer.

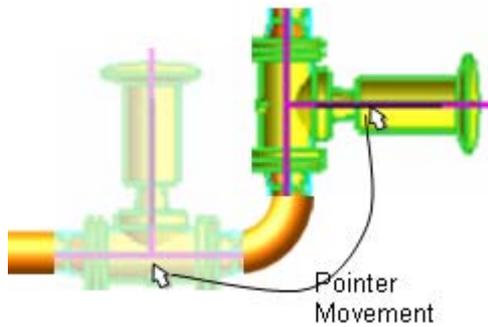


If the distance between the pointer and the handle is less than the distance from the handle to the extremity of the selection, the selection is snapped to the exit of the obstruction or change in direction passed. The pointer retains its relative offset from the handle position.



Where a selection's movement is impeded by a change in direction, the selection only moves around the bend when the pointer crosses the tube of the next leg, as illustrated or where the pointer movement is changed so that it follows the next leg of the pipe.

Pointer movement parallel to the leg the selection is in does not move the selection around a change in direction.

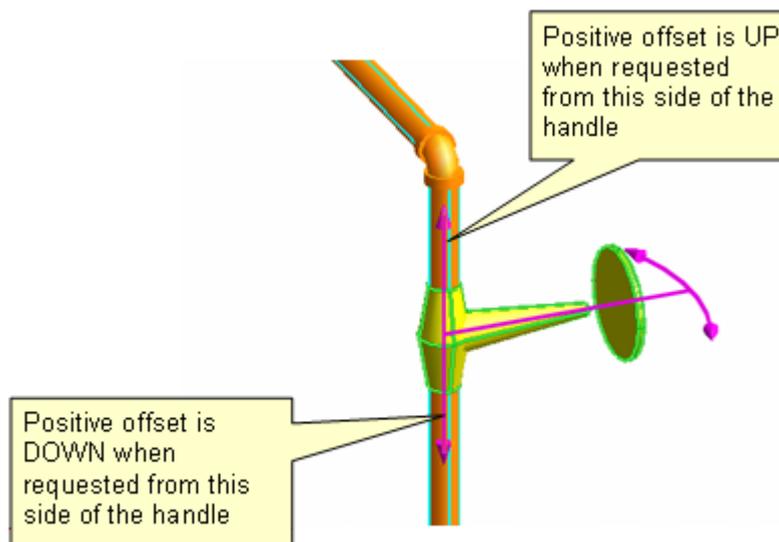


- **Offsetting the Selection**

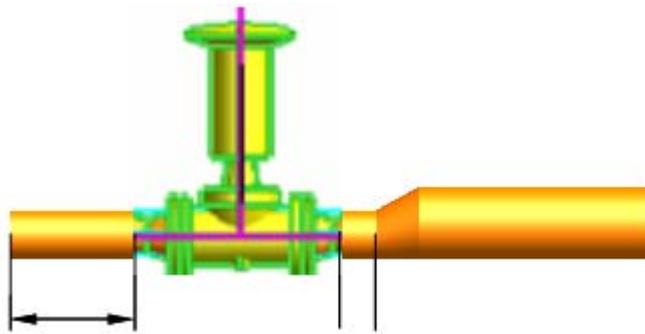
You can offset the Component selection set along the segment of Pipe it is currently in. You access the offset options from the popup menu available on the handle, see [Popup Menus on the Component Modification Handle](#).

Each option presents you with a form which allows you to enter a positive or negative value. You can also 'preview' the specified move before committing the change.

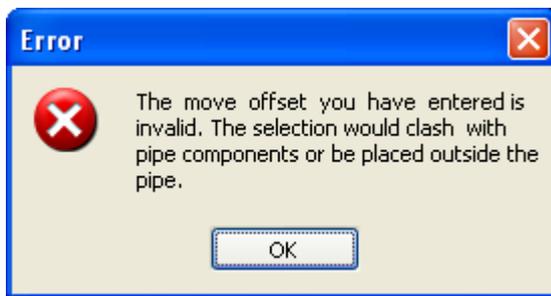
The side of the movement handle at which the pop-up is displayed determines the effect of a positive or negative offset:



Offsetting is not allowed where it moves either extremity of the selected Components out of the current segment of pipe. An appropriate error message is displayed:



Permissible extents of offset adjacent to the selected components



- **Feature Highlighting**

Feature highlighting allows you to position the handle using other elements within the model. Feature highlighting is accessed using popup menus or hotkeys, see [Popup Menus on the Component Modification Handle](#) and [Hotkeys](#).

Positions to be snapped to are derived by the intersection of the constrained direction of movement and planes acting through the identified features. When Feature Highlighting is active, the movement of the selected Components is constrained to be in the leg the selection.

The behaviour of Feature Highlighting in GCM is identical to Feature Highlighting in Quick Pipe Routing.

6.6.2 Rotation Handle

You can rotate the selection using the Rotation Handle about the centreline of the pipe the handle is positioned on. Rotation Handle manipulation options are available from Rotation Handle popup menu, see section [Popup Menus on the Component Modification Handle](#).

By default, dragging the handle rotates the handle and selection by the currently defined angular increments.

- **Feature Highlighting**

Where feature highlighting is active, the derived direction is the same as when using the **Point** option (see below) to change the pointer to identify features.

Where no feature is identified, the rotation reverts to using the standard rotation using the currently defined angular increments.

- **Align with Direction**

The rotation handle can be positioned so that it is aligned with an identified linear feature by using a popup menu option - see section [Popup Menus on the Component Modification Handle](#).

It is possible to toggle between the initial derived direction of the identified feature and its opposite derived direction. It is not possible to select a direction which is parallel to the leg of the pipe the handle is in.

- **Orient to Point**

It is possible to orientate the Rotation Handle with an identified feature, using the **Orient to Point** popup menu option, see section [Popup Menus on the Component Modification Handle](#).

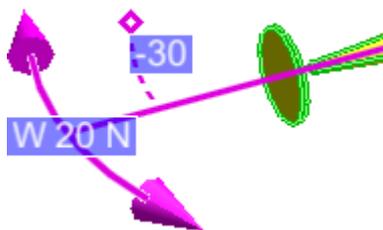
- **Explicit Direction**

You can set the direction of the rotation handle explicitly. As the handle is constrained in its rotation about the centreline of the pipe, the given direction may not be possible, therefore the system tries to resolve the direction so that it is as close to the given direction as possible.

This option is via an option on the menu available on the handle, see section [Popup Menus on the Component Modification Handle](#).

A form is displayed which allows you to specify the explicit direction with respect to the current frame of reference (the World). It is not possible to specify a direction which is parallel to the leg of the Pipe the handle is in.

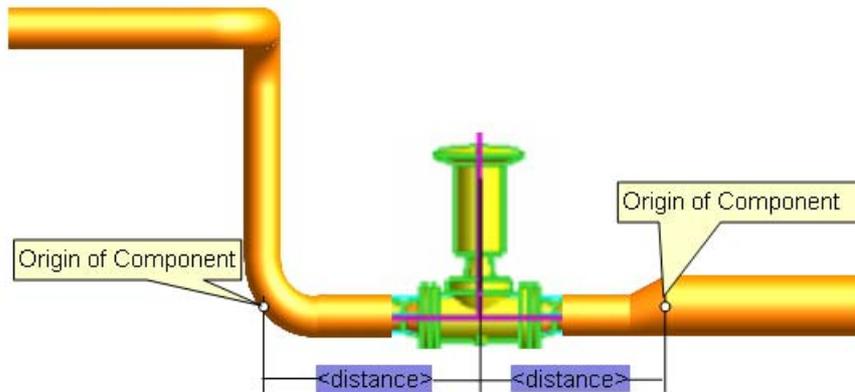
6.7 Feedback



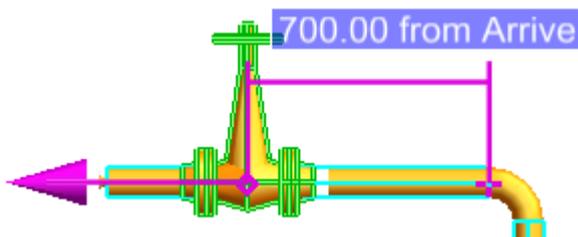
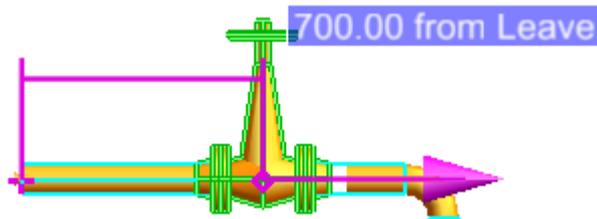
6.7.1 Movement Handle

There are three types of dimensional feedback that are given when moving a selection along a pipe route:

1. Distance from handle to origin of both up- and downstream Components.

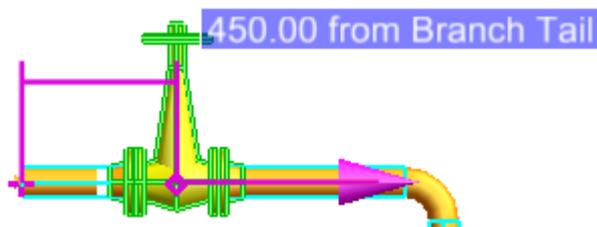


- Distance from handle to Leave of upstream Component and handle to Arrive of downstream Component.



Toggleing between the two feedback options is by use of the D hotkey. By default option (1) is used.

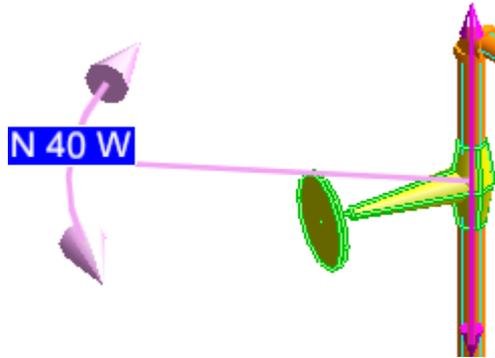
- Distance from Branch Head/Tail



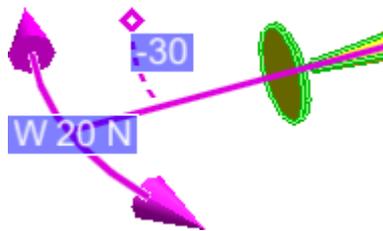
(A drag in the opposite direction would give "from Branch Head" feedback. From Direction Change feedback is also available if the nearest Elbow/Bend is closer than the Branch Head/Tail.)

6.7.2 Rotation Handle

On selection of the Rotation Handle, the current direction of the handle is displayed:



On rotation the direction and angle of rotation from the original direction are shown:



6.8 Popup Menus on the Component Modification Handle

6.8.1 Movement Handle

- **Before A Drag**

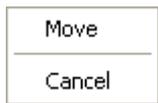
The following options are available on the Movement Handle before a drag:



Option	Description	
Enter Offset...	Displays the Constrained Move form which allows you to enter an offset from the current handle's position along the segment of route the handle is within.	
Enter Distance From>	Displays forms allowing you to choose a distance to move the handle relative to a (context-dependent) point along the route. See the Outfitting Design online help for further details.	
Align with Feature...	Allows you to use the pointer to identify features with which to align the selected Component with, along the leg of the route.	
Move Handle	Arrive of Selection	Repositions the handle to the start of the selected Components.
	Leave of Selection	Repositions the handle to the end of the selected Components.
Distance Feedback	Displays sub-menus allowing you to choose the feedback given relative to a (context-dependent) point selectable from a submenu when the selection is moved. See the Outfitting Design online help for further details.	
Cancel	Returns the handle and selection to its original state before the drag	

- **On Completion of a Drag**

The following options are available on the Extend Handle on completion of a drag, when the **secondary** mouse button has been used to drag the handle.



Option	Description
Move	Leaves the selection and handle at the shown position
Cancel	Returns the handle and selection to its original state before the drag

6.8.2 Rotation Handle

- **Before Drag**

The following options are available on the Rotate Handle before a drag:



Option	Description
Enter Value...	Gives a form which allows you to specify an angle through which to rotate the Rotation Handle.
Orient To Point,,,	Allows you to pick a p-line through a point with which to orient the Rotation Handle.
Align with Direction...	Allows you to identify features with which the handle is to be aligned.
Align with...	Displays a form which allows you to align the handle with a specified direction, or as close as possible to the given direction, about the axis of the pipe.
Move Handle>	Allows you to move the Rotation Handle origin to the Arrive or Leave of the current selection,
Cancel	Returns the handle back to its original state before the drag

- **On Completion of a Drag**

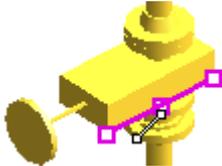
The following options are available on the Rotation Handle on completion of a drag.



Option	Description
Rotate	Leaves the extend handle at the shown direction.
Cancel	Returns the handle back to its original state before the drag.

6.9 Hotkeys

The following 'hotkey' options are available for Movement Handle manipulation options:

Hotkey	Handle	Description
Esc	All	Aborts the current operation in the correct manner.
	All	Cycles through derived directional alignments.
F	All and when in Model Edit mode	Toggle switch for feature highlighting. 
P	Movement	Cycles through derived positions when aligning with feature highlighting.
+	All	Increment linear offset or angular rotation by default increment setting.
-	All	Decrement linear offset or angular rotation by default increment setting.
	Movement	Increment linear offset from current position by "fine linear increment" value.
	Movement	Decrement linear offset from current position by "fine linear increment" value.
D	All	Toggles between the available dimensional feedback options.

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