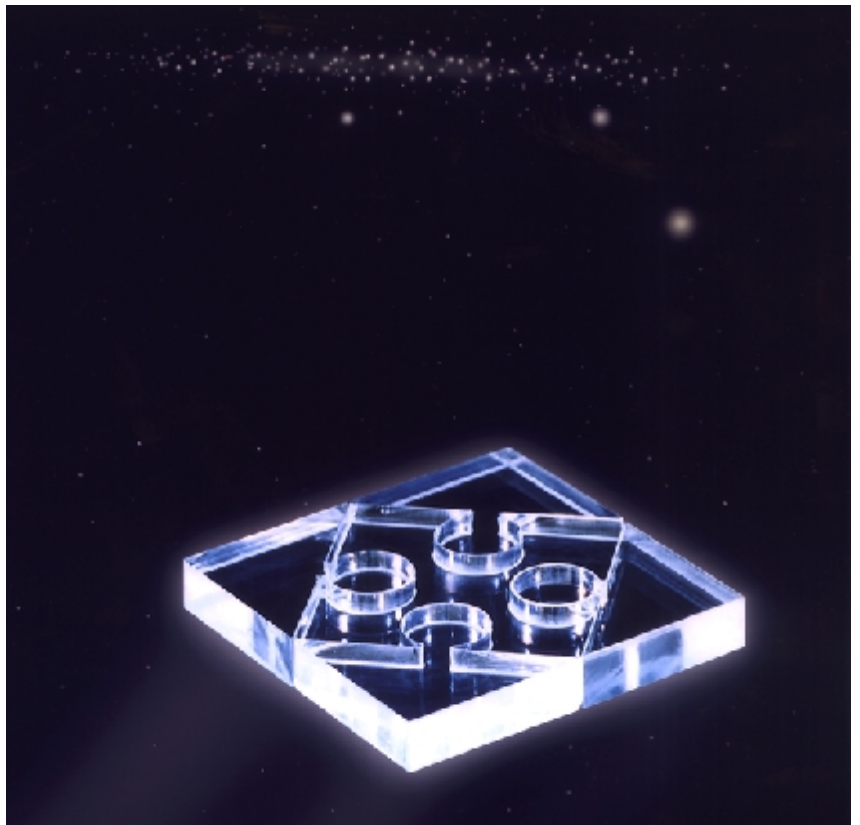# Axyz DM

Data Manager

Software Reference Manual

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Contents

1. Axyz DM - the Data Manager

1.1 About this manual

This manual explains in detail how to operate the software interface to the **Axyz** Data Manager.

It is assumed that the reader has an understanding of how to operate the Core Data Module (CDM) and one of the sensor modules as explained in the following documents

- **Axyz** CDM: Core Data Module - Software Reference
  (This also includes information on Report Generation)
- **Axyz** STM/MTM: Theodolite Module - Software Reference
- **Axyz** LTM: Laser Tracker - Software Reference

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

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

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

1.1.1 Document conventions

The following text formatting conventions are in use:

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

1.1.2 Keyboard and menu conventions

Key combinations and key sequences have the following meanings:

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

1.1.3 Windows conventions

It is assumed that the user is familiar with the Microsoft WINDOWS™ environment. See MS Windows documentation for use of a mouse, windows features and shortcut keys. In particular, the following standard buttons enable the user to respond to requested inputs.

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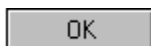
Proceed with actions defined by the settings in the current dialogue box

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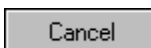
Ignore any changes made in the current dialogue box. Return to the situation which existed before the current box was accessed.

> Browse...
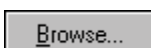
Search folders on disk for the requested information.
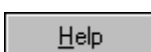
> Help

Provide context-sensitive HELP.
The use of these buttons will in most cases not be further described.

1.1.4 On-line HELP

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

1.2 Data Manager concepts

The Data Manager (DM) provides a structured overview of all data stored within the job file and combines this with detailed editing and selection.

In contrast to the Graphics Modules (**Axyz** View and **Axyz** CAD), the Data Manager provides a numerical display of data in separate tables or *tabs*.

The structured overview is similar to the expandable outline provided by the Windows 95 "Explorer" and the detailed view is similar to a spreadsheet.

The DM itself permits the user to:
• Display numerical and descriptive details of selected items
• Edit parts of the displayed data
• Delete data
• Manually create new data

The DM is also a selection tool which allows users to specify data for:
• Mathematical analysis
• Presentation in a report
• Import and export to and from the database

1.2.1 Multiple DM windows

Several DM windows may be open at once. You can, for example, use this option to view two different types of data on the screen.

The windows may be opened in one module only or in several modules. For example, two windows may be open in the CDM and one window open in the STM/MTM.

All the DM windows are independent although the same job file information is available to each.

Any selections made in an DM window are particular to that window and do not apply to any other.

Only one DM window can be "active" at any time. The selections in the currently active window are also the currently valid selections.

The display properties, for example column widths, are the same for all windows.

1.2.2 Viewing shape points

The DM does not enable users to view the points used when creating shapes. If this is of interest, see the comments given in the section on analysis functions in the CDM Software Reference Manual.

1.2.3 Where to find DM functions

DM functions are available in a number of places:
- On the DM toolbar
- On the "Data" menu
- On the host module's "View" menu
- On the host module's "Window" menu (open DM windows)
- On a popup menu in the detail view (right mouse click to open)

1.3 Starting a Data Manager window

The Data Manager can be started from ***Axyz*** CDM, MTM, STM and LTM.

An DM window is opened:
- When ***Axyz*** is started with an existing job or a new job ("UNTITLED")
- By use of the toolbar button
- By selecting "Data Manager" from the "Window" menu of the host module
- By use of the Select ID button in other menu choices   Select ID...

2. Graphical interface

2.1 Data Manager window

The DM interface has a left pane similar to the "Explorer" in Windows 95. This provides the *outline view* which can be expanded and collapsed. The outline view provides a tree structure showing the principal components of the database. This view can show items such as individual workpieces and stations but not the information associated with them. You must select an item in this pane in order to see associated information in the right pane.

The right pane has a layout similar to a spreadsheet such as MS Excel ™. This pane provides the *detail view*. Within the detail view, tabbed sheets provide access to different types of data associated with the highlighted item in the outline view. Tables show individual data such as 3D point coordinates and measurements which can be viewed and manipulated.

2.1.1 Sample Data Manager window

Outline view   Detail view

IDM win - main.bmp
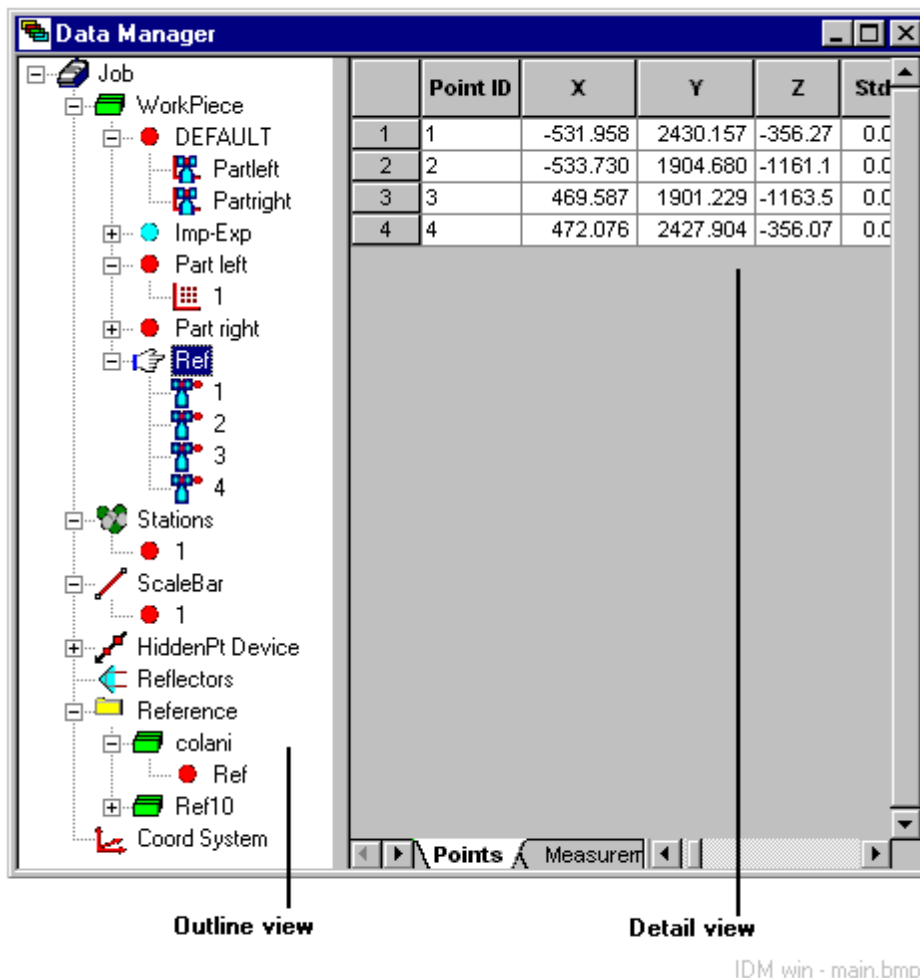
In the example the workpiece "Ref" has been selected in the outline view. In the associated detail view the selected "Points" tab shows a table with information about 3D object points in this workpiece.

2.1.2 Menu and toolbar changes

When a Data Manager window is active the host module's main menu is modified as follows:

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

In addition a DM toolbar is added to the module's toolbars. All the main module toolbars are still visible and accessible.

If a DM window is open but another window is activated, e.g. the graphics window or a measurement window, the **Data** menu and DM toolbar will disappear and the **View** menu will change back to correspond with host module functions.

2.1.3 Structure of the outline view

The outline view shows the job sub-divided into the following principal data categories:

- Workpieces
- Stations
- Scale bars
- Hidden point devices
- Reflectors
- Reference data
- Coordinate systems

Click on the ⊞ expand or ⊟ collapse buttons to reveal or hide the next level of detail, such as individual named workpieces, individual named stations or measurement sets (tracker data only).

☞ At <u>any</u> level you can click on an item to show the associated numeric and descriptive data in the detail view, where it can be modified. The pointing hand symbol appears and indicates that the selected item in the outline view corresponds to the data in the detail view.

Workpieces

Individual workpieces are found under the "Workpiece" symbol. Within each workpiece coordinate and measurement sets may be found. These are mainly generated by trackers.
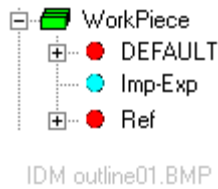
Click on the workpiece symbol to reveal a list of individual workpieces. A red disk ● indicates an individual item. A blue disk ● indicates the currently active workpiece. In the example, this is the workpiece named "Imp-Exp".
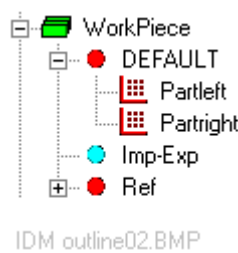
Click on an individual workpiece to reveal any coordinate sets. These are indicated by an array of points in front of 2 axes.

Coordinate sets are created by the surface offset function in the Graphics Module or imported from other sources.
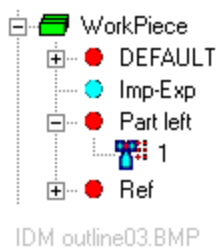
Click on an individual workpiece to reveal any measurement sets from continuously scanned data. These are indicated by a tracker symbol with an array of points.
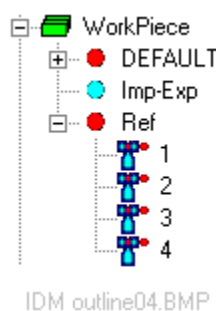
Click on an individual workpiece to reveal any measurement sets recorded for single fixed points. These are indicated by a tracker symbol with a single point.

NOTE
From ver. 1.3 only the averaged point location is stored. This is shown in the workpiece points table. It is no longer possible to store the corresponding set. These sets will only appear in old job files.

Stations, scale bars and hidden point devices
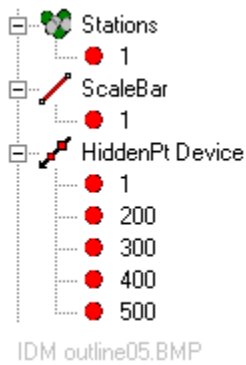
The symbols for stations, scale bars, and hidden point devices can be opened up to reveal individual named items, each indicated by a red disk 🔴 .

IDM outline05.BMP

Reflectors and coordinate systems

Individual reflectors and coordinate systems are listed in the corresponding detail view and do not appear in the outline view.

Reference data

Reference or design data is required for the purposes of "Build and Inspect" and "Transformation". Although there are some differences in the data fields associated with each type of reference point, the same structure is used for both in the database.

Reference data is assigned a "reference ID" and within this reference ID it may be subdivided into "workpieces".

The reference ID is an additional organizational layer which can be used, for example, to separate reference sets into different "files" or different groups depending on purpose such as "build" or "transform".

IDM outline06.BMP
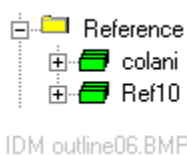
Click on the "Reference" symbol to reveal individual reference IDs or "files", indicated by a green card symbol 🟩 .

IDM outline07.BMP
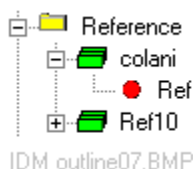
Click on a "Reference ID" symbol to reveal individual reference workpieces represented by a red disk 🔴 .

2.1.4 Summary of data tables in the detail view

The following sections briefly indicate what details are available for each category of data. Different types of information are presented on separate tables (tabs) in the detail view. A full list and explanation of the individual data fields, indicated by the column labels, is given later. See "Data tables and edit forms" on page 52.

Job

The job itself contains two types of data.

Tab 1: Job Information
Descriptive job information

Tab 2: Units
Definition of units

Workpieces (collective)

Click directly on the "workpieces" symbol.

Tab 1: Workpieces
A list of all workpieces in this job, with recorded environmental information.

Workpieces (individual)

Expand the "workpieces" symbol to reveal individual workpieces.

Tab 1: Points
Point coordinates, related statistical data, target thickness information. This covers all object point data except control points and individual points in coordinate sets.

> **Note for tracker users**
> Only stationary points are listed here. See coordinate and measurement sets for other 3D data.

Tab 2: Measurements
Angle and distance values from all stations which measure the points in this workpiece.

Tab 3: Shapes
Shape names, types, parameters and statistical values.

Tab 4: ControlPt
Control point coordinates and related statistical data.

Tab 5: LT meas
For Laser Tracker (LT) data only. This records measurement parameters, such as reflector used and time separation between measurements, for all measurement sets in this workpiece.

Tab 6: Sets
This records coordinate system and target thickness information for all coordinate and measurement sets in this workpiece.

Coordinate sets

Created by digitizing free-form surfaces and spatial curves using a laser tracker, or by importing external data. Expand an individual workpiece symbol to reveal coordinate sets, if any.

Tab 1: Points
Coordinate and statistical values for individual points in the set.

Points do not have individual alpha-numeric identifiers.

Measurement sets for continuous data

Created by continuous measurement using a tracker. Expand an individual workpiece symbol to reveal measurement sets for continuous data, if available.

Tab 1: Meas set
Measurement values (horizontal angle, zenith angle, distance) for individual measurements in the set.

Measurements do not have individual alpha-numeric identifiers.

Corresponding spatial coordinates (x,y,z) for each individual measurement are also shown, if the station has been oriented.

Measurement sets for single fixed points

Created by storing the individual measurements made by a tracker when locating single fixed points. Expand an individual workpiece symbol to reveal measurement sets for stationary points, if available.

Tab 1: Meas set
Measurement values (horizontal angle, zenith angle, distance) for individual measurements in the set.

Measurements do not have individual alpha-numeric identifiers.

To see spatial coordinates, see the averaged stationary point location stored on the **Workpiece/Points** tab.

Stations (collective)

Click directly on the "Stations" symbol.

Tab 1: Stations
A list of all stations in this job, with connection data and parameters (positional and rotational) if available.

Stations (individual)

Expand the "Stations" symbol to reveal individual stations.

Tab 1: Measurements
Angle and distance values to all stationary points sighted from this station.

Tab 2: Ori_Coll meas't
Orientation and collimation measurements from this station.

Tab 3: Calibration info
Tracker parameters such as Birdbath distance and ADM offset.

Scale bars (collective)

Click directly on the "Scale bars" symbol.

Tab 1: Scale bars
A list of all available scale bars with expansion coefficients.

Scale bars (individual)

Expand the "Scale bars" symbol to reveal individual scale bars.

Tab 1: Distance
Distances between target pairs on the scale bar.

Tab 2: Points
3D coordinates of scale bar targets relating to their actual location in the measurement network.

Tab 3: Measurements
Angle and distance values from all stations which measure the scale bar targets in their actual location.

Hidden point devices (collective)

Click directly on the symbol for "Hidden point devices".

Tab 1: Hidden point devices
A list of all available hidden point bars with expansion coefficients, tip coordinates and some descriptive data.

Hidden point bars (individual)

Expand the symbol for "Hidden point bars" to reveal individual hidden point bars.

Tab 1: Dimension
Distances between pairs of offset targets on the bar, or coordinates of individual targets.

Tab 2: Points
3D coordinates of offset targets relating to their actual location in the measurement network.

Tab 3: Measurements
Angle and distance values from all stations which measure the bar targets in their actual location.

Reflectors

Click directly on the symbol for "Reflectors".

Tab 1: Reflectors
List of available reflectors with type descriptions and offset values.

Reference data (collective)

Click directly on the symbol for "Reference data".

Tab 1: Reference
A list of all reference IDs (reference files).

Reference IDs (individual)

Expand the symbol for "Reference data" to reveal individual reference IDs.

Tab 1: Reference workpieces
A list of all reference workpieces in this reference file.

Reference workpieces (individual)

Expand the symbol for "Reference ID" to reach individual reference workpieces.

Tab 1: Points
3D reference coordinates with associated statistics and control flags.

Coordinate systems

Internally coordinate systems are assigned to individual workpieces and therefore have an ID of the format:

workpiece name/ coordinate system name

However it is more convenient to see all coordinate systems in one place. Note that coordinate systems are <u>not</u> additionally displayed in the detail view for an individual workpiece.

Click directly on the symbol for "Coordinate systems".

Tab 1: Coord System
List of coordinate systems with transformation parameters and statistical data.

2.2 DM toolbar

Copy

Edit
Calls up the edit form which corresponds to the type of item(s) selected.
Also accessed via "Edit" option in the "Data" menu.

Insert new
Add a new item to the current table.
Also accessed via "New" option in the "Data" menu.

Delete
Delete the selected item(s) (rows) from the current table.
Also accessed via "Delete" option in the "Data" menu.

Import data from external file
Also accessed via "Import" option in the "Data" menu.

Export selected data to external file
Also accessed via "Export" option in the "Data" menu.

Report
Provides a formatted printout of the selected items.
Also accessed via "Report" option in the "Data" menu.

Sort ascending
Sorts the entire table such that the items in a selected column have the lowest alpha-numeric values at the top.
Display is automatically refreshed for new data items.
Also accessed via "Sort: Ascending" option in "View" menu.

Sort descending
Sorts the entire table such that the items in a selected column have the highest alpha-numeric values at the top.
Display is automatically refreshed for new data items.
Also accessed via "Sort: Descending" option in "View"

Reset sort
Cancels current sort order and reverts to a default sort order.
Display **NOT** automatically refreshed for new data items which are manually entered.
Also accessed via "Sort: Reset" option in "View" menu.

Refresh
Updates the display to reflect the latest situation.
Also accessed via "Refresh" option in "View" menu.

IDM Table - Toolbar.bmp

2.2.1 DM tool bar buttons in brief

The DM tool bar buttons provide access to functions for editing, displaying and generating reports. These are only available when the DM is active and data has been selected in the DM window.

2.3 Manipulating the detail view

This section summarizes the mechanisms which allow you to re-arrange the display and make selections in the detail view.

Any changes are in many cases recorded and preserved. These include:
- Column width (including "hidden" columns)
- Column position
- Title row height

2.3.1 Tab split

The lower edge of the detailed view shows the tabs corresponding to the individual classes of data belonging to the item selected in the outline view. A horizontal scroll bar allows you to scroll right and left across the displayed data.

You can change the split between tabs and scroll bar as follows:
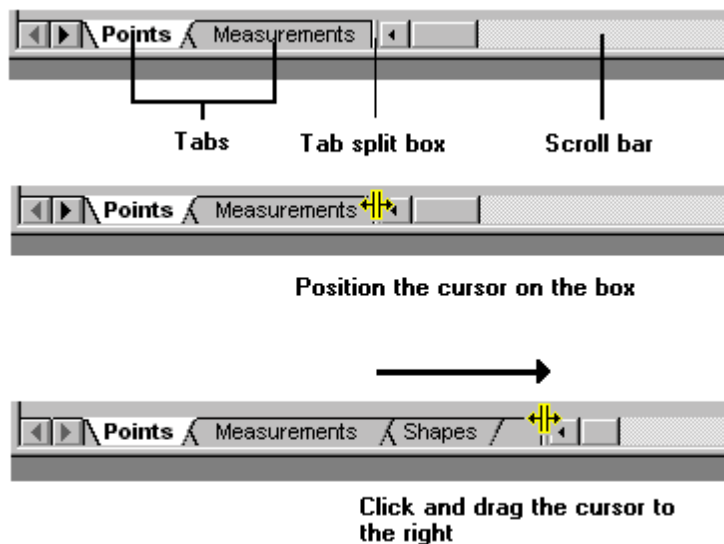
2.3.2 Pane divider

The relative proportions of outline view and detail view can be changed in a similar way to the tab split.
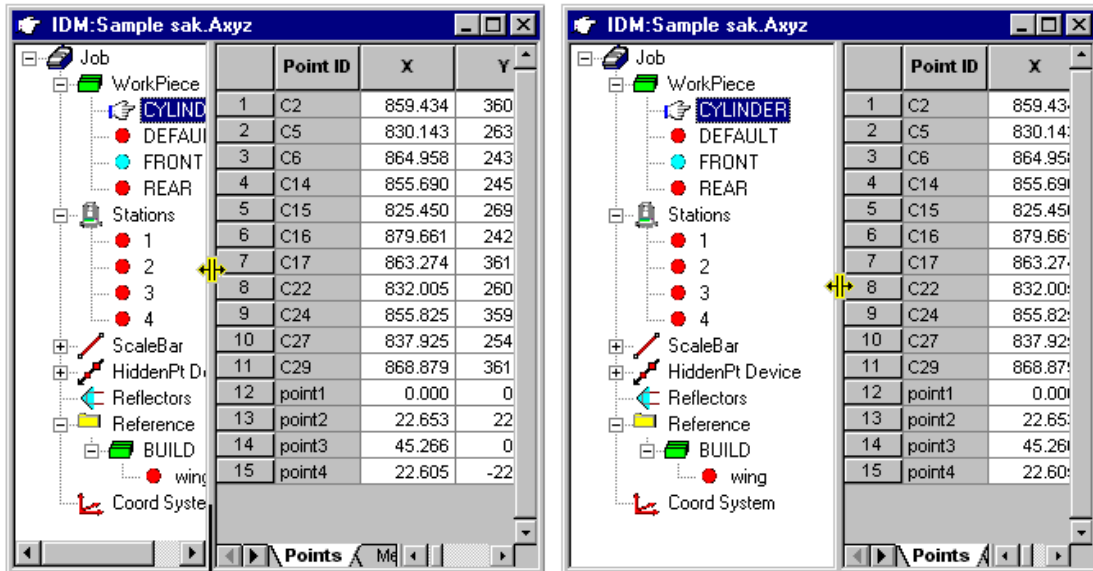
Pane divider

Click and drag cursor to the right

IDM pane split.BMP

2.3.3 Selecting columns

Place the cursor on the column title

	X coord	Y coord	Z coord	Type	Status
1	-1.4179	22.5895	35.9990	Measured	CoordCalc
2	-1.4494	-22.6953	35.9715	Measured	CoordCalc
3	-1.4800	-22.6364	-1.4583	Measured	CoordCalc
4	-1.4366	22.6491	-1.4360	Measured	CoordCalc
5	-1.4005	22.6928	-38.8954	Measured	CoordCalc
6	-1.5470	-22.5860	-38.8987	Measured	CoordCalc

Click to select the column

	X coord	Y coord	Z coord	Type	Status
1	-1.4179	22.5895	35.9990	Measured	CoordCalc
2	-1.4494	-22.6953	35.9715	Measured	CoordCalc
3	-1.4800	-22.6364	-1.4583	Measured	CoordCalc
4	-1.4366	22.6491	-1.4360	Measured	CoordCalc
5	-1.4005	22.6928	-38.8954	Measured	CoordCalc
6	-1.5470	-22.5860	-38.8987	Measured	CoordCalc

IDM col selection.BMP

2.3.4 Selecting rows

Place the cursor on the row label

		X coord	Y coord	Z coord	Type	Status
1		-1.4179	22.5895	35.9990	Measured	CoordCalc
2		-1.4494	-22.6953	35.9715	Measured	CoordCalc
3	→	-1.4800	-22.6364	-1.4583	Measured	CoordCalc
4		-1.4366	22.6491	-1.4360	Measured	CoordCalc
5		-1.4005	22.6928	-38.8954	Measured	CoordCalc
6		-1.5470	-22.5860	-38.8987	Measured	CoordCalc

Click to select

		X coord	Y coord	Z coord	Type	Status
1		-1.4179	22.5895	35.9990	Measured	CoordCalc
2		-1.4494	-22.6953	35.9715	Measured	CoordCalc
3	→	-1.4800	-22.6364	-1.4583	Measured	CoordCalc
4		-1.4366	22.6491	-1.4360	Measured	CoordCalc
5		-1.4005	22.6928	-38.8954	Measured	CoordCalc
6		-1.5470	-22.5860	-38.8987	Measured	CoordCalc

IDM row selection.BMP

2.3.5 Selecting cells

	Workpiece ID	Point ID	Hz	V	
1	CYLINDER	C2	115.6366	82.9302	0
2	CYLINDER	C17	115.5790	89.5174	0
3	CYLINDER	C24	115.6890	96.4691	0
4	CYLINDER	C29	115.4831	100.7479	0
5	CYLINDER	C30	115.8138	102.6040	0
6	DEFAULT	p1	122.5566	117.1940	0
7	DEFAULT	p3	102.8259	125.3667	0
8	DEFAULT	p4	106.2585	117.1136	0
9	REAR	P1	95.0844	81.2424	0
10	REAR	P2	112.9497	76.1249	0

Measurements

Click in the first cell to select it.

	Workpiece ID	Point ID	Hz	V	
1	CYLINDER	C2	115.6366	82.9302	0
2	CYLINDER	C17	115.5790	89.5174	0
3	CYLINDER	C24	115.6890	96.4691	0
4	CYLINDER	C29	115.4831	100.7479	0
5	CYLINDER	C30	115.8138	102.6040	0
6	DEFAULT	p1	122.5566	117.1940	0
7	DEFAULT	p3	102.8259	125.3667	0
8	DEFAULT	p4	106.2585	117.1136	0
9	REAR	P1	95.0844	81.2424	0
10	REAR	P2	112.9497	76.1249	0

Measurements

Drag the cursor to the diagonally opposite cell.

IDM cell selection.BMP

2.3.6 Changing column width

Place the cursor on the column divider

	X coord	Y coord	Z coord	Type	
1	103.001	-78.537	10.148	Measured	Cod
2	10.431	-71.220	10.570	Measured	Cod
3	73.939	139.995	-7.190	Measured	Cod

➡ Click and drag to the right or left

	X coord	Y coord	Z coord	Typ
1	103.001	-78.537	10.148	Measure
2	10.431	-71.220	10.570	Measure
3	73.939	139.995	-7.190	Measure

IDM col width.BMP

The change of width applies to the column on the left of the cursor.

2.3.7 Hiding and restoring ("unhiding") columns

Some data may be of no interest to you. You can hide a column in one of two ways:

1. Make the column width zero. Simply drag the column divider to the left, past the left hand side of the column to be hidden.
2. Double click the column divider to hide the column on the left

Use the "Unhide" command to restore <u>all</u> hidden columns in a selected detail view.

The "Unhide" command can be found on the following menus:
- The "View" menu of the host module
- Shortcut menu on right mouse click in the detail view

2.3.8 Sorting data by column

All the records in any particular detail view can be sorted according to the values in one of the columns. This is applied to <u>all</u> tables of corresponding type. The sorting order is preserved as long as the defined sorting order has not been switched off (see below). Any new data is sorted into the tables according to the selected sorting mechanism, but note exceptions under default operation below.

1. [↓₁₀] "Sort ascending" places the highest alpha-numeric values at the top of the selected column

2. [↑₁₀] "Sort descending" places the lowest alpha-numeric values at the top of the selected column.

The selected sort column is identified with a star next to its label.

These functions are available via the DM toolbar buttons as indicated or via:
- The CDM "View" menu
- The shortcut menu on right mouse click in the detail view

	Point ID	X	Y	Z
1	Origin1	1413.296	3203.968	672.689
2	Point1	1540.053	3255.888	-196.508
3	Point2	1505.940	3117.432	-192.044
4	Point3	1266.939	3187.841	-191.531
5	Point4	1362.307	3184.670	346.665
6	Point5	1424.282	3156.423	343.992
7	Point6	1458.874	3229.188	345.904
8	Point7	1479.587	3241.581	194.233
9	Point8	1439.104	3137.856	190.841
10	Point9	1336.868	3178.882	193.682
11	Point10	1312.151	3173.498	47.094
12	Point11	1425.029	3109.587	40.054
13	Point12	1504.279	3245.843	43.939
14	Point13	1525.194	3258.706	-109.114
15	Point14	1453.864	3094.821	-112.650
16	Point15	1286.155	3166.815	-106.926

Initial arrangement

	Point ID	X	Y	Z *
1	Origin1	1413.296	3203.968	672.689
2	Point4	1362.307	3184.670	346.665
3	Point6	1458.874	3229.188	345.904
4	Point5	1424.282	3156.423	343.992
5	Point7	1479.587	3241.581	194.233
6	Point9	1336.868	3178.882	193.682
7	Point8	1439.104	3137.856	190.841
8	Point10	1312.151	3173.498	47.094
9	Point12	1504.279	3245.843	43.939
10	Point11	1425.029	3109.587	40.054
11	Point15	1286.155	3166.815	-106.926
12	Point13	1525.194	3258.706	-109.114
13	Point14	1453.864	3094.821	-112.650
14	Point3	1266.939	3187.841	-191.531
15	Point2	1505.940	3117.432	-192.044
16	Point1	1540.053	3255.888	-196.508

Results of a "sort up" based on Z value

IDM sort.BMP

Default operation and "Reset sort"

It may not be convenient to have sorting automatically applied when manually entering or modifying data, as the data may be moved to another part of the table before the user has finished reviewing any changes. In this case sorting can be switched off with the **Reset sort** button [↯]. Once changes are complete, click the refresh button [⚡] to update the display to the default sorting order.

A default sorting order applies when sorting is switched off.

For reference data, the default sort restores the order to the sequence in which the data was originally entered (chronological sort). This is beneficial when the reference data also defines a particular sequence of

measurement to be used, for example, in auto inspection of a fixed set of locations.

For all other tables the default order sorts according to point ID, with the lowest alpha-numeric value at the top.

2.3.9 Moving columns

IDM move column.BMP

Note

Although it is possible to select more than one column, it is only possible to move one column at a time.

2.3.10 Changing title row height

IDM title height.BMP

To return the title row to the original height, place the cursor on the row divider and double click.

2.3.11 Multiple selections.

More than one row or column can be selected at the same time. This is known as *multiple selection*. The following examples are given for rows.

Example 1

	X coord	Y coord	Z coord	Type	Status
1	-1.4179	22.5895	35.9990	Measured	CoordCalc
2	-1.4494	-22.6953	35.9715	Measured	CoordCalc
3	-1.4800	-22.6364	-1.4583	Measured	CoordCalc
4	-1.4366	22.6491	-1.4360	Measured	CoordCalc
5	-1.4005	22.6928	-38.8954	Measured	CoordCalc
6	-1.5470	-22.5860	-38.8987	Measured	CoordCalc

IDM multi selection a.BMP

There are two ways to make this selection:
1. Click on row 2 (or 6) and drag through to row 6 (or 2)
2. Click on row 2 (or 6). Then <SHIFT> + click on row 6 (or 2)

Example 2

	X coord	Y coord	Z coord	Type	Status
1	-1.4179	22.5895	35.9990	Measured	CoordCalc
2	-1.4494	-22.6953	35.9715	Measured	CoordCalc
3	-1.4800	-22.6364	-1.4583	Measured	CoordCalc
4	-1.4366	22.6491	-1.4360	Measured	CoordCalc
5	-1.4005	22.6928	-38.8954	Measured	CoordCalc
6	-1.5470	-22.5860	-38.8987	Measured	CoordCalc

IDM multi selection b.BMP

Click on any of the selected rows. Then <CTRL> + click on each of the other rows.

Rows which are together can also be added to the selection by <CTRL> + click and drag as follows:

<CTRL> + click on the top (or bottom) row or the sub-group and then drag through to the bottom (or top) row of the sub-group.

Selecting from different data types and workpieces

You can make multiple selections on different tabs and different workpieces. After starting the selection on one tab, simply click on the next workpiece and/or tab and continue adding with <CTRL> + click.

This is appropriate, for example, in shape fitting where you want to fit shapes across workpieces and use existing shape origins as well as points.

2.3.12 Copying data to a spreadsheet program such as EXCEL

The *Axyz* DM offers a "Copy" function. This allows you to copy a range of cells which can then be pasted into a spreadsheet program for further independent processing.

Note
There is no facility to paste copied cells into the DM.

A range of cells can only be copied from a single table or tab. If a multiple selection includes different data types, for example points and shapes, or the same data types from different parts of the database, for example points from different workpieces, then only the items selected on the last tab will be copied.

Selection of a range by clicking and dragging or click and SHIFT+click will copy any hidden information covered by the selection. To ensure that only the displayed and highlighted cells are copied it may be necessary to build up the selection with CTRL+click.

The same selection pattern must apply to rows or columns. If the selection is asymmetric *Axyz* will extend the selection to achieve symmetry.

Example 1: Copy and paste a row

	Workpiece ID	Point ID	X	Y	Z	Device point	Type
1	FRONT	P1	-37.303	573.915	1864.990	0	Measure
2	FRONT	P2	-34.613	-576.462	1865.419	0	Measure
3	FRONT	P3	-35.601	-575.859	914.596	0	Measure
4	FRONT	P4	-38.014	574.526	913.962	0	Measure
5	FRONT	P5	-37.257	574.735	-37.567	0	Measure
6	FRONT	P6	-37.966	-575.460	-36.589	0	Measure

◄ ► \ Points / Measurements / Shape ◄

Select a complete row in the IDM ..

	A	B	C	D	E	F	G	H	I
1	5	FRONT	P5	-37.257	574.735	-37.567	0	Measured	CoordCalc 10.
2									
3									
4									
5									

.. and paste the results into EXCEL

IDM selection 060.BMP

Example 2: Copy and paste separate columns

	Workpiece ID	Point ID	X	Y	Z	Type	Statu
1	FRONT	P1	-37.303	573.915	1864.990	Measure	CoordC
2	FRONT	P2	-34.613	-576.462	1865.419	Measure	CoordC
3	FRONT	P3	-35.601	-575.859	914.596	Measure	CoordC
4	FRONT	P4	-38.014	574.526	913.962	Measure	CoordC
5	FRONT	P5	-37.257	574.735	-37.567	Measure	CoordC
6	FRONT	P6	-37.966	-575.460	-36.589	Measure	CoordC

◄ │ ► \ **Points** ⋀   Measurements   ⋀ Shape ◄ │   ►

Select separate columns in the IDM ..

	A	B	C	D
1	Point ID	X	Type	
2	P1	-37.303	Measured	
3	P2	-34.613	Measured	
4	P3	-35.601	Measured	
5	P4	-38.014	Measured	
6	P5	-37.257	Measured	
7	P6	-37.966	Measured	
8				

.. and paste them into EXCEL

IDM selection 070.BMP

Example 3: Copy and paste a block of cells

	Workpiece ID	Point ID	X	Y	Z	De p
1	FRONT	P1	-37.303	573.915	1864.990	0
2	FRONT	P2	-34.613	-576.462	1865.419	0
3	FRONT	P3	-35.601	-575.859	914.596	0
4	FRONT	P4	-38.014	574.526	913.962	0
5	FRONT	P5	-37.257	574.735	-37.567	0
6	FRONT	P6	-37.966	-575.460	-36.589	0

◄ │ ► \ **Points** ⋀   Measurements   │ ◄ │   ►

Select a block of cells in the IDM ..

	A	B	C	D	I
1	P2	-34.613	-576.462	1865.419	
2	P3	-35.601	-575.859	914.596	
3	P4	-38.014	574.526	913.962	
4					
5					

.. and paste them into EXCEL

IDM selection 080.BMP

Example 4: Copy and paste an asymmetric selection

	Workpiece ID	Point ID	X	Y	Z	
1	FRONT	P1	-37.303	573.915	1864.99(	
2	FRONT	P2	-34.613	-576.462	1865.41!	
3	FRONT	P3	-35.601	-575.859	914.59(	
4	FRONT	P4	-38.014	574.526	913.96:	
5	FRONT	P5	-37.257	574.735	-37.56:	
6	FRONT	P6	-37.966	-575.460	-36.58!	

▶ \ Points ⟨ Measurements ◀ ▶

Copy an assymetric selection in the IDM ..

	A	B	C	D
1	P2	-34.613	-576.462	
2	P3	-35.601	-575.859	
3	P5	-37.257	574.735	
4				
5				
6				

.. and a modified selection is pasted into EXCEL

IDM selection 090.BMP

2.3.13 Compound selection

Compound selection applies to cases where a list of <u>points</u> must be
selected for processing:

- Points to which a shape is fitted
- Reference points to which object points are transformed
- Object or reference points with which other object points are compared

Here it can be convenient to select a whole group or subset of points with a
single action, known as *compound selection.* The following methods are
available and work either as pre-selection techniques or with Select ID.

Workpieces

- Click on "Workpieces" in the outline view
- Select an individual workpiece in the detail view.

All points are selected <u>except</u> measured control points. Shape origins are
also selected.
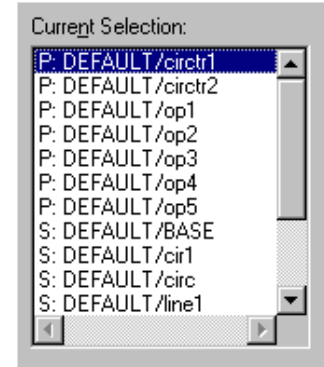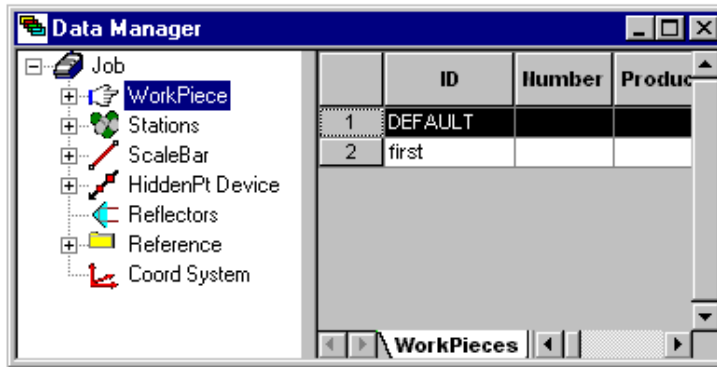
Select the workpiece in the DETAIL view ..   .. and all points and shape origins
                                                     in the workpiece are selected

IDM selection 050.BMP

Shapes

- Click on an individual workpiece in the outline view
- On the "Shapes" tab in the detail view and select an individual shape

All points which make up the shape are selected for use by the processing function.
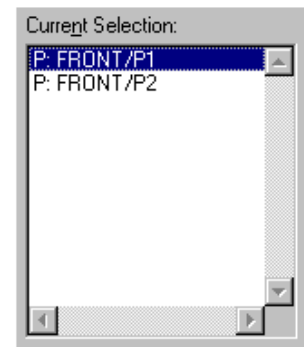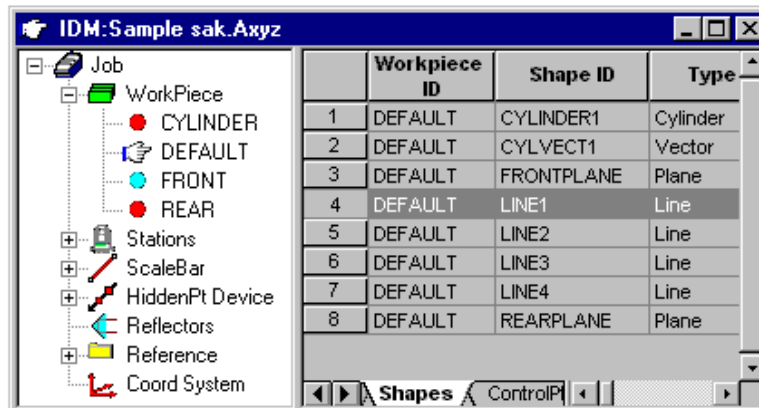
A selection composed of a single selected shape ..   .. is equivalent to selecting
                                                         the points which make up
                                                         the shape

IDM selection 020.BMP

Reference IDs (reference files)

- Click on "Reference" in the outline view
- Select an individual reference ID (file) in the detail view

All points in all workpieces included in the reference file are selected. They can then be used in the "Transformation" and "Compare" functions.

> **Note**
> No reference points will be supplied to the other analysis functions. Only points from the object area can be used so you will first have to swap reference points into the object area if you wish to analyse them.
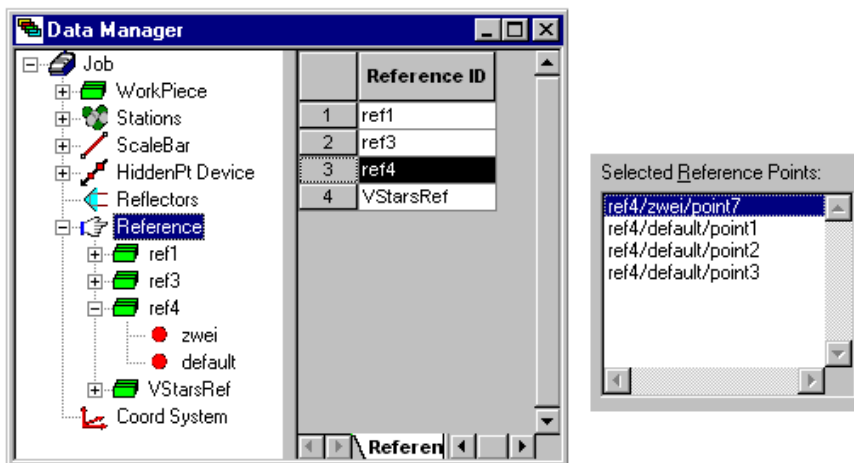
Selecting a reference ID (file) ..   .. selects all points in all
                                        workpieces in that ref. file

IDM Selection 100.bmp

2.3.14 Refresh the view

Although modifications to the database (job file) are immediately
registered on the computer's hard disk, so that the file is always up to date,
the display may occasionally fail to reflect the current situation. A
"refresh" function is provided to enable you to update the display. You can
find this function as follows:

- ⚡ the "Refresh" button on the DM toolbar
- On the CDM "View" menu
- On the shortcut menu using a right mouse click in the detail view
-

2.3.15 Arrange multiple DM windows

Multiple DM windows, and other windows, can be open at any one time.
There are different ways of arranging these windows. See the "Window"
menu of the host module for further details.

3. DM menu summary

3.1 Introduction

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

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

Menus which change are:
- **Edit menu**
- **View menu**
- **Help menu**

A **Data menu** is added.

3.2 Edit summary

Copy	Ctrl+C

IDM Table - Edit menu.bmp

3.3 View summary

	Toolbar		Show/hide the Data Manager toolbar
	Status bar		Show/hide the status bar
	Coord sys:	Active	Show coordinates in currently active coord. system
		Other	Show coordinates in a specified coord. system
⚡	Refresh		Update the display to reflect the latest situation
↓	Sort:	Ascending	Auto sort with the lowest alpha-numeric values at the top of the selected column
↑		Descending	Auto sort with the highest alpha-numeric values at the top of the selected column
↓↑		Reset	Cancel current sort order and revert to default order and display options.
	Unhide columns		Restore all hidden columns in the current detail view
	Save column layout		Save the current settings for col. widths and row heights

IDM Table - View menu.bmp

3.4 Data summary

Edit data		Call up the Data Manager's edit form corresponding to the type of item selected.
New		Add a new item to the job file
Delete		Remove an item from the job file
Report	Ctrl+Shift+R	Create a professional report with the selected data
Import...		Import external files in diverse formats, e.g. ECDS, ManCAT
Export...		Export selected data in diverse formats

DM Table - Data menu.bmp

3.5 Help summary

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

IDM Table - Help menu.bmp

4. Edit menu

4.1 Copy

Copy command (**Edit menu**)   **Alt,E,C**
"Copy the selection and put it on the clipboard"

In a single input field or DM cell, highlight all or part of the data you want and select "copy". The data in the field or cell is then copied and placed on the clipboard for subsequent pasting, if required.

If one or more cells is selected in the DM these are copied to the clipboard and can subsequently be pasted into a spreadsheet.

Shortcuts

DM toolbar :
Keys: CTRL+C

5. View menu

5.1 Toolbar

Toolbar command **(View menu)**   **Alt,V,T**
"Show or hide the toolbar"

Use this command to display and hide the DM toolbar. This toolbar
provides quick access to editing functions within the DM.

A check mark appears next to the menu item when the toolbar is displayed.

5.2 Status Bar

Status Bar command **(View menu)**   **Alt,V,S**
"Show or hide the status bar"

Use this command to display and hide the Status Bar. The Status Bar is
displayed at the bottom of the screen and describes the action to be
executed by the selected menu item or depressed toolbar button, as well as
certain status information.

A check mark appears next to the menu item when the Status Bar is
displayed.

5.3 Coord sys: Introduction

This allows you to select the coordinate system for viewing coordinates in
the detail view. This is a temporary switch. It does not affect the currently
active coordinate system which is still used for on-line measurements and
analysis. The title bar changes to let you know when the active system and
viewing system are different.

5.4 Coord sys: Active

Coord sys: Active command **(View menu)**   **Alt,V,C,A**
"Shows data in active coordinate system "

Use the active coordinate system to display coordinates in the detail view.

5.5 Coord sys: Other

Coord sys: Other command **(View menu)**   **Alt,V,C,O**
"Shows data in coordinate system to be chosen"

Select a coordinate system, other than the active system, to display coordinates in the detail view. When this option is chosen a dialogue box allows you to choose the new coordinate system from the available systems.

Numeric values are displayed in red to indicate that the active system is not being used for display. Title bars also change to state explicitly which coordinate system is used.

5.5.1 Dialogue box: Other coordinate system
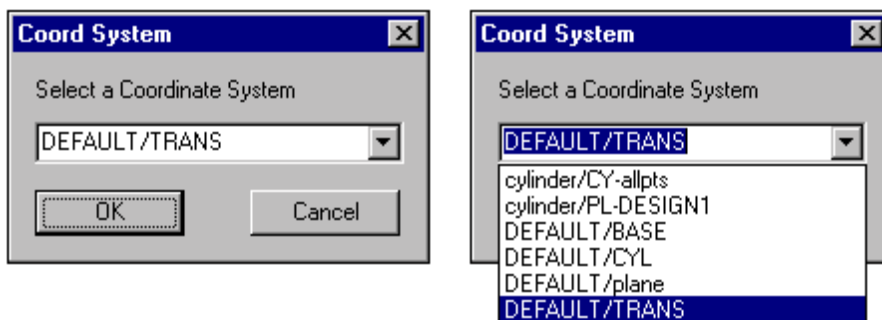
IDM coordsys selection.BMP

The example shows a dialogue box which initially has the name of the system currently used to display the coordinates. The drop-down box shows all other available coordinate systems and shapes which could be used.

5.5.2 Change to title bar

When a coordinate system other than the active system is chosen, the following title bar changes occur:
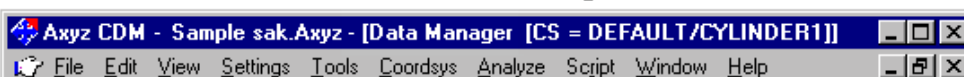
IDM CS other.bmp

5.5.3 Change to text colour

When a coordinate system other than the active system is chosen, numeric text is displayed in red instead of black.
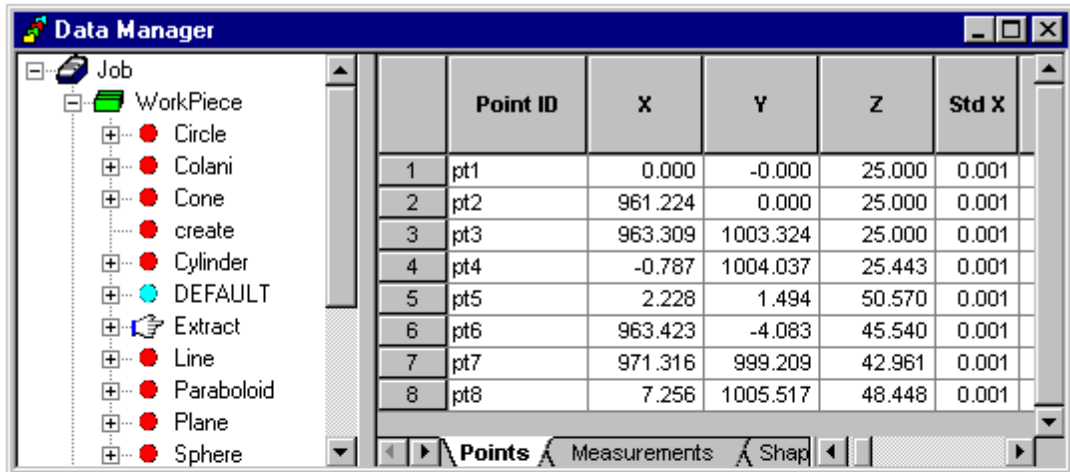
Black display of data in active coordinate system
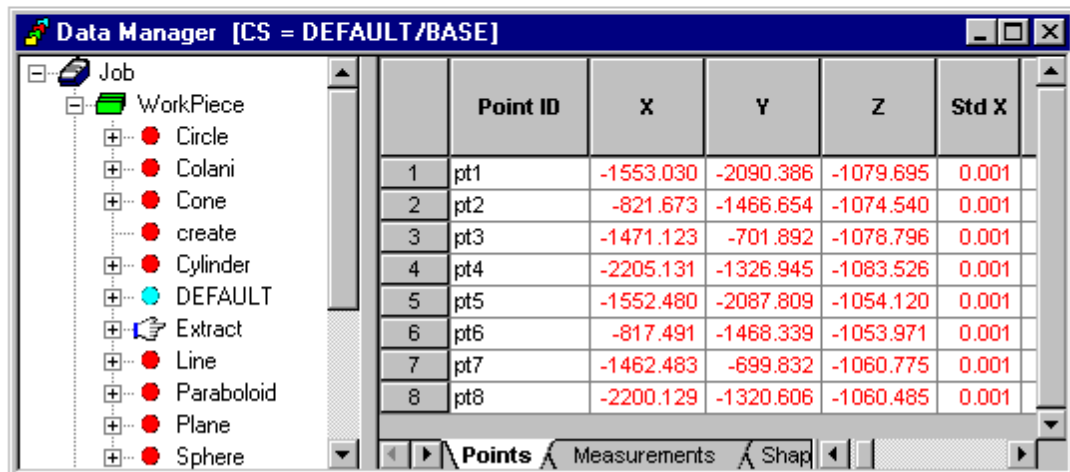
Red display of data in a different coordinate system

IDM CS display colour.bmp

5.6 Refresh

Refresh command (**View menu**)   **Alt,V,R**
"Refresh the data window"

This command will update the display of the Data Manager to reflect the current status of the job file.

Shortcuts

DM Toolbar:
Keys: none

5.7 Sort; Ascending

Sort ascending command **(View menu)**   **Alt,V, O, A**
"Sort according to the selected column"

With the Data Manager active, select a <u>single</u> column of data in the detail view. The command will then sort the whole table in ascending order, i.e. such that the values in this column have their <u>smallest</u> alpha-numeric value at the top and <u>largest</u> at the bottom.

Any new data entered into the table is automatically sorted into position.

For full text on sorting, see "Sorting data by column" on page 18.

Shortcuts

DM Toolbar:
Keys: none

5.8 Sort: Descending

Sort descending command **(View menu)**   **Alt,V, O, D**
"Sort according to the selected column"

With the Data Manager active, select a <u>single</u> column of data in the detail view. The command will then sort the whole table in descending order, i.e. such that the values in this column have their <u>largest</u> alpha-numeric value at the top and <u>smallest</u> at the bottom.

Any new data entered into the table is automatically sorted into position.

For full text on sorting, see "Sorting data by column" on page 18.

Shortcuts

DM Toolbar:
Keys: none

5.9 Sort: Reset

Sort Reset command **(View menu)**   **Alt,V, O, R**
"Switch off individual sort setting and use default"

If sorting has been applied to a particular column in the Data Manager, this actions cancels the current sort order and reverts to the default sort order and operation. This has the following properties:

- For reference data, the sort order is chronological (order of data entry)
- For all other tables sorting is alpha-numeric according to point ID, with the smallest value at the top
- The DM display is not automatically updated for manually entered or modified data. Instead, the refresh button ⚡ must be used to see the currently sorted table
- Other new data, e.g. measurements, are automatically sorted into the default arrangement

For full text on sorting, see "Sorting data by column" on page 18.

Shortcuts
   DM Toolbar: ⬆️
   Keys: none

5.10 Unhide columns

Unhide columns command **(View menu)**   **Alt,V,U**
"Unhide hidden columns"
All columns which have been hidden in the current detail view will be restored by this command.

Shortcuts
   DM Toolbar: none
   Keys: none

5.11 Save column layout

Save column layout command **(View menu)**   **Alt,V,L**
"Save grid settings"
Any changes to the grid layout such as a change in column order or width, or hidden columns, are recorded by this command and the layout used next time a Data Manager window is opened.

Shortcuts
   DM Toolbar: none
   Keys: none

6. Data menu

6.1 Edit

Edit command **(Data menu)**   **Alt,D,E**
"Edit the current selection using a dialogue box"

If records have been selected in the DM, this function calls up an edit
form, if available. The edit form corresponds to the type of data selected
and only some data items can be edited. Where an edit form is not
available in-line editing is an alternative.

Editing has an impact on data integrity. See "Data integrity" on page 43.

For data table elements and edit forms, see "Summary of data tables" on
page 52.

Shortcuts
DM Toolbar:
Keys: none

6.2 New

New command **(Data menu)**   **Alt,D,N**
"Append a new row"

It is sometimes possible to create manually a new data record, i.e. add
another row to a data table. This will be inserted with some default values
and the new record is then edited as appropriate.

Shortcuts
DM Toolbar:
Keys: none

6.3 Delete

Delete command **(Data menu)**   **Alt,D,D**
"Delete selected rows"

When records have been selected in the DM they can be deleted.
Deleting has an impact on data integrity. See "Data integrity" on page 43.

Shortcuts

DM Toolbar:

Keys: none

6.4 Report

Report command (**Data menu**)   **Alt,D,R**
"Creates a report from the currently selected data"

This produces a high quality printed output for selected data. For full
information see "Report generation" on page 127.

Shortcuts

DM Toolbar:

Keys: CTRL+SHIFT+R

6.5 Import

Import command (**Data menu**)   **Alt,D,I**
"Import data from disk file"

External data in a file can be imported into the database. For full details,
see "Importing data" on page 154.

Shortcuts

DM Toolbar:

Keys: none

6.6 Export

Export command (**Data menu**)   **Alt,D,E**
"Export data to disk file"

Selected data can be exported to a file. For full details, see "Exporting
data" on page 141.

Shortcuts

DM Toolbar:

Keys: none

7. Help menu

7.1 Help Topics

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

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

Shortcuts
Toolbar icon: none
Keys: none

7.2 Using Help

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

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

Shortcuts
Toolbar icon: none
Keys: none

7.3 Help Mode

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

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

Shortcuts
Toolbar icon:
Keys: SHIFT+F1

7.4 About Data Manager

About Data Manager command **(Help menu)**   **Alt,H,A**
"Displays program information, version number and copyright"

Shortcuts
Toolbar icon: none
Keys: none

8. Shortcut menu on right mouse click

8.1 Right click in a Data Manager window

Click the right mouse button in any detail view to obtain the following menu:
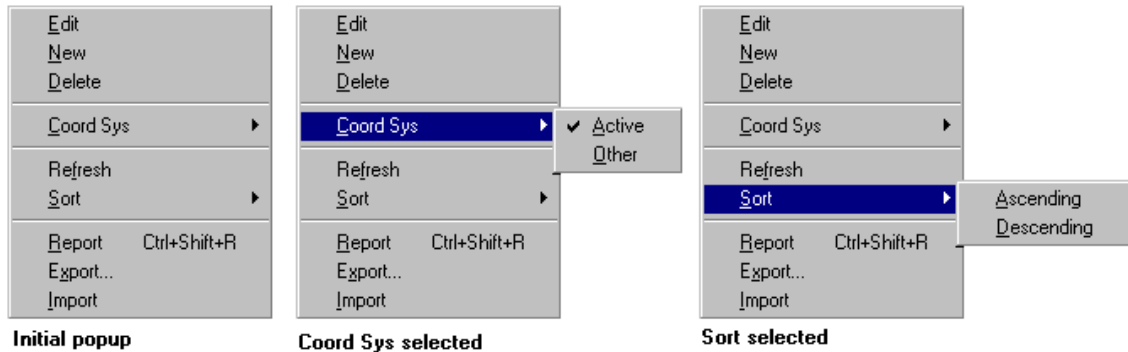
IDM rt click.bmp

Call the **Edit** form for the current selection. Also DM toolbar [✐].

Add a **New** item to the current table. Also DM toolbar [abc].

Delete the selected items. Also DM toolbar [abc].

Coord sys allows a different coordinate system to be used for displaying points, instead of the active coordinate system. Equivalent to menu option **View/Coord sys**.

Refresh the DM display to reflect the current status. Also DM toolbar [⚡].

Sort ascending the current table such that the selected column has the smallest alpha-numeric items at the top. Also DM toolbar [↓].

Sort descending the current table such that the selected column has the largest alpha-numeric items at the top. Also DM toolbar [↑].

Call the **Report** generator for the current selection. Also DM toolbar [▤].

Call the **Import** function. Also DM toolbar [→].

Call the **Export** function. Also DM toolbar [←].

9. Selecting data

9.1 Select ID

The user is frequently asked to specify some item or group of data at many places within **Axyz**. For example:

Action	Requirement
Fit plane to set of points	Select points to be used
Display the parameters of a shape or coordinate system	Select the corresponding shape or coordinate system

To select the required items, call up the DM by clicking on | Select ID... | or using one of the alternative methods listed below.

The purpose of accessing the DM in this way is to restrict the choices open to the user, since the objective is to *select* items for a specific purpose. This has two results.

Firstly, the outline view in the left pane of the DM may only show relevant parts of the database. For example, when choosing a new active coordinate system, only shapes and coordinate systems will be offered as a choice. Clearly it makes no sense to offer, for example, a list of stations. This concept also extends to the detail view. When selecting points for a shape fit the detail view will only offer the tabs for points, shapes and control points, not the tab for measurements.

Secondly, since the objective is to make a selection, editing facilities are not available. Another window is created for this restricted version of the DM and it is not equipped with the DM toolbar.

9.1.1 Other ways of accessing Select ID

Single edit fields are fields in dialogue boxes where you are asked to enter a single item such as the name of a point or workpiece. Where Select ID is used in single edit fields, a right mouse click in the field brings up a shortcut menu with Select ID as the first choice.

Single edit fields and can also initialize Select ID directly by <SHIFT> + Double click inside the input field.

Multiple edit fields are fields showing a list of items such as the points to which a shape must be fitted or the measurements used in a single point calculation.

In a multiple edit field you can directly initialize Select ID by a right mouse click inside the field or by <SHIFT> + double click inside the field.

9.2 Pre-selecting data for analysis

There are usually two ways of selecting data for analysis by one of the CDM analysis functions:
1. Choose the function then select data using **Select ID**
2. First select the data directly in the Data Manager, then choose the function

In the second case the function is prepared with the selected data already in place. It is then further possible to automatically execute the function, which leads to a particularly fast and convenient method for analysing data. See the CDM manual for more on this auto-calculation feature.

When pre-selection is the preferred technique, there is no restriction on what may be selected since the full feature set of the DM is available. However a function will reject selected data which is not of the required type.

Note
Pre-selection does not work across modules. If you initialize the DM in one of the instrument modules, select points and then try to fit a line using the corresponding analysis function in the CDM, the selection is not available.

10. Modifying data

10.1 Data integrity

Data integrity is a general term covering issues which concern:

- **Data access**
  The ability to modify data or access certain functions should be optionally restricted
- **Data protection**
  Data should not be lost, or overwritten without proper controls
- **Data consistency**
  The data in the job file should accurately reflect the current state of measurement and not present confusing or inconsistent results

The consequences of modifying or deleting data are particularly important. Changes do not necessarily affect only the item concerned since other data elements may be linked to it.

Examples

- Deletion of a station logically implies the deletion of all measurements made at that station.
- Modification of point coordinates would change the parameters of a circle fitted to that point.

10.1.1 Access rights

An *editing profile* can be defined for every **Axyz** installation which restricts the ability to modify data or access certain functions. In this way a system administrator or *Superuser* can ensure that operators on site do not accidentally change critical elements of the job.

See the **Axyz** Core Data Module Software Reference Manual
Settings menu/Access rights

10.1.2 Identifiers

Most data, such as measured points, are stored in a workpiece which must already exist in the database. The workpiece ID becomes part of the ID for the data element. For example, a 3D point named "HOLE-36" and located in workpiece ID "DOOR-LEFT" is actually identified to the system as "DOOR-LEFT/HOLE-36".

This applies to shapes and coordinate systems with one exception. Target thickness correction which depends on the ID of a fitted shape must have this ID assigned to the associated measured points before the shape has been created, since points must first be measured before the shape can be created.

10.1.3 Overwrite and delete warnings

Many data items can be deleted or overwritten by re-measurement and re-calculation. In this case the user can optionally generate a warning to ensure that existing critical data is not accidentally changed.

See the **Axyz** Core Data Module Software Reference Manual
    Settings menu/Confirmations

10.1.4 Shape history

Users can optionally choose to maintain a *shape history*, i.e. a record of the other data elements used to create a particular shape. If this is done, any changes to the shape's source elements will cause the shape's parameters to be re-calculated.

See the **Axyz** Core Data Module Software Reference Manual
    Settings menu/General

10.1.5 Deletion of points

The following types of *simple point* are either independent of particular measurements or can easily be recreated from other elements. They can therefore be deleted without further consequence.
1. Entered
2. Reference
3. Control
4. Hidden
5. Calculated
6. Coordinate set

The following types of *complex point* are derived from measurements. Deletion will also cause all associated measurements to be deleted.
1. Measured
2. Measured control
3. Device points
4. Set

10.1.6 Modification of points

Modification of points implies altering coordinate values or other associated numerical data such as standard deviations.

Modification not allowed

Modification has no practical use for the following point types and is therefore not allowed:
1. Coordinate set
2. Set

Modification of simple points

Modification of the following simple point types is permitted and has no further consequences:
1. Entered
2. Reference
3. Control
4. Hidden
5. Calculated

Modification of complex points

Modifying the following complex point types has additional consequences:
1. Measured
2. Measured control
3. Device points

The consequences of modification are:
- Point type is converted to "Entered", so that they then become simple point types
- All associated measurements are deleted

10.1.7 Deletion of measurements

There are further consequences if a measurement is deleted. These apply to the 3D points associated with the measurement.

Consequences are as follows:
- If the corresponding 3D point cannot be re-calculated after deletion of the measurement, then delete the point

- If the corresponding 3D point <u>can</u> be re-calculated after deletion of the measurement, then re-calculate the point using the Single Point Solution. In this case the point type remains the same as before.

    Note
    If deleted measurements were previously used by the Orientation Module, a new orientation is <u>not</u> automatically executed.

Warnings: Deletion of standard measurements

If you delete standard measurements you may lose information critical to you measurement accuracy, for example in the Orientation Module.

If a measurement may be bad, consider one of the following options:
- Temporarily remove it in the bundle adjustment
- Re-calculate any corresponding single point solution using only the other measurements involved in the solution.

Warnings: Deletion of ori. and coll. measurements

If you delete orientation and collimation measurements it may be impossible to re-calculation preliminary orientation information for an optimized network orientation (bundle adjustment).

Accurate collimation measurements may also be critical in ensuring your measurement accuracy.

10.1.8 Modification of measurements

It is not possible to modify any numeric values associated with standard measurements or orientation and collimation measurements.

10.1.9 Deletion of stations

There are further consequences if a station is deleted.

Consequences are as follows:
- All measurements made from the station are deleted
- For each deleted measurement, the consequences of a measurement deletion are implemented
    - Delete a corresponding 3D point if it cannot be re-calculated
    - Re-calculate a 3D point if this is still possible

Warning: Deletion of stations

If you delete a station you lose all measurements associated with it. This may reduce the accuracy of your measurements or make it impossible to re-calculate an orientation network or particular 3D coordinates.

As an alternative, do one of the following:
- Remove the station temporarily from the network by switching off the "use" flag and then re-calculate (orient) the network
- Recalculate (orient) the network but manually select the stations and skip the station under investigation

10.1.10 Modification and creation of stations

It is not possible to modify any numeric parameters associated with a station.

It is not possible to manually define a new station. A new station can only be created in the **Station Setup** menu of the appropriate instrument module.

10.1.11 Deletion of workpieces

Deletion of a workpiece will cause the entire contents of a workpiece to be deleted, i.e. all
- Points
- Measurements
- Shapes
- Coordinate systems

Any additional consequences associated with deletion of elements of the above type will also be implemented. It is not possible to delete:
- The workpiece named "Default"
- The currently active workpiece

10.1.12 Changes to scale bar data

Modification of scale bar distances

Scale bar distances can be altered. If the job file already contains scale bar points with the ID of the modified scale bar, a warning is generated with the corresponding scale bar ID.

Deletion of scale bar point measurements

If these are removed you may not be able to scale the network but an orientation will probably still be possible.

10.1.13 Changes to hidden point device data

Modification of hidden point device distances and coordinates

Hidden point device distances can be modified. If the job file contains device (offset) points with the ID of the modified device, a warning is generated with the corresponding device ID.

10.2 General editing features

There are two principal ways of altering data.

- In-line editing, by directly clicking on an individual *field* (cell) in the detail view
- Form editing, by selecting a complete *data record* (row) and then editing each individual field in a separately displayed form

When editing by forms it is not necessary to select an editing function specific to the type of data being edited. The DM will present the correct form corresponding to the type of data selected. For example, if you select points then the edit form for points is presented.

Complete data records can also be deleted and new data records created.

10.2.1 Grey and white fields

Users are not permitted to alter all information relating to an existing item of information. In the detail view and in the edit forms, the individual data components or *fields* which relate to an existing data item or *record* are colour-coded as follows:

- Fields shown in grey cannot be altered.
- Fields shown in white can be edited.

If the DM allows a new data item to be created then most fields are opened up for editing and displayed in white, since only the user can define the individual elements of the new record.

10.2.2 Editing by forms

Select one or more items or *data records*, then access the corresponding
edit form via:

- DM toolbar button 🖉
- Right mouse click, select **Edit**
- Select **Data menu/ Edit**

Multiple selection

Multiple selections can be made within a single data table such as points in
workpiece A or across tables, such as points in workpieces A, B, C.

Any edited data is then applied to all the items. For example, if new
coordinates of (0,0,0) are defined for points, these will be applied to all the
selected points. The title bar of the edit form will then indicate a multiple
selection.
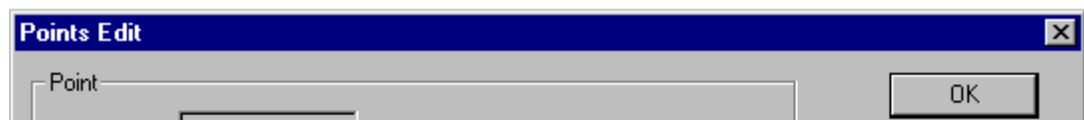
Title bar for "points edit": single item selected

Title bar for "points edit": multiple items selected

IDM edit forms.BMP

Clearly it is only appropriate to select the same type of data for multiple
editing. If a mixed selection of data types is made, for example points and
shapes, then a data form appropriate to only one of the selected data types
is presented.

10.2.3 In-line editing

In-line editing is simply an alternative to editing by forms. A field which
can be edited in a form can be edited the same way in-line, directly in the
detail view. In some instances only in-line editing is available, for example
when defining or editing distances on a scale bar.
For in-line editing, simply click in a white data field and either input the
required value or text, or select an item from a drop-down list which
appears.

10.2.4 Manually creating a new data record

In many cases it is possible to create a new data record manually. Where this is permitted it should be done with care and only when the user has a full understanding of the individual fields.

A new data record is first inserted with some default values. The user then edits this record as required.

To insert the new record, use one of the following methods:
- Click DM toolbar button
- Right mouse click, select **New**
- Select **Data menu/ New**

Complete the definition by one of these methods:
- Highlight the new record, right mouse click, select **Edit**
- Highlight the new record, click DM toolbar button
- Highlight the new record, select **Data menu / Edit**
- Directly edit the new cells in line

Note

Most new data elements require a workpiece. If it does not yet exist it will first have to be created.

New points

When points are manually created they are of type "entered".

10.2.5 Deleting records

One or more records can be selected for deletion. This action should only be done with care. Deletion of measurements, for example, may make it impossible to build a measurement network or may reduce the accuracy of a network.

Select the record or records which you want to delete. Then delete them by one of the following methods:
- Click DM Toolbar button
- Right mouse click, select **Delete**
- Select **Data menu/ Delete**

Note

If a multiple selection is made across tabs, only the selected records on the last tab will be deleted.

10.2.6 "Cut, copy and paste"

Standard Windows 95 cut, copy and paste functions can be applied to the white fields which can be edited. Accessible via shortcut keys:

Cut: CTRL + X

Copy: CTRL + C (also on "Edit" menu and DM toolbar)

Paste: CTRL + V

11. Data tables and edit forms

11.1 Summary of data tables

The following data tables can be viewed and a brief description is provided. In some tables many data elements (fields) can be modified, in others most elements can only be displayed.

11.1.1 Workpiece table

See also "Workpieces" on page 57.

A list of all workpieces in this job, with recorded environmental information.

11.1.2 Object points table

See also "Object point locations" on page 60.

3D object point coordinates, related statistical data and target thickness information.

This covers all object point data <u>except</u> control points and individual points in coordinate sets.

> **Note for tracker users**
> Only stationary points are listed here. See coordinate and measurement sets for other 3D data.

11.1.3 Control points table

See also "Control point locations" on page 65.

Control point coordinates and related statistical data.

11.1.4 Reference data tables

See also "Reference files" on page 67.

Reference data is structured into "files" containing reference workpieces which in turn contain reference point data. This information appears on three tables in the job file:

Reference files

A list of all reference IDs (reference files).

Reference workpieces

A list of all reference workpieces in this reference file.

Reference points

3D reference coordinates with associated statistical data and control flags.

11.1.5 Shapes table

See also "Shapes" on page 71.

Shape names, types, parameters and statistical values.

11.1.6 Coordinate systems table

See also "Coordinate systems" on page 75.

List of coordinate systems with transformation parameters and statistical data.

> **Note**
> Although coordinate systems are stored in particular workpieces, all coordinate systems in the job file, together with their workpiece names, are displayed in the same place.

11.1.7 Set parameters table

See also "Set parameters" on page 80.

This records coordinate system and target thickness information for all coordinate and measurement sets in this workpiece.

11.1.8 Coordinate sets table

See also "Coordinate sets" on page 82.

Coordinate and statistical values for individual points in the set.

Points do not have individual alpha-numeric identifiers.

11.1.9 Measurement set tables

See also "Measurement sets" on page 83.

Measurement sets are recorded for two types of data:
- Distributed points, e.g. points on the track of a moving robot arm
- Stationary points, i.e. multiple recordings of a fixed reflector position to improve accuracy of point location

Measurement sets for distributed points

Measurement values (horizontal angle, zenith angle, distance) for individual measurements in the set.

Measurements do not have individual alpha-numeric identifiers.

Corresponding spatial coordinates (x,y,z) for each individual measurement are also shown, if the station has been oriented.

Measurement sets for stationary points

Measurement values (horizontal angle, zenith angle, distance) for individual measurements in the set.

Measurements do not have individual alpha-numeric identifiers.

To display spatial coordinates, see the averaged stationary point location stored on the **Workpiece/Points** tab.

11.1.10 Object point measurement tables

See also "Standard point measurements" on page 87.

Measurements to object points can be viewed in two ways:

Measurements by workpiece ID:
Select the **Measurements** tab for a selected workpiece to display angle and distance values to all stationary points in this workpiece, from <u>all</u> stations which measure the points.

Measurements by station ID:
Select the **Measurements** tab for a selected station to display angle and distance values to all stationary points sighted from this station.

11.1.11 Orientation and collimation measurements table

See also "Orientation and collimation measurements" on page 91.

Orientation and collimation measurements from this station.

11.1.12 Stations table

See also "Stations" on page 94.

A list of all stations in this job, with connection data and parameters (positional and rotational) if available.

11.1.13 Tracker parameter tables

See also "Tracker parameters" on page 100.

Two types of tracker parameters are stored in the job file as follows:

Tracker measurement parameters

This records measurement parameters for the laser tracker, such as reflector used and time separation between measurements, for all measurement sets in this workpiece.

Tracker calibration data

This records tracker parameters such as Birdbath distance and ADM offset.

11.1.14 Hidden point device tables

See also "Hidden point device definition" on page 104.

Hidden point devices (rods and 3D frames) are defined on two tables in the job file as follows:

Hidden point device list

A list of all available hidden point bars with expansion coefficients, tip coordinates and some descriptive data.

Dimensions of hidden point devices

Distances between pairs of offset targets on the bar, or coordinates of individual targets.

11.1.15 Hidden point device target tables

See also "Hidden point device targets" on page 110.

The actual locations in the object space of targets on hidden point devices, and the associated measurements, are stored on two tables in the job file:

Measured device target locations

3D coordinates of offset targets relating to their actual location in the measurement network.

Measurements to device targets

Angle and distance values from all stations which measure the bar targets in their actual location.

11.1.16 Scale bar tables

See also "Scale bar definition" on page 111.

Scale bars are defined on two tables in the job file as follows:

Scale bar list

A list of all available scale bars with expansion coefficients and some descriptive data.

Scale bar distances (lengths)

Distances between target pairs on the scale bar.

11.1.17 Scale bar target tables

See also "Scale bar targets" on page 115.

The actual locations in the object space of scale bar targets, and the associated measurements, are stored on two tables in the job file:

Measured scale bar target locations

3D coordinates of scale bar targets relating to their actual location in the measurement network.

Measurements to scale bar targets

Angle and distance values from all stations which measure the scale bar targets in their actual location.

11.1.18 Reflectors table

List of available reflectors with type descriptions and offset values.

See also "Reflectors" on page 121.

11.1.19 Units table

Definition of units of measurement such as metres and inches.

See also "Units" on page 122.

11.1.20 Job Information table

Descriptive job information

See also "Job information" on page 125.

11.2 Workpieces

If you use workpieces which correspond to manufactured components you have the opportunity here to store related administrative data such as material used and date of manufacture.

Here you can also:
- Edit information about an existing workpiece
- Create a new workpiece
- Delete an existing workpiece (and all the data it contains!)

Note
A new workpiece can also be created in the CDM "Settings" menu. See *Axyz* Core Data Module, Software Reference: **Settings/Current workpiece**

How to get here:
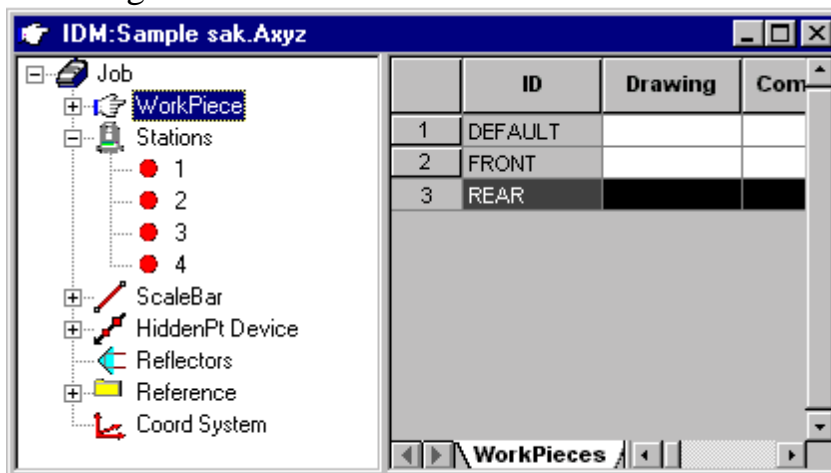
IDM edit wp a.BMP

1. Highlight the workpiece source
2. Select the workpieces tab

11.2.1 Edit workpieces

IDM edit wp b.BMP

Name

Standard, 16 character alpha-numeric identifier or name for this workpiece.

Created

Date when this workpiece was defined.

Drawing Nr

An optional drawing number or manufacturing reference for this workpiece. Maximum 16 characters.

Serial number

An optional serial number for this workpiece. Maximum 16 characters.

Comment

An optional descriptive comment. Maximum 40 characters.

Producer Info

Producer
Optional information about the production. Maximum 21 characters.
Order Nr
Optional order number for the product. Maximum 16 characters.

Environment parameter

Temp.
Optional temperature value concerning the object.
Humidity
Optional humidity value concerning the object.
Pressure
Optional pressure value concerning the object.

Material parameter

Exp Coeff
Optional expansion coefficient of the material used to manufacture the workpiece.
Std Temp.
Optional standard temperature at which the dimensions are defined.

11.3 Object point locations

Object points of type "entered" can be manually inserted here.

How to get here:
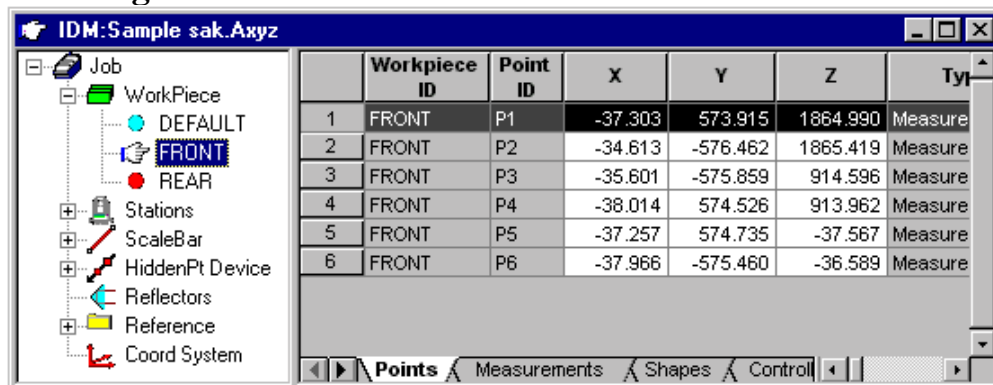
IDM edit points a.BMP

1. Highlight the required workpiece name
2. Select the points tab

Select one or more rows to edit

11.3.1 Edit object points

IDM edit points b.BMP

Note

Either "Std. Deviation" or "RMS" will appear, depending on the general setting in the "Settings" menu.

Workpiece ID

Standard 16 character alpha-numeric workpiece identifier or name.

Point ID

Standard 16 character alpha-numeric point identifier or name.

Device Nr

If the current point represents an offset target on a hidden point device (device point), the target number is shown here. Otherwise directly observed points and the calculated hidden points are given the device number zero and the field is then left blank.

Use

If selected, this point is flagged for use in the next bundle adjustment.

Coordinates and errors

Coordinate values can be altered here. The coordinates are identified with currently defined labels.

> **Note**
> If coordinates of a measured point are altered then:
> - Point type is automatically changed from "measured" to "entered"
> - All associated measurements are deleted

Coordinates
Individual coordinate values in currently active coordinate system.

Std. deviation
Standard deviation values.

If the coordinate values are derived from a bundle adjustment or single point solution, these are the square roots of the variance values calculated by error propagation.

For entered or calculated points a default value is entered here.

Note that a full variance/covariance matrix is stored in the job file but covariances are not revealed by the DM.

RMS

Root Mean Square values.

The full offset residuals (perpendicular and spatial) are expressed in terms of their components along the base system axes. The RMS is computed for each axial set.

Total RMS

This is the Root Mean Square value of the lengths of the full offset residuals (perpendicular and spatial).

Mean Error

This is the variance factor (mean error) calculated by either the Orientation Module or the Single Point Solution, depending on which was used to generate the coordinates. All points calculated in the same orientation procedure (bundle adjustment) will have the same variance factor.

For points not generated by either of these functions a dummy default value is provided.

Target thickness

Concepts

All target thickness parameters can be altered here.

Type

Indicates how the correction is made with one of the following:

- None
  No correction for target thickness
- Axes
  Apply corrections along the axes of a specified shape or coordinate system. The **X,Y,Z** fields are used to specify the corrective shifts.
- Shape
  Apply a correction normal to a shape surface. A value must be specified in the **Thickness** field.

Coord. system

Choose a coordinate system or shape which defines the axes for axial corrections.

Choose a shape if specifying correction normal to a shape's surface.

Thickness

If correcting normal to a shape surface, this is the value of target thickness.

Planar for circle

If correcting to a shape surface which is a circle, the correction can be to the plane of the circle or radial within the plane.

If selected, correction is to the plane of a circle.

X, Y, Z

If correcting along axes, this shows the amount of correction relevant to each axis.

Reflector offset

Concepts

All reflector offset parameters can be altered here.

Type

Indicates how the correction is made with one of the following:
- None
  No correction for reflector offset
- Pos X, Neg Y, etc
  Apply corrections along a specific positive or negative axes of a specified shape or coordinate system.
- Pos Shape, Neg shape
  Apply a correction in the positive or negative direction normal to a shape surface.

Coord. system

Choose a coordinate system or shape which defines the axes for axial corrections.
Choose a shape if specifying correction normal to a shape's surface.

ID

Select the reflector type whose radius defines the amount of offset.

Planar for circle

If correcting to a shape surface which is a circle, the correction can be to the plane of the circle or radial within the plane.

If selected, correction is to the plane of a circle.

Miscellaneous

Type
A point is registered as one of the following types.
- Measured
- Entered
- Calculated
- Control
- Hidden
- Device point
- Scale bar
- Coord syst
- Measured control

Status
Internal parameter.

Created
Date and time when the point was inserted into the job file.

Pointing

This area contains data relevant to points calculated by bundle adjustment or single point solution. For other points, dummy zero values are used.

Best apex
The best apex angle formed by the set of pointings to the target, i.e. the apex angle closest to 90 degs.
Error dist.
The maximum angular residual, expressed as a perpendicular distance offset.

Error ang.
The maximum angular residual.

Device ID
The numeric identifier of any hidden point device used to measure the point. This field is otherwise blank.

Build differences

For object points defined in **Build mode** or checked in **Inspect mode** and which depend on a reference point.

X,Y,Z
These are the axial differences in the currently active coordinate system. Differences are stored as (actual coordinate - reference coordinate).

Total
This is the spatial distance between the measured point and the reference point.

Comment

An optional comment. Maximum 40 characters.

11.4 Control point locations

How to get here:
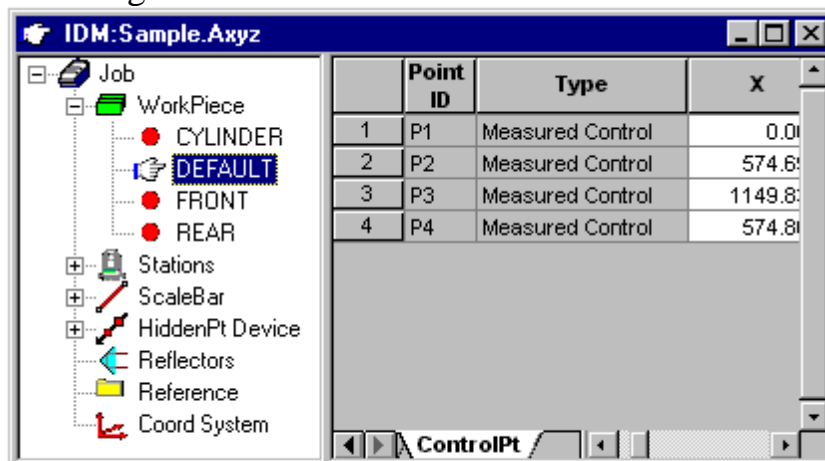
IDM edit control pts a.BMP

1. Highlight a workpiece ID
2. Select the "ControlPt" tab

11.4.1 Edit control points

IDM edit control pts b.BMP

Workpiece ID

Standard workpiece name to which the point is assigned. Maximum 16 alpha-numeric characters.

Point ID

Standard point name. Maximum 16 alpha-numeric characters.

Type

Control points are assigned a point type. Only two types on the list of possible point types apply to control. These are "contol" and "measured control".

Created

Data and time when the control point was created in the database.

Coordinates

X,Y,Z
Coordinate values on each axis (labels depend on current choice)

Weight

Control points are used in the Bundle Adjustment in which they are assigned weights. Three types of weighting can be defined for individual coordinates when weighting by standard deviation is active.

FIXED

This coordinate is defined as fixed. Internally it is assigned a very small standard deviation which will result in a very high weight for the coordinate. This will force the adjustment to hold the coordinate close to the design value.

NOT FIXED

This coordinate is effectively not known and internally is assigned a very large standard deviation which will result in a very low weight for the coordinate. This coordinate will not exert a controlling influence.

WEIGHTED

This coordinate has a particular quality associated with it. When this flag is chosen an **Std** box opens. You must then insert an estimate of the standard deviation of the coordinate into this box. Use this option when you want to introduce a variation in quality at different control coordinates.

When uniform weighting is active, only **FIXED** and **WEIGHTED** apply.

Std deviation

This field holds a standard deviation value and is only offered when the corresponding WEIGHT flag is set to "weighted".

Comment

An optional comment. Maximum 40 characters.

11.5 Reference files

Reference data (design or blueprint coordinates) are organized under *reference IDs*, also called *reference files*. Each reference file contains one or more *reference workpieces* and the workpieces each contain a table of *reference points*.

How to get to the table of reference points:
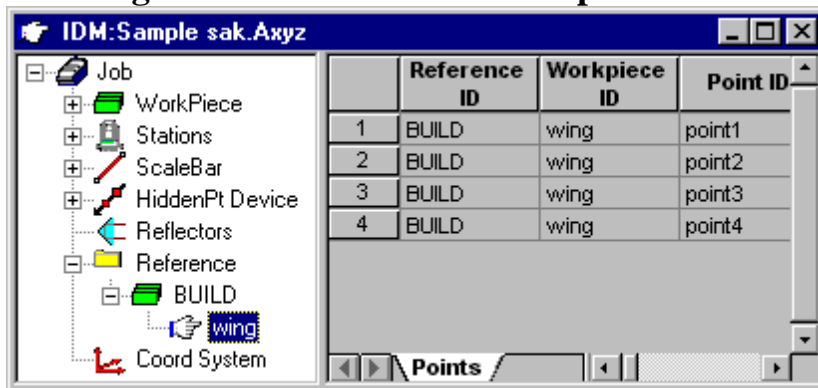
IDM edit ref pts a.BMP

1. Highlight a reference workpiece ID
2. Select the "Points" tab

11.5.1 Edit reference points
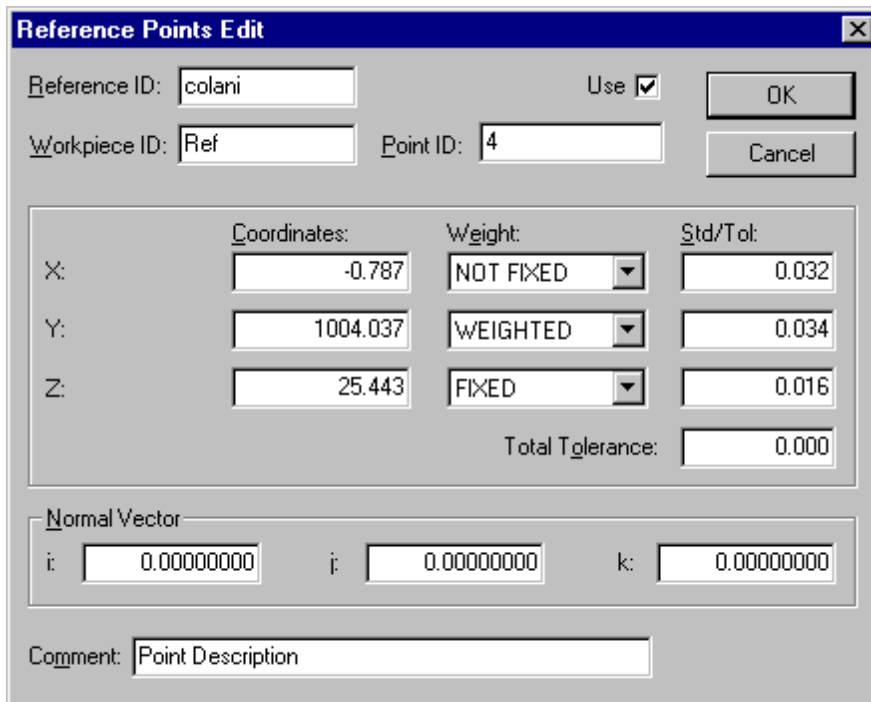
IDM edit ref pts b.BMP

Reference ID

The "reference file" to which this point is assigned, maximum 16 alpha-numeric characters.

Workpiece ID

Standard name for the reference workpiece to which the point is assigned, maximum 16 alpha-numeric characters. This reference workpiece name does not need to correspond to any workpiece names in the object area.

Point ID

Standard point name, maximum 16 alpha-numeric characters.

Use

If set, this flag indicates that the point is to be used for transformation purposes.

Coordinates

X,Y,Z
Coordinate values on each axis (labels depend on current choice)

Weight

The weight flag is only required for transformation points. Three types of weighting can be defined for individual coordinates although all 3 may not always be offered (see below).

FIXED
This coordinate is defined as fixed. Internally it is assigned a very small standard deviation which will result in a very hight weight for the coordinate. This will encourage a very close fit at this location.

NOT FIXED
This coordinate is effectively not known and internally is assigned a very large standard deviation which will result in a very low weight for the coordinate. This will permit a very loose fit at this location.

Warning
If the 3 transformation setup points involve reference coordinates flagged as NOT FIXED, then the actual value entered for the coordinate should be reasonably close to the true value.

WEIGHTED
This coordinate has a particular quality associated with it. When this flag is chosen an **Std/Tol** box opens. You must then insert an estimate of the standard deviation of the coordinate into this box. This will be used to create a weight value which permits a variation in closeness of fit at points with different standard deviations.

Weighting options for unit weighting
It is possible to give the transformed points unit weights.
In this case the reference coordinates are only permitted either very high
weights (FIXED) or very low weights (NOT FIXED).

Std/Tol

This field is interpreted as **Standard deviation (Std)** if associated with a
transformation point which has the flag WEIGHTED.

This field is interpreted as **Tolerance (Tol)** if associated with a Build and
Inspection point.

Transformation points require weights, which are derived from standard
deviations, in order to configure the best fitting least squares
transformation.

Build and Inspect points may optionally use individual tolerance values to
indicate if a build or inspected point lies inside or outside permitted limits.
As an alternative to individually set tolerances, common tolerance values
may be used.

Total Tolerance

For Build and Inspect points an individual total tolerance can be defined
for a point. This defines a maximum offset distance beyond which a build
or inspected point is considered "out-of-tolerance".

Normal vector

Some industries require information relating to the direction of the normal
vector to a surface when building or inspecting points. The direction
cosines (i,j,k) of the normal vector at this reference point can be specified.

Remember
The total length of the vector must be unity!

Comment

An optional comment. Maximum 40 characters.

11.5.2 Adding new reference data

When manually creating object points they can only be added to existing workpieces. If the corresponding workpiece does not exist then it must first be created, for example on the table of workpieces. The new point can then be added to this workpiece.

However reference points are structured in a different way. Internally the information is held in a single table, with a reference ID and reference workpiece name for each reference point. The DM automatically creates an outline of the structure in the left pane by filtering the data according to these identifiers.

This means you can create a new reference ID and/or a new reference workpiece in <u>any</u> list of reference points simply by inserting a new record and editing the default names for the reference ID and reference workpiece.

When the DM window is refreshed, the outline view will change to reflect the new structure and the new point record will be moved to the new reference ID/reference workpiece.

11.6 Shapes

How to get here:

IDM edit shapes a.BMP
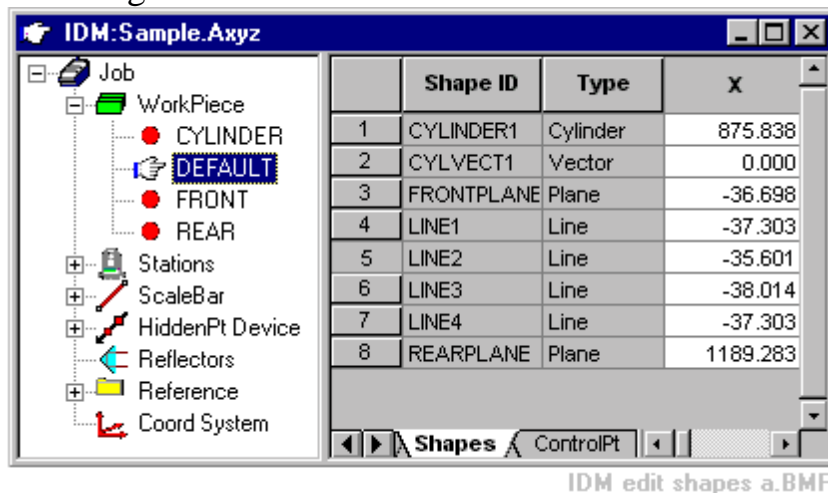
- Highlight a workpiece name
- Select the "Shapes" tab

11.6.1 Edit shapes

IDM edit shapes b.BMP

Workpiece ID

Name of workpiece in which this shape is located.

Shape ID

Identifier for the current shape.

Created (Date Time)

Date and time the shape was created.

Type

The shape can be one of the following types:
- Line
- Plane
- Circle
- Cylinder
- Paraboloid
- Sphere
- Cone
- Vector

Translation

X,Y,Z value
These are the coordinates of the shape's origin, displayed in the current coordinate system.

X,Y,Z std. deviations
These are the standard deviations corresponding to the shape's coordinates.

Rotation

Omega, Phi, Kappa: Angle (Rot X, Rot Y, Rot Z)
These are the 3 rotational parameters which define the tilt of the local shape coordinate system. The rotations are applied about each of the current coordinate system axes. For a rotation ω about the first axis, ϕ about second axis and κ about the third axis, the total relative rotation matrix, R, from the system axes to the local shape axes is given by

$$R = \omega * \phi * \kappa$$

Omega, Phi, Kapa: sd (Std/ Rot X, Std/ Rot Y, Std/ Rot Z)
These are the standard deviations corresponding to the 3 rotational parameters.

Radius/Angle

This is the radial or angular parameter appropriate for the selected shape.

Radius/Angle
The actual value of the parameter.

Std Rad/Ang
The standard deviation of the parameter.

Scale

Coordinate systems and shapes are stored in the same table. These parameters relate to coordinate systems.

Scale
Scale factor applicable to this coordinate system definition. Normal value is 1.0. A value very different from 1 probably indicates a deliberately scaled up or scaled down system.

Std Scale
Standard deviation of the scale factor.

Normal vector (i,j,k)

i, j, k
These are the components of the unit vector along the positive direction of
the shape's axis, stated in the active coordinate system.

Std i, Std j, Std k
These are the standard deviations of the components of the normal vector.

Error information

Mean Error (flag)
If selected this box means that weighting by standard deviation was used
and the mean error (variance factor) was calculated.

Mean Error (value)
The mean error calculated for the shape fit.

RMS total
This is the value displayed on the results page of a shape fit as "RMS
error".
It is the RMS value of the total point residuals (deviations), as displayed in
the results.

RMS X, Y, Z
This is the RMS value of the x, y and z coordinate residuals (deviations)
calculated for the shape fit.

Miscellaneous

Status
Internal parameter.

Active CS (Beginning CS)
Shapes do not currently use this field. By default, the name of the
coordinate system active when the shape was created is stored here.

Approx val

When a shape is calculated, the parameters must first be calculated by some approximate method. This flag records which of the folowing methods was used.

- CurCoordSys
- EnteredParams
- SetupPts

Note

The technique of using the current coordinate system is no longer offered in the shape fitting dialogue.

Fix size parameter

If selected, this box means that the size parameter of the shape was fixed during calculation.

Target thick flag

If selected this box means that target thickness was taken into account when calculating the shape parameters.

Description

A descriptive comment for the shape. Maximum 40 characters.

Size parameters (graphics)

Internal parameter.
These are required to limit the display of calculated shapes which mathematically have an infinite extent in one or more directions.

11.7 Coordinate systems

How to get here:
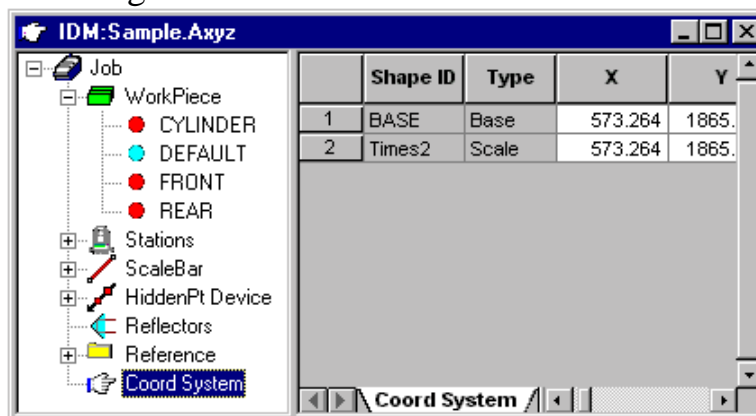
IDM edit coord. systs. a.BMP

- Highlight "Coord System" in the outline view
- Click on the "Coord System" tab in the detail view

11.7.1 Edit coordinate systems

Coordinate systems and shapes are stored in the same table and the same dialogue box is used for each.

IDM edit coord. systs. b.BMP

Workpiece ID

Name of workpiece in which this coordinate system is located.

Shape ID

Identifier for this coordinate system.

Created (Date Time)

Date and time the coordinate system was created.

Type

The coordinate system can be one of the following types, depending on the method of creation.

- Base
- Scale
- Translation
- Rotation
- Bestfit
- Alignment

Translation

X,Y,Z values

These are the coordinates of the coordinate system's origin, displayed with respect to the active coordinate system.

X,Y,Z std. deviations

These are the standard deviations corresponding to the origin coordinates.

Rotation

Omega, Phi, Kappa values

These are the 3 rotational parameters which define the tilt of this coordinate system with respect to the active coordinate system. The rotations are applied about each of the current coordinate system axes. For a rotation ω about the first axis, ϕ about second axis and κ about the third axis, the total relative rotation matrix, R, from the active coordinate system to this coordinate system is given by

$$R = \omega * \phi * \kappa$$

Omega, Phi, Kapa standard deviations

These are the standard deviations corresponding to the 3 rotational parameters.

Radius/Angle

Coordinate systems and shapes are stored in the same table. These fields are only applicable to shapes and default zero values are shown for coordinate systems.

Scale

Scale value
Scale factor applicable to this coordinate system definition, calculated with respect to the active coordinate system. Normal value is 1.0. A value very different from 1 probably indicates a deliberately scaled up or scaled down system.

Scale to base
This shows the scale factor of the coordinate system with respect to the base system. This may not be the same as the scale factor with respect to the active system.

Scale Std
Standard deviation of the scale factor.

Error information

The following errors are relevant to coordinate systems created by a best fitting transformation, i.e. of type "Bestfit".

Mean Error (flag)
An x in this box means weighting by standard deviation was used and the mean error (variance factor) was calculated for the fitted points.

Mean Error (value)
The mean error calculated for the transformation.

Total RMS
This is the value displayed on the results page of a transformation as "RMS error". It is the RMS value of the total point residuals (deviations), as displayed in the results.

RMS X, Y, Z
These are the RMS values of the x, y and z coordinate residuals (deviations) calculated for the transformation.

Miscellaneous

Status
Internal parameter.

Active CS (Beginning CS)

When a coordinate system is calculated the name of the starting system is stored here. This is mainly of interest to manual transformations which are all specified relative to an existing system.

Systems created by axis alignment or best-fit transformation record the name of the base coordinate system.

Approx val

When a coordinate system is calculated, the parameters must first be calculated by some approximate method. This flag records which of the following methods was used.

- CurCoordSys
- EnteredParams
- SetupPts

Fix size parameter

Coordinate systems and shapes are stored in the same table. This option is only applicable to shapes.

Target thick flag

Coordinate systems and shapes are stored in the same table. This option is only applicable to shapes

Description

A descriptive comment for the coordinate system. Maximum 40 characters.

Size parameters (graphics)

Internal parameter.

These are required to limit the display of calculated shapes which mathematically have an infinite extent in one or more directions.

11.8 Set parameters

An edit form is not available. In-line editing only.

How to get here:
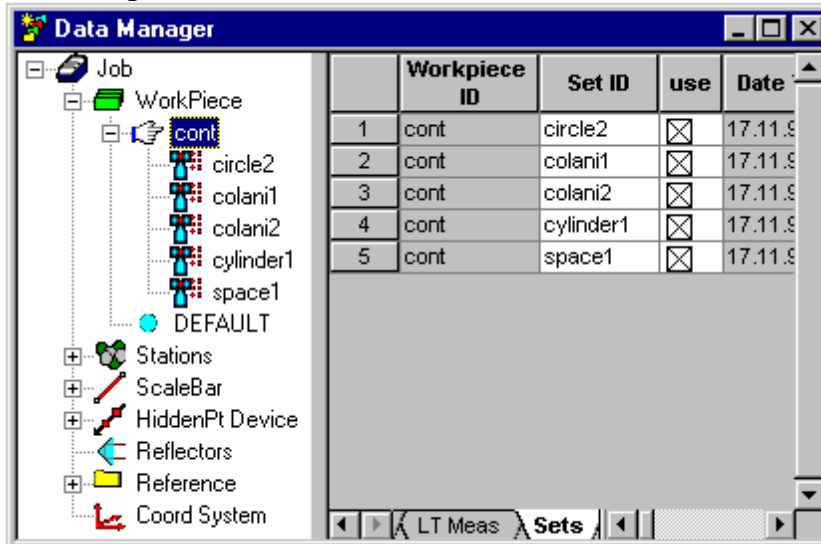
IDM Edit set params a.bmp

- Select a workpiece containing coordinate or measurement sets
- Select the "Sets" tab

11.8.1 Edit set parameters

Workpiece ID

Standard name for the workpiece to which the set is assigned, maximum 16 alpha-numeric characters.

Set ID

Standard 16 character alpha-numeric identifier for this coordinate or measurement set.

Date/Time

Date and time when this set was recorded.

Th type

Indicates how any thickness correction, due to the use of special targets or retro-reflectors, should be made. The following possibilities are available:

- None
  No correction for target thickness
- Axes
  Apply corrections along the axes. The fields "Tx, Ty, Tz" are used to specify the corrective shifts.
- Shape
  Apply a correction normal to a shape surface. A value must be specified in the "Thickness" field.

Thickness

If correcting for target thickness normal to a shape surface, this is the thickness value.

Target CS

Name of the shape or coordinate system used to define the direction of correction for target thickness.

Tx, Ty, Tz

If correcting for target thickness along axes, this shows the amount of correction relevant to each axis.

Planar

If correcting for target thickness to a shape surface which is a circle, the correction can be to the plane of the circle or radial within the plane. If selected, correction is to the plane of a circle.

Comment

An optional descriptive comment may be entered here.

Refl Offset type

This specifies how the reflector offset correction is to be applied:
- Along the positive or negative X, Y or Z axis
- On the outside or inside of a standard **Axyz** shape surface

The appropriate coordinate system is defined in field **Refl CS**.

Refl CS

Name of the shape or coordinate system used to define the direction of correction for reflector offset.

Refl Planar

If correcting for reflector offset to a shape surface which is a circle, the correction can be to the plane of the circle or radial within the plane. If selected, correction is to the plane of a circle.

11.9 Coordinate sets

How to get here:
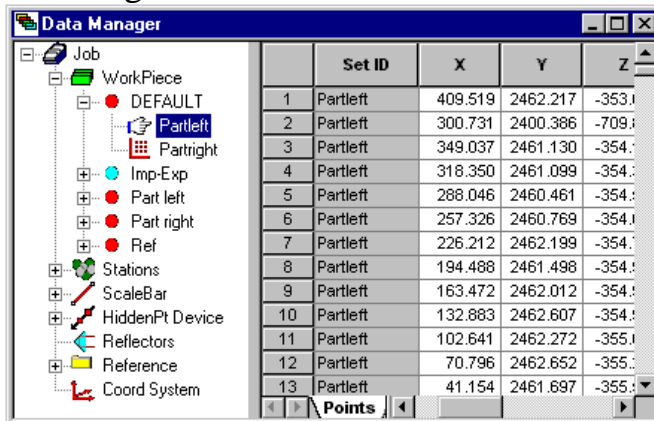
IDM edit coord sets a.bmp

- Expand a workpiece name
- Highlight a coordinate set

11.9.1 Edit coordinate sets
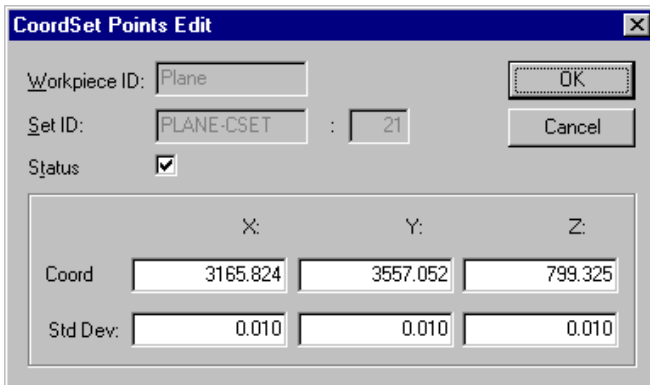
IDM edit coord sets b.bmp

Workpiece ID

Standard name for the workpiece to which the set is assigned, maximum 16 alpha-numeric characters.

Set ID

Standard 16 alpha-numeric identifier for this set of 3D points.

(ID#)

The sequence number of the individually selected point in the set is shown next to the set ID.

Status

Internal parameter.

X,Y,Z

Coord
Individual coordinate values in currently active coordinate system.

Std Dev
Corresponding values for standard deviation.

11.10 Measurement sets

Measurement sets can be recorded for a distributed (dynamic) set of points using **Continuous** or **Grid** mode.
They can also be recorded for single fixed points using **Standard** mode and the methods **Stationary, sphere, circle.**

How to get to measurement sets for distributed points:
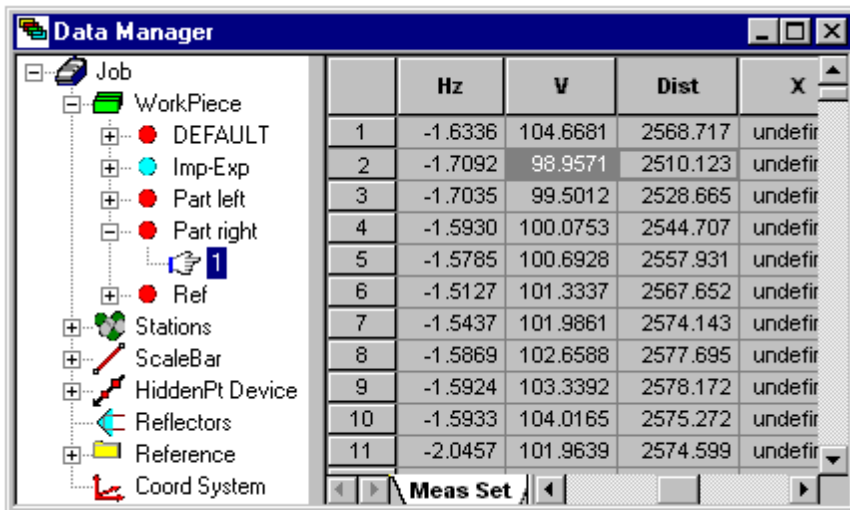
IDM edit meas set a.bmp

- Expand a workpiece name
- Highlight a distributed measurement set

How to get to measurement sets for fixed points:
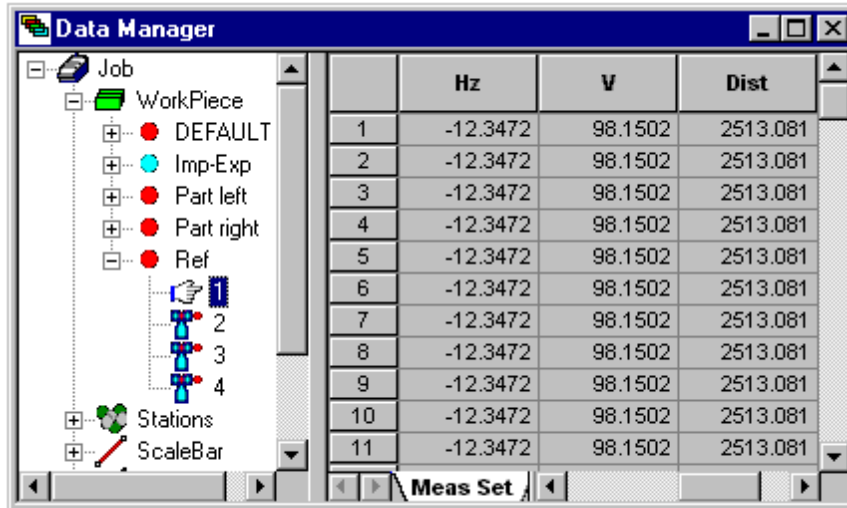
IDM edit meas set b.bmp

- Expand a workpiece name
- Highlight a fixed point measurement set

11.10.1 Edit measurement sets for distributed points

No practical editing facilities possible.
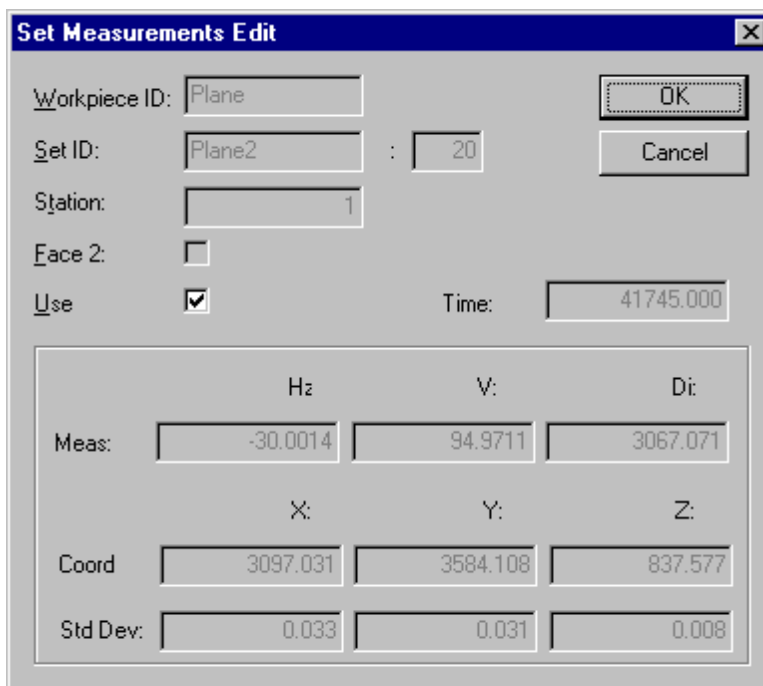
IDM edit meas set c.bmp

Workpiece ID

Standard name for the workpiece to which the set is assigned, maximum 16 alpha-numeric characters.

Set ID

Standard 16 character alpha-numeric identifier for this set of 3D points.

(ID #)

The sequence number of the individually selected point in the set is shown next to the set ID.

Station

The station number from which the measurements were made.

Face II

If selected, the measurement was made in the reversed mirror position (face 2).

Use

Internal flag only.

Time

This is a time stamp in milliseconds since the first point was recorded.

Coord X,Y,Z

If the station has been oriented, these are the equivalent network coordinates in the currently active coordinate system.

If the station has not been oriented, the value "undefined" is shown.

Std Dev X, Y, Z

These are the calculated standard deviations corresponding to network coordinates.

Meas Hz, V, D

Horizontal angle, vertical (zenith) angle and distance values for each individual measurement.

11.10.2 View measurement sets for stationary points

No editing facilities are possible.
No edit form is available.

Workpiece ID

Standard name for the workpiece to which the set is assigned, maximum 16 alpha-numeric characters.

Set ID

Standard 16 character alpha-numeric identifier for this set of 3D points.

Station

The station number from which the measurements were made.

Face II

If selected, the measurement was made in the reversed mirror position (face 2).

Hz, V, D

Horizontal angle, vertical (zenith) angle and distance values for each individual measurement.

Time

This is a time stamp in milliseconds since the first point was recorded.

11.11 Standard point measurements

How to get here (measurements related to a specific workpiece:

IDM edit meas a.BMP

1. Highlight a workpiece name
2. Select the measurements tab

How to get here (measurements related to a specific station):

IDM edit meas b.BMP

1. Highlight a station
2. Select the measurements tab

11.11.1 Edit standard measurements

IDM edit meas c.BMP

Station ID

Number of station from which measurement was made.

Workpiece ID

Workpiece name to which target point is assigned.

Point ID

Standard 16 character alpha-numeric identifier for this target.

Device number

Device number for this target. Normally zero but a positive integer appears here if the measurement is to an offset target on a hidden point device.

Use for computation

If selected this box means that the measurement is used in the Orientation Module.

Angle and distance measurements

Hz, V, D values

Horizontal angle, vertical angle and distance corresponding to this measurement.

Hz, V, D std. deviations
Standard deviations for measured horizontal angle, vertical angle and distance.

Status

Face two
If selected this box indicates that the measurement is in face 2 (reversed telescope/mirror position).

Bolt hole
If selected this box indicates that this is a bolt-hole measurement.

Distance
If selected this box indicates that a distance was measured.

Run Average
The number in this box indicates how many pointings were averaged to create the measurement.

Miscellaneous

Type
The drop-down list box shows the following:

Types relevant to normal theodolite measurements:
- Normal meas - measurement to a normal target point
- HiddenPt meas - measurement of offset target on hidden point device

Types relevant to orientation methods:
- Forward Collim - accurate collimation pointing to another station, face 1
- Reverse Collim - accurate collimation pointing to another station, face 2
- Rel Ori Meas - ECDS-style relative orientation measurement
- Obj Ori Meas - ECDS-style relative orientation measurement
- Fwd/Rv collim - approximate collimation to another station

Type relevant to scale bar measurement:
- Scale bar meas

Types relevant to tracker measurements:
- (Measurement) Set - measurement set for stationary or distributed points
- 2Face Set - measurement set recording 2-face pointings for calibration
- BallBar Set - measurement set recording Ballbar pointing for calibration

Created
Date and time the measurement was recorded.

Device
Identifier for a hidden point device, if used.

Orient Type
This sub-classification is only relevant to ECDS-style orientation measurements:
- "Rel Ori Meas" - relative orientation
- "Obj Ori Meas" - object orientation.
These are not relevant to the standard measurements table.

The possible sub-types available in the drop-down box are:
- DistMeasStat - estimate distance to station
- DistMeasPt - estimated distance to point
- XaxisMeas - pointing along an X axis
- YaxisMeas - pointing along a Y axis
- ZaxisMeas - pointing along a Z axis

Temp
Ambient temperature recorded at time of measurement.

Pressure
Ambient pressure recorded at time of measurement.

Reflector
If distance measurements made, this is the ID of the reflector used.

Comment
An optional 40 character comment relating to this measurement.

Laser tracker

Mean error
Mean error (variance factor) of the measurement set for this stationary point.

Max deviation
Maximum deviation of the measurement set for this stationary point.

Crt Cal#
Current calibration number.

Crt DM Cal#
Current ADM calibration number.

11.12 Orientation and collimation measurements

How to get here:

IDM edit ori&coll meas a.BMP
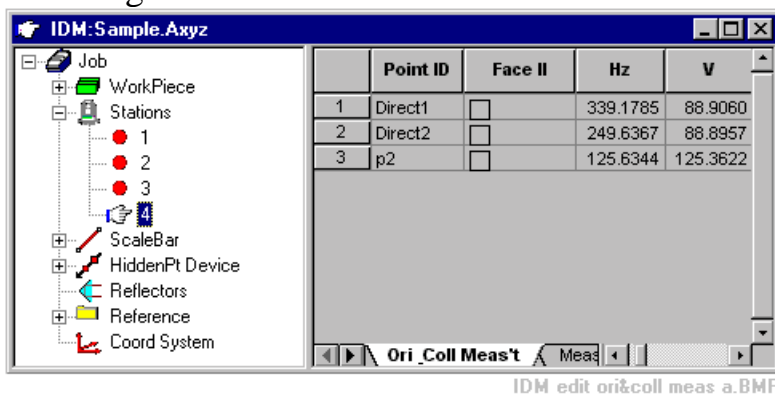
1. Highlight a station
2. Select the "Ori_Coll Meas't" tab

11.12.1 Edit ori. and coll. measurements
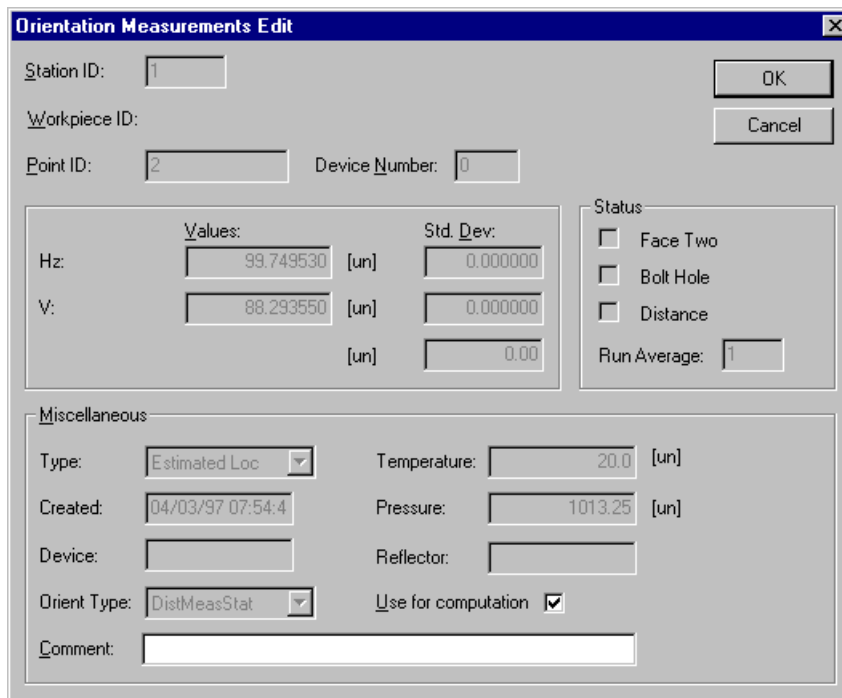
IDM edit ori&coll meas b.BMP

Station ID

Number of station from which measurement was made.

Workpiece ID

Not relevant to orientation and collimation measurements.

Point ID

Standard 16 character alpha-numeric identifier for this target.

Device Number

Not relevant to orientation and collimation measurements.

Hz, V, Distance measurements

Hz, V, Distance values
Horizontal angle, vertical angle and distance corresponding to this measurement.

Hz, V, Distance std. deviations
Standard deviations for measured horizontal angle, vertical angle and distance.

Status

Face two
If selected in this box indicates that the measurement is in face 2 (reversed telescope position).

Bolt hole
Not relevant to orientation and collimation measurements.

Dist measured
If selected this box indicates that a distance was measured.

Average
The number in this box indicates how many pointings were averaged to create the measurement.

Miscellaneous

Type
The drop-down list box shows the following:

Types relevant to orientation methods:
- Forward Collim - accurate collimation pointing to another station, face 1
- Reverse Collim - accurate collimation pointing to another station, face 2
- Rel Ori Meas - ECDS-style relative orientation measurement
- Obj Ori Meas - ECDS-style relative orientation measurement
- Fwd/Rv collim - approximate collimation to another station

Types relevant to normal theodolite measurements:
- Normal meas - measurement to a normal target point
- HiddenPt meas - measurement of offset target on hidden point device

Type relevant to scale bar measurement:
- Scale bar meas

Types relevant to tracker measurements:
- (Measurement) Set - measurement set for stationary or distributed points
- 2Face Set - measurement set recording 2-face pointings for calibration
- BallBar Set - measurement set recording Ballbar pointing for calibration

Created
Date and time the measurement was recorded.

Device
Not relevant to orientation and collimation measurements.

Orient Type
This sub-classification is only relevant to ECDS-style orientations:
- "Rel Ori Meas" - relative orientation
- "Obj Ori Meas" - object orientation.

The possible sub-types available in the drop-down box are:
- DistMeasStat - estimate distance to station
- DistMeasPt - estimated distance to point
- XaxisMeas - pointing along an X axis
- YaxisMeas - pointing along a Y axis
- ZaxisMeas - pointing along a Z axis

Temp
Ambient temperature recorded at time of measurement.

Pressure
Ambient pressure recorded at time of measurement.

Reflector
If distance measurements made, this is the ID of the reflector used.

Use for computation
If selected this box means that the measurement is used in the Orientation Module.

Comment
An optional 40 character comment relating to this measurement.

11.13 Stations

There is no facility to create a new station in the DM. It is a complex procedure to define the correct parameters and flags, and to ensure that these are consistent with the existing network.

Since it is not a simple task to create a new station, it is equally complex to allow editing of station information, particularly if the Theodolite Manager is running and potentially modifying the database.

Adding and modifying station data should therefore only be done through the Theodolite Manager.

Deletion of a station will delete all measurements made from that station. In some situations it may then be impossible to construct the network or measure certain critical points. A safer option is to remove the station temporarily from the network by switching off the "use" flag.

How to get here:
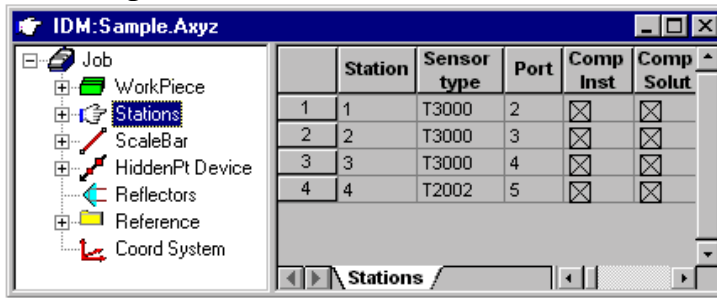
IDM edit stations a.BMP

1. Highlight a station
2. Select the "Stations" tab

11.13.1 Edit stations
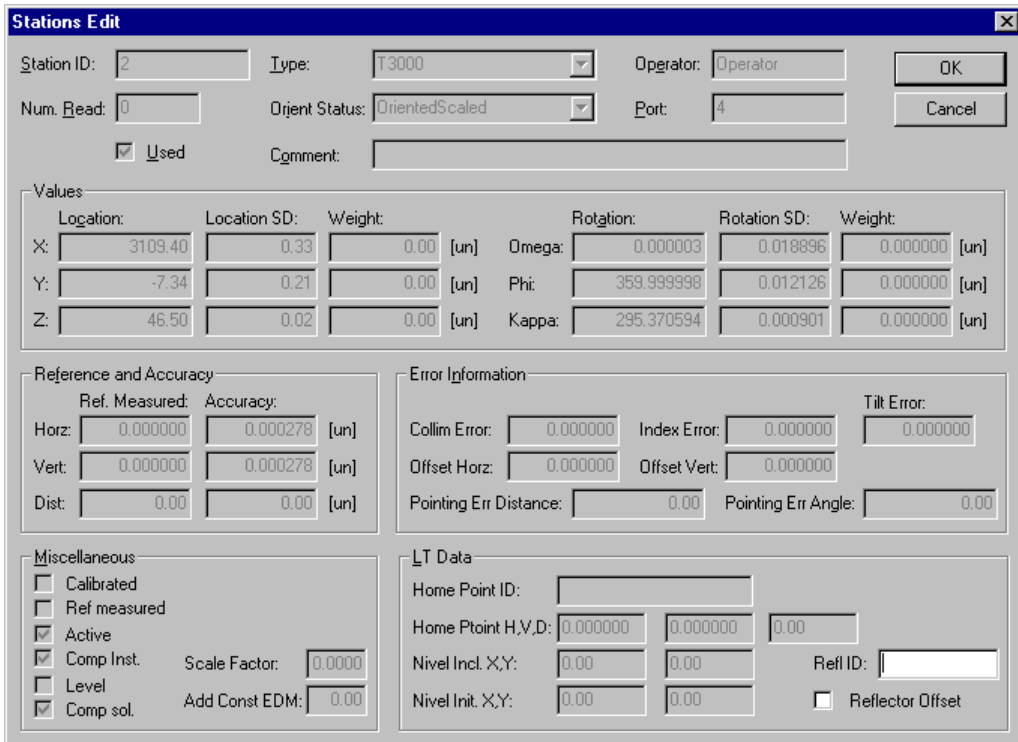
IDM edit stations b.BMP

Station ID

Number of this station

Type

Type of instrument in use at this station. The list currently includes the following theodolites, Total Stations and Laser Trackers:

- T3000
- T2002
- T2000
- T1600
- T1610
- T1800
- E2

- TM1800
- TC2002
- TC1610
- TC1600
- TC1800
- TCM1800
- TC2000

- TM5000
- TDM500
- Smart 310
- LT500
- LTD500
- Smart ADM
- External device

Num Read

The setting last used to define how many readings should be averaged for each pointing.

Orient Status

One of the following status levels is recorded:

- No measure
  (for use by instrument module)
- Not oriented

- Oriented

- Orientable
  (for use by Orientation Module)

- Oriented Scaled
  (for use by Orientation Module)
- Oriented Control
  (for use by Orientation Module)
- Oriented Unscaled
  (for use by Orientation Module)
- Oriented User Entered
  (for use by Orientation Module)

Used

A check mark in this box means that the station and its measurements will be included in any Bundle Adjustment.

Note
You can switch this option on and off in the **Station Setup** option of the corresponding instrument module.

Operator

The name of the operator at this station.

Port

The computer port to which the instrument at this station is connected.

Comment

An optional 40 character descriptive comment about this station.

Values

X,Y,Z location
Coordinates of this station.
X,Y,Z location SD
Standard deviation of station coordinates, taken as the square root of the coordinate variances obtained from the variance-covariance matrix.
X,Y,Z weight
Weights assigned to the coordinates during the last bundle adjustment.

Omega, Phi, Kappa rotation
These are the 3 rotational parameters which define the tilt of the local instrument axes.

The rotations are applied about each of the current coordinate system axes. For a rotation ω about the first axis, ϕ about second axis and κ about the third axis, the total relative rotation matrix, R, from the system axes to the local instrument axes is given by

$$R = \omega * \phi * \kappa$$

Omega, Phi, Kappa rotation SD
Standard deviation of station rotations, taken as the square root of the rotational variances obtained from the variance-covariance matrix.

Omega, Phi, Kappa weight
Weights assigned to the rotations during the last bundle adjustment.

Error information

During the Bundle Adjustment, calibration (index) parameters can be calculated for theodolites and Total Stations as follows:

Collim Error
Horizontal collimation error compensates for a line of sight which is not exactly perpendicular to the transit axis.

Index Error

Index error compensates for a vertical index error where a zenith angle of 90 degs. is not exactly at right angles to the primary (standing) axis. When the instrument is exactly levelled, the primary axis should be exactly vertical and a zenith angle of 90 degs. should be exactly horizontal.

Tilt Error

This compensates for transit axis tilt. The transit axis should be exactly perpendicular to the primary (standing axis).

Offset Horz

The line of sight should pass through the rotation centre of the instrument. This compensates for a horizontal offset.

Offset Vert

The line of sight should pass through the rotation centre of the instrument. This compensates for a vertical offset.

Pointing Err Distance

Last recorded pointing error in distance units, at this station.

Pointing Err Angle

Last recorded pointing error in angle units, at this station.

Reference and accuracy

To check an instrument's stability a reference direction can be recorded. During a measurement session the pointing along this direction can be re-measured and compared with the reference value.

Hz, Vt, Dist measured

Original readings along reference direction.

Preliminary (a priori) quality estimates are required for measurements at every station. Individual quality values cannot be assigned to individual measurements but only the type of measurement. These general assignments can be modified in the **Station setup** option of the corresponding instrument module.

Hz, Vt, Dist accuracy

Estimated standard deviations for all horizontal angles, vertical (zenith) angles and distances measured at this station.

Miscellaneous

Calibrated

A check mark in this box means that, in the Bundle Adjustment, additional parameters are calculated at this station to allow for theodolite or Total Station calibration.

Ref measured

A check mark in this box means that a reference direction was measured.

Active

This flag is indicates that an on-line station assigned to a measurement window.

Comp Inst

A check mark here indicates that the instrument's tilt compensator is in use.

Level

A check mark in this box means that this station has been held levelled in the Bundle Adjustment.

Comp Sol.

A check mark in this box indicates that tilt compensation is active and the station should be held level in the bundle adjustment.

Scale factor

This is a scale factor applied to EDM measurement.

Add const EDM

This is an additive constant for EDM measurement.

LT Data

Home point ID

Internal parameter.

Home point H,V,D

Horizontal angle, vertical angle and distance to the currently defined Home Point (Birdbath location).

Nivel incl. X,Y

Current or last measured tilt values of any NIVEL tilt sensor attached to this station.

Nivel init X,Y

Internal parameter.

Refl ID

The ID of the reflector type currently in use, or last used, at this station. (Applies to Total Stations and Laser Trackers)


Reflector offset

If selected, reflector offset correction is currently in use, or last used, at this station. (Applies to Total Stations and Laser Trackers)

11.14 Tracker parameters

Two tables are used to record tracker parameters. One provides information relating to recording parameters of measurement sets such as time separation between measurements. The other records alignment (calibration) parameters of particular instruments.

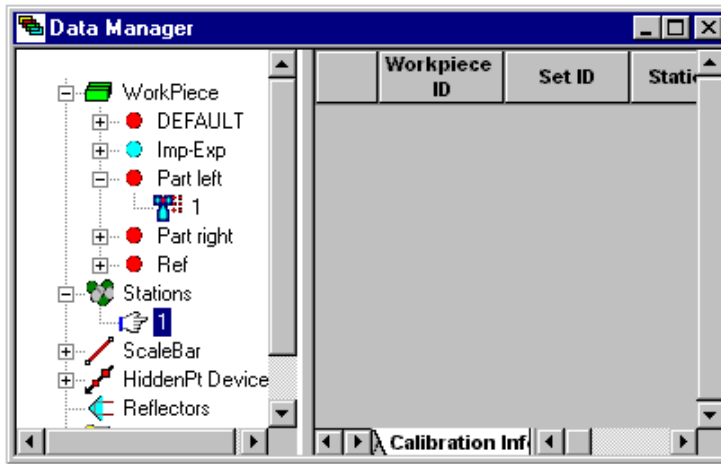**How to get to tracker measurement parameters**

- Click on a workpiece containing measurement sets
- Click on the "LT meas" tab
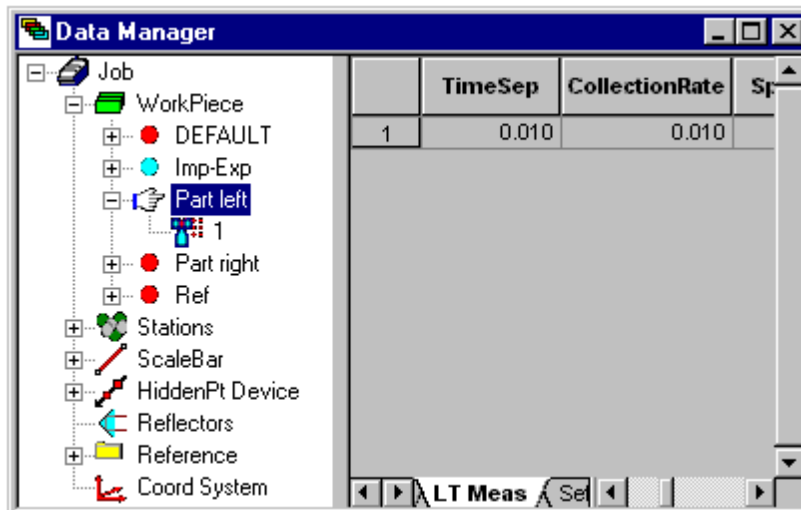
IDM edit tracker params a.bmp

How to get to tracker calibration information

- Click on an individual station
- Click on the "Calibration info" tab

IDM edit tracker params b.bmp

11.14.1 View tracker measurement parameters

No editing facilities are possible. No edit form is available.

Workpiece ID

Standard name for the workpiece to which the measurement set is assigned, maximum 16 alpha-numeric characters.

Set ID

Standard 16 character alpha-numeric identifier for this measurement set.

Station

Station from which measurement set was recorded.

Face II

0 = measurements made in face 1
1 = measurements made in face 2

Reflector ID

ID of reflector type used to make the measurements.

Number of point measurements

If data is filtered by number of measurements, this shows the total number of individual measurements made in this set.

Time separation

If data is filtered by time separation, this shows the time interval in milliseconds between individual measurements.

This filter is applied on top of the basic *collection rate.*

Collection rate

This shows the basic data collection rate from the tracker when the measurements were recorded.

This data stream can be further filtered by *time separation*.

Sphere radius

If the measurement set relates to a stationary point located using a spherical adapter, this shows the radius of the adapter.

Separation mode

Specifies separation between points as one of the following methods:
- Time sep
- Dist sep XYZ
- Reg sphere
- Reg cube
- Dist sep total
- Time sep sphere
- Time sep cube
- XYZ sep sphere
- XYZ sep cube
- Total Dsep sphere
- Total Dsep cube

Distance separation total

If data has been filtered according to a total spatial separation between successive measurements, this shows the value of the separation.

Otherwise zero is shown.

Distance separation axis X,Y,Z

If data has been filtered according to an axial separation between successive measurements, this shows the value of the separation along the appropriate axis (X,Y or Z).

Otherwise zero is shown.

Region 1 X,Y,Z

No longer in use. Previously used for defining grid for free-form surface scanning.

Region 2 X,Y,Z

No longer in use. Previously used for defining grid for free-form surface scanning.

11.14.2 View tracker calibration information

No editing facilities are possible. No edit form is available.

Workpiece ID

Standard name for the workpiece to which the measurement set is assigned, maximum 16 alpha-numeric characters.

Set ID

Standard 16 character alpha-numeric identifier for this measurement set.

Station

Station from which measurement set was recorded.

Face II

0 = measurements made in face 1
1 = measurements made in face 2

Birdbath distance

Current or last used Birdbath distance.

ADM offset

This is the offset distance calculated to give a best fit between ADM and IFM values.

ADM distance

Internal parameter.

ADM Temperature

The internal temperature reading which is used to compensate for material expansion inside the tracker.

11.15 Hidden point device definition

Hidden point devices are defined in the job file using two tables.

1. The first table contains a list of all current devices with their general properties such as number of offset targets (device points).
2. The second table lists the dimensions which relate to a specific device.

A new hidden point device must therefore be defined as follows:
1. The device is first created with default general properties which are then modified.
2. The table of default dimensions, created automatically, must then be edited.
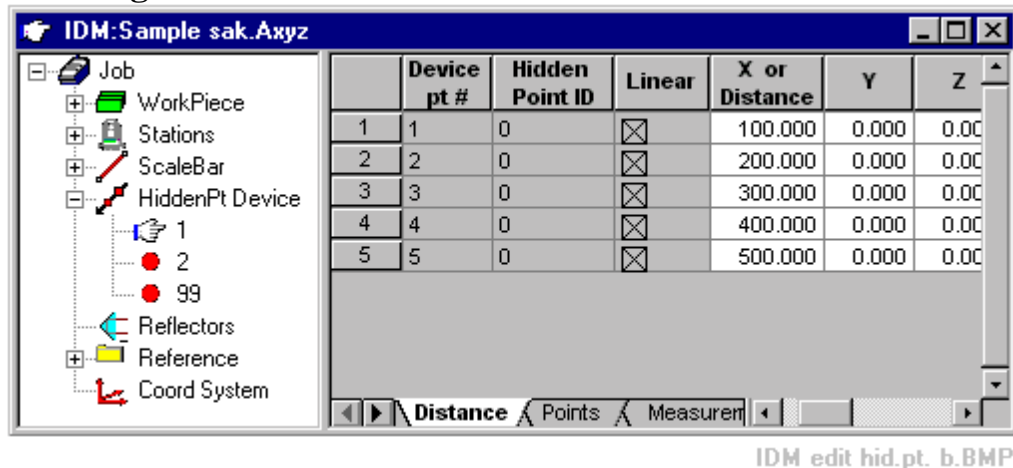
An existing hidden point device is edited by modifying these two tables.

How to get to the general properties:
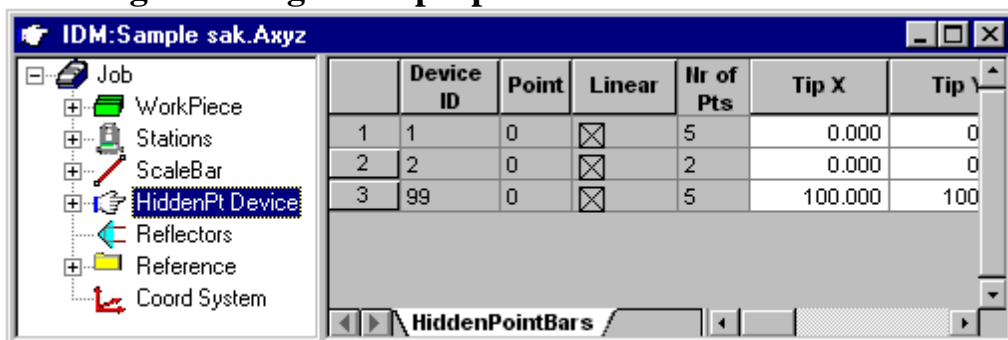
IDM edit hid.pt. a.BMP

1. Click on "Hidden point device"
2. Highlight the "Hidden point bars" tab

How to get to the table of dimensions:

	Device pt #	Hidden Point ID	Linear	X or Distance	Y	Z
1	1	0	☒	100.000	0.000	0.00
2	2	0	☒	200.000	0.000	0.00
3	3	0	☒	300.000	0.000	0.00
4	4	0	☒	400.000	0.000	0.00
5	5	0	☒	500.000	0.000	0.00

IDM edit hid.pt. b.BMP

1. Click on the ID of the device to be edited
2. Highlight the "Distance" tab

11.15.1 Principles of hidden point devices

Hidden point devices enable you to measure points which are not directly visible or cannot be directly targeted.

On a linear rod, two or more offset targets (device points) lie on a straight line with the tip which is brought into contact with the hidden point. The separations of the tip and targets is known, by design or prior calibration.

Any two offset targets can be measured and define a vector in space. Since the distance along this vector from either point to the tip is known, the hidden point may be calculated.

A modified version of this rod is the sine bar which has two targets. Instead of locating a tip beyond the line of the targets, a position between the targets is calculated. The device is typically inserted into a gap and could be used, for example, to find the mid-point of the gap. The hidden point is calculated by first locating a nominal tip position and then calculating an offset from this.

On a non-linear rod the targets and tip need not lie on a straight line. By design or prior calibration a local coordinate system can be established on the device. The device points have known coordinates in this local system. The tip can be a physically defined point or any virtual point defined in this coordinate system. If 3 or more offset targets are measured in the base coordinate system a transformation can be computed between the device

and base systems. It is then possible to generate the tip coordinates (hidden point) in the base system.
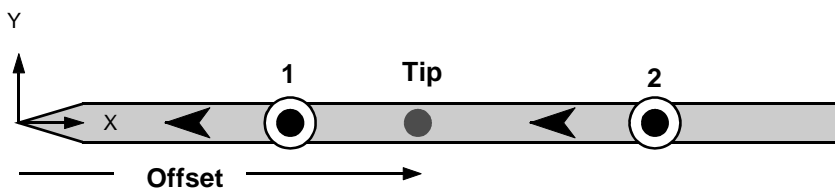
The diagrams show the above principles graphically.
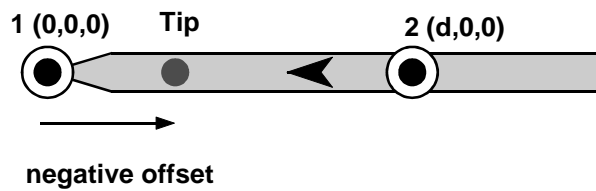
Diagram: Linear hidden point rod

Multi-target hidden point rod (linear device)
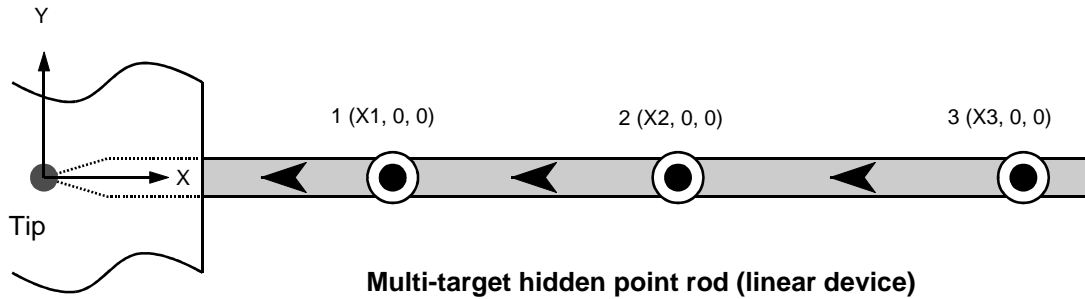
HIDPT-B.WMF
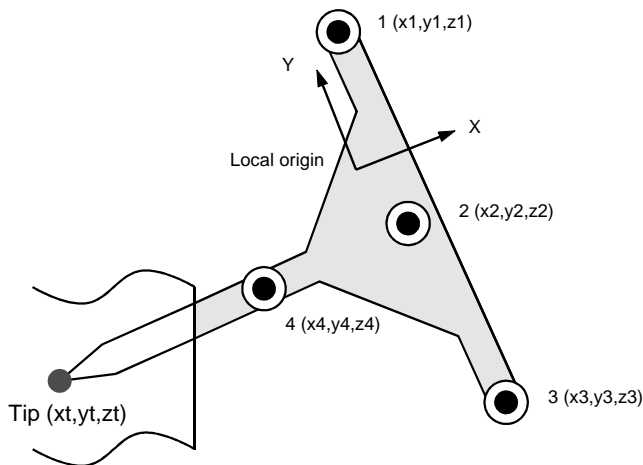
Diagram: Sine bar

A sine bar requires an offset to place the tip between the targets

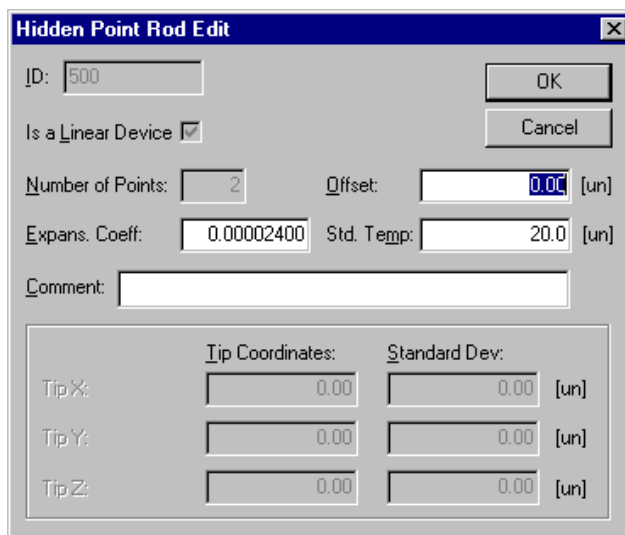**Typical Sine Bar definition**

HIDPT-F.WMF

Diagram: Non-linear hidden point device

Multi-target hidden point frame (non-linear device)

HIDPT-C.WMF

11.15.2 Edit hidden point devices: general properties

IDM edit hid. pt. c.BMP

ID

This is the number of the hidden point device which may be any positive integer.

Is a linear device

When selected, this box indicates a linear device, otherwise a non-linear device is implied.

Number of points

Indicates how may offset targets on the device.

Offset

This parameter is required for *sine bars* which are devices with two targets and a hidden point between them.

When calculating the hidden point, the nominal tip position (zero position) is first computed and then the offset applied. Since the offset is normally calculated in the reverse direction in order to place the tip between the targets, the offset is normally a negative value.

Expans Coeff

Expansion coefficient of material of device.

Std Temp

The temperature at which the device is calibrated.

Comment

An optional text description. Maximum 40 characters.

TipX, TipY, TipZ coordinates

On non-linear devices these are the coordinates of the hidden point in the local coordinate system.

TipX, TipY, TipZ standard dev.

On non-linear devices these are the standard deviations of the hidden point coordinates in the local coordinate system.

11.15.3 Edit hidden point dimensions

In-line editing only.
There is no equivalent edit form.

Device ID

ID number of current hidden point device.

Device pt

The offset target numeric ID. The offset targets must be numbered in a positive sequence starting at 1.

X or distance

For a non-linear rod, enter the x coordinate of the corresponding offset target (device point).

For a linear rod, enter the distance of the target from the tip.

Y

For a non-linear rod, enter the y coordinate of the corresponding offset target (device point).

For a linear rod this value is zero.

Z

For a non-linear rod, enter the z coordinate of the corresponding offset target (device point).

For a linear rod this value is zero.

Std/TipX,Y,Z

For non-linear devices they are the standard deviations of the device point coordinates in the local coordinate system.

11.15.4 Define a new hidden point device

Define general properties
- Highlight "Hidden point devices" in the outline view
- Add a new entry to the list of hidden point devices
- Modify the default values in the new entry with the edit form for scale bars or in-line editing

The new hidden point device is added to the outline view.

Edit the hidden point dimensions
- Highlight the new entry in the outline view.
- Select the "Distance" tab.
- Use in-line editing to define the correct distances or local coordinates. (Form editing not available.)

5 offset targets are defined by default.

If there are too many offset targets delete the extra ones.
If there are insufficient offset targets, add new ones.

On linear devices, an increasing point number implies an increasing
distance from the tip.

For sine bars, enter a negative value for the offset distance.

11.16 Hidden point device targets

When a hidden point device has been positioned and measured,
measurements to the device points (offset targets) and the corresponding
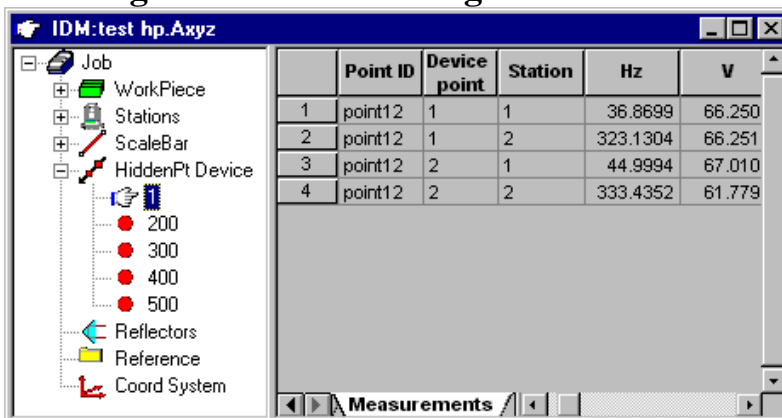3D locations are stored on two tables.

How to get to the table of device point (offset target) locations:
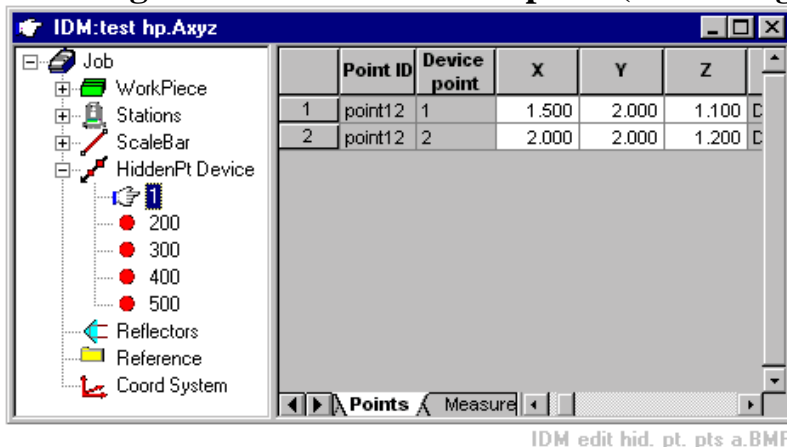
IDM edit hid. pt. pts a.BMP

- Highlight the required hidden point device in the outline view
- Click on the "Points" tab in the detail view

How to get to the table of target measurements:

IDM edit hid. pt. meas a.BMP

- Highlight the required hidden point device in the outline view
- Click on the "Measurements" tab in the detail view

11.16.1 Edit device points locations

Offset targets (device points) on hidden point devices are edited in the same way as normal points and the same edit form used.

See "Edit object points" on page 60.

11.16.2 New device point location

New hidden points with device number zero can be manually created on the "Points" tab for hidden point devices. However they can equally well be created directly on the "Points" tab for normal points. The procedure is the same in either case, i.e. the same as for a manually created normal point. The result is a point of type "entered".

It is not possible to directly create device points with numbers greater than zero, i.e. you cannot create the actual offset points.

11.16.3 Edit device point measurements

Device point measurements can be edited in the same way as normal measurements and the same edit form is used.

See "Edit standard measurements" on page 88.

11.17 Scale bar definition

Scale bars are defined in the job file using two tables.

1. The first table contains a list of all current scale bars with their general properties such as number of targets and expansion coefficient.
2. The second table lists the dimensions which relate to a specific bar.

A new scale bar must therefore be defined as follows:
1. The scale bar is first created with default general properties which are then modified
2. The table of default scale lengths, created automatically, must then be modified
An existing scale bar is edited by modifying these two tables.

How to get to the general properties:
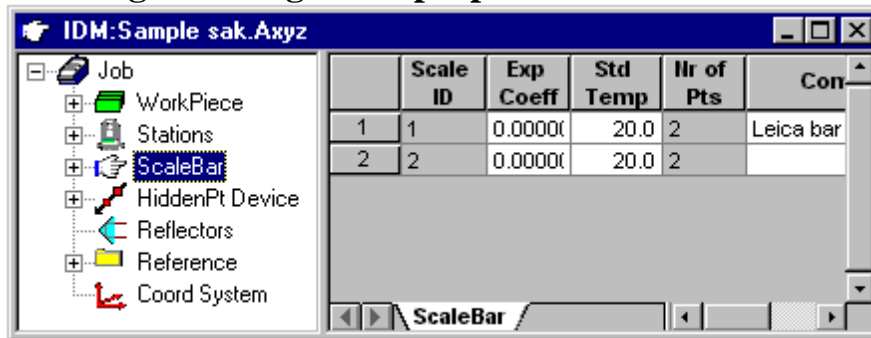
IDM edit scale bar a.BMP

1. Click on "Scale bar"
2. Highlight the "Scale bar" tab

### How to get to the table of scale lengths:
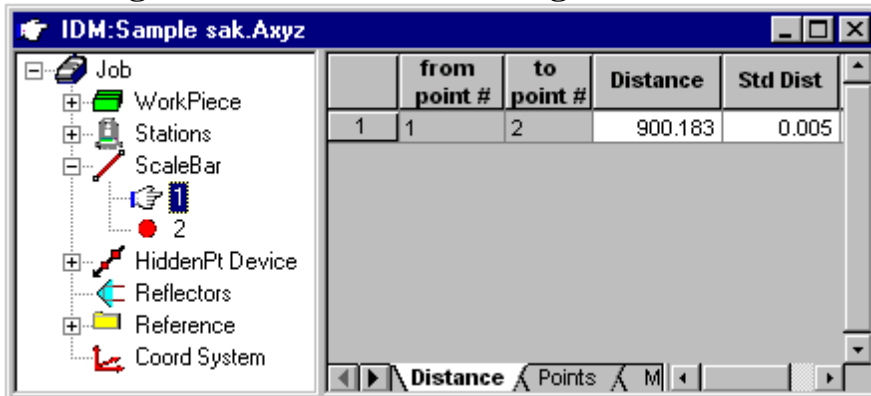
IDM edit scale bar b.BMP

1. Click on the ID of the scale bar to be edited
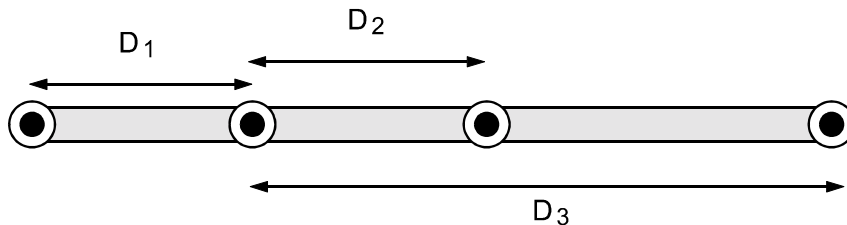2. Highlight the "Distance" tab

11.17.1 Scale bar principles

In brief the ***Axyz*** scale bar concept is as follows:
- A scale bar is a rigid device with 2 or more targets (need not be in line)
- Pairs of targets define separate scale lengths.
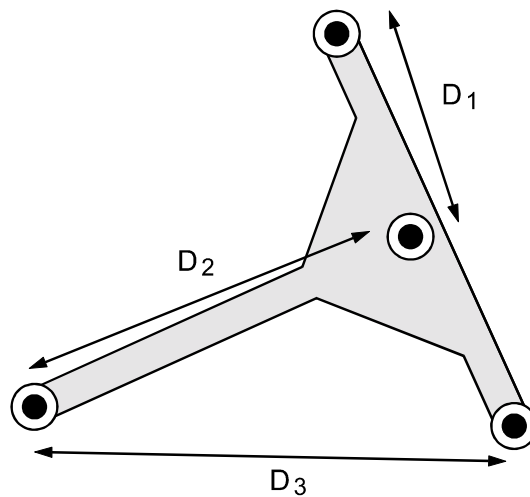- Not all possible lengths need to be defined.

Diagram: Scale bars

D
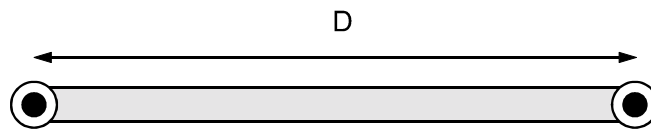
Typical scale bar defining a single distance

D_1 D_2

D_3

A multi-target scale bar defines several reference lengths

D_1

D_2

D_3

General *Axyz* scale bar concept:
A device which combines several standard bars in one unit

SCALEBAR.WMF

11.17.2 Edit scale bars: general properties

Scalebar Edit	
ID: |1	OK
Number of Points:	2	Cancel
Expansion Coefficient:	0.00000240 [un]	
Standard Temperature:	20.0 [un]	
Comment:	Black Leica bar, serial-No. xxx'xxx	

IDM edit scale bar c.BMP

ID

Numeric ID of scale bar which can be any positive integer.

Number of points

Number of targets on this scale bar.

Expansion coefficient

Expansion coefficient of the material of the scale bar.

Standard temperature

Temperature at which the scale bar is calibrated.

Comment

A optional text description. Maximum 40 characters.

11.17.3 Edit scale lengths

In-line editing only.
There is no equivalent edit form.

From point

One end of a target pair defining a distance.

To point

One end of a target pair defining a distance.

Distance

Calibrated distance between the defined targets.

Std distance

Estimated standard error of the calibrated distance.

Use

If this flag is set (x in box) then the scale length will be used in the next bundle adjustment.

If the length is not used but the corresponding targets are measured, then the targets will be treated as normal unknown points by the adjustment.

11.17.4 Define a new scale bar

Define general properties
- Highlight "scale bars" in outline view.
- Add a new entry to list of scale bars
- Modify the default values in the new entry with the edit form for scale bars or in-line editing

The new scale bar is added to the outline view.

Edit the default scale distances
- Highlight the new entry in the outline view.
- Select the "distances" tab.
- Use in-line editing to define the correct distances. (Form editing not available.)

If not all target pairs are shown, add a new entry and continue modifying.

11.18 Scale bar targets

When a scale bar has been positioned and measured, measurements to the scale bar targets and the corresponding target locations are stored on two tables.

How to get to the table of target locations:
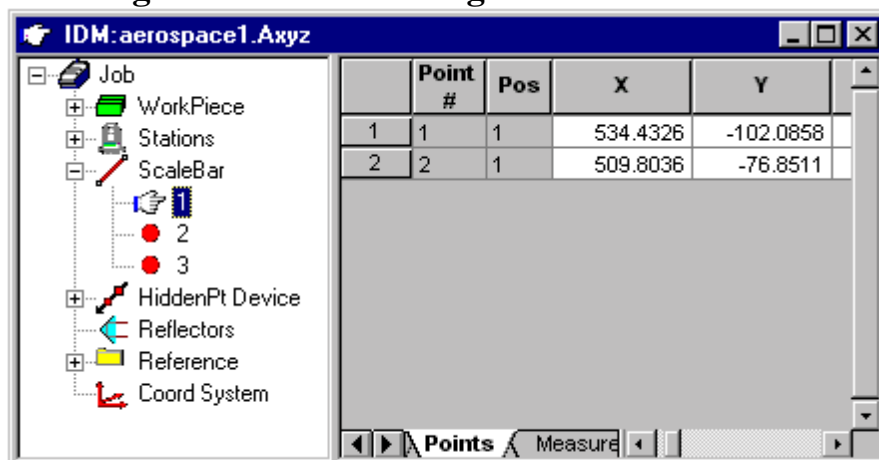
IDM edit scale bar pts a.BMP

- Highlight the required scale bar in the outline view
- Click on the "Points" tab in the detail view

How to get to the table of target measurements:
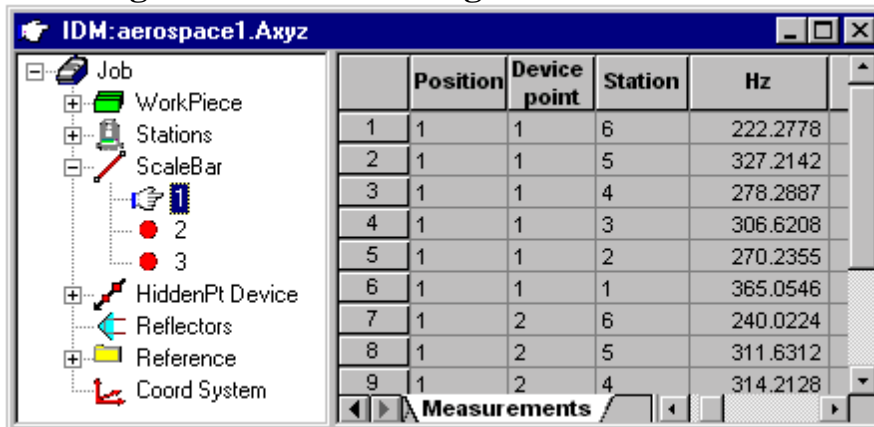
IDM edit scale bar meas a.BMP

- Highlight the required scale bar in the outline view
- Click on the "Measurements" tab in the detail view

11.18.1 Edit target locations

IDM edit scale bar pts b.BMP

Scalebar ID

Identifying number (positive integer) for this scale bar.

Point Nr.

This is a combination of two numbers which uniquely identify the target point on the scale bar in its current location.

The first number is the identifying number (positive integer) for the location of this scale bar.

The second number is the identifying number (positive integer) of the scale bar target being edited.

X,Y,Z coordinates

Individual coordinate values of this scale bar target.

X,Y,Z std. deviation

Standard deviations of the coordinates.

If the coordinate values are derived from a bundle adjustment or single point solution, these are the square roots of the variance values calculated by error propagation.

Note that a full variance/covariance matrix is stored in the job file but covariances are not revealed by the DM.

X,Y,Z RMS

Root Mean Square values.
The full offset residuals (perpendicular and spatial) are expressed in terms of their components along the base system axes. The RMS is computed for each axial set.

Total RMS

This is the Root Mean Square value of the lengths of the full offset residuals (perpendicular and spatial).

Mean Error

If the coordinates were produced by the Orientation Module, this is the variance factor (mean error) of the bundle solution which produced the results. All points from this bundle adjustment will have the same value here.

If the coordinates were produced by a single point solution, this is the variance factor calculated for that particular point.
For any other type of point a dummy default value is provided.

Target thickness

All target thickness parameters can be altered here.

Concepts

Type
Indicates how the correction is made with one of the following:

- None
  No correction for target thickness
- Axes
  Apply corrections along the axes. The fields "Tx, Ty, Tz" are used to specify the corrective shifts.
- Shape
  Apply a correction normal to a shape surface. A value must be specified in the "Thickness" field.

Shape ID
Name of the coordinate system used to define the direction of thickness correction.

Thickness
If correcting normal to a shape surface, enter the value of target thickness.

Planar for circle
If correcting to a shape surface which is a circle, the correction can be to the plane of the circle or radial within the plane.

If selected, correction is to the plane of a circle.

X,Y,Z
If correcting along axes, enter the amount of correction relevant to each axis.

Miscellaneous

Point Status
Internal parameter.

Created
Date and time when the point was inserted into the job file.

Use for computation

If selected, this point is flagged for use in the next bundle adjustment. If not flagged for use then the corresponding scale length will not be used.

Pointing

Best apex

The <u>best apex angle</u> formed by the set of pointings to the target, i.e. the apex angle closest to 90 degs.

Err dist

The <u>maximum</u> angular residual, <u>expressed as a perpendicular distance</u> offset.
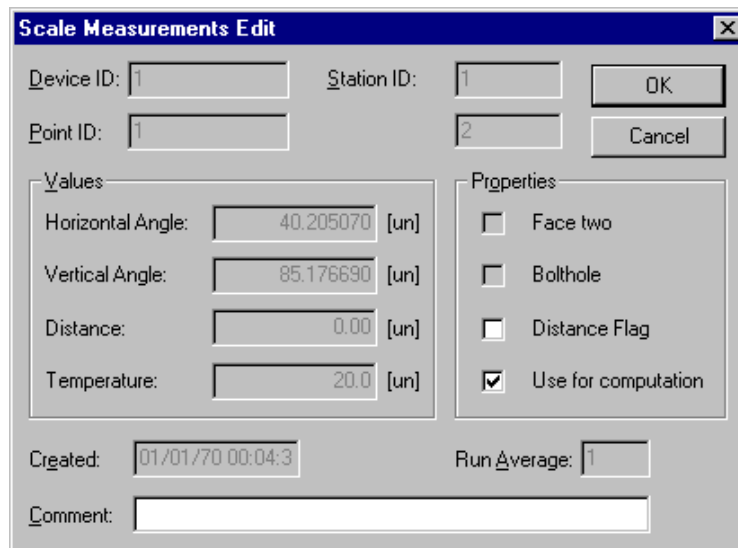
Error angle

The <u>maximum</u> angular residual.

Comment

An optional comment. Maximum 40 characters.

11.18.2 Edit target measurements

IDM edit scale bar meas b.BMP

Device ID

Numeric identifier (positive integer) for scale bar.

Point ID

This is a combination of two numbers which uniquely identify the target point on the scale bar in its current location.

The first number is the identifying number (positive integer) for the location of this scale bar.

The second number is the identifying number (positive integer) of the scale bar target being edited.

Station ID

Numeric identifier (positive integer) for station where measurement was made.

Properties

Face two
A check mark here indicates that the measurement was made in face 2 (reversed telescope position).

Bolt hole
Not relevant to scale bar targets.

Distance flag
A check mark here indicates if distance as well as angles were measured.

Use for computation
A check mark here indicates that the measurement should be included in the next Bundle Adjustment.

Values

Horizontal angle, vertical angle, distance
Measured horizontal angle, vertical angle and distance (if available).

Temp
Measured ambient temperature.

Created

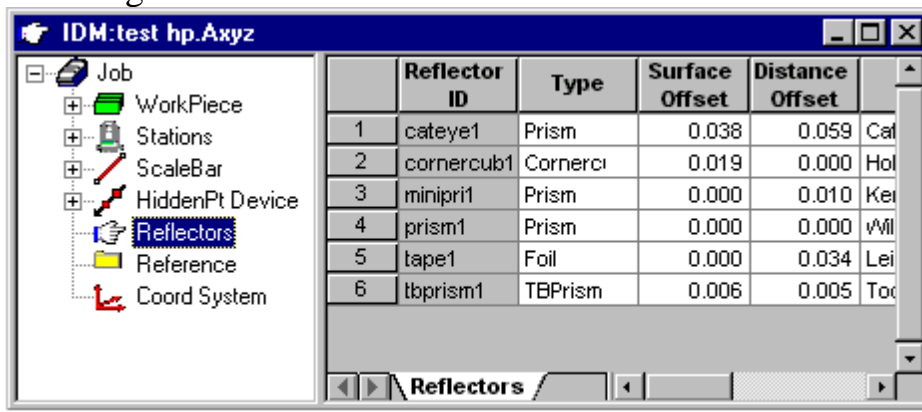Date and time of measurement.

Run average

The figure here indicates how many pointings were averaged to generate the measurement.

Comment

An optional descriptive comment for this measurement, max. 40 characters.

11.19 Reflectors

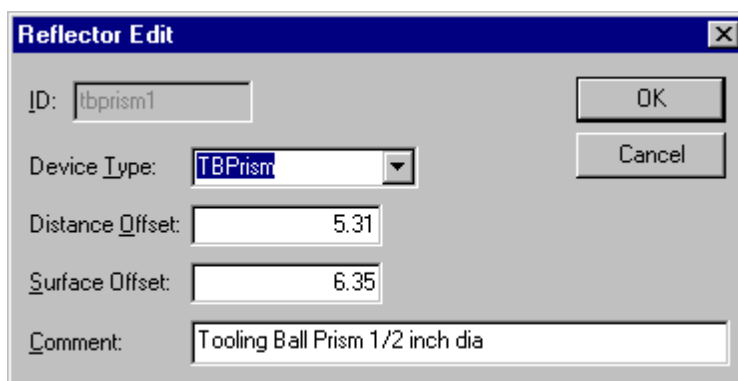How to get here:

IDM edit reflectors a.BMP

- Highlight the "Reflectors" in the outline view
- Click on the "Reflectors" tab in the detail view

11.19.1 Edit reflectors

IDM edit reflectors b.BMP

ID

A 16-character alpha-numeric identifier for this reflector.

Device type

A reflector can be one of the following types:
- Cateye   - a "cat's eye" retro-reflector
- Cornercube   - an air-path corner (triple mirror) retro-reflector
- Foil   - adhesive reflective tape
- Prism   - a glass prism (triple mirror) retro-reflector
- TBPrism   - a "tooling ball" prism

Distance offset

The design of a reflector may cause a fixed systematic error in any distance measurement. For example, a prism retro-reflector causes light to take a longer path through the prism, thus increasing the distance measurement. An air-path corner cube does not cause any error.

Any value here must be subtracted from any distance measurement to the reflector.

Surface offset

Reflectors are supported in spherical housings. This is the radial offset of the centre of the reflector from the surface of the housing.

Comment
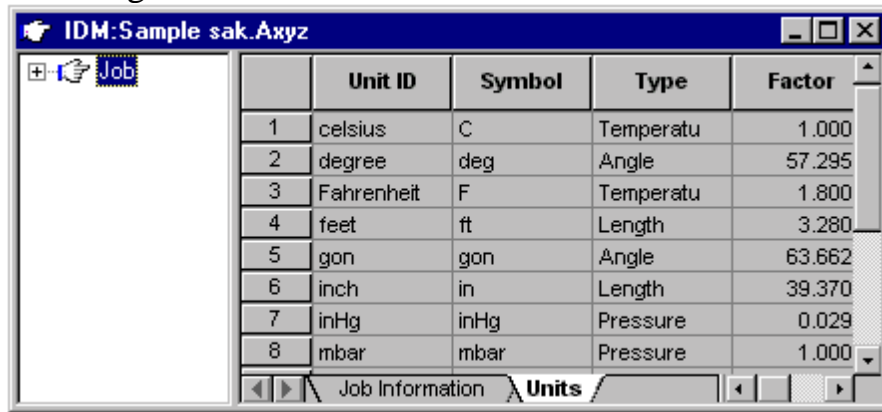
An optional descriptive comment, max. 40 characters.

11.20 Units

Users can define their own units of measurement by adding new ones. Existing units can only be modified by:
- Change of display format
- Deletion of the unit

How to get here:

IDM edit units a.BMP

1. Highlight the job source
2. Select the units tab

11.20.1 How units are defined

Axyz stores data internally using the following standard units of measurement:

Type	Internal unit
Length	metre
Angle	radian
Pressure	millibar
Temperature	Celcius

For the user's convenience, data may be viewed in external units. The following formula is used to convert between internal and external units:

Internal unit = (External unit - offset) / factor
External unit = (factor * internal unit) + offset

Here are two examples for the definition of the offset and factor.

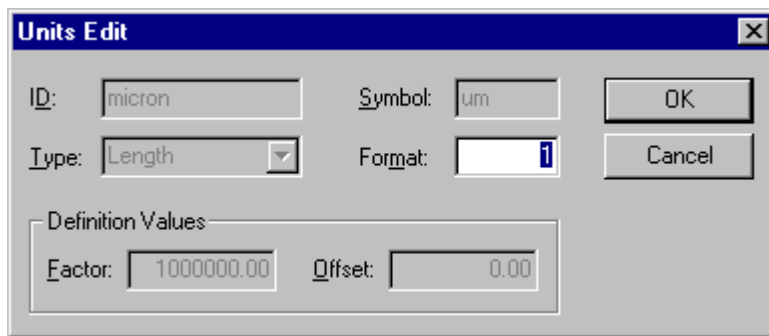**Example 1 - millimeter**
metre = (millimetre - zero) / 1000
millimetre = 1000 * metre + zero

Example 2 - Fahrenheit
Celcius = (Fahrenheit - 32) / 1.8
Fahrenheit = (1.8 * Celcius) + 32

11.20.2 Edit units

IDM edit units b.BMP

ID

A 16-character alpha-numeric identifier for this unit.

Symbol

A short 4-character identifier which will be displayed with values in this unit.

Type

The unit can be one of the following types:
- No units
- Length
- Angle
- Temperature
- Pressure
- Meas Time
- Min Time
- Speed
- Angle Speed
- ppm

Format

Number of decimal places to be used when displaying values in this unit.

Factor

Conversion factor between internal/external units.

Internal unit = (External unit - offset) / factor
External unit = (factor * internal unit) + offset

Offset

Offset between internal/external units.
Internal unit = (External unit - offset) / factor
External unit = (factor * internal unit) + offset

### 11.20.3 Creating a new unit

Add a new default definition by:
- using DM toolbar button ![abc button]
- Right mouse click in detail view, select "new" from shortcut menu
- via CDM "Edit" menu

A new record will be added to the existing set, partially filled with default values in the fields. Define the values you want using in-line editing or select the new data record (row) and input the values on the edit form.

For a new definition all fields in line and on the edit form can be modified.
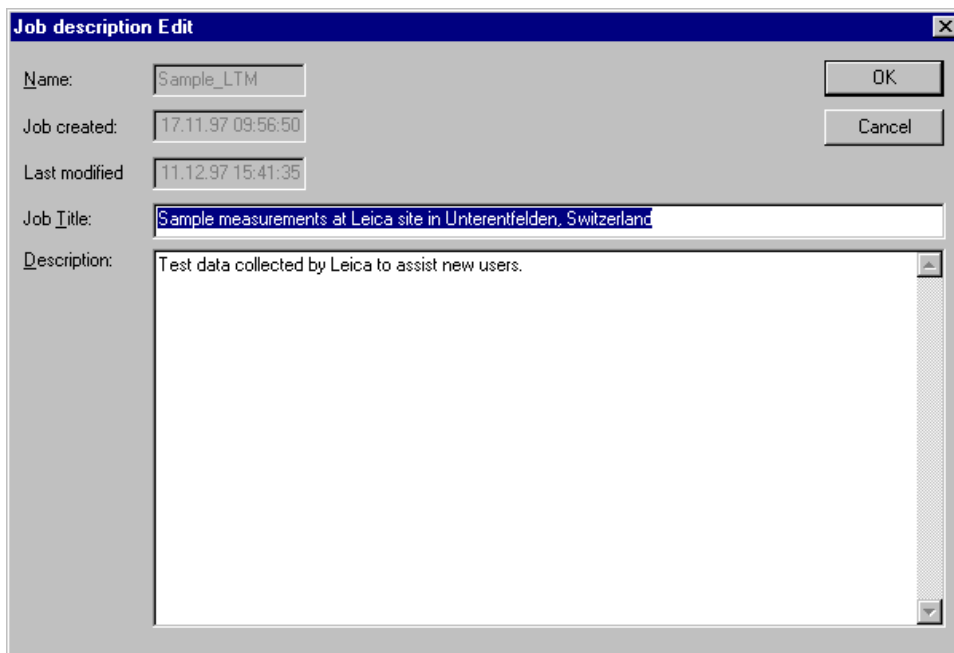
11.21 Job information

How to get here:
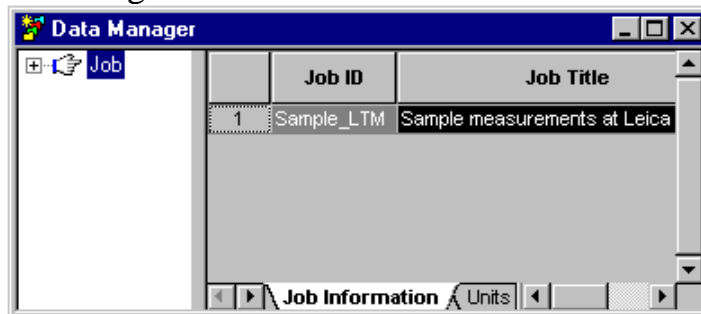
IDM Edit job a.bmp

1. Highlight the job source
2. Select the **Job information** tab

11.21.1 Edit job information

IDM Edit job b.bmp

Name

Name of the file (*.axyz) in which data relating to this job is stored.

Job created

Date when this job file was first created.

Last modified

Date when this job file was last modified.

Job title

Optional brief descriptive text for use as a job title.

Description

Optional full descriptive text about this job.

12. Report generation

12.1 Introduction to report generation

A report is a professionally formatted presentation of a selected set of data, for example a list of points making up a circle, together with their coordinates and standard errors. The quality of the presentation makes it suitable for printing and inclusion in reports.

The sequence of operations in creating a report is as follows. Using the DM a number of records of one or more *data types* are selected, for example some *point* records and some *shape* records. These are placed in an intermediate database. One or more *templates* can then be applied to this data. A template, associated with a record type, specifies which parts or *fields* in a record are to be used in the final report. It also defines the layout of a report, such as which standard header information to include, where columns are located and the precision to which numerical data is displayed.

Different templates can be applied to the same data to produce alternative presentations. For example, one template could take point records and produce a list showing only point name and coordinates. Another template also operating on point data could additionally present the statistical information which is available in the selected records.

Each template presents its results in a separate *report window* inside the Report Generator. If several data types have been selected then several windows are normally opened, one for each type. Some templates can combine different data types in one window. For example, a template is available to present a list of workpiece names, each followed by a list of points in that workpiece. This template requires data selected from the "Workpieces" table as well as data from corresponding "Points" tables.

Users can directly select which template to apply to their selected data from the ones available. If a template is chosen for which there are no records of the corresponding data type, this simply results in a blank report containing only the template's standard header information. If a template takes information from two data types and only one of these was selected, then parts of the resulting presentation will be blank, corresponding to the missing selection.

A default assignment of a particular template to a particular data type or combination also exists and can be changed at any time. When the Report Generator receives a data selection this feature ensures that report windows are automatically generated for the selected data types or combinations.

Once a report window is open, the information it shows can be printed out or exported. Only data in the active window can be output in this way. If several windows are displayed you must either click the **Print** or **Export** buttons on each window or activate each window in turn and use the main menu **Print** function.

Report generation is made possible with a third party product, Crystal Report Generator ™. The standard *Axyz* implementation provides a *runtime* version of this product which is sufficient to generate reports with the templates supplied. Only the full version of Crystal Report can be used to create templates, so this aspect of report generation will not be discussed here.

12.1.1 Standard and tailored templates

Leica have produced a number of standard templates in both "A4" (European) and "Legal" (American) format. These are stored in sub-folders named "DINA4_METRIC" and "LEGAL8,5x11_INCH" at the following location:

C:\Program Files\Leica\Axyz\RepForms

When assigning templates to data types for automatic report generation, users can make the assignment directly to the template in the corresponding format folder. Alternatively, since corresponding templates have the same name in each folder, the complete set can be copied out of either folder into the "RepForms" folder and the assignment made there. This has the advantage that you can simply overwrite these files with the ones from the other folder in order to make a fast change from A4 to Legal format. Re-assignment of templates is not necessary since the names are unchanged.

If the default layout in the standard templates does not meet your requirements and you would prefer, for example, to have your own company logo and your own standard data selection making up the report, you have two options.

1. You can commission templates to your specification from a Leica engineering team
2. You can purchase your own full featured copy of Crystal Report Generator ™ and use this to develop other report templates. You may additionally want a Leica training course to speed up your learning curve.

12.2 How to create a report

From within the Core Module (CDM) or one of the instrument modules (MTM, LTM), start the DM.

In the DM select the items you want to output . A multiple selection of one or more data types is possible. Generate a report for these items in one of the following ways:

- In the module's File menu, choose "Report"
- Click on the Report button on the DM toolbar
- In the DM detail view, right mouse click, select "Report"

The report or reports are automatically presented for preview and may then be printed or the data exported.

12.2.1 Changing the selected data

When data is selected within one of the modules (CDM, MTM, LTM) this will only become the current report selection when an report is explicitly requested by clicking the DM's **Report** button, or equivalent action.

Note
Existing report windows displaying different data types may remain open but, once closed, cannot be restored since the data selection has changed.

12.2.2 Reports for single data types

Most reports relate to a single type of data. If a multiple selection is made from different data tables, a report can be generated for each of the data types selected.

On first selection, reports are created automatically, using the templates currently assigned to the relevant data types.

12.2.3 Combination reports for Workpieces and Stations

Standard combination reports can be generated for:
- A list of workpieces, each followed by points in the workpiece
- A list of workpieces, each followed by measurements in the workpiece
- A list of stations, each followed by measurements made at that station
- A list of stations, each followed by orientation and collimation measurements made at that station

To create one of these, select either workpieces or stations from the corresponding tabs and then click the DM's **Report** button, or equivalent action.

You will then be offered a choice of points or measurements for presentation with workpieces, or measurements and collimation measurements for presentation with stations, or no additional data.

RepGen - WP tabs.BMP
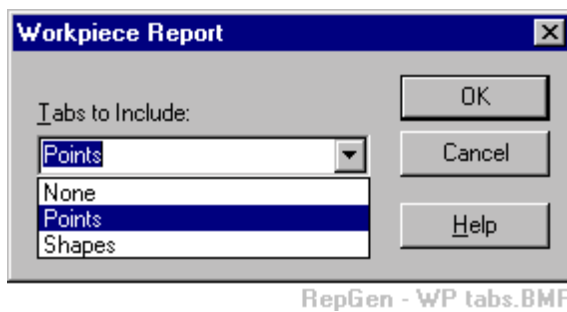
The example shows the choice offered in the case of workpieces.

On first selection, one or two reports are created automatically, depending on the options chosen, using the templates currently assigned to the relevant data types.

12.2.4 Reports on comparison of data sets

The results of the "Compare" function in the "Analysis" menu can also be presented in a report. When results are calculated a **Report** button is available which will automatically create the report using the template currently assigned to data of type "Comparison".

12.3 Report generator graphical interface

12.3.1 Report generator main screen
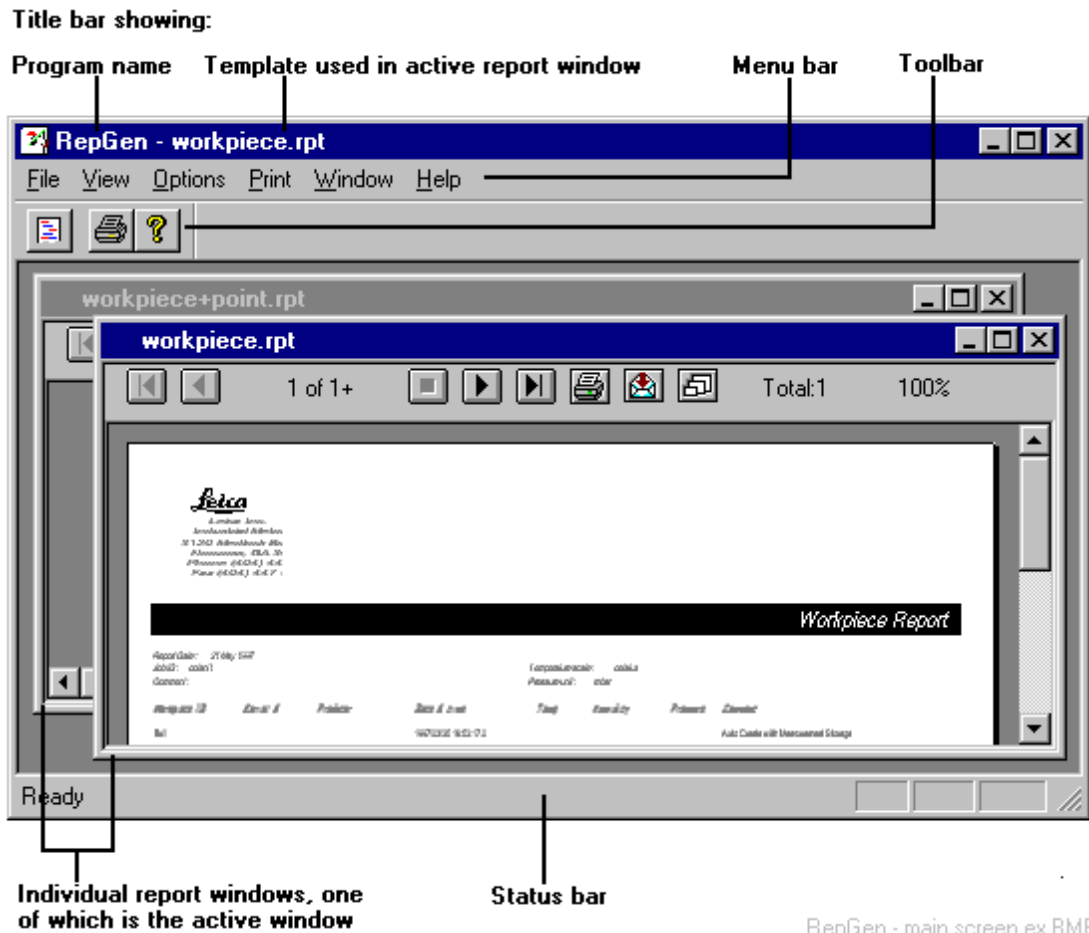
The example shows what happens when a range of workpiece records are selected, together with the point data for the selected workpieces.

Two separate reports can be created, one showing workpiece information only and the other showing the point data listed by workpiece.

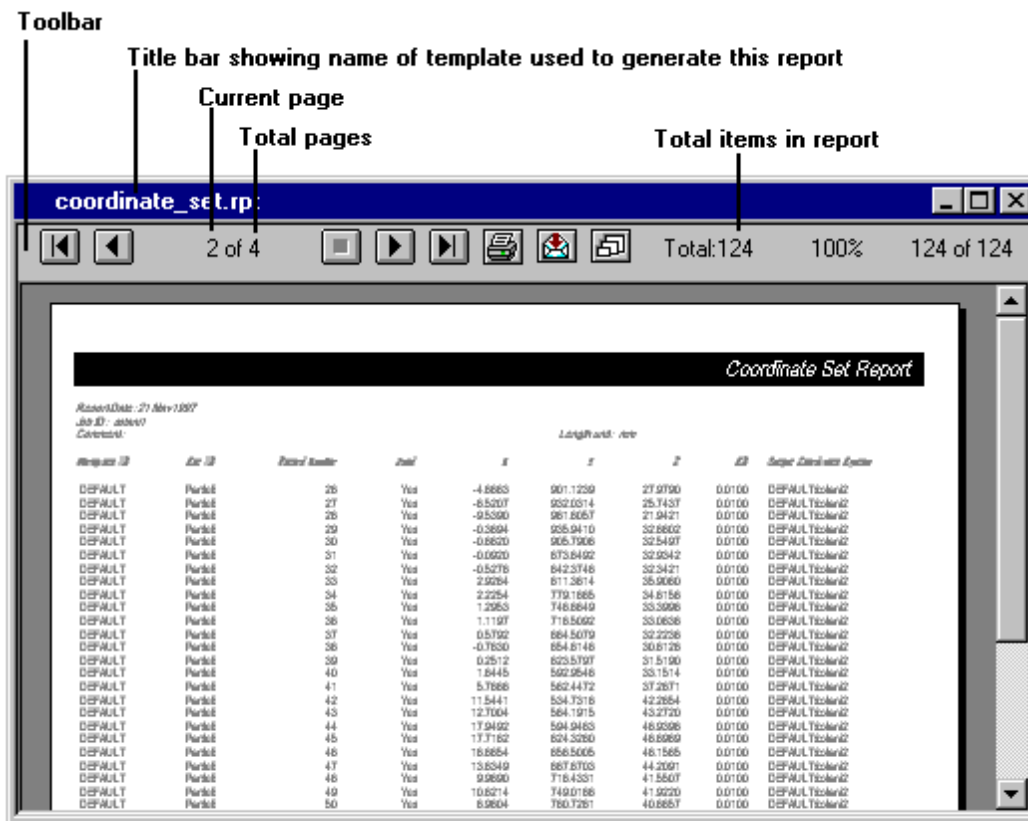### *12.3.2 Report generator toolbar summary*

12.3.3 Report window

Toolbar

Title bar showing name of template used to generate this report

Current page

Total pages

Total items in report

RepGen report window.BMP

12.3.4 Individual report toolbar summary

 Move to first page of report

 Move back one page in report

 Move forward one page in report

 Move to last page in report

 Currently not in use.

 Cycle through 3 zoom levels to view report

 Print out this report

 Export the reported data (various formats)

Table RepGen report toolbar.BMP

12.4 File menu (Report Generator)

12.4.1 Open template

Open template command **(File menu/Report Generator) Alt,F,O**
"Open a Crystal report template file"

Use this command to select a template and generate a corresponding
report..

Note
If there is no selected data of the type corresponding to the template, a
blank report will be generated.

Shortcuts
Toolbar icon:
Keys: CTRL+O

Open template dialogue box

RepGen - Open template.BMP

File Name

Type the name of the job you want to open. If no extension is given, *.rpt
is assumed. Otherwise select the job by clicking in the display.
Open the job with the **Open** button or <ENTER>.

Files of Type

Only report template files of the form *.rpt are offered.

Look in

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

Open button
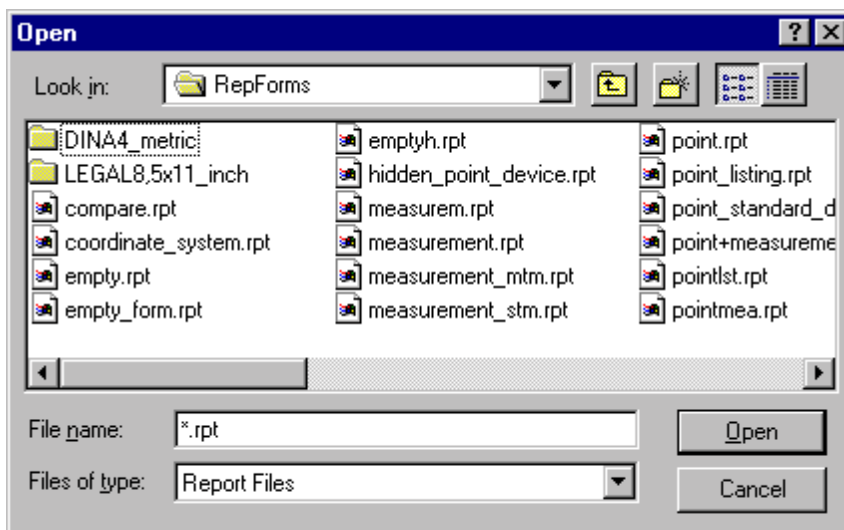
When you click the **Open** button the selected template generates a report window showing any selected data of the type corresponding to the template.

Windows HELP

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

12.4.2 Print Setup

Print Setup command **(File menu/Report Generator)**   **Alt,F,P**
"Change the printer and printing options"
Use this command to select a printer and a printer connection. This is done using the standard "Print Setup" dialogue box used by WINDOWS™. The options will therefore depend on the printers the user has installed.

Shortcuts

Toolbar icon: none
Keys: none

Print Setup dialogue box

SW-CM10b.BMP

Printer

Name

Select one of the currently installed printers shown in the drop-down box. You can install printers using the option for "Settings/Printers" on the Windows "Start" button.

Information on the selected printer is then displayed:

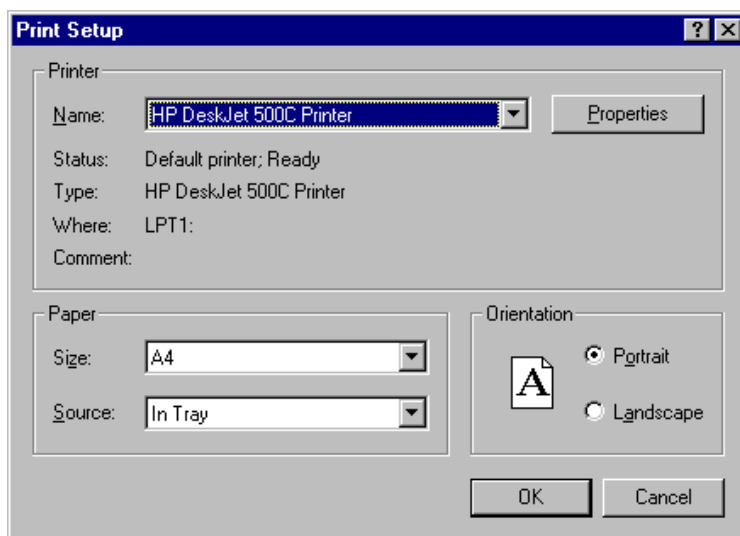|	
Status	operational state
Type	make of printer
Where	connection port or network location
Comment	any additional information

Paper

Size

Select the size of paper that the document is to be printed on.

Source

Some printers offer multiple trays for different paper sources. Specify the tray here.

Orientation

Choose Portrait or Landscape.

Properties button

Displays a dialogue box where you can make additional choices about printing, specific to the type of printer you have selected (no further details here).

12.4.3 Exit

Exit command (**File menu/Report Generator**)   **Alt,F,X**
"Quit the application: prompts to save documents"

Use this command to close the Report Generator

Shortcuts

Mouse:	Click the application's "Close" button.
Toolbar icon:	none
Keys:	none

12.5 View menu (Report Generator)

12.5.1 Toolbar

Toolbar command **(View menu/Report Generator)**   **Alt,V,T**
"Show or hide the toolbar"

Use this command to display and hide the Toolbar. The Toolbar is
typically displayed horizontally across the Report Generator's main screen
and includes buttons for common commands such as Print.

A check mark appears next to the menu item when the Toolbar is
displayed.

Shortcuts
Toolbar icon: none
Keys: none

12.5.2 Status bar

Status bar command **(View menu/Report Generator)**   **Alt,V,S**
"Show or hide the status bar"

Use this command to display and hide the Status Bar. The Status Bar is
displayed at the bottom of the Report Generator's main screen and provides
some status information and HELP text.

A check mark appears next to the menu item when the Status Bar is
displayed.

Shortcuts
Toolbar icon: none
Keys: none

12.6 Options menu

12.6.1 Template options

Template options command **(Options menu)**   **Alt,O,T**
"Set data type to template file association"

Use this command to change the template currently assigned to each data type.

Shortcuts

Toolbar icon: none
Keys: none
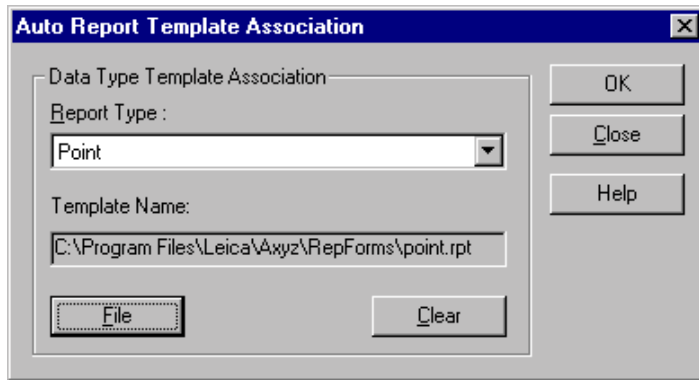
RepGen - template association.BMP

A template can be assigned to each report (data) type in the list, by highlighting the type and selecting a file with the **File** button. The standard Windows file selection box is provided for this purpose.

12.7 Print menu

12.7.1 Print template

Print template command **(Options menu)**   **Alt,P,P**
"Print template file"

Use this command to print the currently active report.

Note
The **Print** button on the main toolbar prints the currently active window.

Shortcuts

Main toolbar:

Report window:
Keys: CTRL+P

Print dialogue box

RepGen - Print.BMP
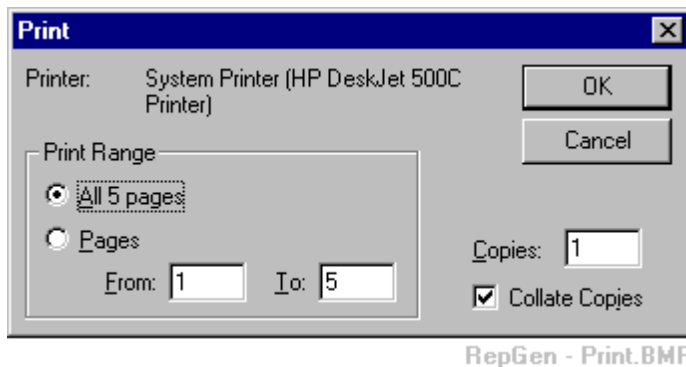
Printer

This shows the printer connected to your system.

Print range

Choose one of the following options:

All
Print all pages in the report.
Pages
Print only those pages starting at the number **From**, up to and including the number **To.**

Copies

Enter the number of copies you require.

Collate copies

Select this option to ensure that individual copies have their pages properly grouped together.

12.8 Window Menu (Report Generator)

This menu is only available if there is at least one report window open.

12.8.1 New window

New window command **(Window menu/Report Generator) Alt,W,N**
"Open another window for the active document"
Create a new copy of the currently active report window.

Shortcuts
   Toolbar icon: none
   Keys: none

12.8.2 Cascade

Cascade command **(Window menu/Report Generator)**   **Alt,W,C**
"Arrange windows so they overlap"
Arrange the open report windows in overlapping "cascade" fashion.

Shortcuts
   Toolbar icon: none
   Keys: none

12.8.3 Tile

Tile command **(Window menu/Report Generator)**   **Alt,W,T**
"Arrange windows as non-overlapping tiles"

Arrange the open report windows which are not minimized to occupy
equal amounts of the display area, without overlaps.

Shortcuts
   Toolbar icon: none
   Keys: none

12.8.4 Arrange icons

Arrange icons command **(Window menu/Report Generator)** **Alt,W,A**
"Arrange icons at the bottom of the window"

The open report windows can be minimized and positioned anywhere
within the graphical display area. Use this command to arrange them in a
line along the bottom.

Shortcuts
   Toolbar icon: none
   Keys: none

12.8.5 Open window list

At the bottom of the Window menu is a list of the currently open windows. Click on one of these to make it the active window. If the window has been minimized, it will be automatically restored.

12.9 Help menu (Report Generator)

12.9.1 About RepGen

About RepGen command **(Help menu/Report Generator)Alt,H,A**
"Display program information, version number and copyright"

Shortcuts
Toolbar icon: none
Keys:

12.10 Export data from a report window

The data presented in a report window cannot only be printed out but can be exported in a range of electronic formats, such as text files, MS EXCEL ™ files, MS WORD ™ files.

Click the **Export** button in a report window to access the options.

12.10.1 Export (Report) dialogue box
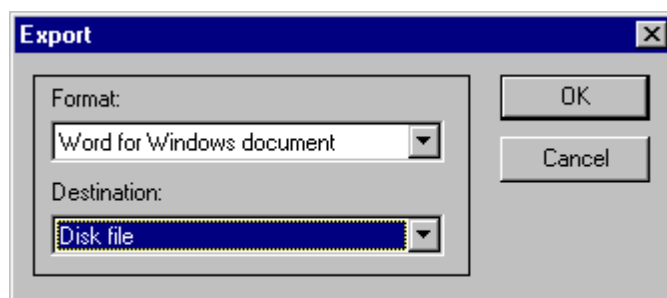
RepGen Export.bmp

Format
Select an output format from the drop-down list.

Destination
Report data in the selected format can be sent to either a disk file, the MS Exchange folder or for e-mail despatch via Microsoft mail.

13. Exporting data

13.1 Export concept in brief

Axyz permits the user to export selected records from the job file to an external text file. Records are exported using an *export file type* or template which defines which fields from the selected records are to be written to the output file, together with their order and format. One internal record produces a single output line.

Only records of a single data type can be selected for export, such as 3D measured points or shape definitions. Templates can therefore only be used for a single data type. If records are selected and the incorrect template chosen, then a status message informs the user that zero records of the correct type are available for export.

Records must be selected for processing before the export function can be activated.

Axyz provides standard templates for exporting data but the export function itself allows the user to either define completely new templates or modify existing templates. A *wizard* is provided to assist in preparing these.

Since data exchange is ordinarily a two-way process, templates are stored in a named IED file which contains both an import and export description. When a new export template is created, a corresponding import template is automatically created. An overwrite warning guards against accidental overwriting if the file already contains an import template. Deletion of an export template will also delete the corresponding import template, but again a warning guards against accidental deletion of the wrong template.

13.2 Exporting selected data
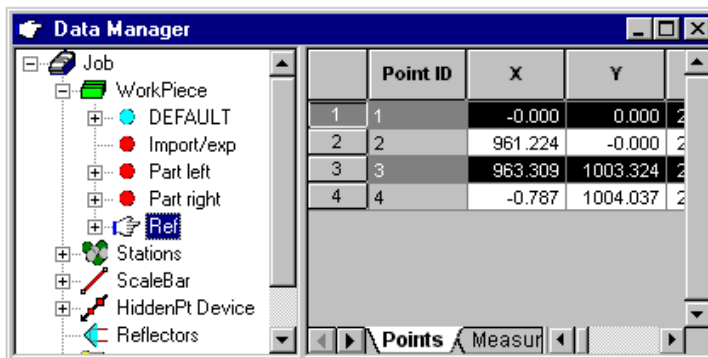
Exp seln 01.BMP

Select records for output. The order of the exported records corresponds to the row order in the DM and not to the order in which the selection was made. However the records can be re-sorted in the DM to change the row order and hence the sequence of the output records.
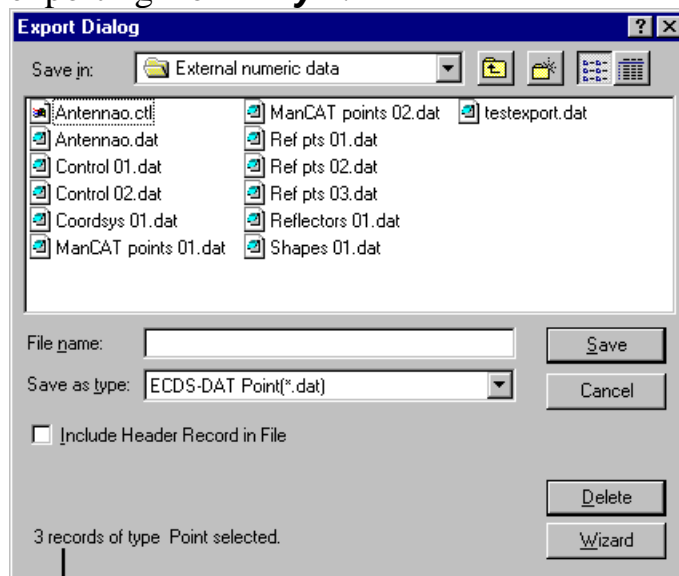
If one or more columns is selected, this is equivalent to selecting all the records.

Call up the export function by one of the following means:
- DM toolbar button:
- Data menu: Export
- Right mouse click in an open DM detail view: Export

13.2.1 Dialogue box: Export

A standard Windows dialogue box is used, with modifications for exporting from *Axyz*.

Status message   Exp 01.BMP

File Name

Type a new name for the external file or select an existing name by clicking in the display.

The displayed existing files have extensions which match the type selected for saving.

Save as Type

Select the file type which specifies the required export template.

Note

If the selected data is not the same type as defined for the template, a blank output file will be generated. In this case the status message will indicate zero records of the defined type.

Save in

Select the drive and folder in which you want to store the job.

Include header record in file

Select this option to record the DM column headings corresponding to the output data fields in the first line of the export file.

Status message

The status message in the bottom left corner indicates how many records of the type associated with the selected export template have been selected.
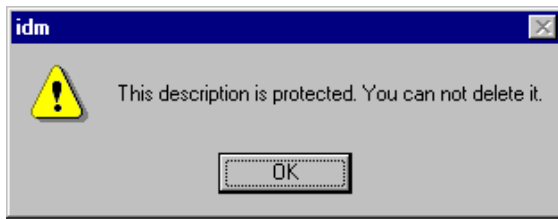
Save button

Click this button to create and/or save the specified export file.

Delete button

Use this button to delete an existing export template. This is the template named in the **Save as type** box.

Some templates supplied as part of the original installation may not be deleted, and the following message appears:

Imp-Exp - deletion not OK.bmp

Templates you create yourself may be deleted, but a check message appears. For example, if template **Pt_meas (*.*)** was chosen, this message would appear:
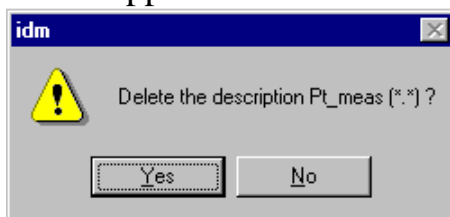
Imp-Exp - deletion OK.bmp

Wizard button

Click the **Wizard** button to define or modify export templates.

Windows HELP

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

13.3 Wizard - Defining and modifying export templates

You must first select some data in order to define or modify a template. There are various ways of making the initial selection. This may be combined with either:

- A new, undefined export template (chosen on **Export** dialogue box)
- An existing export template (chosen on **Export** dialogue box)
- An existing import template (chosen on page 1 of **Wizard**)

The actual procedure affects the fields which are available when defining the output. This is more fully explained in "Fields available for selection" on page 151.

Most users will use the **Wizard** to define a completely new export template, and this is provisionally assumed in the following description.

You are recommended to select the columns representing the fields you wish to export. This also has the effect of selecting all the records in that table. However it is not necessary to export the selected data after defining the template and a new selection can be made.

In the main export dialogue box, select the file type "New (*.*)" which implies that an export template does not yet exist.

Click on the **Wizard** button to move to the first page of the export wizard.
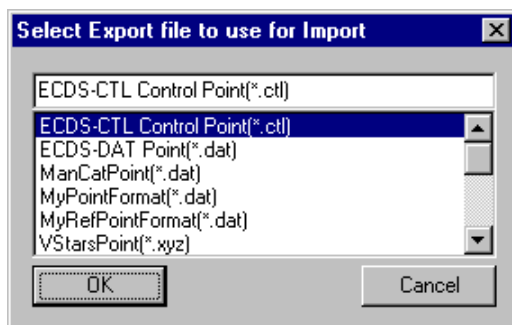
13.3.1 Export wizard: Page 1
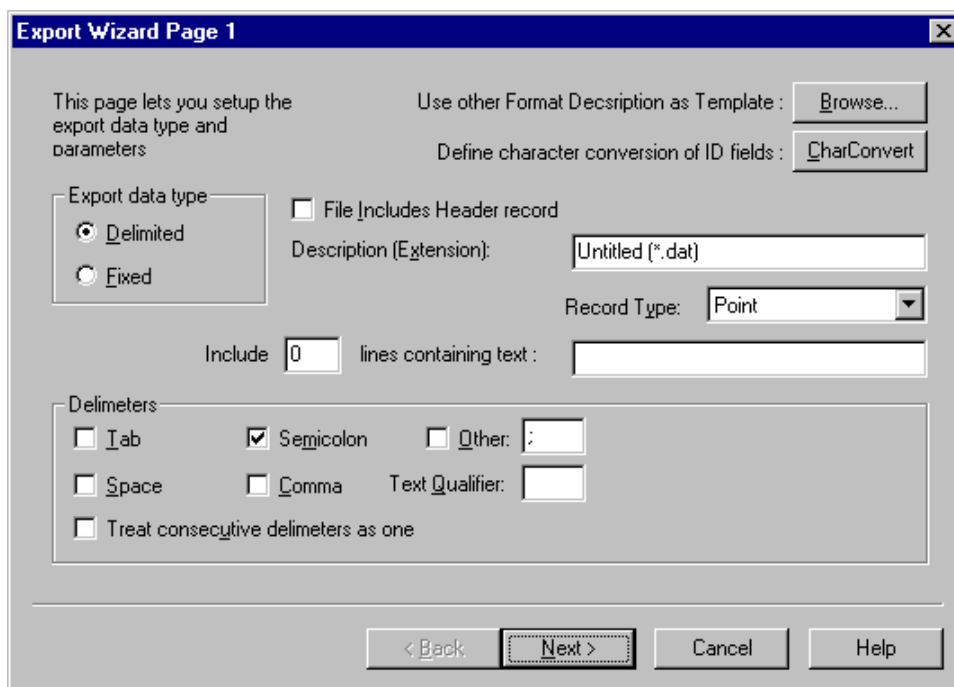
Exp 02.bmp

Use other format description as template

You can base the new export template on an existing import template. Click the **Browse** button if you want to do this. A list of available templates will be presented in another dialogue box as follows:

Exp 05.BMP

Select the required template from the drop-down list.

CharConvert button

This button provides a dialogue box to convert character pairs from an internal format to an external format. This conversion is only applied to IDs .

See "Export wizard: Character conversion" on page 148.

Export data type

Specify if the exported data records should have the fields separated by a particular delimiter character or if they are to be written to fixed width columns.

File includes header record

Select this option if the exported data should have the DM column headings for the corresponding output fields as the first output line.

Description (extension)

This is the name for the export file type, together with its default extension in brackets, which will be used when saving the export template. Change the name if wished. It can also be altered in the final stage of the definition.

Record type

The export file type or template is associated with an internal record type.

The following data types can be exported:
* Workpiece
* Point
* Control point
* Measurement
* Shape
* Coordinate system
* Reference point
* Measurement sets
* Coordinate sets (set points)

Include lines containing text

In order to make export files compatible with import files containing text header lines which are skipped on import, exported files can also be given an equivalent number of dummy header lines.

Enter the number of lines after **Include**.
Enter the dummy text after **text:**

Delimiters

Required for output records in which the individual fields are separated by a particular character. Choose one of the characters or select **Other** and type the single character of your choice in the box to the right.

Treat consecutive delimiters as one
A sequence of consecutive delimiters implies a series of fields between the delimiters, each containing blank data. This may not be the interpretation you want. Instead a delimiter sequence may simply mean the same as a single delimiter and should be interpreted as such.

This is mainly useful on importing data where, for example, fields are separated by multiple blanks but they do not quite line up in vertical columns.

Text qualifier
Text strings exist in the database, for example 16 character alpha-numeric identifiers and comments. These may contain characters which are the same as the chosen delimiter and will therefore be treated as multiple fields if the output data is subsequently imported.

The start and finish of text strings can therefore be identified in the output file by a different character.

Next button

Click this button to move to the next page of the export wizard.

13.3.2 Export wizard: Character conversion
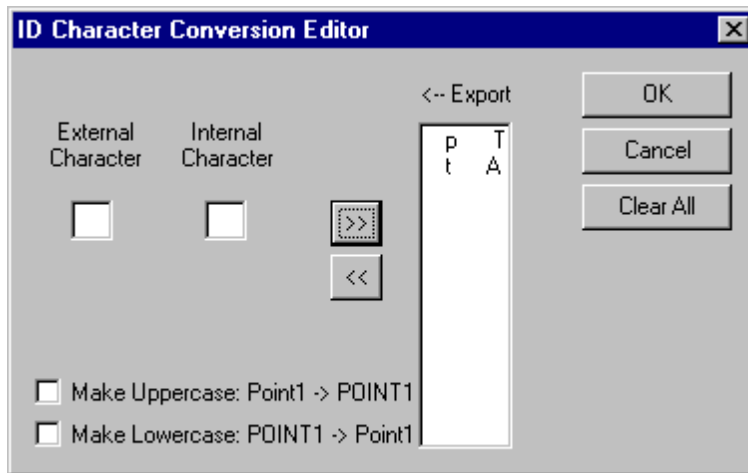
Exp 10.bmp

This box defines character pairs which define conversion from an internal format to an external format. This is applied only to IDs. The example shows that the internal characters "T" and "A" in any ID will be converted to the external characters "p" and "t" respectively.

Enter an **External character** in the box provided.
Enter the corresponding **Internal character** in the box provided.
Click ⏵⏵ to add the pair to the **<- Export** list.

To remove a pair from this list, highlight the pair and click ⏴⏴.

Make uppercase
Converts internal lowercase letters to external uppercase as shown.

Make lowercase
Converts internal uppercase letters to external lowercase as shown.

13.3.3 Export wizard: Page 2
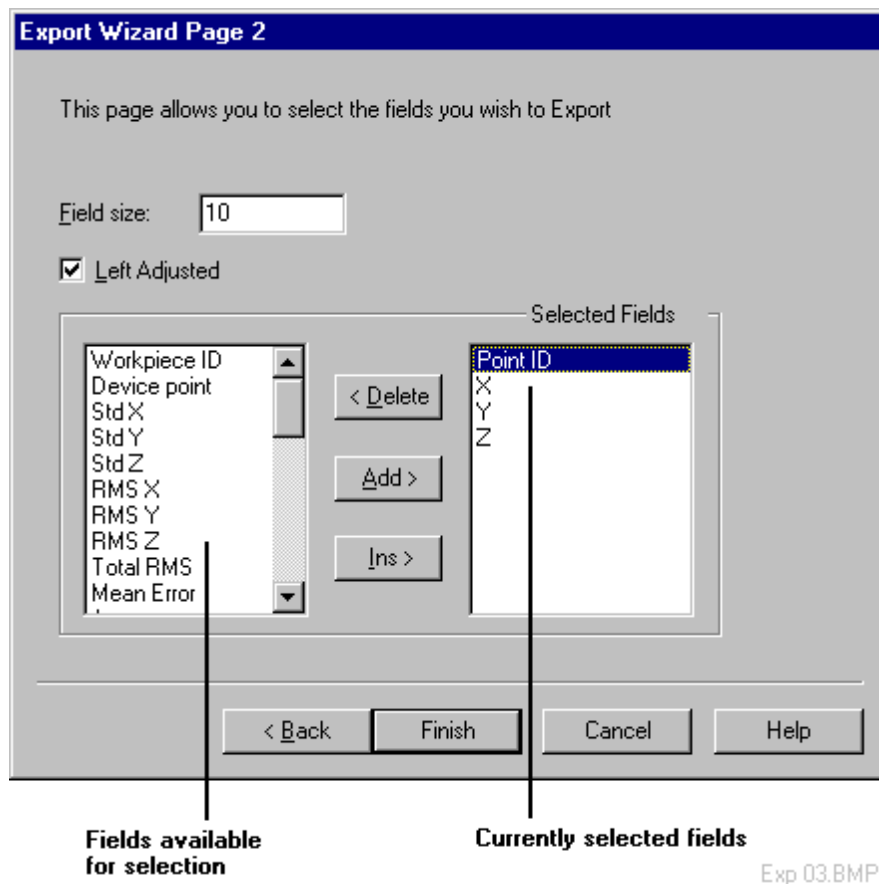

Fields available for selection   **Currently selected fields**

Exp 03.BMP

The purpose of this box is to generate a list of selected fields which are used for each output record. These are the currently selected fields shown in the right hand field box. The top-to-bottom order corresponds to the left-to-right order in an output record.

The fields available for selection depend on how you enter the export wizard. See "Fields available for selection" on page 151.

Delete, add, insert buttons

Use these buttons to manipulate the currently selected fields used to define the output records. By a combination of deletion, addition or insertion you can also change the order of the output fields.

Delete applies to the right hand list. Click on a field to delete it. It will be placed on the bottom of the list of available fields on the left.

Add applies to the left hand list. Click on a field to add it to the bottom of the list of selected fields on the right.

Ins (insert) takes a selected field on the left hand list and inserts it in front of a selected field on the right hand list.

Field size, left adjusted

These are relevant to fixed width output. Click on a selected output field to see the current number of spaces reserved for the field (field size). A check mark beside **left adjusted** means that the output will be left adjusted within the output field. If not checked, the output will be right adjusted.

The user may change the settings.

> **Note**
> If the output field is too small to accommodate the information, the data will be truncated from the right hand side. Numerical values are not rounded to fit the field.
>
> **Examples**
> Point ID "DOOR23A" sent to a field of size 5 will produce an output of "DOOR2".
>
> Coordinate value "102.58924801" sent to a field of size 6 will produce an output of "102.58" (the decimal point requires one space in the field).
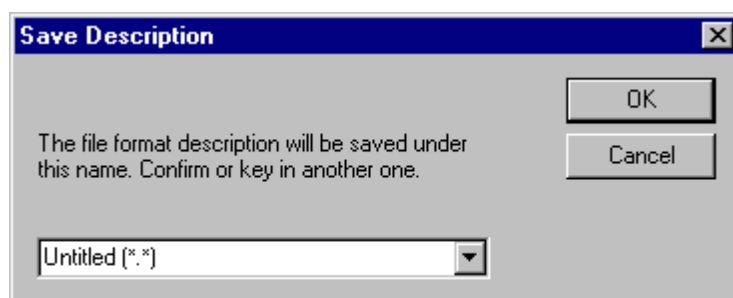
Back button

Click this button to return to page 1 of the wizard and change any definitions.

Finish button

Click this button to complete the definition.

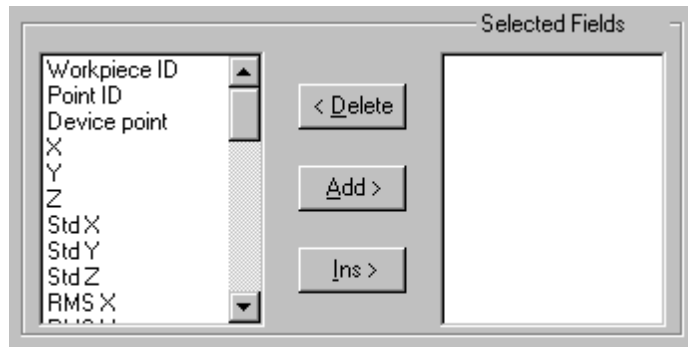## 13.3.4 Export wizard: finish

Exp 04.BMP

Save your defined export format with a specific name here.

13.3.5 Fields available for selection

The initial selection and the fields available for selection, depend on how some prior choices are made.

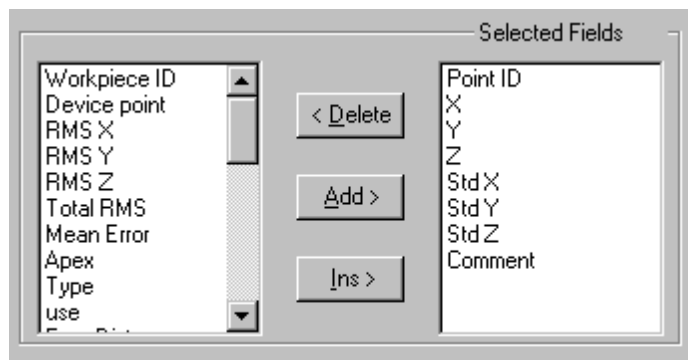### *Select rows in DM, no existing template used*

Exp 06.BMP

Depending on the output record type selected on page 1 of the wizard, the left hand list shows all the fields associated with this type.

The right hand list is initially blank.

The example shows the list for record type "Point".

Select rows in DM, existing template used

Exp 07.BMP

This depends on the output record type selected on page 1 of the wizard as well as the fields defined for the existing import template.

The right hand side initially shows the fields defined for the existing import template. In the example ManCatPoint(*.dat) was the chosen import template.

On the left hand side all fields associated with the selected output record type are shown, <u>except</u> for any fields already on the right hand side. In the

example, the output record type "Point" was selected. Notice, for example, that the field "Point ID" is not shown on the left hand side because it is already present on the right hand side as part of the definition for ManCatPoint(*.dat).

Select columns in DM, no existing template used
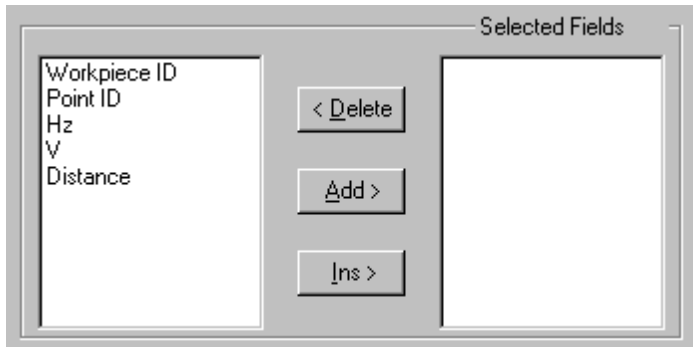
Exp 08.BMP

In the example, fields for "Workpiece ID", "Point ID", "Hz", "V" and "Distance" were selected on the "Measurements" tab of a workpiece.

If no changes are made on page 1 of the wizard, these fields appear on the left hand list and the right hand list is initially blank.

Select columns in DM, existing template chosen
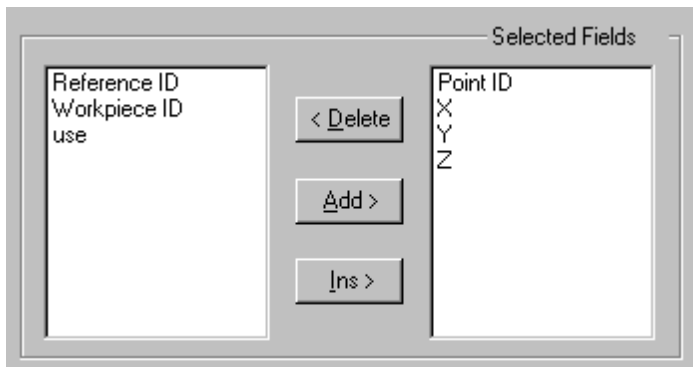
Exp 09.bmp

In this example, fields for "Reference ID", "Workpiece ID", "Point ID", "use", "X", "Y", "Z" were selected. An existing export template, "ECDS-NOM ReferencePoint (*.nom)" was chosen for modification. All the fields appear in the dialogue box.

Any fields already present in the selected export template are shown on the right hand side.

Any fields not present in the selected export template are shown on the left hand side.

Choosing an existing template

The procedure is essentially the same when basing a new template on an existing export template or an existing import template.

An existing import template is chosen on page 1 of the **Wizard**.

An existing import template is chosen as the file type before starting the wizard.

Template type not the same as data type

It is possible to select data of one type but define a template for another type. The template is defined as though rows of the corresponding type had been selected.

14. Importing data

14.1 Import concept in brief

Axyz permits the user to insert records into the database from an external text file. Records are imported using an *import file type* or template which defines which parts of the external record correspond to which fields of the internal record. One line of the external file is an external record and it creates a single internal record.

External files can only generate internal records of a single data type, such as 3D points with the classification "entered".

In order to identify individual fields in the external data records, **Axyz** permits the use of *delimiter* characters such as semi-colons or tabs which separate the fields. Alternatively the data can be input in *fixed width* columns. External files with this format have elements which line up vertically when printed.

Axyz provides standard templates for importing data but the import function itself allows the user to define new templates. A *wizard* is provided to assist in preparing these.

Since data exchange is ordinarily a two-way process, templates are stored in a named IED file which contains both an import and export description. When a new import template is created, a corresponding export template is automatically created. An overwrite warning guards against accidental overwriting if the file already contains an import template. Deletion of an import template will also delete the corresponding export template, but again a warning guards against accidental deletion of the wrong template.

14.1.1 Missing and modified input

If fields required for internal records are missing from the external records, default values can be prepared for these. For example, if the external data contains a simple list of coordinates without identifiers a default identifier can be set which is given an incrementing numerical extension for succeeding input records.

Fields in the external records can be ignored entirely or their information replaced by default information.

It is also possible to test the external records and alter the corresponding internal fields. For example, an external record might contain the value -99 meaning "treat this coordinate as accurately known and fixed in any transformation". Any other value in this field means "this is a standard error for the coordinate". **Axyz** can make use of this information but handles it differently internally. It would be possible to define a *conditional check* which will insert the internal label "FIXED" when the value -99 is found, but otherwise insert the actual value.

In this way internal records can be generated whose properties closely match the properties of the external records.

14.2 Templates for importing VSTARS data

The VSTARS videometric system creates output data files containing mixed types of 3D data. These are recorded in separate sections of the output file, under different headers. The individual records can also be recognized by the naming convention used.

Three different data types can be imported into **Axyz** from a VSTARS output file:
1. Label records
2. Code records
3. Probe records

By choosing the correct template, records starting with the appropriate code name (LABEL, CODE, PROBE) can be imported into **Axyz** using standard templates.

14.2.1 Import LABEL records

Use the template "VSt3D VStars 3D LabelPoints (*.txt)".

VSTARS record format:
LABELi, x, y, z, stdx, stdy, stdz, offset, residualRMS, flag

When imported, LABEL records create points of type **Measured**.

Fields not specified in the "Advanced" dialogue box are interpreted as follows:

VSTARS field	*Axyz* field
Offset	Target thickness
	Thickness type is "Shape" but the shape ID is not yet defined.
residual RMS	Total RMS
LABELi	Point ID
flag	cannot be directly used

14.2.2 Import CODE records

Use the template "VSt3D VStars 3D CodePoints (*.txt)".

VSTARS record format:
CODEi,   x, y, z, stdx, stdy, stdz, offset, residualRMS, flag

When imported, CODE records create points of type **Control**.

Fields not specified in the "Advanced" dialogue box are interpreted as follows:

VSTARS field	*Axyz* field
residual RMS	Total RMS
CODEi	Point ID

14.2.3 Import PROBE records

Use the template "VSt3D VStars 3D ProbePoints (*.txt)".

VSTARS probes are treated as *Axyz* hidden point devices in which the device points are measured independently and the hidden point computed off line, using the corresponding analysis function.

VSTARS record format:
PROBEi, {ProbeName}, x1, y1, z1, x2, y2, z2, x3, y3, z3, x4, y4, z4, x5, y5, z5

Axyz can only use a numerical ID for the probe name (hidden point device name). In VSTARS the probe name should start with a numerical ID, e.g.

"100Heli-Probe with 6 mm Ball Tip (sn16-3)"

The initial numerical part of the name is taken as the corresponding hidden point device ID, in this case "100". This device must therefore also be defined in the *Axyz* job file.

If the numerical ID cannot be taken from the string and/or is not in the job file, the current default device ID will be assumed.

Once imported, remember to calculated the corresponding hidden point using the corresponding CDM Analysis function.

14.3 Importing an external file of data

Call up the import function by one of the following means:
- DM toolbar button:
- Data menu: Import
- Right mouse click in an open DM detail view: Import

Note
If the DM is open, the currently displayed table does not indicate where the imported data is to be stored. The storage location of the imported data depends on settings made during import and on the type of data imported.

14.3.1 Dialogue box: Import

A standard Windows dialogue box is used with modifications for importing into the *Axyz* database.

File selection list

Imp 01.BMP

Status message   **Preview list**
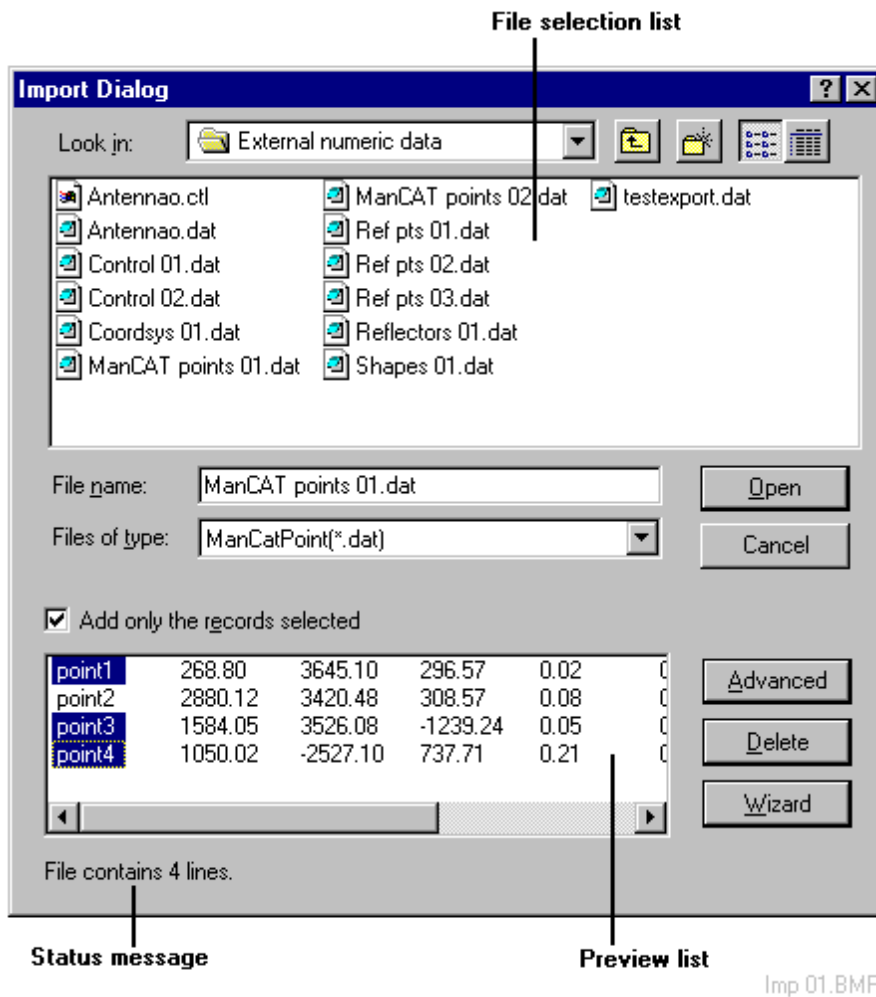
Look in

Select the drive and folder containing the files you want to import.

File Name

Insert the name of the file you want to import by clicking on it in the
selection list of available files.

Files of type

Select the file type which specifies the required import template. The
extension name of the import template determines which files are
presented in the selection list.

Add only the records selected

Click this option to select specific records from the external file, otherwise
all records will be read in.

Make the selection by clicking on the items in the first column of the preview list using standard windows techniques:

- Single click selects a single item in the list
- SHIFT+click selects a block
- CTRL+click adds or removes a single item

In the example, only records with the IDs "Point1", "Point2", "Point4" will be imported.

Preview list

This shows the external records provisionally interpreted according to the selected template.

Status message

The status message in the bottom left corner indicates how many records in the external file.
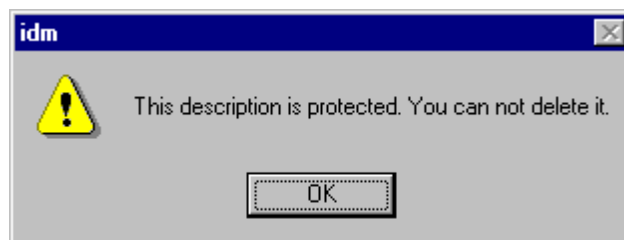
Open button

Click this button to import the records from the specified file.

Delete button

Use this button to delete an existing import template. This is the template named in the **Files of type** box.

Some templates supplied as part of the original installation may not be deleted, and the following message appears:

Imp-Exp - deletion not OK.bmp

Templates you create yourself may be deleted, but a check message appears. For example, if the template **Pt_meas (*.*)** was chosen, this message would appear:
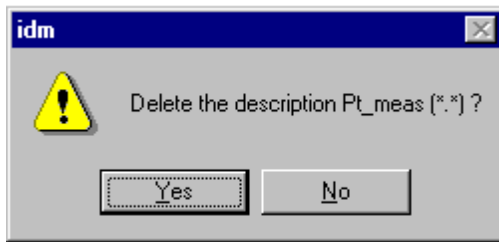
Imp-Exp - deletion OK.bmp

Wizard button

Click the **Wizard** button to define or modify import templates.

Advanced button

Click the **Advanced** button to modify default IDs and to specify units and coordinate system (if relevant) of the data being imported.

Windows HELP

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

14.3.2 Dialogue box: Advanced

The imported data may not contain identifiers which indicate where it is to be located in the database. In addition point IDs may not be imported. In both cases default specifications are required.

If the external data contains measurement or coordinate data, then the external units and coordinate system may have to be specified in order to transform the data into the default storage values used by the database.

See also "Coordinate System of external data" on page 162.
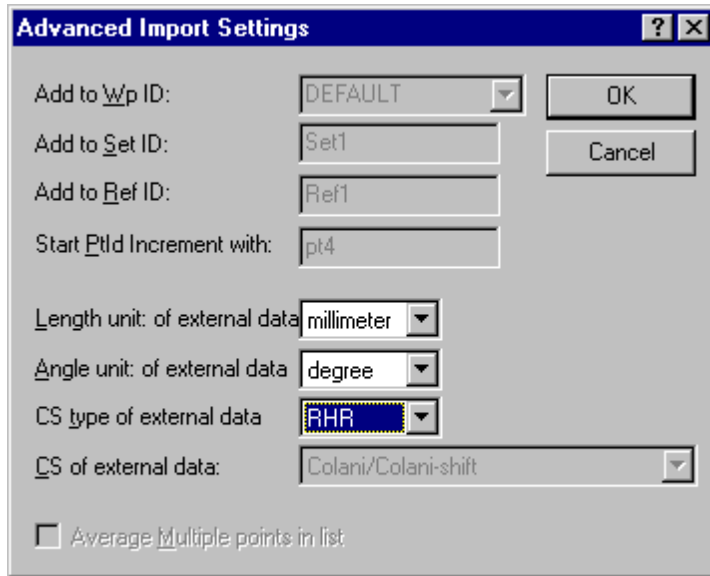
Imp 02.BMP

Add to Wp ID

Relevant to any data which must be stored in a specific workpiece. Specify the default workpiece ID here.

Add to Set ID

Relevant to tracker measurement and coordinate sets. Specify the default set ID here.

Add to Ref ID

Relevant to reference data. Specify the default reference set ID here.

Start PtId increment with

Relevant to any data requiring point IDs in the data base. Specify a starting point ID here. Successive imported records receive a point ID by incrementing a numeric suffix of this ID.

CS type of external data

Specify the type of coordinate system in which the external data are stored by selection from the drop-down list.

Length unit of external data

Specify the length units in which the external data are stored by selection from the drop-down list.

Angle unit of external data

Specify the angle units in which the external data are stored by selection
from the drop-down list.

CS type of external data

Relevant to any imported data containing 3D data, except for:
- Reference points for transformation calculations, build and inspect tasks
- Control points for orientation

The coordinate system in which the external data are stored must already
be defined in the database. Select the appropriate coordinate system from
the drop-down list.

For a fuller discussion, see "Coordinate System of external data" on page
162.

Average multiple points in list

This is relevant to external data stored in the GSI8 format used in the Leica
REC module for recording data in the field. This is a 3D data format which
may result in several measurements of the same point. These multiple
measurements will be averaged to a single measurement if this option is
selected.

14.3.3 Coordinate System of external data

Internally measured 3D data and information derived from it, such as
standard *Axyz* shapes, are stored in the **Base Coordinate System**.

External data which is being imported into the measured data may be
stored in a different coordinate system. It is therefore necessary in many
cases to transform the external data from its own coordinate system into
the base coordinate system. This is only possible if the external coordinate
system already exists in the database and the necessary transformation
parameters are therefore known.

Some external data does not need to be transformed. Transformation is not
required if point data imported for the following purposes:
- Reference points for transformation calculations, build and inspect tasks
- Control points for orientation

Direct importation of coordinate systems does not involve transformation since these provide a direct definition of such transformations.

Some external data does not contain 3D point information, e.g. reflector definitions, and transformation is not relevant in such cases.

When imported data has been transformed, the following dialogue box appears:
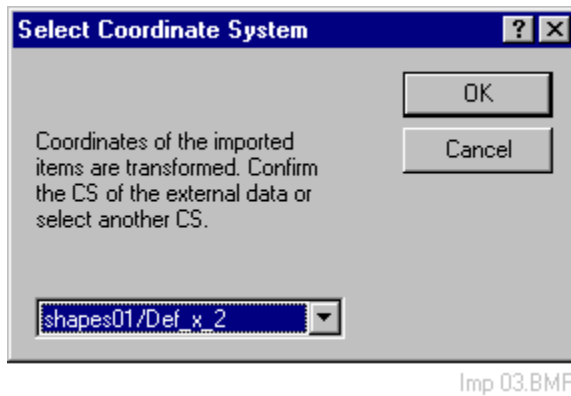
This is a security measure only. If the incorrect coordinate system has been defined in the **Advanced** dialogue the correct system can be chosen from the available drop-down list.

14.4 Wizard - Defining and modifying an import template

To define an import template you need a file containing data in the format you wish to read. The wizard will then guide you though the procedure.

It is simpler to create a template if the data to be imported was originally exported using an **Axyz** export template. The import template can then be directly generated from this export template, and minor modifications made if required.

Alternatively the methods for manually defining the layout of the external data records are straightforward.

In the main import dialogue box, select the file type "New (*.*)" which implies that an import template does not yet exist.

Click on the **Wizard** button to move to the first page of the import wizard.

14.4.1 Import wizard: Page 1
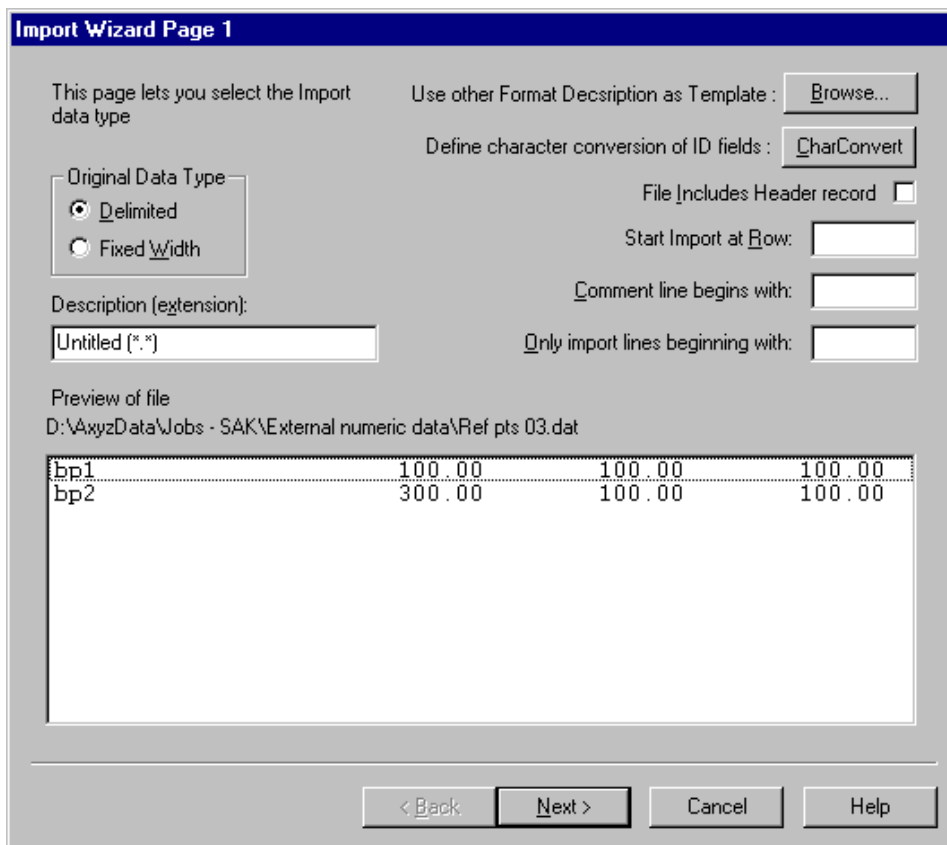
Imp 04.BMP

Original data type

Indicate if the external data has fields separated by special characters (delimited) or if it is arranged in fixed width columns.

Use other format description as template

If the external data was originally exported from *Axyz*, select this option, which is recommended if possible. Click the **Browse** button to see a list of available templates as follows:
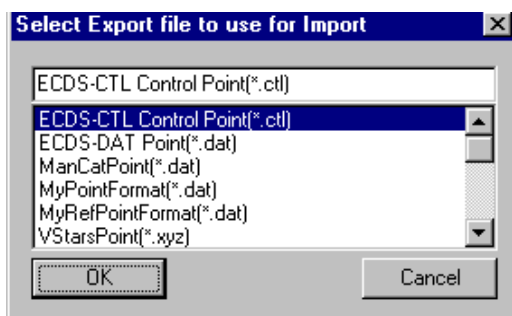
Imp 08.BMP

Select the required template from the drop-down list.

CharConvert button

This button provides a dialogue box to convert character pairs from an external format to an internal format. This conversion is only applied to IDs .

See "Import wizard: Character conversion" on page 166.

File includes header record

Select this option if the first record is a header record. A header record can quickly define the fields.

Start import at row

The first records in an external file may not contain relevant data. Indicate the first row containing data.

> **Note**
> If you have specified that the external file contains a header record then the following record is considered to indicate row 1. If all records after the header are valid data records then start importing at row 1 in this case.

Comment line begins with

If your external data is interspersed with comment lines which start with a particular character string of up to 3 characters, these can be ignored by specifying the character string here.

Only import lines beginning with

If you only want to use external records which have a particular identifying character string at the start, specify the string here.

Description (extension)

This is the name for the import file type, together with its default extension in brackets, which will be used when saving the import template. Change the name if wished. It can also be altered in the final stage of the definition.
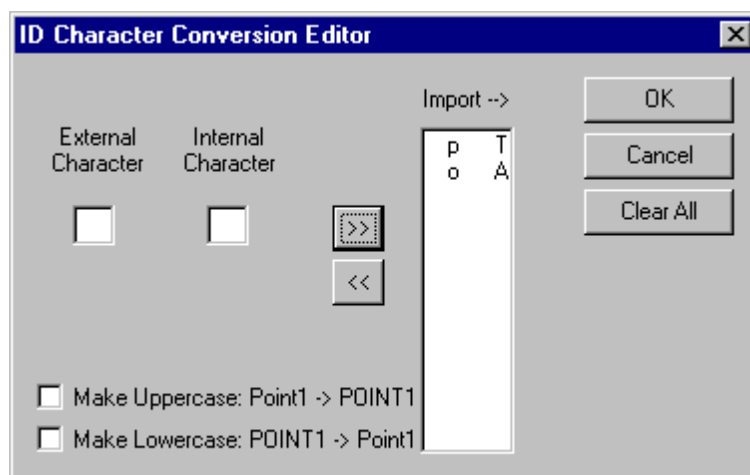
Preview list

The preview list shows the initial records unchanged from their external format. Tabs are indicated by vertical bars.

Next button

Click this button to move to the next page of the export wizard.

14.4.2 Import wizard: Character conversion

Imp 11.bmp

This box defines character pairs which define conversion from an external format to an internal format. This is applied only to IDs. The example shows that the external characters "p" and "t" in any ID will be converted to the internal characters "T" and "A" respectively.

Enter an **External character** in the box provided.
Enter the corresponding **Internal character** in the box provided.
Click [>>] to add the pair to the **Import ->** list.

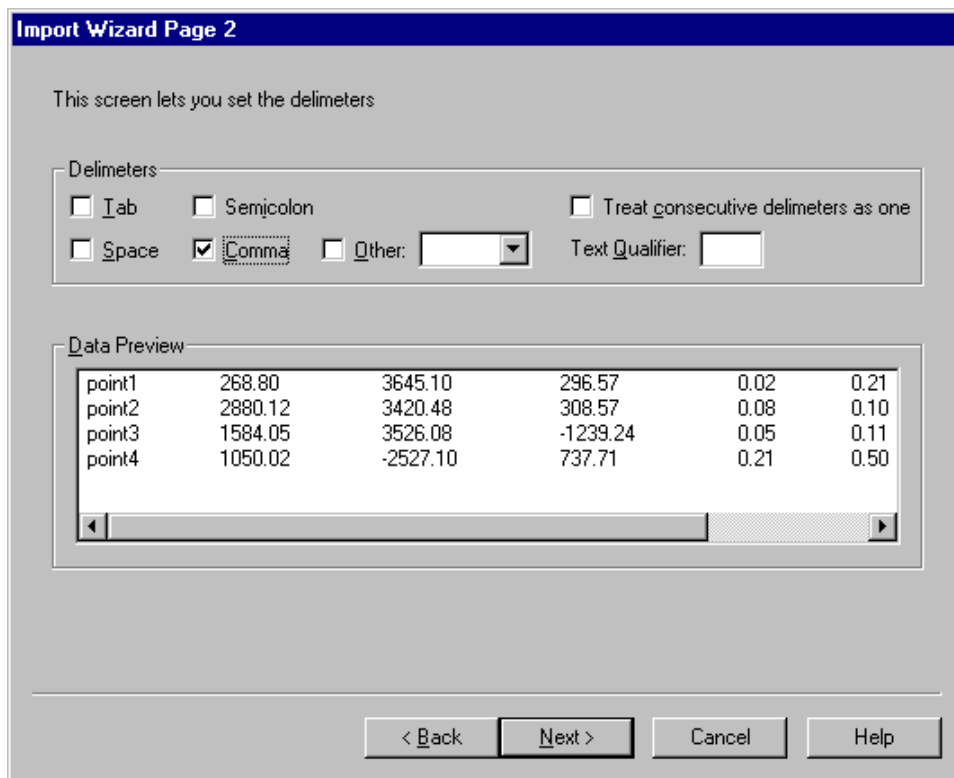To remove a pair from this list, highlight the pair and click [<<].

Make uppercase
Converts external lowercase letters to internal uppercase as shown.

Make lowercase
Converts external uppercase letters to internal lowercase as shown.

14.4.3 Import wizard: Page 2 for delimited data

Imp 05.BMP

This dialogue box is presented if you have specified delimited external data on page 1 of the wizard.

Delimiters

Choose one of the characters or select **Other** and type the single character of your choice in the box to the right.

Treat consecutive delimiters as one
A sequence of consecutive delimiters implies a series of fields between the delimiters, each containing blank data. This may not be the interpretation you want. Instead a delimiter sequence may simply mean the same as a single delimiter and should be interpreted as such.

This is mainly useful on importing data where, for example, fields are separated by multiple blanks but they do not quite line up in vertical columns.

Text qualifier
Text strings exist in the database, for example 16 character alpha-numeric identifiers and comments. These may contain characters which are the

same as the chosen delimiter and will therefore be treated as multiple fields when the data is imported.

To avoid this, the start and finish of text strings can be identified in the external file by a different character. Specify the character here.

Preview list

This shows the external records split up into fields according to the definition of the delimiter characters.
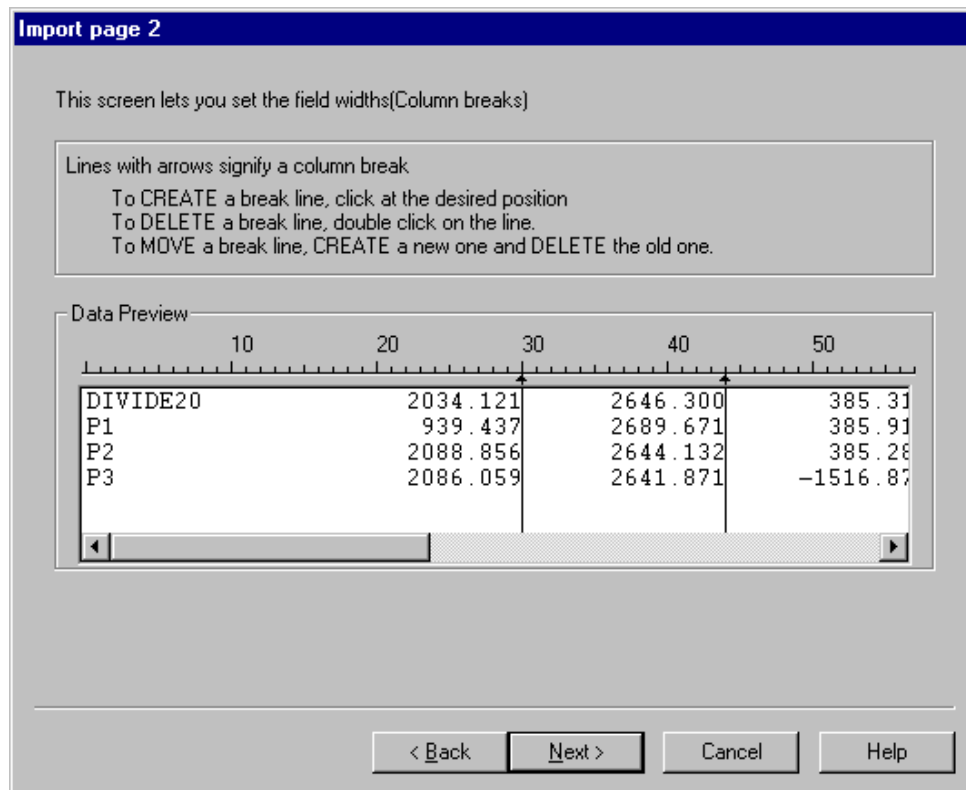
Back button

Click this button to return to page 1 of the wizard and change any definitions.

Next button

Click this button to move to page 3 of the wizard.

14.4.4 Import wizard: Page 2 for fixed width data

This dialogue box is presented if you have specified fixed width external data on page 1 of the wizard.

The objective here is to ensure that the external data is divided into the columns corresponding to the individual fields. In the data preview vertical lines break the data up into columns. Follow the instructions on the box to define columns by adding or removing lines.

Back button

Click this button to return to page 1 of the wizard and change any definitions.

Next button

Click this button to move to page 3 of the wizard.

14.4.5 Import wizard: Page 3

Imp 06.BMP

On entry to this stage of the wizard the external data records will be divided into fields (columns). If the data contained a header record, and this was specified on page 1, then these fields will already be provisionally labelled with the external headers. Otherwise the fields are provisionally labelled [Skip] to indicate that they will, by default, be ignored.

The principal objective here is to assign correct headings to the fields you want to import. Click on a field (column) heading in the **Data Preview** box in order to make a change. Then use the following features.

Record type

This provides a drop-down list of all record types which can be imported into the *Axyz* database.

The type chosen here will be the type associated with the import definition and will determine in which general area of the database the imported data will be stored.

The selection here will also determine which field names are available for assignment to the fields of the external data.

Choose a type corresponding to the data to be imported.

Define name of selected

Click on a field name in the drop-down list in order to apply this name to the selected column.

The list contains all the *Axyz* database headings corresponding to the chosen internal record type.

Skip selected field

Click on a column and select this option to skip the associated data. The column header is then labelled [Skip].

Select field as condition

Click on this option to specify a conditional modification of the data in the selected field. The box to the right of the option indicates the currently applied condition. The column header is then labelled [Cond].

Use the following dialogue box to apply a condition:

Imp 09.BMP
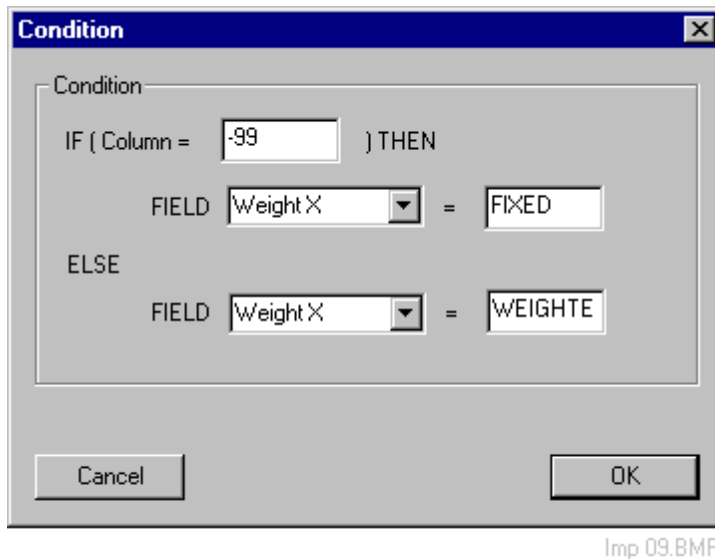
IF

Type the numeric or alpha-numeric value in the column which triggers the
conditional response.

THEN

Select any field from the drop-down list and type a value to be written to
this field if the conditional response is triggered.

ELSE

If the conditional response is not triggered you may optionally select any
field from the drop-down list and specify a value which it should receive in
this case.

Restore from header button

If the data contained a header record, and this was specified on page 1,
then this button is active. This header record specifies the initial column
headings. If you change these and want to return to the initial condition,
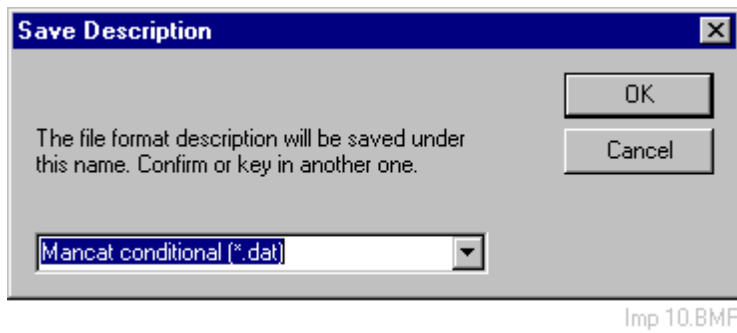click this button.

Back button

Click this button to return to page 2 of the wizard and change any
definitions.

Finish button

Click this button to complete the definition.

14.4.6 Import wizard: Finish

Imp 10.BMP

Save your defined import format with a specific name here.